EDISTO BEACH
COASTAL STORM DAMAGE REDUCTION
GENERAL INVESTIGATION STUDY

APPENDIX J

HARDBOTTOM AND CULTURAL RESOURCE SURVEYS

Contract No. W912HN-12-D-0016
Delivery Order No. DW02

U.S. Army Corps of Engineers
Charleston District

HARDBOTTOM AND CULTURAL RESOURCE SURVEYS

EDISTO BEACH OFFSHORE BORROW SITE
EDISTO BEACH, SOUTH CAROLINA

Prepared for:
Charleston District
US Army Corps of Engineers
69 Hagood Avenue
Charleston, SC 29403

Prepared by:
Dial Cordy and Associates Inc.
201 N. Front Street, Suite 307
Wilmington, NC 28401

and

Panamerican Consultants Inc.
91 Tillman Street
Memphis, TN 38111

April 2013

Hardbottom and Cultural Resource Surveys
of the
Edisto Beach Offshore Borrow Site
Edisto Beach, South Carolina

APRIL 2013

Prepared for:

Charleston District
US Army Corps of Engineers
69 Hagood Avenue
Charleston, SC 29403

Prepared by:

Dial Cordy and Associates Inc.
201 N. Front Street, Suite 307
Wilmington, NC 28401

and

Panamerican Consultants Inc.
91 Tillman Street
Memphis, TN 38111

ABSTRACT

Dial Cordy and Associates Inc. and Panamerican Consultants Inc. performed a remote survey of the proposed sand borrow area during the month of February 2013 for the Edisto Beach hurricane and storm damage protection project. The project purpose was to determine the presence or absence of cultural and hardbottom resources within the proposed borrow site so as to assist in project planning, impact assessment, and for compliance with applicable federal regulations. The survey included the use of sidescan sonar, magnetometer, and a subbottom profiler to characterize resources within the study area.

Eighteen magnetic anomalies, thirty-one sidescan sonar targets, and two subbottom impedance contrast features in the form of paleolandform areas were recorded during the current survey. Out of all the anomalies, sonar targets, and subbottom impedance contrast features, no anomalies were considered to potentially represent significant historic cultural resources. Several sidescan sonar contacts and subbottom features were considered to represent vestiges of paleolandforms that have the possibility of containing prehistoric cultural resources sites. Two areas of potential paleolandscape settings that should be avoided from future dredging include an area of exposed paleolandscape with multiple logs (or stumps) that has one feature of possible upright posts indicating a possible structure and a portion of a buried paleochannel. Since the first site may contain potentially eligible pre-Contact cultural resources, it should be avoided by a distance of 1,500 feet around an arbitrary point at E2213373, N232446. The second area, based on the subbottom record, is a buried paleochannel feature with horizontal margins within the study area at the far southeastern corner. Because the age of this feature is unknown, it is recommended that it should be avoided by a radius of 1,500 feet around an arbitrary center point at E2218203, N227338, or studied in more detail.

Based on review of available marine resource GIS data sources and review of the collected sidescan records, there is not likely to be any hardbottom habitat within the borrow site survey area. Based on coordination with the United States Army Corps of Engineers, Charleston District, following completion of the remote survey, no further investigation is deemed necessary. Review and concurrence with the National Marine Fisheries Service, Charleston Office, is required to conclude consultation on this Essential Fish Habitat resource type.

In a letter received on the draft report from the South Carolina Institute of Archaeology and Anthropology on 12 August 2013, Mr. James Spirek, State Underwater Archaeologist, concurred with the above findings. The agency did, however, request that any inadvertent discovery of potential archaeological materials, i.e., wood structure, prehistoric lithics, ceramics, etc. during dredging operations cease from that area until inspections may reveal the source of this material. Further, the agency had no objections from a submerged cultural resources viewpoint for dredging to occur within the proposed borrow area.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS

ARCOOP	Archaeological Research Cooperative
AWOIS	Automated Wreck and Obstruction Information System
calybp	Calibrated Years Before Present
DC&A	Dial Cordy and Associates Inc.
DGPS	Digital Global-based Positioning Software
GIS	Geographic Information Systems
GPS	Global-based Positioning Software
LGM	Late Glacial Maximum
MSK	Minimum-Shift Keying
MST	Marine Sonic Technology
MWP	Meltwater Pulses
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
Panamerican	Panamerican Consultants, Inc.
PIDBA	Paleoindian Database of the Americas
RNC	Raster Navigation Charts
ROW	Right of Way
SEAMAP	Southeast Area Monitoring and Assessment Program
SOW	Scope of Work
SCDAH	South Carolina Department of Archives and History
SCIAA	South Carolina Institute of Archaeology and Anthropology
US	United States
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
ybp	Years Before Present

1.0 INTRODUCTION

Dial Cordy and Associates Inc. (DC&A), through their DCA/GEC A Joint Venture LLC, was contracted by the United States Army Corps of Engineers (USACE), Charleston District to perform a remote survey of the proposed sand borrow site located offshore Edisto Beach, Colleton County, South Carolina (Figure 1). The purpose of this study was to identify magnetic and or sonar anomalies that may represent historic or prehistoric resources that would affect use of the survey area as a proposed source of sand for storm and hurricane damage protection along Edisto Beach. A secondary project purpose was to identify, map, and characterize any hardbottom habitat based on analysis of sidescan sonar records and, if found, confirm by towed video. The data compiled during this study will be used to refine the borrow area footprint for use and to avoid or minimize impacts to cultural and/or biological resources. This information is required to comply with Section 106 of the National Historic Preservation Act of 1966, as amended (PL 89-665); the National Environmental Policy Act of 1969; the Archaeological Resources Protection Act of 1987 as amended; the Advisory Council on Historic Preservation Procedures for the Protection of Historic and Cultural Properties (36 CFR Part 800); the Abandoned Shipwreck Act of 1987; and for hardbottom resources the Magnuson Stevens Fisheries Conservation and Management Act. The Scope of Work (SOW) for this task order is provided in Appendix A.

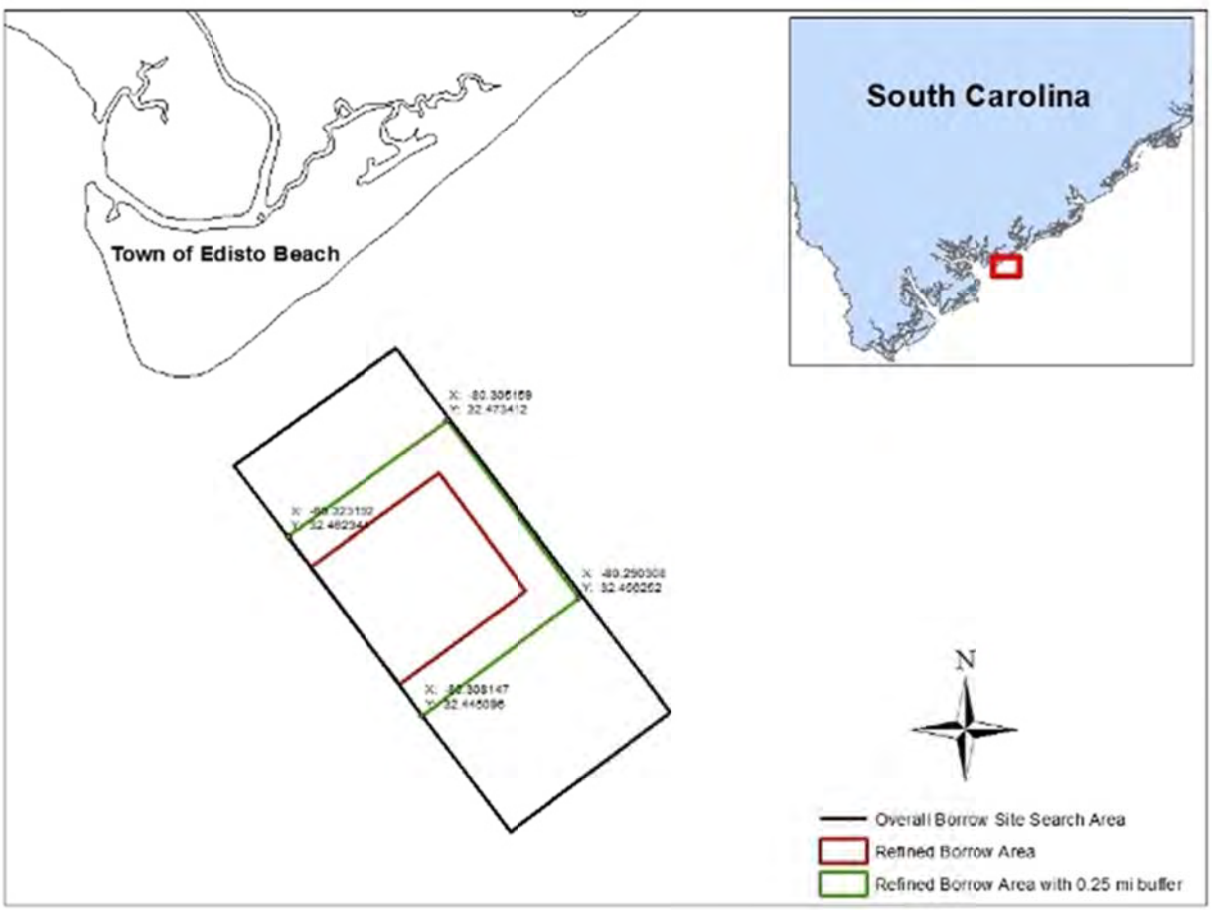


Figure 1. Edisto Beach Remote Survey Location Map

In order to assist the USACE, Charleston District, with meeting compliance requirements, DC&A along with Panamerican Consultants, Inc. (Panamerican), of Memphis, Tennessee conducted a comprehensive submerged cultural and hardbottom resources investigation of the Edisto Beach borrow area in response to the USACE's SOW entitled *Hardbottom and Cultural Resource Surveys of the Edisto Beach Offshore Borrow Site, Edisto Beach, South Carolina*. The area surveyed for the proposed borrow site, including a buffer area, was 1.25 nautical miles by 1.13 nautical miles within the area coordinates listed in Table 1 below and shown in Figure 1. This report includes sections pertaining to Historic and Prehistoric Overview, Methods employed, Investigative Findings, Conclusions, and References used.

Table 1. Edisto Beach Borrow Site Survey Area Coordinates.

Boundary	X	Y
North Corner	80.305159	32.473412
South Corner	80.308147	32.445096
East Corner	80.290308	32.456252
West Corner	80.323192	32.462344

Coordinates in NAD83 South Carolina State Plane East U.S. Survey Feet.

2.0 PREHISTORIC AND HISTORIC OVERVIEW

Divided into three major sections, this background narrative is written to present information relevant to surveying for and identifying prehistoric and historic submerged cultural resources in the form of prehistoric archaeological sites and shipwreck sites. In the first section, the geologic setting and local sea level history are described in order to reconstruct paleoenvironmental and paleolandscape conditions of the Project Area in order to better understand past paleolandscapes in the Project Area. Next, a cultural historical narrative is presented that describes the evolution of human occupation of the Project Area as it progressed from the late Pleistocene through the early Historic periods. In this case, Paleoindian through Late Middle Archaic prehistoric culture groups were around while the survey area was subaerially exposed. Last, the navigation history of the area is presented to establish the type, frequency, and time periods of expected shipwreck sites.

2.1 Paleoenvironmental Setting

2.1.1 Geology

The Edisto Beach borrow survey area is located offshore the modern South Edisto River, South Carolina; one of several tide dominated drainage channels and passages between barrier islands in the center of a large, curved, embayment called the Georgia Bight that stretches from Myrtle Beach, South Carolina in the north to St. Marys River, Florida in the south (Figure 2). To the west, along the coast, are a series of drumstick barrier islands, and their marsh land lagoons that first formed about 40,000 years ago with higher sea levels and then again over the last 6,000 years with Holocene sea level rise and continental shelf transgression (Booth et al. 1999). The survey area is 1.2 to 2.7 statute miles (1.9 to 4.3 kilometers) offshore in 3 to 15 feet of water (1 to 3 meters), on the "inner" shelf. To the east and extending offshore, a large expanse of continental shelf gradually slopes to the shelf break located 75 statute miles (120 kilometers) offshore, where coastlines were at full glacial times.

The Georgia Bight is referred to as a "passive" continental margin meaning that it is not tectonic or isostatically influenced, although evidence for isostasy farther from the ice margins than expected seems to be gaining consensus—even as far south as the Project Area in South Carolina (Baldwin et al. 2006; Colquhoun et al 1995;6). The Georgia Bight is the result of "paleo-

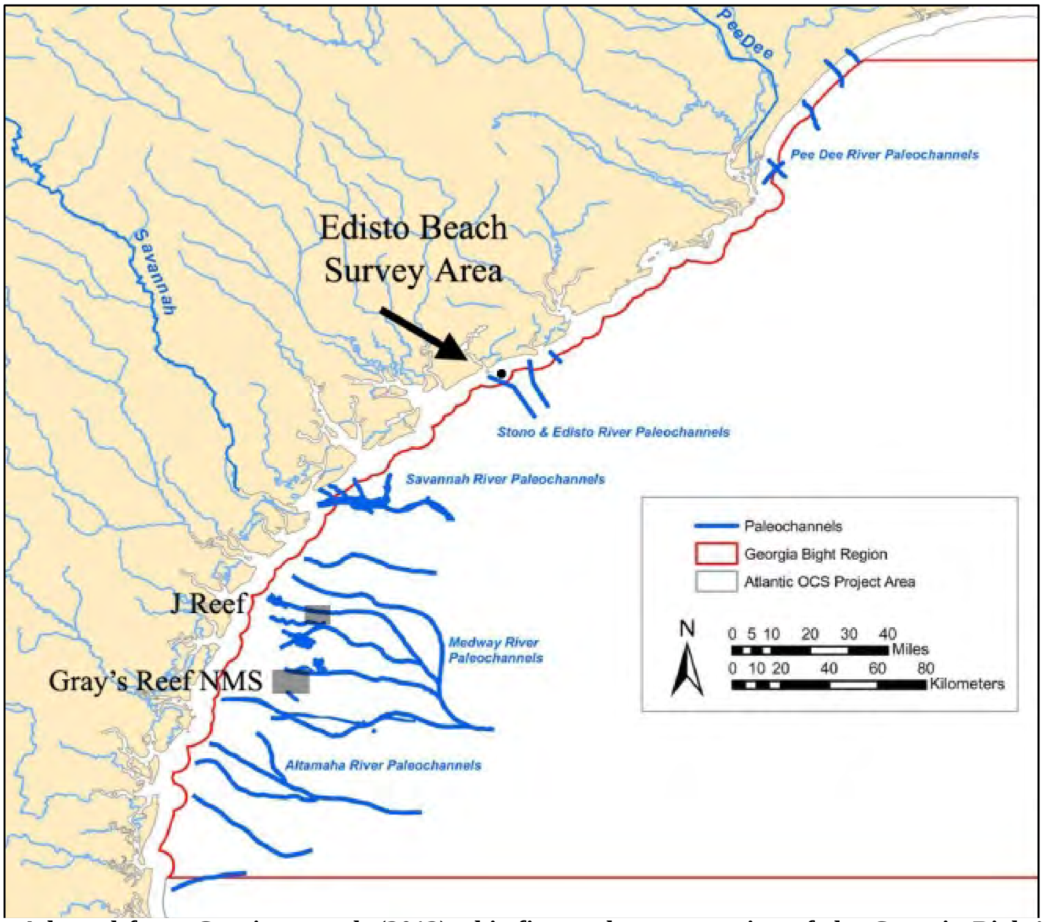


Figure 2. Adapted from Garrison et al. (2012), this figure shows a portion of the Georgia Bight's known paleochannels, J Reef and Gray's Reef, and the location of the Edisto Beach survey area.

oceanographic processes" (Garrison et al. 2012:109) which is to say regression and transgression over several cycles of glaciation and deglaciation; exposing, then flooding, and creating patterned paleolandscape settings formed from reworking and development of marine derived and terrestrially derived sediments. These glacial-interglacial "couplets"—11 over the past 2.8 million years—are caused by Earth orbit parameters (Emiliani et al. 1975), but it is only the last, "Flandrian," latest Pleistocene-early Holocene melting of huge expanses of glaciers and concomitant transgression of the continental shelves by rising sea levels that is of concern for this Project Area. This is because the earliest vestiges of human occupation of the region, outlined below, are constrained to these times. Basically, glacial melting started globally about 17,000 calibrated years before present (calYBP), slowed substantially by 6,000 calYBP, and has fluctuated in relatively minor ways (geologically) since. Sea levels for this project are discussed in more detail below.

The continental shelf of the Georgia Bight is covered with a significant amount of transgressive lag deposits in the form of a marine sediment bed drape. Ravinement (erosion) is dominant during transgression, meaning that terrestrial deposits are truncated and redeposited into marine dominated sediments with sea level rise.

Much of the Georgia Bight is covered with a 1- to 2-meter (thin) veneer of sandy sediments (Harris et al. 2005; Garrison et al. 2012). These are the "… eroded relicts of earlier subaerial coastal landforms characterized by dunes, wetlands, coastal rivers and forest much like today"

(Garrison et al. 2012:109). These sediments have been reworked within the sand and shell marine dominated sediments that form the "palimpsest sand sheet" that blankets the continental shelf. This sand sheet is also reworked and moved by bottom currents generated by storms, tides, and wind depending.

These large areas of sand offshore are interspersed with rocky outcrops of "harbottom" (Garrison et al. 2012:111) that are Miocene- and Pliocene-aged limestones scattered as erosional remnants, ledges, and "ramps." Some of these features indicate weathering in subaerial (exposed) conditions, including evidence for stream erosion and karst formation (Garrison et al. 2012:111). Notches in the Pliocene-aged Raysor Formation at the 20-meter isobath, indicate a still stand, but its age of formation is unknown. These limestone outcrops are the main geomorphic features that occur in the Georgia Bight, some having live bottoms like Gray's Reef and J Reef shown in Figure 2, indicating sustained exposure of the outcrop.

Other geomorphic features more relevant to the Edisto Beach study area include Pleistocene - and Holocene-aged shoal complexes made up of silt to gravel-sized sediments of terrigenous origin, abundant shell, and areas of dispersed peat (Sexton et al. 1992). The seaward relief of these features can be steep, with the near-coastal portions less of a slope. The shoal complex seaward of the Santee/PeeDee Delta is the largest—a deltaic deposit with shore parallel scarps that are evidence of pause or still stand during Holocene sea level rise. The islands are supposed to be migrating along with sea level rise, but abandoned examples could be expected given the magnitude and rapidity of some sea level rise estimates.

Sources of terrigenous sediments are the rivers draining the coastal plain, including reworking from previous high stand materials as parent materials for subaerial pedogenesis and landforms, with reworking again with Holocene transgression. Sediment packages build up in the lagoon on the lee side of the islands, and if those were preserved offshore, they could be expected to retain stratigraphic integrity and be at or near locations of human activities and refuse.

Drowned coastal stream and river paleochannels occur, but most are truncated and buried under the sand sheet drape such that they are not usually apparent on the surface in the bathymetry (Figure 3). Therefore, they cannot be adequately remotely sensed with bathymetric or sidescan sonar devices; rather, they need be remotely sensed with seismic subbottom profiler devices (Baldwin et al. 2006). Studies by Garrison et al. (2008) and others (Baldwin et al. 2006; Harris et al. 2005) confirm that these paleochannels are buried, albeit shallowly, under the reworked marine sediment drape cover (Garrison et al. 2012). Baldwin et al. (2006) used a dense pattern of subbottom profiler lines over great space to reconstruct and offer ages for the paleochannels offshore South Carolina.

Figure 2 above shows the Garrison et al. (2012) compilation of Geographic Information System (GIS) data for the Paleo-Altamaha, Paleo-Savannah, and Paleo-Meway rivers offshore Georgia, and the Stono-Edisto and Pee Dee paleochannels offshore South Carolina. Several generations of the ancestral Pee Dee River system have been mapped beneath and along the coast and inner continental shelf revealing a complex pattern of paleochannels of different ages (Baldwin et al. 2006). Figure 2 also shows the location of the Edisto Beach study area. The Investigative Findings chapter of this document reports another channel segment vestige or segment.

During sea level low stands, drainage valleys are shallowly incised into the continental shelf and backfilled with various sediment types, depending on local conditions and sea level rise and fall rates. Paleovalleys have backfilled during cyclic changes in sea level with sediment types ranging from estuarine muds to clean shelly sands (Harris et al. 2005 in Garrison et al. 2012:116). Quaternary paleochannels tend to be filled with muds, sandy muds, and muddy

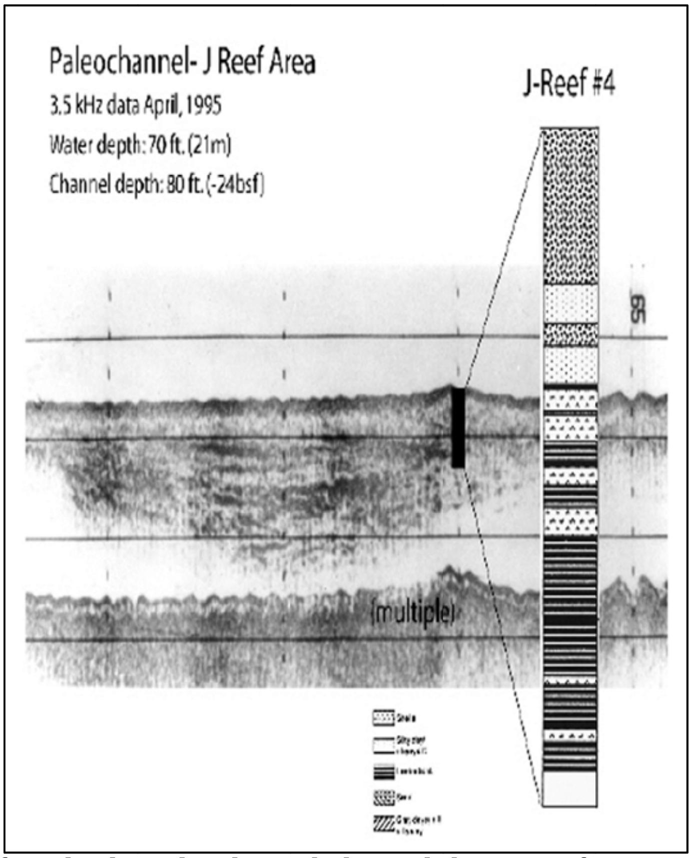


Figure 3. An example of a paleochannel underneath the sand sheet cover from Garrison et al. (2008) that is analogous to the paleochannel feature recorded in this survey project.

sands; whereas, tidally scoured paleochannels general contain clean shelly sands (Harris et al. 2005:511). Prior to 7,000 years ago, the islands would have been part of the mainland, hill-like ridges with valleys in between with tributary gullies cutting into the hills (Figure 4). The marshes surrounding the Project Area would have been dryer swales. In a similar way, Garrison and Tribble (1981) model the paleolandscape of the marshland during the late Pleistocene-Early Holocene as grassland and savannas with non-tidal perched streams and possible spring connections. If these spring locations could be identified, there may be archaeological remains around them.

The age of a peat bed marking coastal marsh at Cracker Tom Marsh on St. Catherine's Island, Georgia was around 6,800 calYBP (Booth and Rich 1999; Rich and Booth 2011:134). But in the coastal plains of the Project Area, archaeological sites are lacking in this middle Holocene (and earlier) age frame (Turck et al. 2011). Sites earlier than 6,800 calYBP are either missing or possibly located in buried stratigraphic units buried by later Holocene transgression and sedimentary processes, or in areas offshore that have been submerged. An exposed paleolandscape setting 28 feet below the river water level found in a St. Augustine River study area confirms the potentials for this kind of buried archaeology. The radiocarbon age of an in-place stump there was 8,100 calYBP (7300 +/- 40 YBP; Beta 36234; James et al. 2012).

The earliest Holocene salt marsh in this newly submerged area, recently discovered at a location along the southwestern edge of St. Catherine's Island, has been radiocarbon dated to 4,060 ± 50 YBP [shell, United States Geological Survey (USGS) #WW1262]. This provides the best available indication of when the island became isolated from the mainland (Booth et al. 1999:84) and probably the age at which the Edisto Beach study area was completely submerged.

ARCHAEOLOGICAL SEA LEVEL EVIDENCE 1293

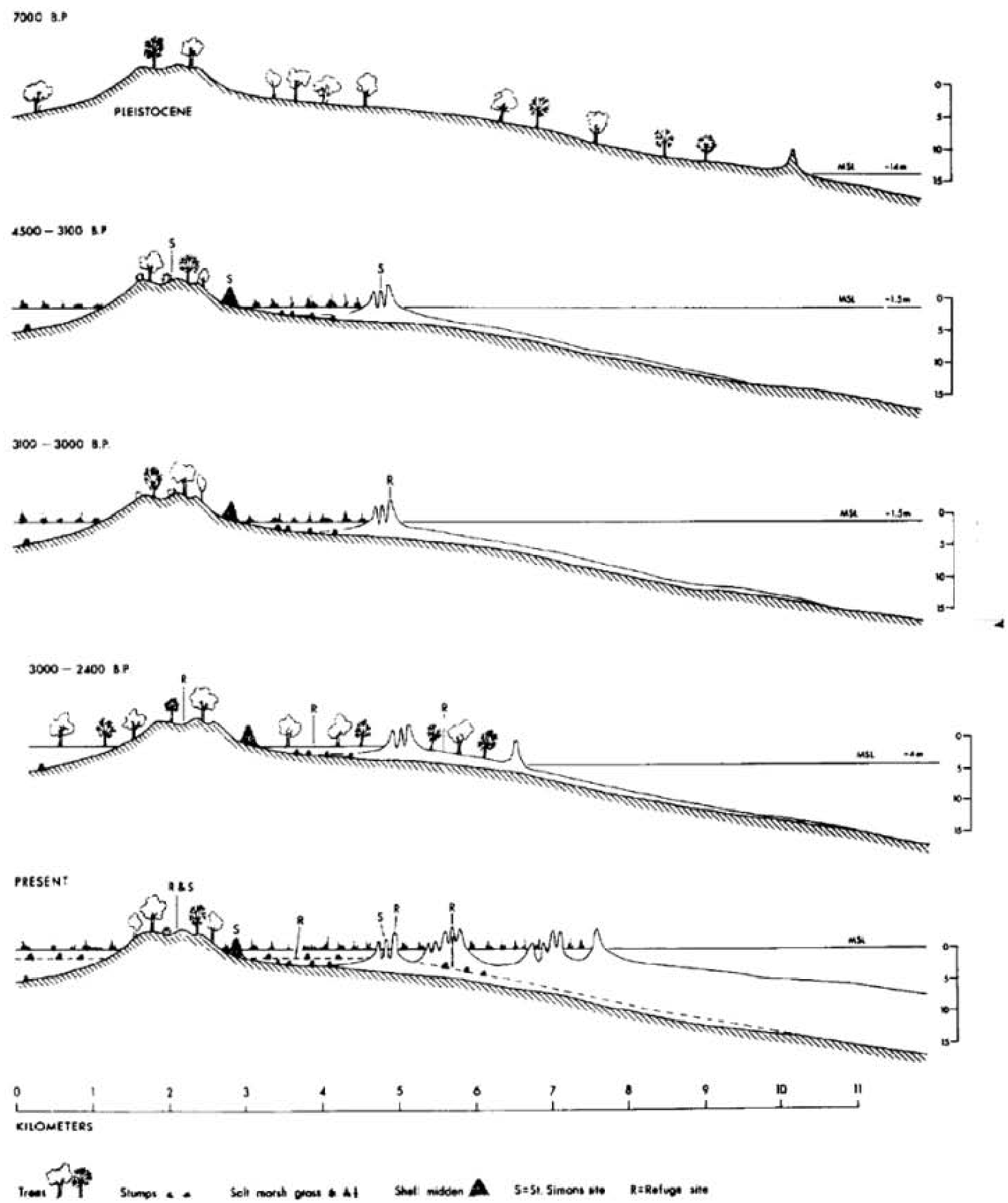


FIG. 2.—Schematic cross-section showing changes in coastal morphology and sites of Indian occupation on the Georgia coast from 7000 B.P. to present. This reconstruction is a composite of data gathered along the whole Georgia coast. The profile, however, is based on the area immediately south of the Savannah River where maximum shoreline progradation has occurred.

Figure 4. Conceptual drawing of the different land forms that the islands had at different stages of the transgression, including a proposed regression (as presented in DePratter and Howard 1981:1293:Figure 2).

The configuration of the survey area appears to be a paleobarrier feature transgressed by late Holocene sea level rise. Paleochannel margins, of late Pleistocene early Holocene age, are prime locations for submerged pre-Contact archaeological sites and barrier-marsh coastal systems are likely draws to humans for a variety of resources.

2.1.2 Sea Level History

As alluded to above, global sea levels have fluctuated over the past 2.8 million years during 11 cycles of glacially driven advancements and retreats of sea levels across the continental shelves of the world (Emiliani 1975). The last full extent of glaciers, known as the Late Glacial Maximum (LGM), occurred at 26,500 and 19,000 calYBP, resulting in coastlines 100 meters or more lower in elevation than today. At that time, global eustatic (glacially controlled) sea levels fluctuated at the continental shelf break 100 kilometers (65 miles) from the survey area.

Sea levels have been rising continuously since 17,000 calYBP (Table 2 and Figure 5), but this continuous melting has been punctuated by three significant Meltwater Pulses (MWP 1a, 1b, and 1c; Blanchon 2011; Blanchon and Shaw 1995). These pulses indicate major rapid ice events resulting from ice sheet collapse (Blanchon and Shaw 1995) as well as sources of displaced populations retreating from the high water during storm front and other erosional processes (Waters 1992).

Blanchon (2011) has published recently on the magnitudes and rates of these three MWPs as estimated from drowned corals around the world: MWP 1a is estimated to have been 13.5 meters of sea level rise over 290 years at 14,600 calYBP (12,600 YBP); MWP 1b was a 7.5-meter rise of sea level in 160 years at 11,400 calYBP (10,000 YBP); and MWP 1c is a recent addition to the reconstruction of glacial melting that is estimated to have occurred at 8,000 calYBP (7,200 YBP) with 6.5 meters of sea level rise in less than 140 years at 8,000 calYBP.

Marine terraces are markers of paleoshoreline still stands of sea level at times of relative stability or stasis. Several paleoshorelines occur above today's coastline and Clovis or Younger Dryas shorelines have been identified in the Gulf of Mexico (Faught and Donoghue 1997) and the North Atlantic Bight (Nordjford 2006). In general, terraces are "bounded by a steeper ascending slope on the landward side and a steeper descending slope on the seaward side. Due to its reasonably flat shape, the terrace is often used for anthropogenic structures like settlements and infrastructure." Drowned shorelines can be locations of prehistoric archaeological sites, although the potential for truncation and reworking is high. Apparently there is no scarp-like feature in the Georgia Bight to correlate with these.

Local geologic conditions, proximity to the weight of the glaciers, or other factors can affect the relative apparent local sea level. This is especially true for the coastal portions of the Georgia Bight, in those areas of the inner lagoonal systems (Colquhoun and Brooks 1986; Colquhoun et al. 1995).

The survey area is 1.2 to 2.7 statute miles offshore in 3 to 15 feet of water. Table 2 shows that this area would have been subaerially exposed through all three MWPs and probably submerged between 5,500 and 4,500 calYBP (5,000 and 4,000 YBP).

Relative sea levels have fluctuated along South Carolina's coast after 6,000 YBP as sea levels began to affect the modern barrier islands. DePratter and Howard (1981) and Colquhoun and Brooks (1986) have shown a high stand and subsequent regression that Gayes et al. (1992) constrained between 5,300 and 3,600 YBP (Colquhoun et al. 1995). These fluctuations are shown

Table 2. Characterization of Late Pleistocene and Holocene Transgression Sequence, Magnitude and Rates.*

Time Period (YBP)	Description
Late Glacial Maximum 26,500 to ~19,000 calYBP Melting begins 17,000 calYBP Meltwater Pulse 1a 14,600 calYBP 13.5 meters in 290 years	Full glacial conditions, sea levels at maximum lowering and full exposure of the continental shelf offshore 120-60m. Glacial melting begins after 14,000 with a major pulse of melting at 14,600 calYBP (Blanchon 2011) at a rate and magnitude of 13.5 meters in 290 years. Almost half of the total glacial melting occurred between MWP 1a and MWP 1b. Sea levels rose somewhere between 40- and 60-meter isobaths depending on regional particulars (Balsillie and Donoghue 2004; Lowery et al. 2012; Siddall et al. 2003).
Younger Dryas (YD) 13,000 to 11,400 calYBP Reduction in melting	Younger Dryas return to glacial conditions. The abrupt initiation of climate change is absolutely coterminous with the appearance of Clovis Paleoindian cultural groups.
Meltwater Pulse 1b 11,400 to 9,000 calYBP 7.5 meters in 160 years	Dramatic glacial melting occurred a second time known as MWP 1b. Early Archaic cultural time frame.
Meltwater Pulse 1c at 8,000 calYBP 6.5 meters in less than 140 years	MWP 1c is the last pulse of meltwater.
After 5,000 less than 5 m below today, fluctuations	High and low stands proposed

*From Blanchon 2011

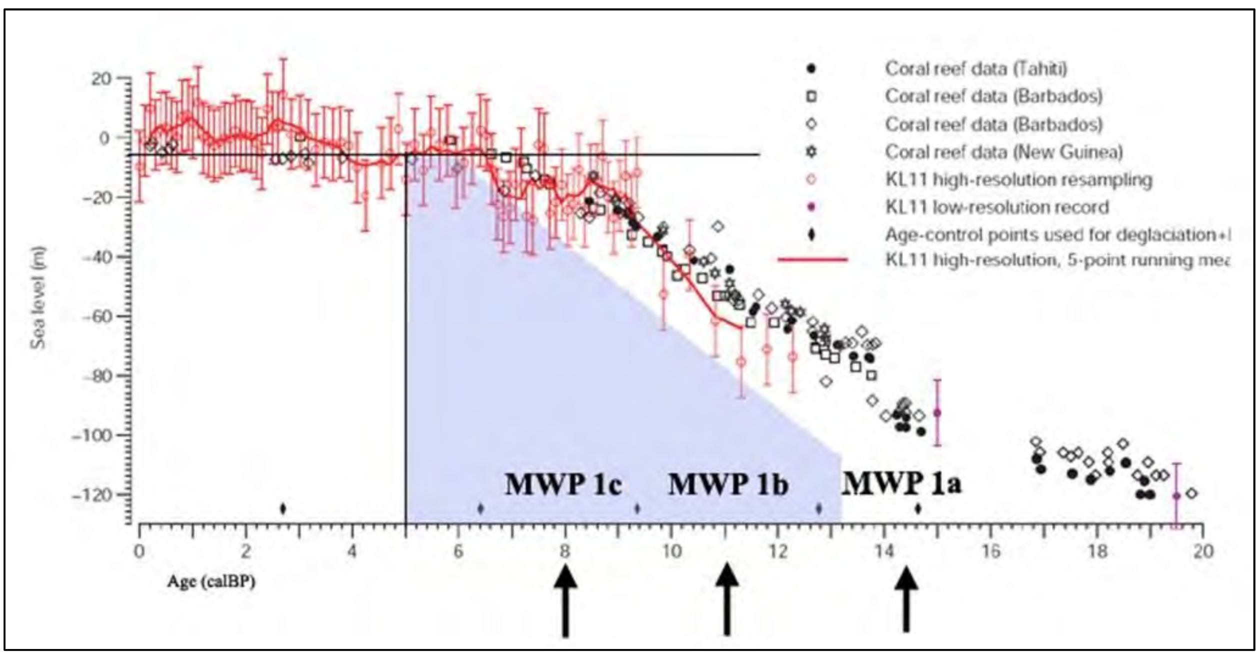


Figure 5. Global eustatic sea level curve from Siddall et al. (2003) with Blanchon (2011) chronology of MWPs 1a, 1b, and 1c shown. The horizontal line represents the survey area depths, indicating submergence after 5,000 calYBP.

in the sea level curve in Figure 6 and they have been reconstructed using archaeological site distributions in combination with other radiocarbon evidence. The implication is that the study area was terrestrial before 8,000 calYBP and probably near coastal after that, until submergence between 5,000 and 4,000 YBP.

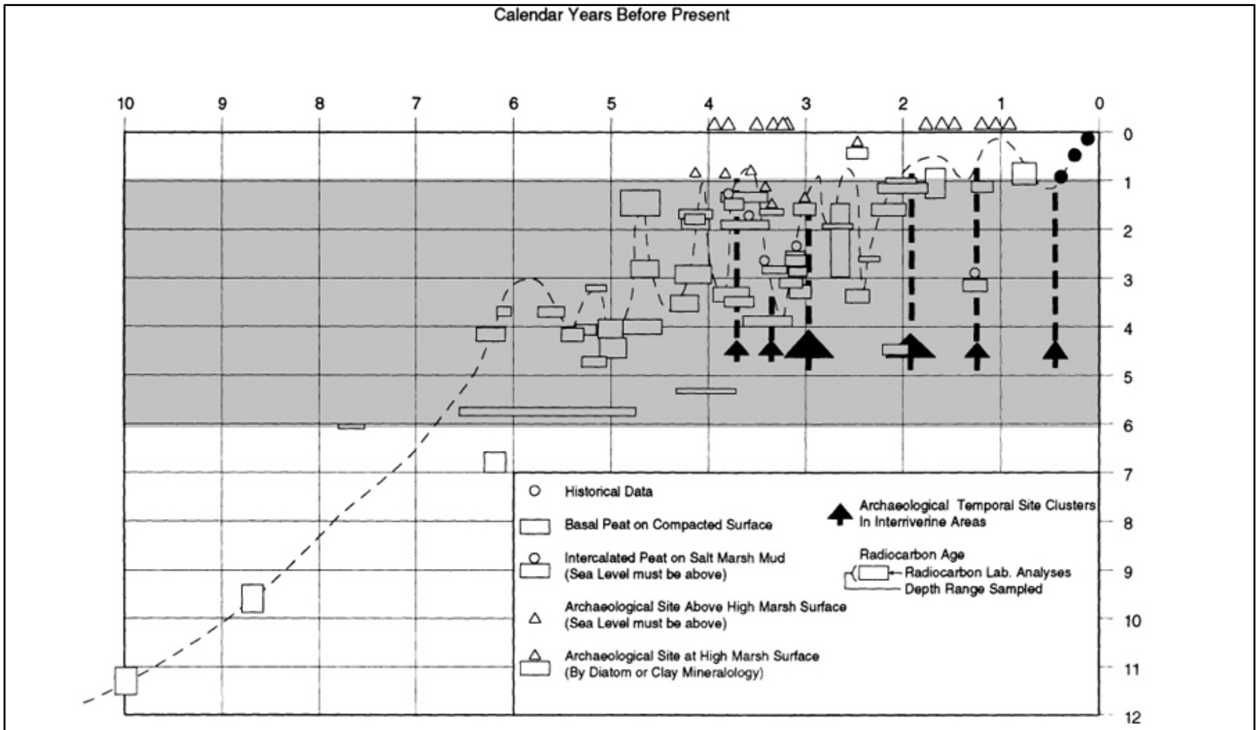


Figure 1. Historic and Holocene high marsh and estuarine associated archeologic sea level indicators relative to the present high marsh surface, South Carolina coastal zone (after COLQUHOUN and BROOKS, 1986).

Figure 6. Fluctuating sea level curve for South Carolina from Colquhoun et al. (1995) relevant to the Project Area showing depths recorded in the Edisto Beach study area. The implication is that the study area was terrestrial before 8,000 calYBP and probably near coastal after that, until submergence between 5,000 and 4,000.

2.2 Prehistoric Context

2.2.1 Paleoindian and Early Archaic Culture Groups

The chronological and spatial distributions of archaeological sites in the local area inform on when and where sites might be located offshore in the Edisto Beach survey area, whereas the cultural material assemblages and diagnostic artifacts inform on the chronology and cultural historical group encountered.

Given the details described above in the sections on Geology and Sea Level History, the time-use-range of the survey area when it was subaerial would include latest Pleistocene pre- or proto-Clovis Paleoindians, Clovis and later lanceolate using Paleoindians, and early Holocene, Clovis related notched point making people until about 9,000 calYBP, as well as Middle and possibly early Late Archaic people.

Pre- or perhaps we might say “proto-″ Clovis sites are proposed at Mile Point in Maryland, Topper in South Carolina, Page Ladson in Florida, and, even though far away, Buttermilk Creek in Texas (Dunbar 2006; Lowery et al. 2010; Waters et al. 2011). Theoretically, sites of these ages (pre-13,000 calYBP) could have existed all the way out to the shelf break/LGM coastline, where at least one artifact and some megafaunal remains have been discovered (Lowery et al. 2010), and human activities could be represented around the survey area if it offered resources or topography conducive to human presence.

Regardless of whether there are pre-Clovis sites in the Southeast or not, this region (the Southeast) has produced the most abundant numbers of diagnostically early artifacts (fluted and unfluted lanceolates) of anywhere in North America. These data indicate Clovis Paleoindian intrusion sometime in the late Pleistocene, settling in the Early Holocene, and shared lithic reduction strategies and artifact assemblages that indicate survival and cultural continuity well into middle Holocene time and therefore, in a general sense, very likely to have had forays on and around the Edisto Beach study area (Anderson et al. 1996; Kimball 1996; Ledbetter et al. 1996; Sassaman 2010).

Figure 7 shows contours of the frequency of fluted and unfluted lanceolates contoured in Surfer (at 2 points per interval), using data with county level positioning data from the Paleoindian Database of the Americas (PIDBA) that can be found online. The filled circles in Figure 7 represent the locations of sites with diagnostics, stratigraphic exposures, age estimates of 9,000 calYBP (8,000 YBP) or older, or some combination of all of the above, especially those described by O'Steen (1996) and Ledbetter et al. (1996).

Three time frames have been estimated to date the Clovis and Clovis-related projectile point types that, if found, would be diagnostic: Early Paleoindian fluted lanceolate points forms (ca. 13,000 to 12,700 calYBP); Middle Paleoindian fluted and unfluted lanceolates such as Cumberland, Suwannee, Simpson, Quad, and Beaver Lake (ca. 12,700 to 12,500 YBP), and finally, Late Paleoindian incipient corner- and side-notched forms like Dalton, Greenbriar, Hardaway Side Notched (ca. 12,500 to 11,400 YBP; Anderson et al. 1990:6-9; 1996:7-8).

Even though the evidence is rare in the Southeast, and the degree to which hunting megafauna contributed to Paleoindian subsistence is assumed rather than confirmed, the remains of extinct Pleistocene animals have been found in submerged contexts that are indicative, potentially, of co-existence with early human populations and in contexts when sea levels were lower. For instance, in Florida, a Bison antiquus skull with an embedded projectile point fragment was found in the Wacissa River as well as other evidence of association (Webb et al. 1984). Dunbar and Webb (1996:333-350) have reported several worked mammoth, mastodon, and horse bones as well as carved-ivory implements made from mammoth tusks, presumably while the ivory was still in a green state. Wright (1976:319) reported remains of *Mammut americanum* dredged up at the Surfside Springs site in South Carolina, as well as *Bison*, *Cervus*, and *Ursus* from the deposits that also contained two bifacially modified artifacts (see Goodyear et al. 1989:6).

Closer to the study area, a proximal fragment of a proboscidean rib was found on Edisto Beach, apparently from a submerged context (Goodyear et al. 1989:9). One edge of the rib displays a fairly continuous series of grooves or incisions that are proposed to have been produced by human action.

While the degree to which megafauna contributed to Paleoindian subsistence in the Southeast remains conjectural, it is certainly agreed that post-Paleoindian, post-late Pleistocene, Early Archaic, and early Holocene assemblages indicate a wide range of activities including exploitation of local mammals and birds such as found at Dust Cave in northern Alabama; as modification with the makers of fluted points almost 2,000 years earlier. Any coastal adaptations would be located on the outer continental shelf, well away from the survey area.

Figure 7. A composite of ARCOOP (Archaeological Research Cooperative) data of archaeological sites earlier than 9,000 calYBP (black dots) and distribution of Paleoindian lanceolates contoured from PIDBA data. Note the cluster of late Paleoindian and Early Archaic sites up the Savannah and Pee Dee rivers.

Diagnostics from a pan-regional sequence of early Holocene Early Archaic projectile point traditions that cover two millennia (11,400 to 9,000 calYBP) would represent a means of determining the chronology and cultural association of a submerged prehistoric site or isolated find from the dredge material. This early group includes the Side-Notched Tradition (11,400 to 10,500 calYBP), Corner-Notched Tradition (10,500 to 10,200 calYBP), and the Bifurcate Tradition (10,200 to 9,000 calYBP), although the latter is more common to the north (Elliott and Sassaman (1995:21 26).

Inspection of the Georgia Bight coastal areas in Figure 8 shows that diagnostics and early sites have been found most frequently inland, along the Savannah River between Georgia and South Carolina and in the Oconee River behind the Wallace Dam. The best stratigraphic sequence is 9GE309, which is located on the alluvial plains of the Oconee River (Ledbetter et al. 1996:272; O'Steen 1996:99-100). Excavations revealed that the bottom-most deposits contained Clovis

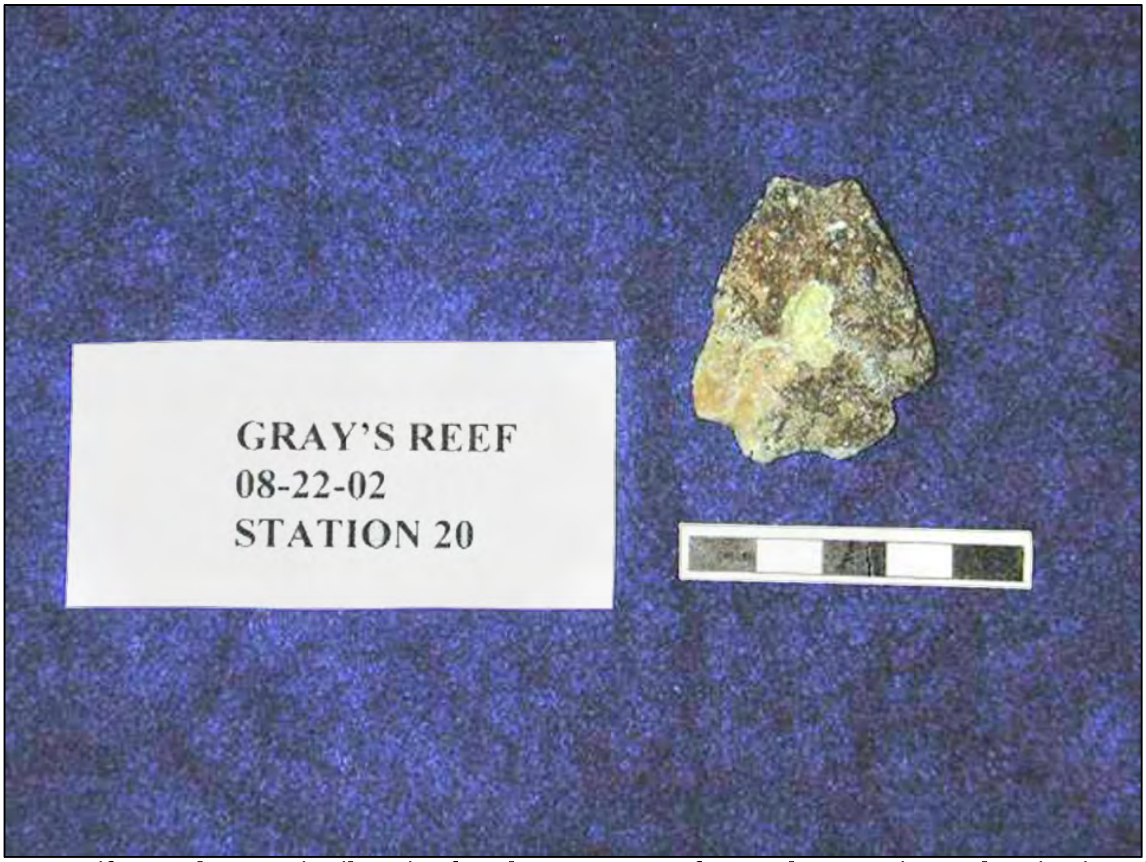


Figure 8. Bifurcate base projectile point found at Gray's Reef, note the corrosion and patination of the surface of the material from exposure to the saltwater environment (photo courtesy of E. Garrison; scale in centimeters).

points while overlying strata yielded artifacts from earliest to latest in stratigraphic order: Clovis; Dalton/Big Sandy; Kirk Corner Notched; Bifurcates; and Kirk Stemmed varieties.

Examples of any of these diagnostics could have been left in the Edisto Beach survey area in the past, when it was in a terrestrial configuration. A fluted biface was found underwater at Ossabaw that confirms this proposal (Ray 1986), as do the discoveries of ivory tool fragments and bifurcated projectile points made at Gray's Reef, indicating human presence. The Ossabaw artifact has been designated as a "Clovis" point, but it is more consistent as a fluted biface preform. It would appear from the current state of knowledge that Paleoindian and Early Archaic sites do not occur in the coastal areas of South Carolina. However, it is a potential problem that the sites are there, but buried by more recent sediments in the coastal plain and marshlands and have yet to be discovered.

2.2.2 Middle and Late Archaic Groups

The Middle Archaic in Georgia may be demarcated by the appearance of stemmed projectile points rather than notched or bifurcate base varieties (Chapman 1985:148), but the extremely low numbers of Middle Archaic sites known from the coast seem to indicate low probabilities for these sites in the inland waterways and marshes, unless they are buried by sedimentation.

Archaeological sites increase in great numbers on barrier islands in Late Archaic time frames after 5,000 calYBP, when evidence shows people exploiting a rich variety of resources in the marshland estuaries, particularly shellfish and other aquatic resources. Slightly earlier sites of these culture groups could be submerged in the Edisto Beach survey area because the environments they utilized occurred out there and then migrated inland, retreating from the rising coastline.

2.2.2.1 Middle Archaic

The Middle Archaic can include demarcation by the appearance of stemmed bifaces (Chapman 1985:148). The earliest Middle Archaic hafted biface types of this genre are the Kirk Stemmed, Kirk Serrated, and Stanley Stemmed types. On the other hand, Morrow Mountain projectile points are clearly one of the better known Middle Archaic stemmed points recovered from the South Atlantic Slope. Sassaman and Anderson (1995:24) reviewed a series of radiometric assays associated with various Morrow Mountain contexts in Tennessee, Alabama, Georgia, and South Carolina. The date estimates ranged from approximately 7,500 to 5,500 YBP, well within the range of Later Middle Archaic points that are found in the Coastal Plains of the region including the Guilford-related Brier Creek type. Sassaman and Anderson (1990:153) indicated that Brier Creek was possibly a Coastal Plain version of Guilford. They described a stratigraphic sequence at the Pen Point site in the Savannah River in which Brier Creek was found in a context lying above Morrow Mountain and below Savannah River Stemmed. Elliott and Sassaman (1995:34) suggested Guilford dates ranging from 6,000 to 5,000 YBP. They also mentioned the presence of other presumably coeval types resembling the closely related Sykes, White Springs, and Benton types. These varieties could be useful diagnostics if found in offshore contexts.

Sassaman and Anderson (1995:149) pointed out that Middle Archaic sites are not very abundant in the South Atlantic Coastal Plain. Inasmuch as a vegetation or ecotone shift related to sea level rise may have occurred during this period in which pine expanded at the expense of oak, some researchers have suggested that the pine-rich forests were not as productive and therefore less attractive for human exploitation. Be that as it may, there is sufficient evidence of Middle Archaic activities in the region to conclude that the Coastal Plain was not completely abandoned. If there were more cores in the marshes, we might have a better control on the development of the marshes as sea levels approached today's levels. Likewise, the ecotones of interest to the prehistoric inhabitants may have existed farther offshore, with slightly lower sea levels.

2.2.2.2 Late Archaic

The earliest archaeological sites along the Georgia Bight barrier islands date to about 4,000 years ago, when evidence shows people exploiting a rich variety of resources in the marshland estuaries, particularly shellfish (Turck et al. 2011). Three types of Late Archaic sites have been identified that might be used for modeling the kinds of sites expected in the Edisto Beach study area: (1) scattered sites along marsh edges and bluffs (including those not bearing substantial shell accumulations); (2) marsh shell middens; and (3) shell rings (Waring 1968). Shellfish collecting also appears to have been an important activity in riverine settings, particularly along the Savannah and Ogeechee rivers (Elliott and Sassaman 1995:143). Other common diagnostic artifacts include net sinkers, steatite vessels, and shell ornaments. In addition, there were weir features and other technologies for aquatic and avian resources (Elliott and Sassaman 1995:38-38). These features could be expected in the study area in intact situations.

Crook (2007) has described research at the Bilbo Site (9CH4) in Savannah that indicates evidence of a pile-dwelling and shell midden during the late middle Holocene about 4,000 to 3,000 YBP. Crook argues that pile dwellings "…were a central feature of the cultural adaptive system, allowing settlements to be located in wetlands that provided optimal access to the evolving food resources of multiple, dynamic environments" (Crook 2007:223). One of these may have been located in the Edisto Beach study area (described in the *Sidescan Sonar Results* section below).

There is little potential for Woodland period or later culture groups in the Edisto Beach study area and therefore no need to continue describing the local prehistoric background.

2.2.3 Potential For Submerged Prehistoric Sites

As Garrison et al. (2012) point out; the potential for sites offshore is directly related to the presence of more recent quaternary age strata, which are most often significantly eroded. Sediment packages can build up in the lagoon on the lee side of barrier islands, and if those were preserved offshore, they could be expected to retain stratigraphic integrity and be at or near locations of human activities and refuse.

The margins of paleochannels and terraces are prime locales for submerged prehistoric sites, and it is known that paleochannels can be preserved offshore (Figure 9). On the other hand, paleochannels are not perceivable by bathymetry because of the marine sediment cover, indicating that seismic (subbottom profiler) remote sensing is a critical tool for site survey and prediction (Garrison et al. 2008).

Figure 9. Cover of Thomas (2008) showing Native Americans along Georgia's coast and the array of features and structures they had built for catching, processing, and preserving marshland fauna. These kinds of features can be preserved offshore given local preservation parameters.

2.3 Historic Context

The Project Area, located just offshore the South Edisto River Inlet, represents a minor maritime approach into and out of the South Edisto River and its tributaries, and to a lesser extent into and out of St. Helena Sound and its tributaries throughout the Historic period. This involved navigating through the often hazardous and constantly changing bars found across the mouth of the Sound. Located between the major commercial maritime ports of Charleston to the north and Savannah to the south, the history and associated maritime economies of the Project Area are in large part tied to these two centers. A historical accounting of these areas is therefore relevant when it comes to a discussion of the Project Area and any potential for historic shipwreck sites.

The initial European contact within the Carolinas took place in 1514, as Luis Vasquez de Ayllon sent an agent to find a source of labor for his plantations in the Caribbean. In 1521, Francisco Gordillo, supported by de Ayllon, sailed along the American coast north of Florida. Although the adventure was unprofitable for Ayllon, he still held hopes of profiting in the region. In 1523, he received a patent from the King of Spain to explore the coast and set up a colony. After an initial reconnaissance in 1525, he fitted out four vessels with over 500 colonists and left Santo Domingo for the Carolinas in 1526 (Edgar 1998:21; Morison 1971:332). The initial landing, suspected near the Cape Fear River, was unsuccessful and they moved south and established San Miguel de Gualdape near the mouth of the Waccamaw River, South Carolina—although some place it at Punta de Santa Elena, which is the sight of modern Port Royal to the south of the Project Area. By 1527, Ayllon was dead and the colony broke up; approximately 150 survivors straggled back to Hispaniola (Coker 1987:2).

Three years after Gordillo's initial Carolina reconnaissance, Verrazano, an Italian from Florence sailing for Francois I, the King of France, left Europe on a voyage to find a route to China in January 1524. His vessel *La Dauphine*, named after the French heir to the throne, was 100 tons and manned by a crew of 50. After a tempest-tossed crossing, he fetched up close to Cape Fear, North Carolina in early March. Verrazano initially coasted south along the eastern coast of present day South Carolina for approximately 100 miles, but then turned north to avoid the Spanish who had dominant control over the Caribbean (as well as Floridian) waters. After some brief reconnaissance along the coast, he continued on his voyage north and eventually returned to France in July. Being a competent seaman and navigator, Verrazano was able to conclude that he did not reach China, but a New World (Morison 1971:314). The French, however, did not follow up on Verrazano's discovery of these lands.

Hernando de Soto explored the southeastern coast starting from north of Florida to the Mississippi River. Part of de Soto's itinerary took him through the sand hills and piedmont region of South Carolina. His travels aided in reinforcing the Spanish claim to the lands north of Florida. In 1559, King Philip II of Spain ordered a settlement be placed at Punta Santa Elena in Port Royal Sound, the best natural harbor in the Southeast (just south of St. Helena Sound and the Project Area). This settlement was to act as a buffer to other encroaching European powers. The settlement was a failure however, as a hurricane destroyed three of the four vessels and 26 of the ~100 men involved in the expedition died (Edgar 1998:22-26).

During 1562, the French sent two more vessels to explore along the Carolina coast. Jean Ribaut took possession of the area in the name of the King of France Charles IX. The original settlement at Port Royal did not survive long, as there was internal dissention and the post was abandoned. The French were not to be discouraged and two years later a second attempt, under Rene de Laudonniere, established a settlement at Fort Caroline, on the St. Johns River in Florida (Coker 1987:3).

The French settlement in Florida was a danger to the Spanish homeward fleets carrying New World wealth to Spain. King Philip II of Spain dispatched Menendez de Aviles to eradicate the problem in 1565. Fort Caroline was taken by a land assault and, after a promise of fair treatment; the defenders were all put to death. The French avenged the treachery three years later when the fort was retaken and all Spanish prisoners were murdered (Morison 1971:470). The Spanish, in an attempt to maintain sovereignty over the region, resettled at Port Royal in 1566. When Francis Drake captured and burned St. Augustine in 1586, the post was abandoned.

Being on the edge of Empire, South Carolina took on a frontier characteristic. The English, late into the colonization lottery, established some New World colonies and concentrated north of Virginia. There were attempts to settle the area between Virginia and Spanish-controlled Florida, but all failed until the 1660s. On March 24, 1663, King Charles II of England granted a charter to eight men to be the "absolute lords and proprietors" of a colony between Virginia and Spanish Florida (Edgar 1998:39). The same year Captain William Hilton, for which Hilton Head Island is named, along with Robert Sanford would explore the Port Royal Sound and identify the area as suitable for a settlement. Prompted by the discoveries, a settlement was begun on the Ashley River on a bluff called Albemarle Point.

The same year, with the aid of the local Indians, the English established their first permanent South Carolina settlement at Charles Towne in 1670. A decade later it was reported that there were between 1,000 and 1,200 residents in town (Coker 1987:8). As Charleston became an English commercial center, advantageously situated just off the Gulf Stream, it attracted a various number of entrepreneurs. Close proximity to the Spanish and French positions in the Caribbean encouraged trade, both legal and illegal. During the early Colonial period, piracy was an activity that was tolerated, if not encouraged; if the intended targets were of the mother country's adversary and there was an advantage to be gained (Ritchie 1986:11-26). Throughout the years, men such as Drake and Morgan were lionized by the English for their activities against the Spanish. In America, New York, Boston, Newport, and Charleston were havens for many pirates (Cordingly 1995:15). Coker (1987:10) states, at Charleston, "The authorities of the fledgling colony were in no position to challenge them. In fact, they may have encouraged these outlaws of the sea, since their booty was scattered around generously." At first, these coastal ports took advantage of the "wealth" created by these individuals. Nevertheless, as frontier status moved inland and coastal ports expanded as economic and cultural centers, attitudes changed. By the end of the seventeenth century, views towards piracy began to change.

English pressure continued to increase on the northern Spanish border as the seventeenth century progressed. In 1680, an attack on the town of Santa Catalina was repelled, but the inhabitants were ordered to pull back to the south, out of attack range. This move may have protected Spanish settlements from English attack, but the Spanish departure also encouraged the Yamasee to revolt under the leadership of Chief Altamaha in 1683. This revolt resulted in a Spanish order to withdraw from the Guale area entirely and into the Spanish territory of Florida. With the Spanish out of Guale and the English coming in from the north out of Charles Towne, some Yamasee moved into central Georgia, while others moved into the interior of South Carolina and Florida (McKivergan and Fryman 1996:70; Coleman 1991:13).

In 1702, European politics spilled over into the colonies when Queen Anne's War (The War of Spanish Succession) erupted in 1702. This war had a devastating effect on Spanish colonial holdings in America. In this war, the Governor of Carolina, James Moore, swept through Guale and into Florida. When the war ended in 1713, most Spanish missions in Georgia and Florida were completely destroyed, as was St. Augustine. Only the fortress at St. Augustine escaped destruction by Moore's force.

Immediately following Queen Anne's War, the Yamasee rebelled against what they felt were unfair trading practices by British traders, despite having, just two years earlier in 1711, fought on the side of the British in the Tuscarora War. This revolt, known as the Yamasee War, was characterized by repeated attacks on English frontier outposts and settlements. Over 400 colonists and an unknown number of Yamasee were killed (Braley et al. 1985:4). Much of this was played out near the Project Area when, after several massacres in Colleton County and across the Edisto River, Governor Craven on Good Friday 1715 dispatched the militia which defeated a band of eight to ten Indian canoes at the southern tip of Daufuskie Island. After the defeat of the Yamasee, the General Assembly of South Carolina opened Indian lands for settlement. With the establishment of Georgia in the 1730s as a defensive buffer between Spanish Florida and English planters in Charles Towne, the Yamasee were permanently relocated with the Spanish in Florida, who then moved some of them to Cuba and Veracruz, Mexico, as slaves, with the exception of a few scattered remnants of the Yamacraw. This signaled the removal of the last significant numbers of native people from the coastal South Carolina area (Divine et al. 1995:58-60; McKivergan and Fryman 1996:70-71).

During this period, the town of Beaufort was founded based on its position to offer commerce in naval stores. With the establishment of the town, and the final 1728 raid against the Yamasee, St. Augustine signaled the beginning of settlement of the coastal lowlands and allowed the emergence of rice cultivation, which would form one of the mainstays for the area's maritime commerce along with Sea Island cotton and naval stores. Free labor was not an option at this time, as it seems that it took the terror of the slave system to compel men and women to accomplish the herculean tasks involved in rice production. The crop had managed to sink its roots into South Carolina, and by the dawn of the eighteenth century, it was well established. In less than 25 years, it would become one of the most important commodities produced in South Carolina. At first, rice had been planted in an upland setting on marshy soil, but in the first half of the eighteenth century, an irrigation method was developed that utilized the swamps so common in the area. Everything about the production of rice was labor intensive and this labor was conducted with nothing more than hand tools; from clearing swamps, planting, and cultivating, to threshing and polishing the rice. Every step involved backbreaking work (Clifton 1978).

In the upland setting, rice could be grown on a small-scale, but its production was not dependable. In the early 1750s, a new technique was developed that utilized the coastal tidal flow to move freshwater in and out of the cultivated rice fields (Clifton 1978). This technique would eventually supplant the upland method, but on the eastern coast it was only a viable option along the river systems south of Cape Fear to the Georgia coast and within 10 to 20 miles above saltwater. To make the land ready for this type of cultivation, a monumental amount of work was required. Generally, as one gang of slaves worked on clearing the area of trees and stumps, another built a large dyke around the area to be cultivated. Inside this enclosed area a smaller series of levees were built to encompass rice fields, usually about 20 acres in size. Canals and ditches were dug with trunk culverts serving as floodgates to control the water flow. Leaving an indelible mark in the maritime economies of the region, the outline of the rice plantation fields can still be seen along the banks of the South Edisto River on Jehossee and Sampson Islands.

By the eighteenth century, piracy became a liability as a national strategy and for colonial commerce as best exampled by the fate of Captain Kidd. Originally under charter with establishment patronage, Kidd was later hung as a pirate in 1701 (Ritchie 1986). Cities that once welcomed pirate loot were soon targets of their predications. The early eighteenth century saw this shift in tactics, and Charleston (formerly Charles Town) was a perfect example of the phenomena. In August 1717, a pirate known as Stede Bonnet plundered a brigantine outside Charleston Harbor (Coker 1987:20). In late 1718, Captain Vane took eight vessels off the coast of South Carolina (Cordingly 1995:111). During the same year, the famous pirate Blackbeard (Edward Teach) plundered many vessels, disturbing much trade. Blackbeard then disbanded his pirate fleet off the coast (Coker 1987:18; Cordingly 1995:136). Other pirates left their mark on Charleston during the first decades of the eighteenth century as well. The colony of South

Carolina soon looked to England and other colonies for help in ridding her waters of the sea marauders.

British initiative to stop piracy took an active role at the beginning of the eighteenth century as a new form of national policy. The penalty for piracy was death, usually hanging. Charleston saw one of the largest executions of pirates in 1717 with the demise of Captain Stede Bonnet, when he and 29 of his men were hanged (Cordingly 1995:245). By 1720, Royal navy vessels patrolled off the coast of South Carolina to keep both the marauders and the Spanish away from the colony. In 1724, George Anson was stationed at Charleston as a permanent feature of English protection. When he left his station in 1730, the colony was in a much more tranquil state (Coker 1987:29-34). However, in 1741, Spanish privateers operated in South Carolina waters and one was often seen operating in the waters of St. Helena Sound. In March 1742, one anchored in the Edisto Inlet for several days culminating in a running gun battle in the Sound between the privateer and the *Elizabeth*, a brigantine out of New York, with the brigantine escaping capture (Rowland 1996:149).

The English soon established Savannah, Georgia on the banks of the Savannah River in 1733, between South Carolina and Spanish Florida. This colony acted as a buffer to Charleston and aided in the growth and relative security of South Carolina. The final Spanish land advance north was stopped in 1742 at the Battle of Bloody Marsh on St. Simons Island, Georgia (Ginn 1987). The Treaty of Paris (1763) settled the matter, as the Spanish relinquished all claim to lands north of the St. Mary's River. With a population expanding into the interior, the production of agricultural goods for export trade began to flourish. Timber, naval stores, rice, indigo, and eventually cotton were the main agricultural products exported from coastal, and later, the interior of South Carolina.

Trade was to be the economic driving force of the colony. Situated at an important juncture along traditional sailing routes, Charleston prospered by this proximity. Vessels sailing from the Caribbean to points north and Europe could easily stop over to fill their vessels with local products. Charleston, one of only two major ports in the Southeast (the second being Savannah), extended its trade influence into Georgia and North Carolina. Just prior to the Revolution, the port cleared approximately 450 vessels and had total annual imports and exports to Great Britain of some 800,000 pounds (Labaree 1999:101-103).

Charleston also controlled the slave trade of the southern colonies. The Carolina low country produced rice and indigo, with cotton soon becoming the major cash crop. Such large tracts of land required a large work force generally made up of African slaves; hence, the slave population expanded greatly. Early in the history of the province, it was feared that the African population was becoming numerically superior. By 1703, there were actually a few more blacks in South Carolina than whites. Twenty years later, blacks outnumbered whites 2 to 1, a ratio which would continue to the Revolution (Edgar 1998:69). The reason for this was the slave trade and economic dependence on labor-intensive agriculture. "Between 1700 and 1775, 40 percent of the Africans imported into North America came through Charleston" (Edgar 1998:67).

During the American Revolution, the Carolina backcountry was a bit of an anomaly. Railing against their defacto disenfranchisement by coastal areas and more inclined to self-rule, parts of the backcounty supported the British. At first, the British counted on the support of the large Germanic community in support of England's German King George III. However, the conflict became a local hell with Tory/British supporters and Whig/Republicans committing numerous acts of cruelty upon each other in the region, disrupting settlements and agriculture (Savage 1956:207, 214-218). However, the shippers and planters along the coast were firmly in the camp of the republican cause.

While the Revolution was disastrous for Charleston, it also left its mark on the local area. Port Royal to the south saw a British invasion with Fort Lyttleton the focal point, although the invaders were beaten back. Beaufort would be taken, but would be recaptured by 1872. With the signing of the Treaty of Paris, hostilities would end, but the markets in the West Indies once open to maritime trade would be lost, subsequently inflicting an economic downturn for the area.

However, the development by Eli Whitney of the cotton gin in 1793 would bring about radical economic changes to the local landscape. With this one machine, the entire southern region would become locked into an agricultural economy based on cotton. In 1791, South Carolina raised about 1,500,000 pounds of cotton and by 1834, approximately 65,500,000 pounds were produced, an almost 4,400 % increase (Wallace 1951:364).

Virtually all of the rice and cotton from plantations along the South Carolina and Georgia coasts, as well as exported produce from the farms and landings, were handled by the coastal trade (Haunton 1968:2; Pearson 1991:488). Pearson, in a study of a Georgia coasting captain, states that:

> …the factors and commission merchants of Savannah were indispensable in the agricultural economy of the region and were the key figures in marketing crops. They acted as combination merchant, buyer, and banker for the planters, providing an outlet for plantation produce, a source of credit, which was a necessity in a staple crop agricultural economy, and a store for many of the finished and luxury goods plantation owners and their families required. The coastal ship captain was the tie connecting the planter and factor. His vessels carried the casks of rice and bags of cotton from the plantation landings to the factorage houses in Savannah and returned with building materials, machinery, farming implements, domestic goods, foodstuffs and other commodities. The commerce of the region was dependent upon this coastal fleet [Pearson 1991:488].

Most of the vessels in the coastal trade sailed between Savannah or Charleston and smaller towns and plantations along the South Carolina and Georgia coast. Their cargoes were brought to the two cities and transshipped on larger sailing vessels to the North, Europe, and throughout the Caribbean (Pearson 1991:492). Rice and cotton were the major agricultural items shipped by coastal vessels:

> "Most shipments of rice occurred between October and March, although it was not uncommon for them to continue into Savannah as late as May or June … The cotton harvest corresponded closely to that of rice, beginning in September or October … (with) the bulk of the cotton … shipped between January and April peaking a couple of months after the rice shipments" (Pearson 1991:493-496). Pearson continues that, "in addition to cotton and rice, the coasting vessels carried lesser quantities of other commodities from the coastal area: wood, resin, turpentine, hides, lime, molasses, moss, syrup, potatoes, and corn" [Pearson 1991:496].

Vessels involved in the coastal trade were primarily small sloops and schooners, generally under 100 tons burden, and most of these coastal vessels were built in small shipyards of the mid-Atlantic and Northeast coasts. The fact that vessels were built elsewhere for the area's coastal trade was a reflection of the small shipbuilding industry in the Southeast (Pearson 1991:491-492).

The Civil War was disastrous for the State of South Carolina. Port after port fell to the relentless Union attack. Port Royal, in South Carolina, was one of the first to fall; by mid-November 1861, it was in federal hands. Beaufort and Port Royal would become the South Atlantic Blockade Squadron headquarters with its naval vessels blockading the ports of Savannah and Charleston.

The economic impact of the war had a dramatic effect on the local economy and way of life including maritime trade. For many parts of the South, Reconstruction meant adjusting to an entirely new way of life, both economically and socially; however, old land-use patterns established prior to the Civil War persisted. The number of small family farms continued to grow, in part due to the establishment of farms by many freed African Americans. The timber/naval-stores industry expanded as well, though its real heyday would not arrive until the 1880s, at which time the industry drove the economy and fueled expansion and development throughout the area. The term "naval stores" refers to products produced from the resin of pine trees. Naval-store products had many uses and were a necessary part of waterproofing wooden ships. Naval-store products included resin (the raw pine gum), tar, pitch, rosin, and turpentine (Butler 1998:12). The turpentine industry is often overlooked in historical archaeology in the South, yet it was one of the most economically significant modes of commerce, a majority of the product being shipped down local rivers to the ports of Savannah and Charleston for transshipment.

Always a relatively unpopulated area, Edisto Island as with many of the lowcountry's barrier islands, began to attract tourists in the early twentieth century. Mostly forgotten during World War II, the island's real estate development began to increase. However, the island still boasts a very small population, with vacation homes fronting the beach opposite the Project Area.

2.3.1 Previous Investigations, Site File, Shipwreck Inventory, Automated Wreck and Obstruction Information System, and Cartographic Reviews

2.3.1.1 Previous Investigations

One of the best tools for accurately assessing the potential for unknown submerged cultural resources is to compare the Project Area with findings and results of previous investigations, including both remote sensing and cultural resource surveys that have been completed in or near the current Project Area. Varying in degree of applicability to Panamerican's research, these studies allow us to identify potentially significant resources. The studies also help in the recognition of specific problems or aspects that are inherent in the assessment of survey data and in the identification of potential resources.

While numerous submerged cultural resource surveys (in the form of historic research and remote sensing, as well as diving investigations) have been undertaken over the past recent years in South Carolina's inland and offshore waters (i.e., Hall 2005, 2007; Watts 1998, 2005; etc.), only a few have been conducted in the general vicinity of the current Project Area. None have included any aspect of prospecting for or identifying submerged prehistoric sites.

The archaeological investigation that perhaps has the most relevancy and proximity to the current project involved a remote sensing survey of a sand borrow area offshore Hunting Island in Beaufort County. Conducted by Tidewater Atlantic Research in 2005, the project area was just offshore the southern end of Hunting Island, which forms the southern side of St. Helena Sound, to the south of the current survey area. The report concluded that two magnetic anomalies had signal characteristics compatible with shipwrecks or shipwreck debris and were recommended for avoidance (Watts 2005). It should be mentioned that a subbottom profiler system was not employed and presence or absence of submerged prehistoric sites was not considered.

In addition to these findings, the report provides an excellent shipwreck inventory for the area that has been modified for the Edisto area and is presented below (Table 3). In the report's review of previous investigations for the area, a shipwreck site, 38BU157, is identified onshore on (Reynolds) Hunting Island. Identified as vessel remains suggestive of a well smack, a type of fishing vessel introduced in the 1830s-1840s, its location compares favorably with a wreck notation on an 1857 chart, and is a candidate for the schooner *Tybee* listed in the shipwreck inventory below (see Table 3 and Figures 10 and 11).

Table 3. Inventory Of Known Shipwrecks in the Project Area Vicinity.*

Name	Type	Lost	Cause	Location
Unknown		1554	Wrecked	Near St. Helena
Unknown	French Ship	1578	Wrecked	Near Hilton Head or Bay Point
Unknown	Boat	19 Jan. 1739	Wrecked	North Breaker's off St. Helena Sound
Unknown	Schooner	23 Apr. 1744	Lost	St. Helena Sound
Dundee	Ship	5 Sep. 1745	Ashore	Off Edisto
Wanton	Sloop	28 Feb. 1747	Lost	St. Helena
Unknown	Schooner	13 Jul. 1748	Lost	Near St. Helena
Unknown	Brigantine	1751	Ashore	Edisto Island
Unknown	Snow	30 Sep. 1752	Beat to pieces	Near Inlet at St. Helena
Unknown	Schooner	29 Dec. 1753	Ashore	St. Helena
Unknown	Brigantine or Snow	29 Dec. 1753	Ashore	St. Helena
King of Prussia	Schooner	3 Sep. 1762	Ashore	South Edisto breakers
Pedee	Schooner	3 Sep. 1762	Ashore, possibly got off	South Edisto breakers
Mary	Schooner	24 Dec. 1762	Captured and sunk	Off South Edisto
Unknown	Brigantine	30 Mar. 1763	Ashore	St. Helena breakers
Unknown	Sloop	18 Oct. 1768	Believed lost	Off South Edisto
Patsey	Sloop	13 Feb. 1770	Beat to pieces	On the "Bird Cage," a shoal near St. Helena
Robert and Elizabeth	Brig or Brigantine	5 May 1772	Ashore	Near South Edisto
Unknown	British Sloop	28 Jul. 1779	Aground and burned	Hunting Islands
Dispatch (Despatch)	Brigantine	16 Aug. 1781	Ashore	St. Helena Sound
Anna	Sloop	26 Jun. 1804	Lost	Off South Edisto
Guilielmi	Schooner	7 Sep. 1804	Ashore "High & Dry"	On St. Helena
Unknown	Schooner	7/8 Sep. 1804	Ashore "High & Dry"	On St. Helena Island
Unknown	Schooner	14 Sep. 1810	Ashore	About 1 league north of South Edisto Bar
Munroe	Schooner	17 Sep. 1810	Ashore	Edding's Bay near South Edisto Inlet
Unknown	Sloop	Aug. 1814	Captured and burned	St. Helena Sound
William	Schooner	9 Nov. 1814	Captured and burned	South Edisto
Nancy	Sloop	10 Nov. 1814	Captured and burned	St. Helena Sound
Hornet	Pilot Boat	1 Jul. 1820	Bilged and broke up	Bird Key Bank, South Edisto River
Anna Maria	Pilot Boat	Feb. 1823	Cut adrift	11 fathoms of water off St. Helena
Tybee	Schooner	16 Nov,1851	Ashore	North end of Hunting Islands
Unknown	Brig	9 Apr. 1862	Ashore	Edisto Island
Kingfisher	Bark	28 Mar. 1864	Wrecked	Combahee Bank, south end of Otter Island, St. Helena Sound
#3	Steam Launch	8 Jun. 1865	Wrecked	St. Helena Shoals
Unknown	Boat	25 Dec. 1865	Sank	Near Edisto Island
Pet		30 Apr. 1909	Sank	St. Helena Sound

*Shipwreck data from Watts 2005.

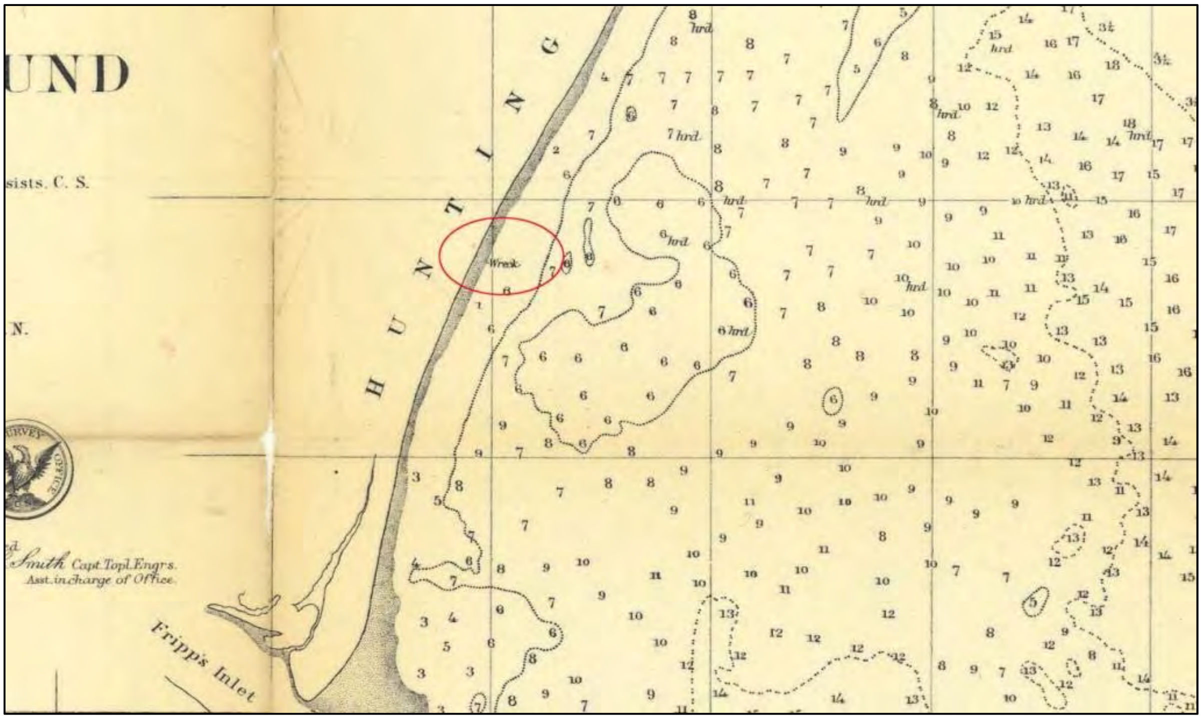


Figure 10. Excerpt from the 1857 Coastal Survey Chart "St. Helena Sound" showing single wreck notation on shore at the southern end of Hunting Island across the sound from the Project Area (Courtesy of National Oceanic and Atmospheric Administration's Office of Coast Survey's Historical Map and Chart Collection).

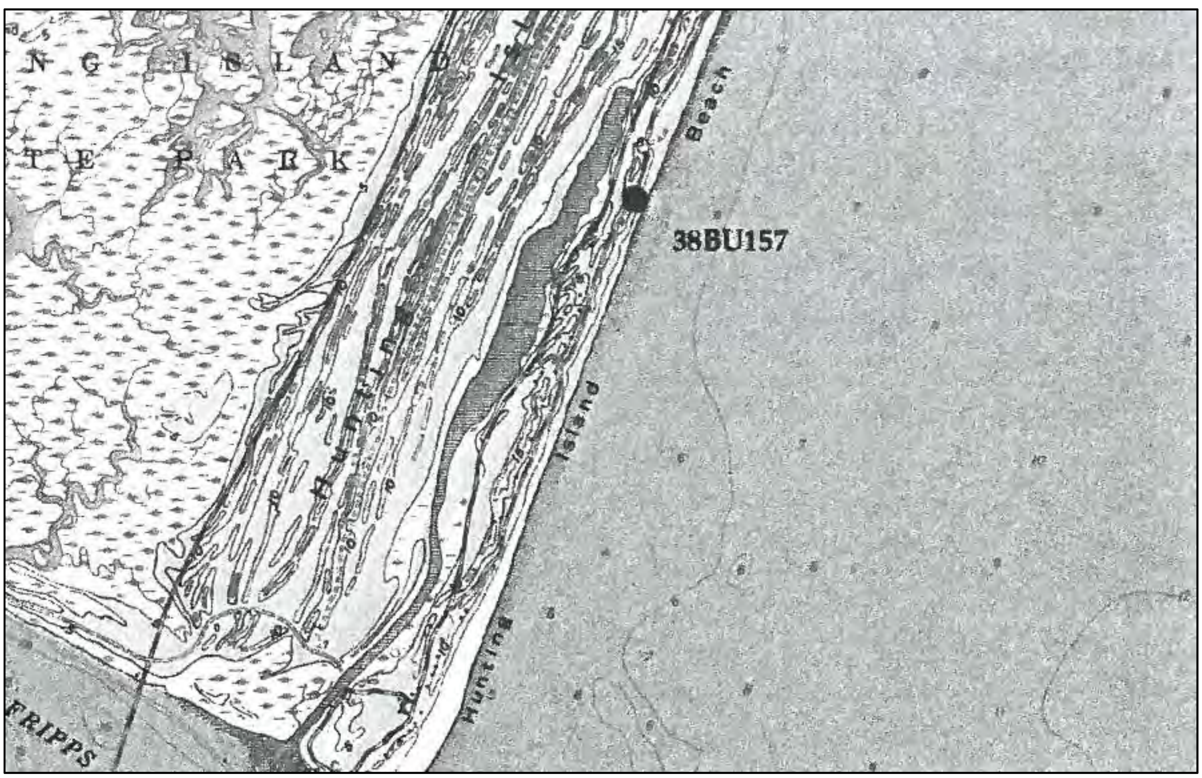


Figure 11. Location of Site 38BU157, vessel remains suggestive of a well smack, a type of fishing vessel introduced in the 1830s-1840s (as presented in Watts 2005:17). Compare the site's location with the wreck noted in Figure 10 above.

Another archaeological investigation that has relevancy to the current project involved a multi-year study by the Maritime Research Division with South Carolina Institute of Archaeology and Anthropology (SCIAA) that included remote sensing surveys of a limited number of naval shipwreck sites and activity areas primarily from the Civil War. One of the included areas was Port Royal, the next sound south of St. Helena Sound. The study surveyed several areas within and outside the Sound as well as several tidal creeks. The survey identified numerous wrecks including the Union gunboat, USS *Dai Ching* and the USS *Boston* (Spirek and Amer ed. 2004).

2.3.1.2 Site File Review

In order to ascertain the presence of previously recorded submerged archaeological sites and investigations in or adjacent to the Project Area, South Carolina's Archaeological Site File was reviewed. Obtained through ArchSite, the web-based site registry and GIS was compiled by the SCIAA in collaboration with South Carolina Department of Archives and History (SCDAH). Illustrated in Figure 12, a review of recorded cultural resources sites indicates that no submerged cultural resources in the form of shipwrecks or prehistoric sites have been recorded; only terrestrial, riverine, and maritime interface-type sites exist. None are in or immediately adjacent to the survey area.

In addition to remotely accessing ArchSite, the offices containing the South Carolina State Site File at SCIAA in Columbia were also visited. Discussions were conducted with Mr. Keith Derting, Information Management Division head, and site files were reviewed and copied, as were relevant cultural resources reports. In addition, the office of Mr. James Spirek, State Underwater Archaeologist and head of the Maritime Research Division was visited. Discussions with Mr. Spirek, as well as the site file review, indicate that no submerged cultural resources in the form of shipwrecks or submerged prehistoric sites have been recorded in or near the Project Area.

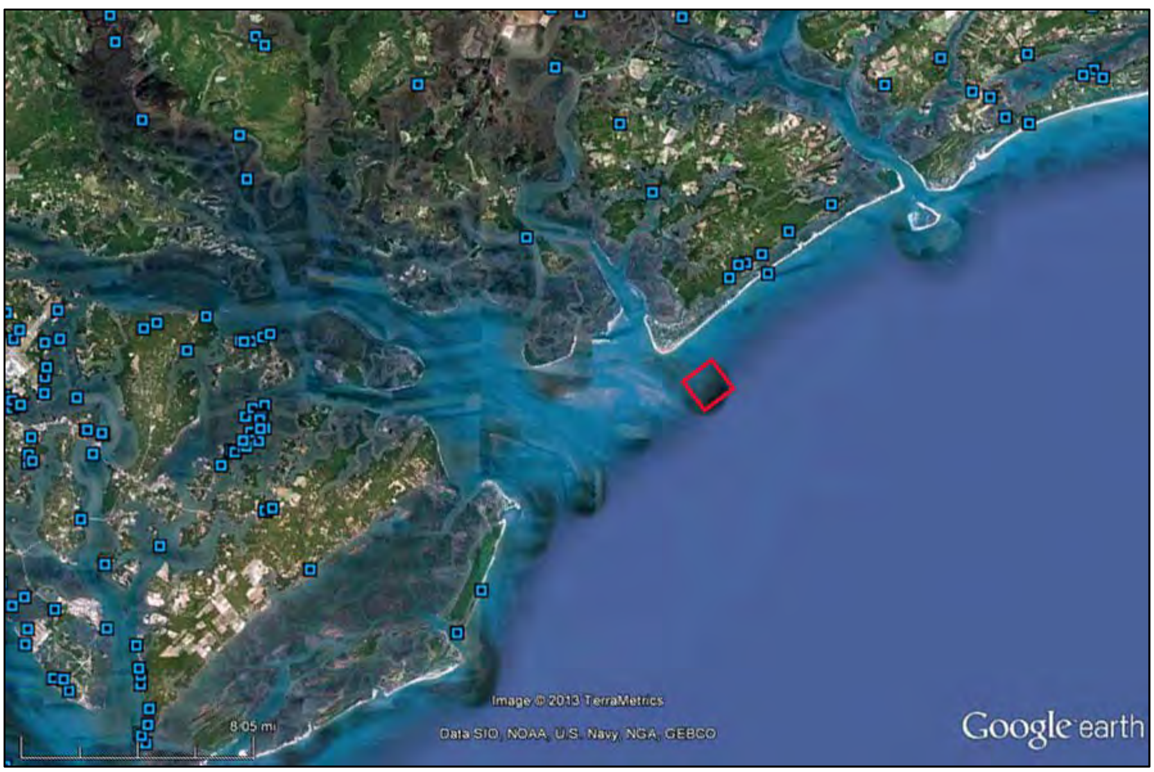


Figure 12. Recorded cultural resources sites with trinomials in relationship to the Project Area (base map courtesy of Google Earth). Note the two sites along the shore of Hunting Island to the south are shipwreck sites mentioned above.

2.3.1.3 Shipwreck Inventory

The South Carolina Site File does not list any historic shipwreck sites within or immediately adjacent to the Project Area. Past submerged cultural resources investigation reports for the region also do not list any shipwrecks within or immediately adjacent to the Project Area. The most comprehensive shipwreck inventory for the area was compiled by Gordon Watts as part of a past survey off Hunting Island south of the Project Area (Watts 2005). Table 3 is an excerpt of his inventory and lists only those wrecks located near or possibly in the current survey area off Edisto Beach. Other wrecks are known in the general vicinity, for instance the USS *Dai Ching*, USS *Boston* (Spirek and Amer eds. 2004), and USS *George Washington*. All Civil War losses, these wreck sites are up estuary rivers inland and well away from the Project Area.

2.3.1.4 Automated Wreck and Obstruction Information System

In addition to the South Carolina State Site Files and previous investigations, the current online edition of the National Oceanic and Atmospheric Administration's (NOAA's) Automated Wreck and Obstruction Information System (AWOIS) list was consulted relative to known wreck sites or obstructions within or near the current survey corridor. The AWOIS database contains information on over 10,000 wreck sites and obstructions/hangs in the coastal waters of the United States (U.S.). Information within the database includes a latitude and longitude of each feature along with any known historic and/or descriptive details. The AWOIS website, which may be accessed at http://www.nauticalcharts.noaa.gov/hsd/AWOIS_download.html, allows researchers to search for wrecks based on Latitude/Longitude coordinates for a given area. An Access Database file, a review of the AWOIS database does not indicate any wrecks or obstructions within a 5-mile radius of the Project Area.

2.3.1.5 Cartographic Review

A review of historic navigation maps and charts for the region is also another excellent tool for identifying shipwrecks within or adjacent to the Project Area. Often noting shipwrecks, obstructions, and other various hazards for the mariner, many of these maps can be accessed from NOAA's Office of Coast Survey's Historical Map and Chart Collection at http://www.historicalcharts.noaa.gov/historicals/search, while others are found in various repositories, publications, or websites. The NOAA website allows the researcher to specify a region of interest and then review all available maps for that area. A valuable utility provided by this site is the virtual magnification feature, which allows the researcher to zoom in and out of specific areas. Note that shipwreck symbols in each of the following maps, if present, are circled in red to more easily indicate their proximity to the Project Area, which is boxed in red.

All St. Helena Sound charts produced by the Coastal Survey, the first is the 1857 version. Illustrated in Figure 13, interestingly a Light Ship and buoys mark the entrance and channel into St. Helena Sound. However, there is no channel noted for the Edisto Beach borrow area Project Area, just numerous "Breakers." No wrecks are noted anywhere near the Project Area. One wreck, which was discussed above, is noted on the southern end of Hunting Island.

Illustrated in Figure 14 on the 1864 chart, the wreck symbol has disappeared from Hunting Island. The Light Ship is also no longer present, marking the Sound Channel just buoys, possibly a result or reflection of the Civil War activities. Navigation directions are present for entering South Edisto River and goes between two sets of breakers, one on each side of a very narrow channel. No wreck symbols are present.

The 1867 chart, illustrated in Figure 15, finds no change from the 1864 chart. By 1878, as illustrated in Figure 16, the South Edisto River entrance channel now has two buoys marking the channel through the breakers.

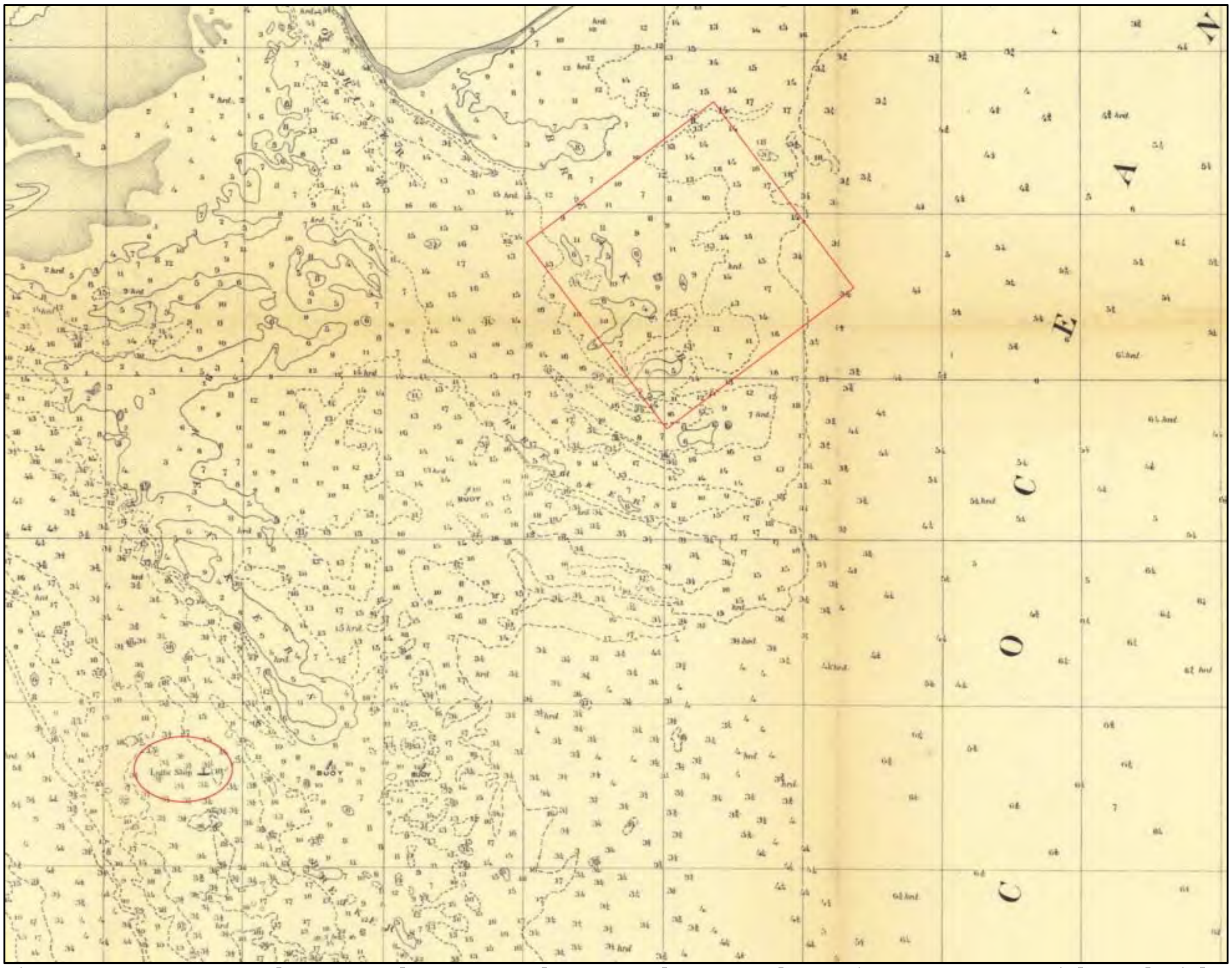


Figure 13. 1857 Coastal Survey Chart "St. Helena Sound." Note the Project Area upper right and Light Ship marking the channel into the sound circled in red at lower left. No buoys or directions are noted for entering South Edisto River, while buoys mark the entrance into the sound channel (courtesy of NOAA's Office of Coast Survey's Historical Map and Chart Collection; Project Area is approximate and not geo-referenced).

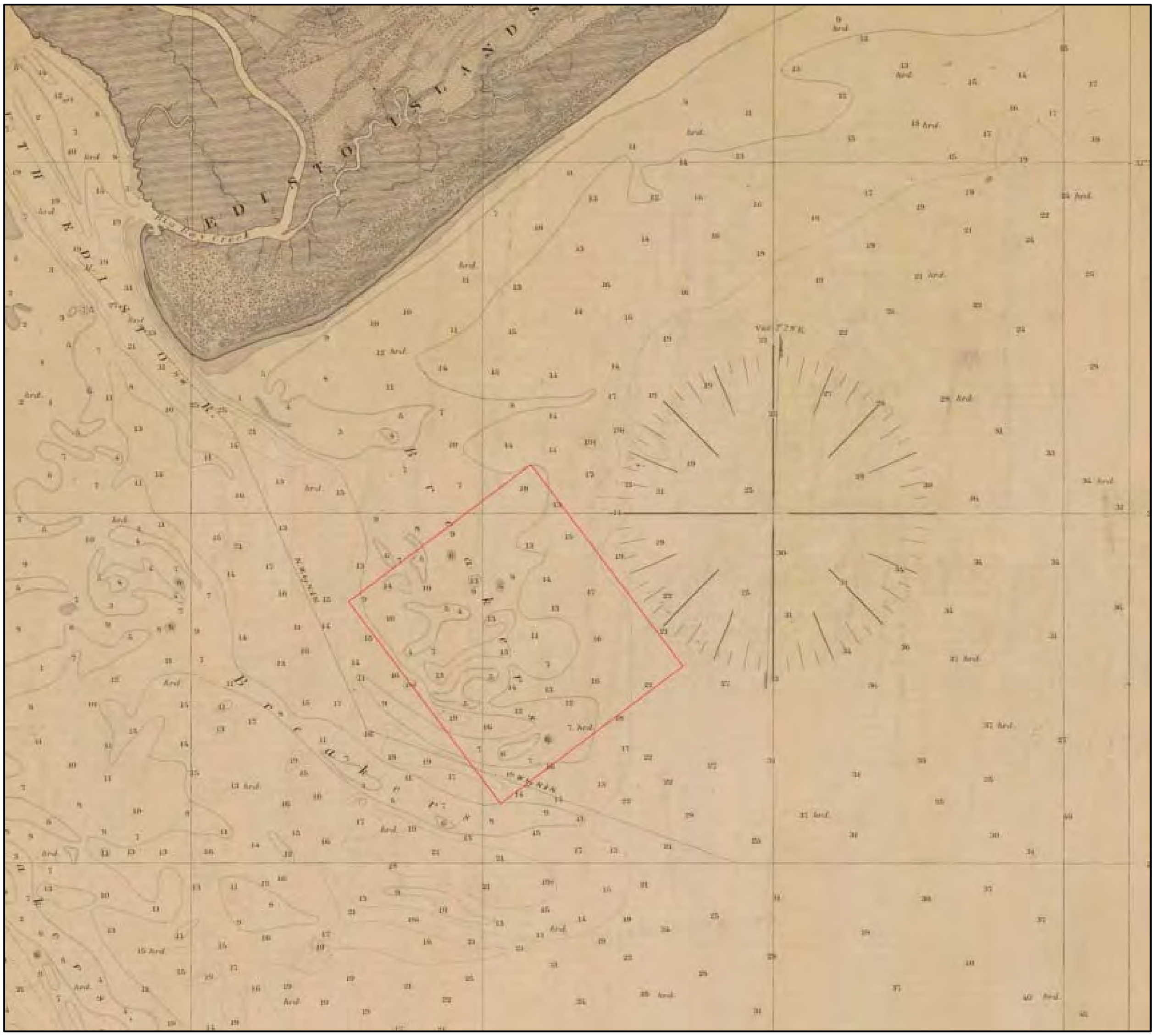


Figure 14. 1864 Coastal Survey Chart "St. Helena Sound." Note that navigation directions are present for entering South Edisto River and goes between two sets of breakers, one on each side of a very narrow channel (courtesy of NOAA's Office of Coast Survey's Historical Map and Chart Collection).

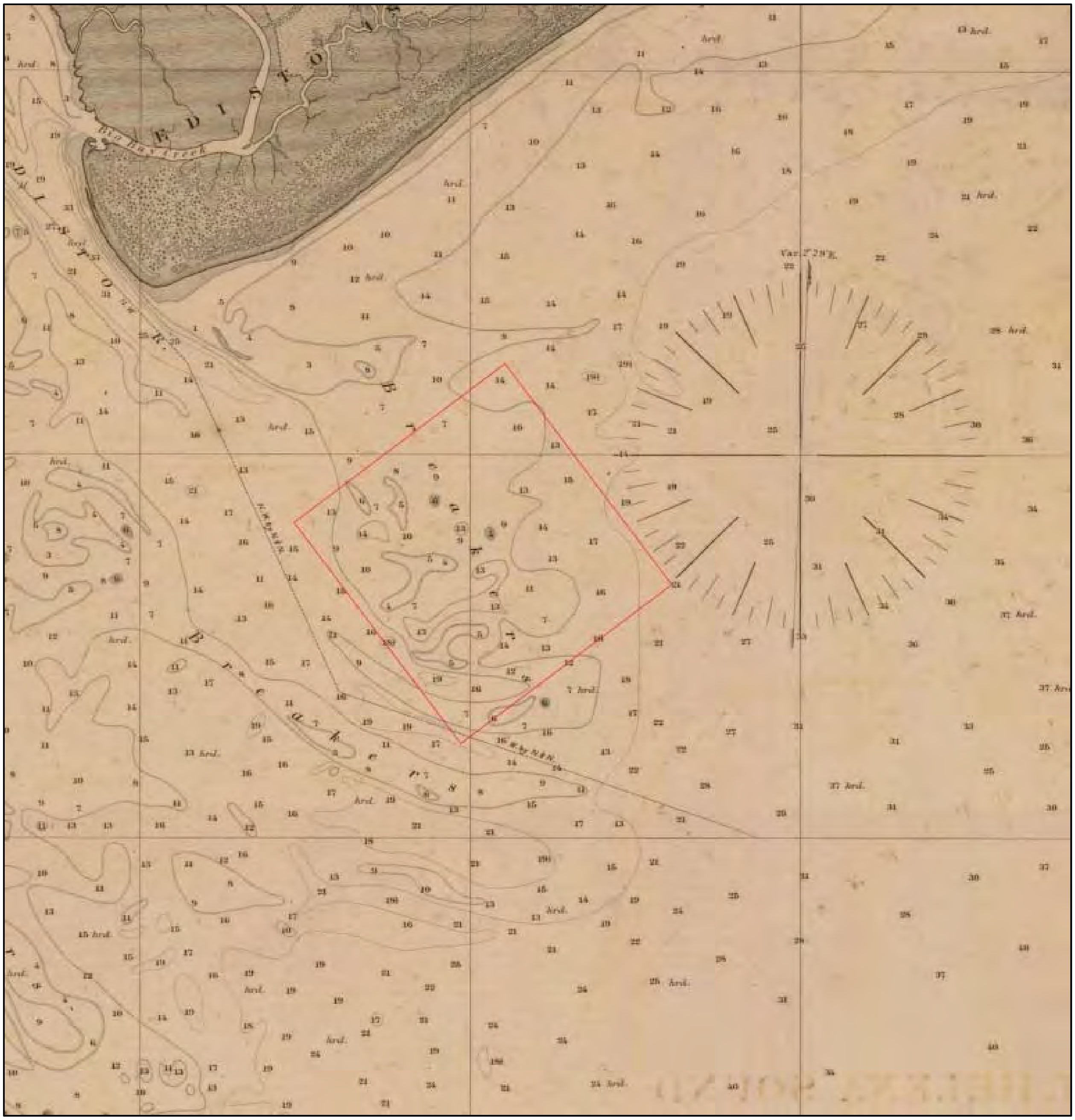


Figure 15. 1867 Coastal Survey Chart "St. Helena Sound" showing no change from the 1864 chart (courtesy of NOAA's Office of Coast Survey's Historical Map and Chart Collection).

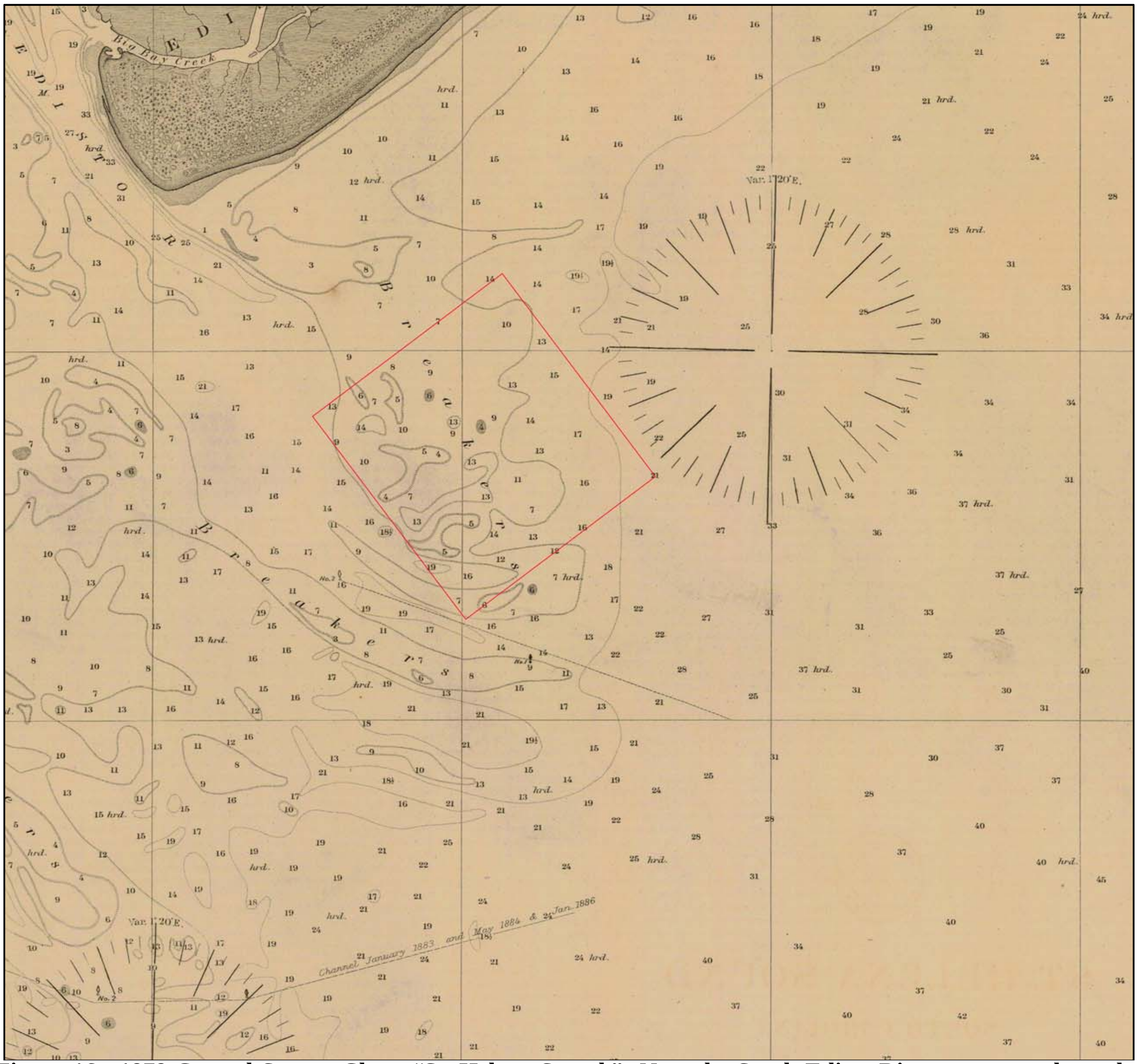


Figure 16. 1878 Coastal Survey Chart "St. Helena Sound." Note the South Edisto River entrance channel now has two buoys marking the channel through the breakers (courtesy of NOAA's Office of Coast Survey's Historical Map and Chart Collection).

By 1897, the South Edisto River entrance channel is well marked by two buoys. A “Sea Whistle” buoy is now in place offshore the entrance channels for the Sound and South Edisto River. No wreck symbols are depicted (Figure 17).

The 1903 chart, illustrated in Figure 18, finds no real changes from the 1897 chart. No wreck symbols are present.

Illustrated on the 1918 chart, the entrance into St. Helena Sound is well marked but has moved further south; the buoys once marking the South Edisto River entrance channel are not present indicating a possible closure of the channel by shifting sands or storm (Figure 19). While no wreck symbols are present, an obstruction, possibly a wreck, is noted at the head of the sound southwest of Otter Island (not pictured).

Similar to the 1918 map, the 1931 chart shows no buoys marking the channel through the breakers. Note that the beach on Edisto Island is labeled McConkie Beach. Bay Point is also labeled (Figure 20).

By 1974, the channel is marked with two channel markers. Some exposed/above high tide shoals are now noted for the area. No wreck symbols are present. Note that maps between 1931 and 1974 were not located (Figure 21).

The 2007 chart indicates the channel is well marked with very little shoaling. Breakers are still labeled on the northern side of the channel. A wreck symbol is present to the southeast of the Project Area and another is located well to the northeast closer to shore. These are not noted in AWOIS (Figure 22).

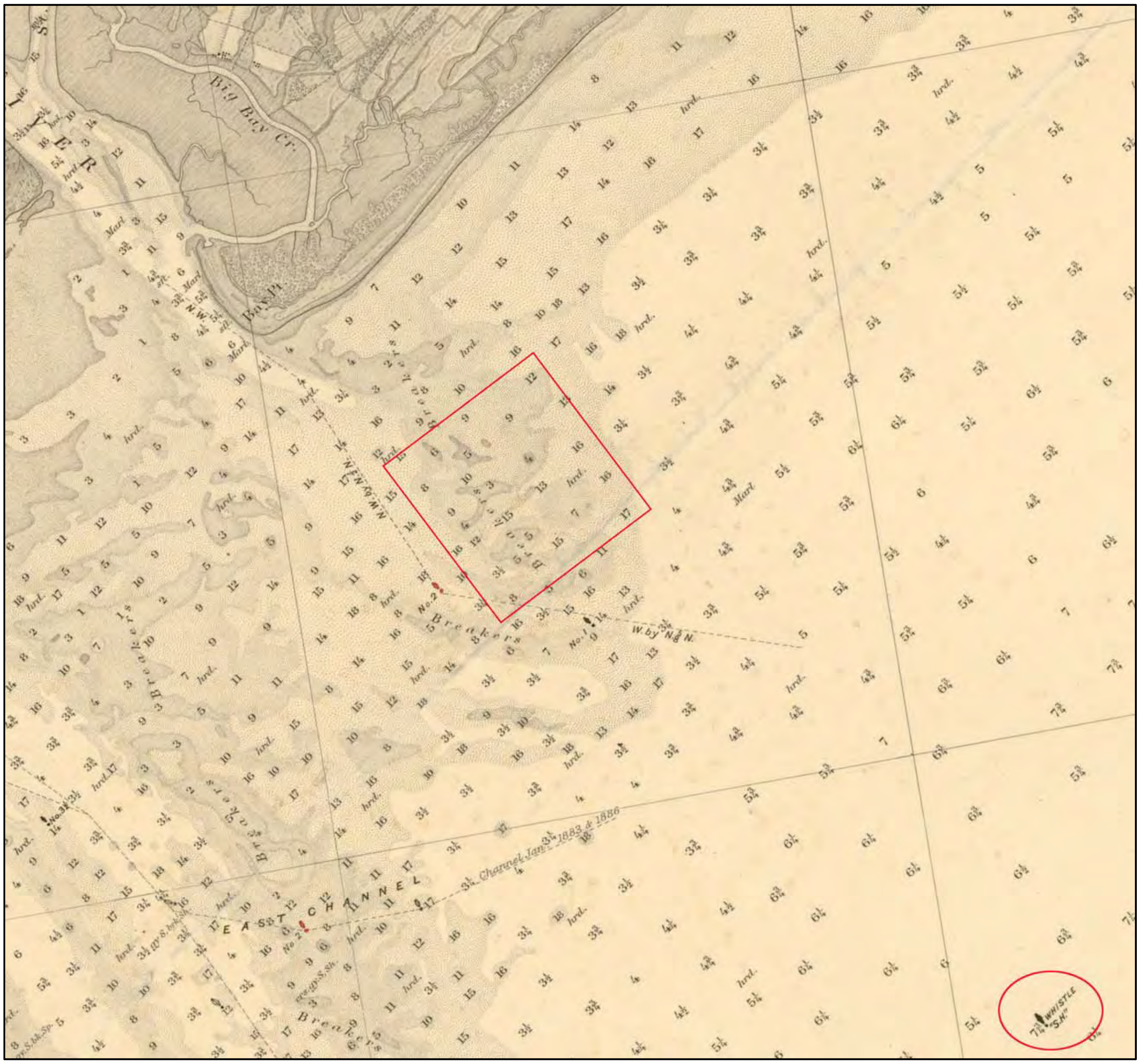


Figure 17. 1897 Coastal Survey Chart "St. Helena Sound." Note the South Edisto River entrance channel is well marked by two buoys. A "Sea Whistle" buoy is now in place offshore the entrance channels for the Sound and South Edisto River (courtesy of NOAA's Office of Coast Survey's Historical Map and Chart Collection).

Figure 18. 1903 Coastal Survey Chart "St. Helena Sound." There are no real changes from the 1897 chart, and no wreck symbols are present (courtesy of NOAA's Office of Coast Survey's Historical Map and Chart Collection).

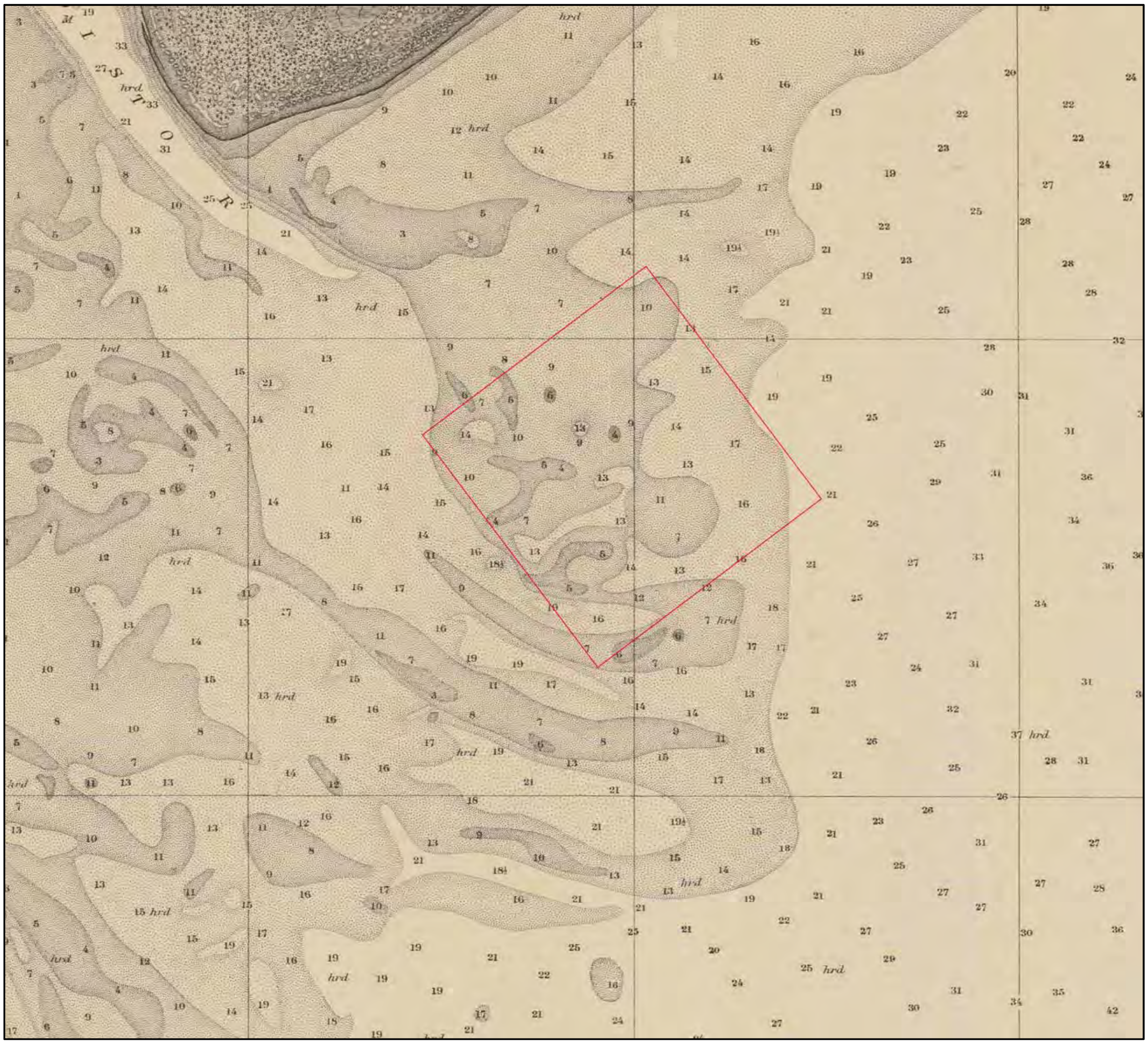


Figure 19. 1918 Coastal Survey Chart "St. Helena Sound." Note the buoys once marking the South Edisto River entrance channel are not present, indicating a possible closure of the channel by shifting sands or storm. (courtesy of NOAA's Office of Coast Survey's Historical Map and Chart Collection).

Figure 20. 1931 Coastal Survey Chart "St. Helena Sound" shows no buoys marking the channel through the breakers. Note that the beach on Edisto Island is labeled McConkie Beach. Bay Point is also labeled (courtesy of NOAA's Office of Coast Survey's Historical Map and Chart Collection).

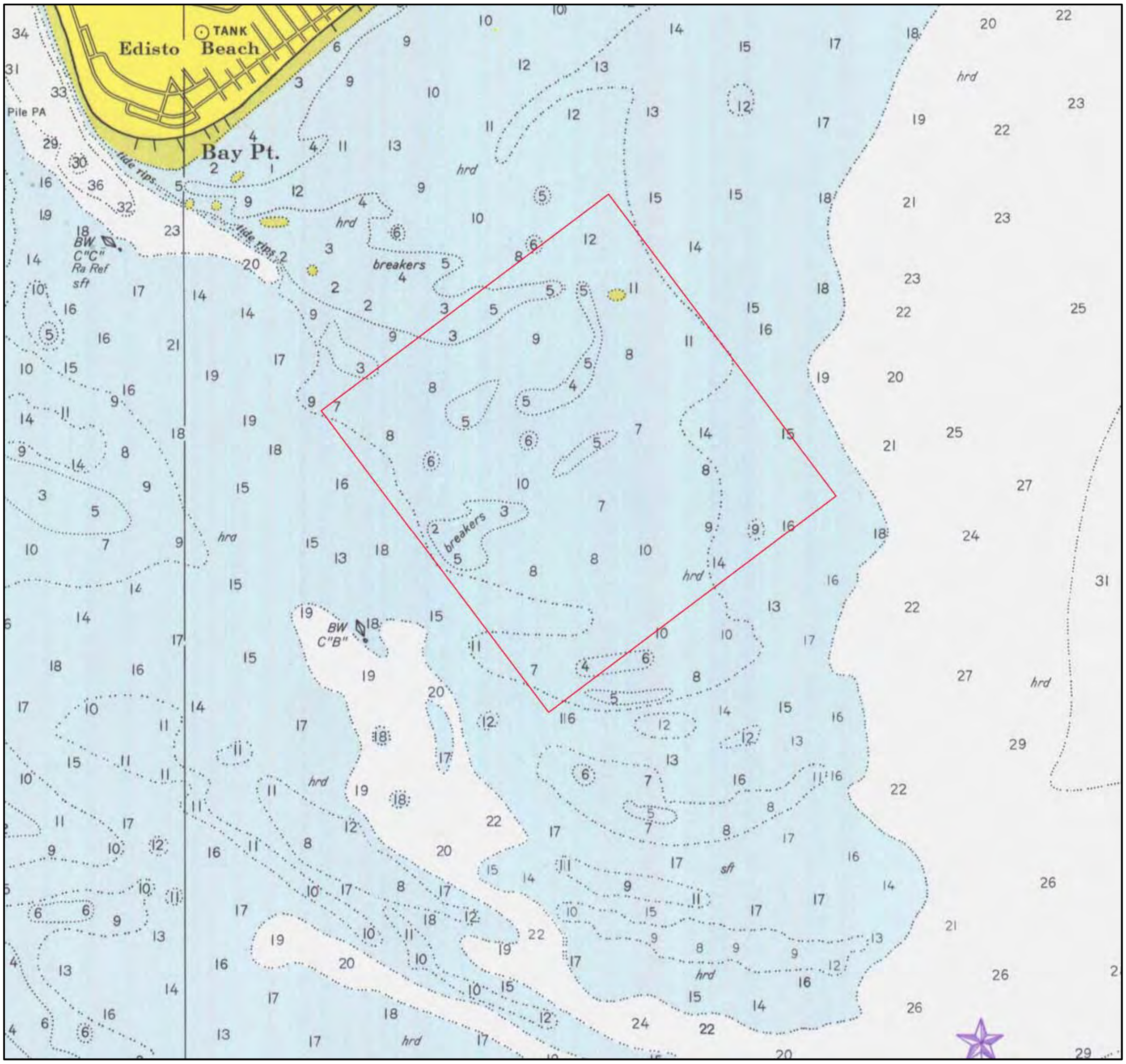


Figure 21. 1974 Coastal Survey Chart "St. Helena Sound" showing the channel is marked with two channel markers. Some exposed/above high tide shoals are now noted for the area. No wreck symbols are present (courtesy of NOAA's Office of Coast Survey's Historical Map and Chart Collection).

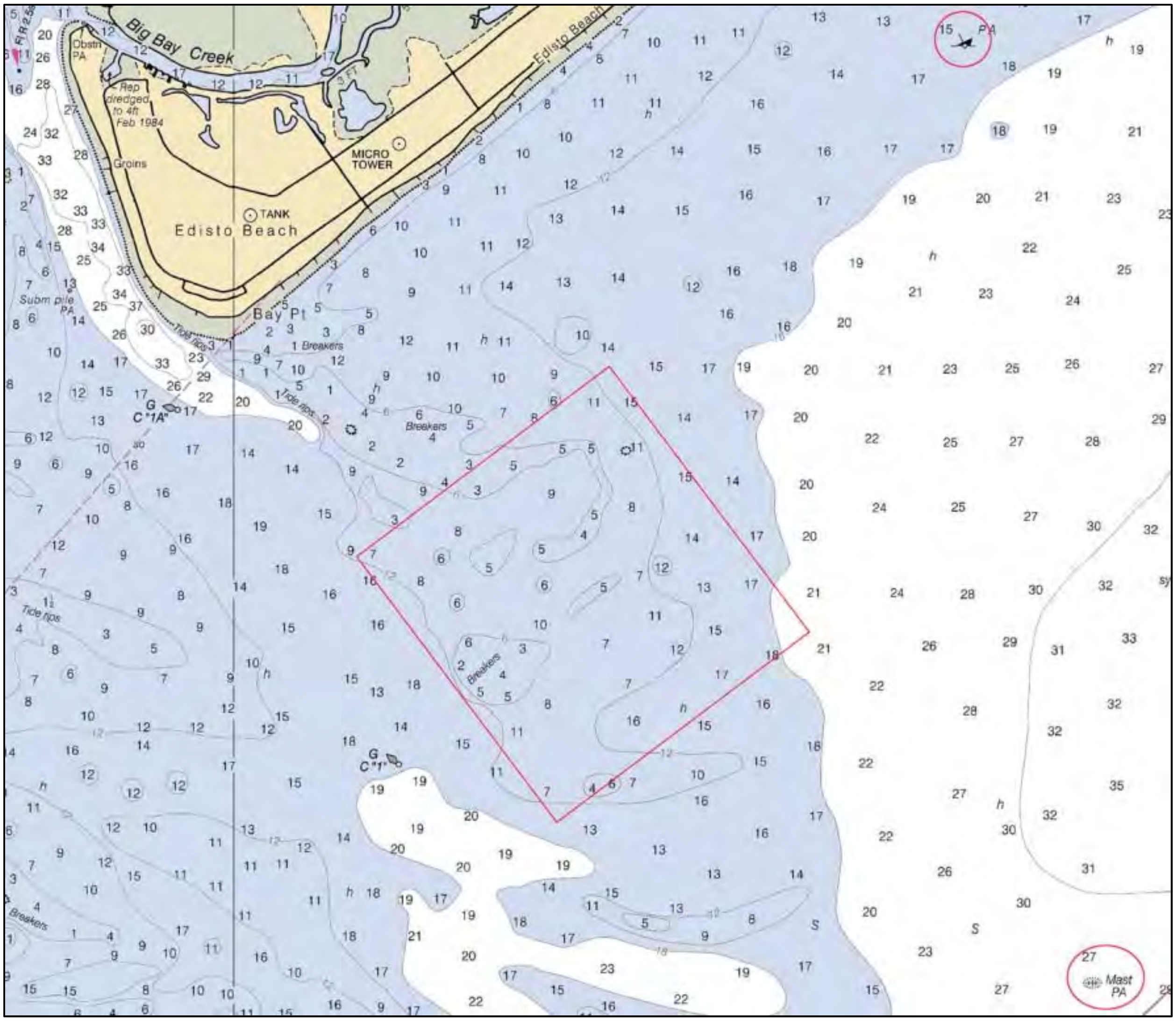


Figure 22. 2007 Coastal Survey Chart "St. Helena Sound." Note the channel is well marked with very little shoaling. Breakers are still labeled on the northern side of the channel. A wreck symbol is present to the southeast of the Project Area and another is located well to the northeast closer to shore. These are not noted in AWOIS (courtesy of NOAA's Office of Coast Survey's Historical Map and Chart Collection).

3.0 METHODS

3.1 Project Area Environment

Figure 23 conveys the environment of the Project Area just offshore Edisto Beach and illustrates the working conditions of the survey area during one of the calm days. Conducted in February, the sea state often changed from good to bad with several weather days being encountered. Because of allowable weather windows during this winter month, the survey was conducted in two periods, February 5 to 7 and then again from February 14 to 20. This latter period saw survey allowable days on February 14, 18, and 20 with the days in between too rough for allowable data.

3.2 Personnel

All personnel involved with the remote sensing survey had more than requisite experience to effectively and safely complete the project as contracted. Dr. Michael Faught (Ph.D., RPA) served as Remote Sensing Specialist along with Mr. Matt Gifford (M.A., ABT) and Mr. James Duff (M.A., ABT) serving as Remote Sensing Technicians; Mr. Robert Hunsaker, who served as the boat captain for survey operations, is also well versed in all remote sensing technologies and equipment. Dr. Faught processed and analyzed the subbottom and sidescan sonar data for cultural resources, Mr. Andrew D.W. Lydecker (M.A., RPA) processed and analyzed the magnetometer data and produced the magnetic contour and GIS maps, and Mr. Mike Rice analyzed sidescan records for hardbottom resources. Mr. Duff conducted archival research in Columbia, South Carolina.

Figure 23. Looking north towards Edisto Beach from the southern end of Project Area. Boom at left holds the subbottom profiler. The smooth sea state shown here is the exception rather than the rough norm encountered during the survey.

3.3 Remote Sensing Survey Equipment

The remote sensing tools chosen for this investigation were the magnetometer (to detect ferrous materials), sidescan sonar (to create images of the bottom), and the subbottom profiler (to reconstruct the structure of the underlying sediment beds). Locational control was conducted with Differential Global Positioning Systems (DGPS) technology. Analysis of the data was conducted with Hypack and SonarWiz.MAP, which are described in detail below.

3.3.1 Differential Global Positioning System

The primary consideration in the search for any submerged item is positioning. Accurate positioning is essential during the running of survey tracklines and it is essential in returning to recorded locations for remote sensing refinement or diver investigations. Positioning was accomplished on the project using two Trimble DSM12/212 Global-based Positioning Systems (GPS) and antennae; one was used for the subbottom; and one split to the navigation/magnetometer computer and to the sidescan (Figure 24).

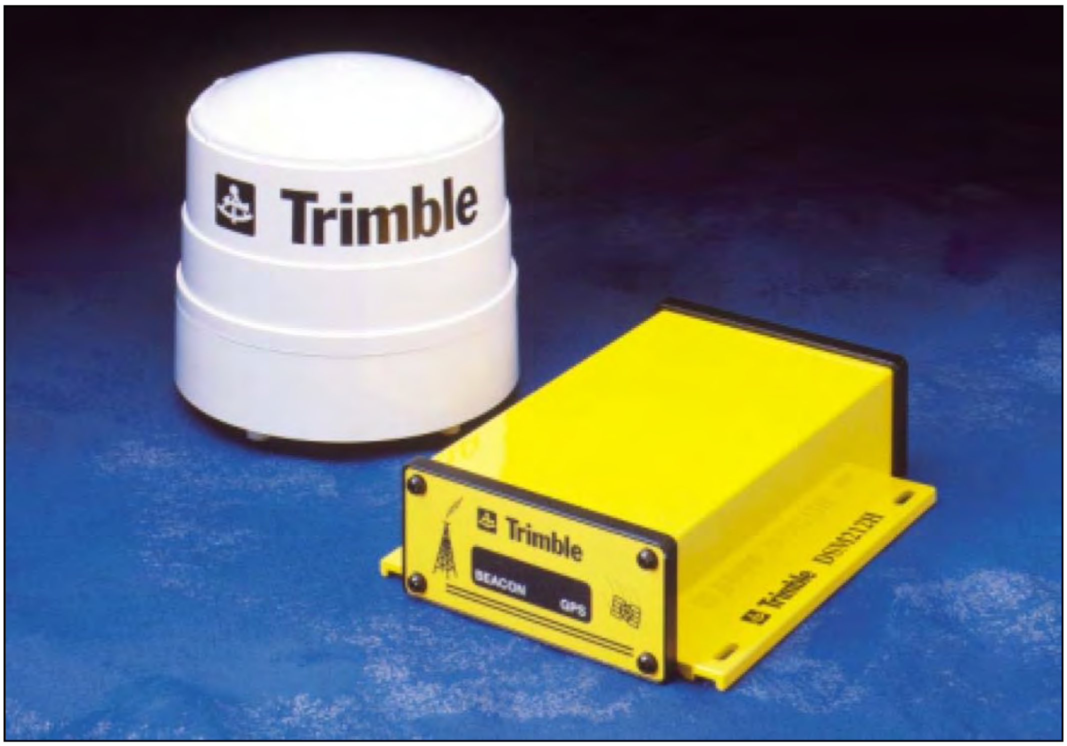


Figure 24. Trimble Navigation DSM 12/212 global-based positioning system used during the investigation.

The DSM12/212 GPS attains sub-meter precision with a dual-channel Minimum-Shift Keying (MSK) differential beacon receiver. This electronic device combines data from satellites and shore-based differential beacon stations, which increases the precision of the satellite data alone. DGPS positions were updated at one-second intervals, the same rate as the magnetic data was recorded (Trimble Navigation Limited 1998:1-2).

The USACE project was planned in the NAD83 South Carolina State Plane East, U.S. survey feet, and all sidescan, subbottom, and magnetometer target data have been converted to this datum and projection. The DGPS data streams are in geographic format, WGS84 (i.e., latitude, longitude), and converted on the fly by the navigation software.

Navigation was conducted with a Capaccino Twister PC computer, using the 2011 version of the Hypack Max for navigation, which was written and developed by Coastal Oceanographics, Inc. specifically for marine survey applications. The magnetometer data was acquired with this program as well.

All positioning coordinates are based on the position of either of the two DGPS antennae. Layback for each of the remote sensing devices was noted and used in the target location determination (Figure 25). This layback information was critical for accurate positioning of targets in the data analysis phase and in relocating any targets for additional investigations.

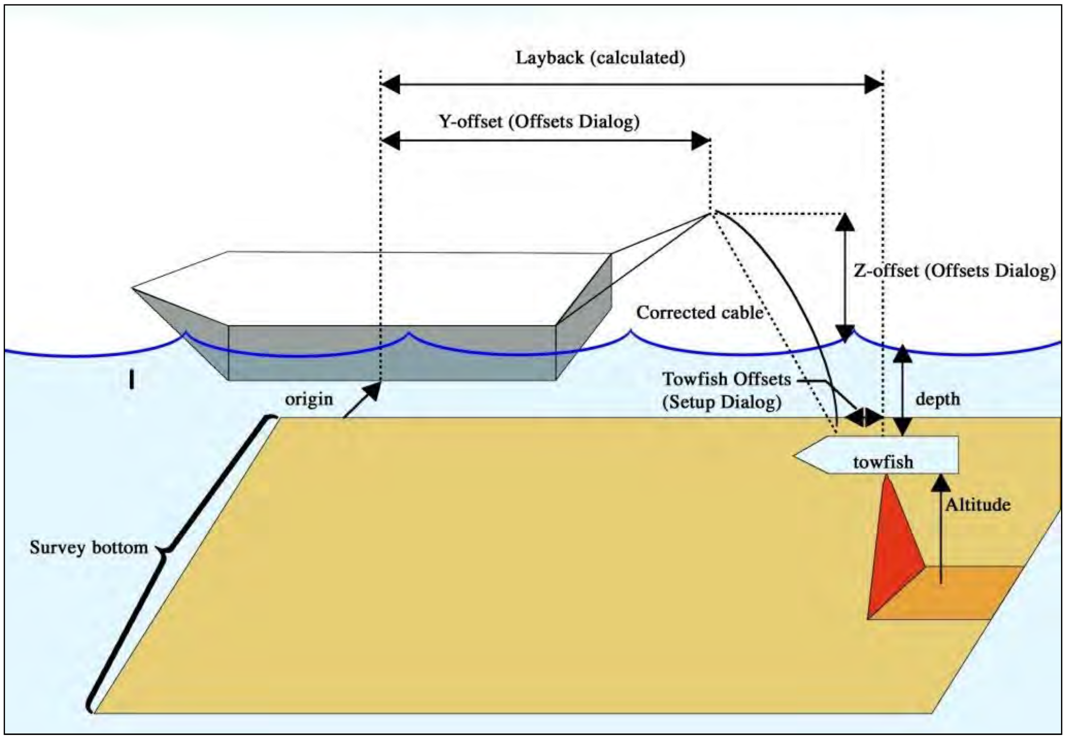


Figure 25. Equipment schematic illustrating layback (courtesy of Coastal Oceanographics, Inc.).

3.3.2 Magnetometer

Magnetometers measure the intensity of magnetic forces with a sensor that measures and records the ambient (background) magnetic strength and deviations from the ambient background (anomalies) caused by ferrous and some other sources (Breiner 1973). These measurements are recorded in nanoteslas, the standard unit of magnetic intensity.

The success of the magnetometer to detect anomalies in local magnetic fields has resulted in the instrument being a principal remote sensing tool of maritime archaeologists because of anomalies that can be components of shipwrecks and other historic debris or objects hazardous to dredging or navigation. While it is not possible to identify specific ferrous objects from the magnetic field contours, it is occasionally possible to approximate shape, mass, and alignment characteristics of wrecks or other structures based on complex magnetic field patterns (see Tables 3 and 4 for examples). In addition, other data (historic accounts, use patterns of the area, diver inspection), which overlap data from other remote sensing technologies, such as the sidescan sonar and prior knowledge of similar targets, can lead to an accurate identification of potential targets. Finally, it must be noted that other sources of magnetic field variation can overwhelm any smaller objects. These include: electrical magnetic fields that surround power transmission lines; underground pipelines; navigation buoys; or bridges and dock structures, which can be quite extensive when the feature is massive.

A Marine Magnetics SeaSPY Overhauser magnetometer was used for this survey (Figure 26). The system was powered by a 110-volt gasoline powered generator. Because water depths in the survey area were extremely shallow and ranged between 0 and just under 20 feet depending on the tide, the towfish had to be floated to keep it off the bottom. However, the sensor was never more than 20 feet off the bottom and was much closer for the majority of the survey. Data were stored in the navigation computer and archived. The SeaSPY is capable of sub-second recordation for precise locational control, but data were collected at one-second intervals, providing a record of both the ambient field and the character and amplitude of the encountered anomalies.

Figure 26. Survey instruments employed during the investigation included (from right to left) the magnetometer, the sidescan sonar, and the subbottom profiler. Honda generator employed to power the instruments is in the background adjacent to the transom.

3.3.3 Sidescan Sonar

The remote sensing instrument used to search for physical features on or above the ocean floor was a Marine Sonic Technology (MST) Sea Scan sidescan sonar system. The sidescan sonar is an instrument that, through the transmission of dual fan-shaped pulses of sound and reception of reflected sound pulses, produces an acoustic image of the bottom. Under ideal circumstances, the sidescan sonar is capable of providing a near-photographic representation of the bottom on either side of the trackline of a survey vessel.

The Sea Scan PC has internal capability for removal of the water column from the instrument's video printout, as well as correction for slant range distortion. This sidescan sonar was utilized with the navigation system to provide manual positioning of fixed or target points on the digital printout. Sidescan sonar data are useful in searching for the physical features indicative of submerged cultural and hardbottom resources. Specifically, the record is examined for features showing characteristics such as height above bottom, linearity, and structural form. Additionally, potential acoustic targets are checked for any locational match with the data derived from the magnetometer and the subbottom profiler.

The MST Sea Scan PC sidescan sonar was linked to a towfish that employed a 600-kilohertz power setting and a variable side range of 20 meters-per-channel (131 feet) on each of the survey lines. The 20 meters-per-channel setting was chosen to provide detail and 100% overlapping coverage with the 50-foot line spacing to ensure full coverage of the survey area. The power setting was selected in order to provide maximum possible detail on the record generated; 600 kilohertz was the preferred frequency.

3.3.4 Subbottom Profiler

Employed to determine the character of near-surface geologic features over the survey area, subbottom profilers generate low frequency (0.5 to 30 kilohertz) sound pulses capable of penetrating the seabed and reflecting off sediment boundaries or larger objects below the surface. The data are then processed and reproduced as cross sections based on two-way travel time (the time taken for the pulse to travel from the source to the reflector and back to the receiver). This travel time is then interpolated to depth in the sediment column by calculating at 1,500 meters-per-second (the average speed of sound in water).

Subbottom profilers have different ranges of sound wave frequency (sparkers, boomers, pingers, and chirp systems). Sparkers and boomers operate at low frequency (5 hertz to 2 kilohertz) and afford deep geologic penetration and low resolution, useful for deep geologic time. Pingers (3.5 and 7 kilohertz) are more useful to penetrate late Pleistocene- and Holocene-aged deposits or paleolandscape features of interest to prehistoric archaeologists. CHIRP systems sweep multiple frequency ranges and are the most precise and accurate of the subbottom profiler systems; they operate at ranges of between 3 to 40 kilohertz. The resolution can be on the order of 10 centimeters (6 inches) depending on sediment type and the quality of the acoustic return.

An EdgeTech 3100 CHIRP subbottom profiler system with a topside power unit, laptop processor and SB-424 towfish was used for this survey. The device was operated at a setting of 4 to 16 kilohertz, the lowest setting of the device, for maximum penetration.

Seismic cross sections reconstruct the shapes and extents of reflectors such as facies in channel sediments, rock/sediment interfaces, marine sand bed cover, and so forth. In addition to subbottom profiling, and depending on the density of data points, the first bottom return data can be used for high-resolution bathymetry. Shipwrecks can be studied with subbottom profilers once their location is known. Finding shipwrecks with a subbottom profiler survey is less useful.

High and low amplitude reflectors (light and dark returns) distinguish differences of sediment characteristics such as particle size and consolidation (Stevenson et al. 2002). Facies contacts can be identified by discontinuities in the extent, slope angle, or shape of the reflector returns. This latter fact is important when identifying the sinusoidal shapes of drowned channel systems and other relict and buried fluvial system features (e.g., estuarine, tidal, lowland, upland areas around drainage features). Parabolic-shaped reflectors indicate individual objects of sufficient size and consolidation. The parabolic shape is the result of sound propagating outwardly from the item. There are also five types of signals that may cause misinterpretation in the two dimensional records: direct arrivals from the sound source; water surface reflection; side echoes; reflection multiples; and point source reflections. Judicious analysis is required to identify them.

Peats tend to reflect strongly, as do other fine-grained or muddy sediments. Sand and shell deposits like those around and in the South Carolina coast are less reflective, and difficult to penetrate without lower seismic frequencies such as those employed by the profiler system used here.

3.3.5 Survey Vessel

The vessel employed during the remote sensing survey was the 25-foot Parker 2520-XL *Haley Ann* (Figure 27), a modified V-hulled motor vessel powered by twin 125-horsepower Yamaha outboards. The vessel has a covered cabin and an ample covered-deck area for the placement and operation of the necessary remote sensing equipment. The vessel conforms to all U.S. Coast Guard specifications, according to class, and has a full complement of safety equipment. It carries all appropriate emergency supplies including lifejackets, spare parts kit, tool kit, first-aid supplies, flare gun, and air horns.

Figure 27. DC&A's 25-foot *Haley Ann* employed for the survey investigations.

3.4 Survey Procedures

Spaced at 65-foot (20-m) intervals and positioned in a northeast-southwest direction, 118 survey lines were programmed into the navigation computer to effectively cover the survey area (Figure 28). The magnetometer, sidescan, subbottom, and DGPS were mobilized, tested, and found operational; then the trackline running began. The helmsman viewed a video monitor linked to the DGPS and navigational computer to aid in directing the course of the vessel down the survey tracklines. The monitor displayed the pre-plotted trackline, the real time position of the survey vessel, and the path of the survey vessel. The speed of the survey vessel was maintained at approximately 3 to 4 knots for the uniform acquisition of data. As the survey vessel maneuvered down each trackline, the navigation system monitored the position of the survey vessel relative to the tracklines every second, each of which was recorded by the computer. Event marks delineated the start and end of each trackline. The positioning points along the traveled line were recorded on the computer hard drive and the magnetic data was also stored digitally.

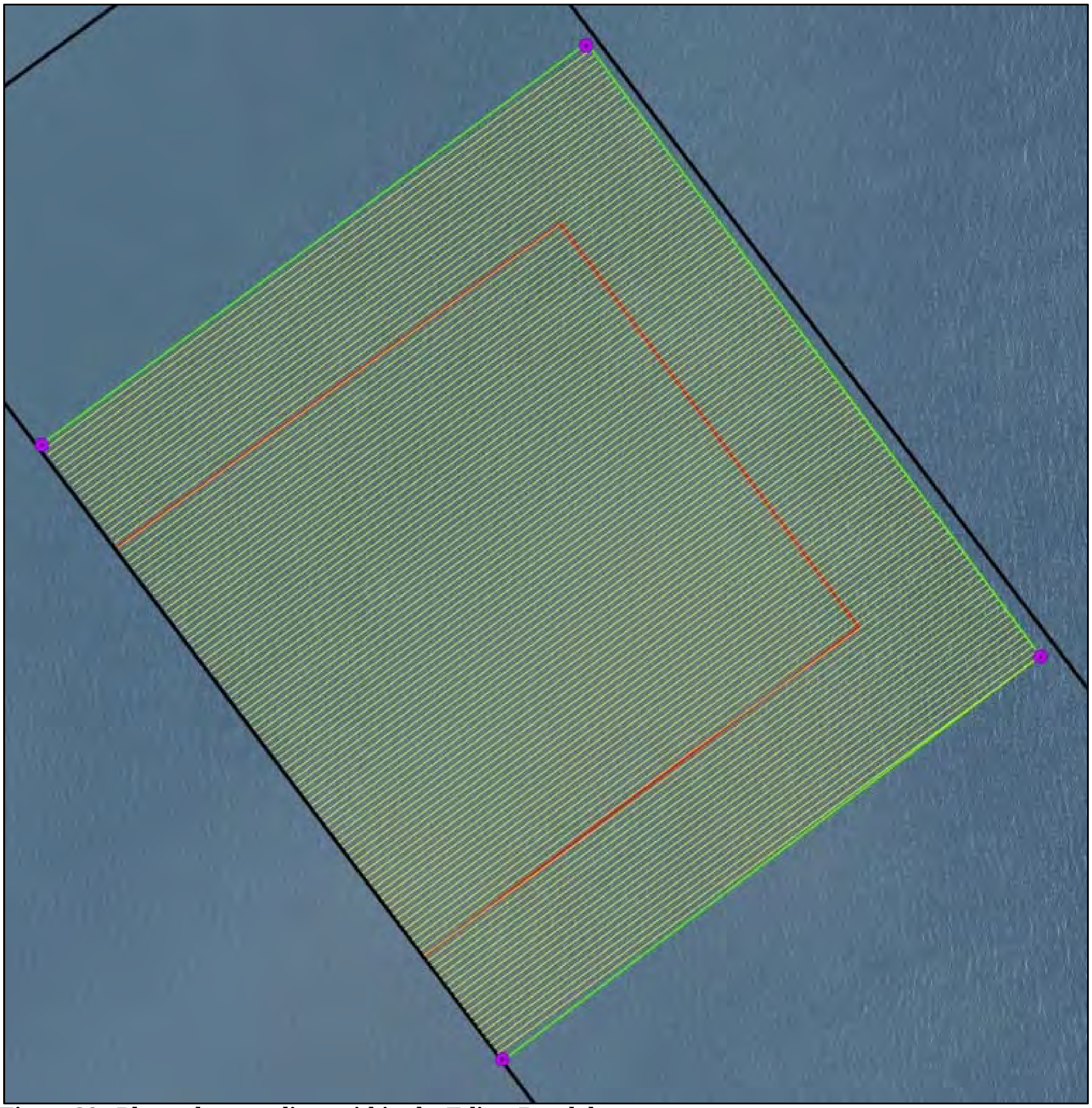


Figure 28. Planned survey lines within the Edisto Beach borrow area.

3.5 Data Analysis

3.5.1 Data Processing

Once collected, survey data was processed and analyzed using an array of software packages designed to display, edit, manipulate, map, and compare proximities of raster, vector, and tabular data. These packages included SonarWiz.MAP for mosaicing sidescan sonar and subbottom profiler data, mapping target extents and generating target reports, figure details, and GIS layers; Hypack Single Beam Editor, Hypack TIN Modeler, and Hypack Export for tabulating anomaly characteristics and contouring magnetic data, and generating GIS data layers. ESRI ArcMap and ArcView were used to display the data on background charts, to conduct a "proximity analysis" for each of the three types of targets (e.g., see which magnetometer, sidescan, and subbottom profiler anomalies are near each other and may explain each other) and to create maps and figures for this report.

3.5.2 Magnetic Data Collection and Processing

Data from the magnetometer was collected using Hypack Max. The data is stored as *.RAW files by line, time, and day. Raw data files were opened, and layback parameters were set. Contour maps were produced of the magnetic data with the TIN Modeler. The DXF file was saved and exported into the combined GIS database. The contour maps allowed a graphic illustration of anomaly locations, spatial extent, and association with other anomalies. Magnetic data was reviewed by the Hypack® Single Beam Editor (Figure 29), and the location, strength, duration, and type of anomaly was transcribed to a spreadsheet along with comments.

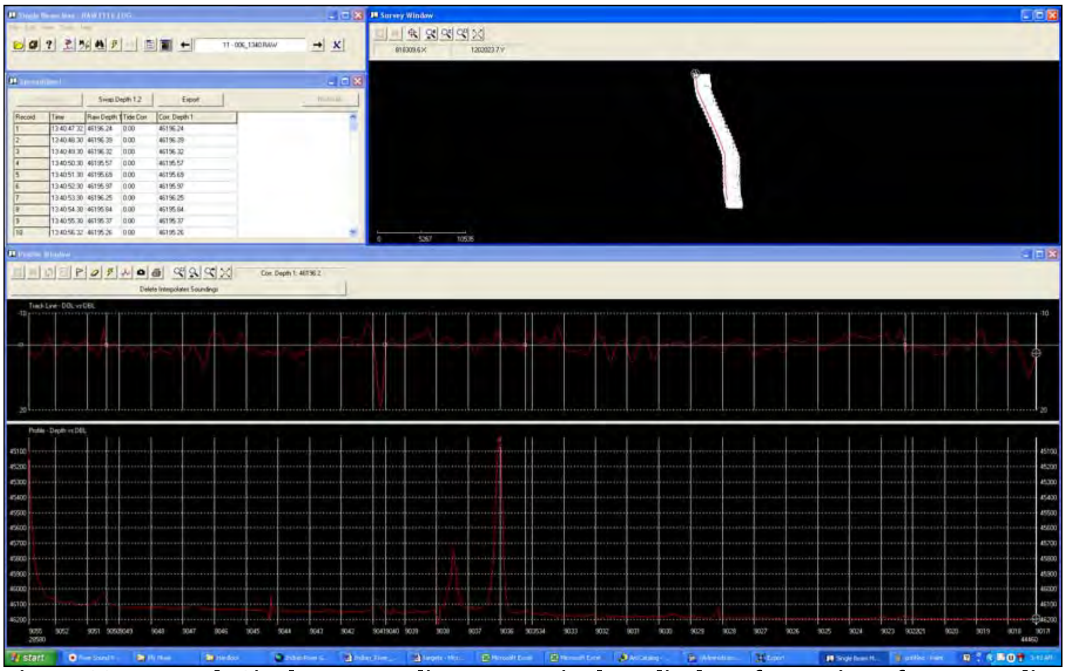


Figure 29. Hypack Single Beam Editor magnetic data display of a section of a survey line. Using these windows one can analyze anomaly position, strength, duration, and type. The peaks of these variations are the locations of target coordinates; their width is the duration.

3.5.3 Sidescan Sonar Data Collection and Processing

Post processing of sidescan sonar was accomplished using SonarWiz.MAP, a product that enables the user to view the sidescan data in digitizer waterfall format, pick targets, and enter target parameters including length, width, height, material, and other characterizations into a database of contacts. In addition, SonarWiz.MAP "mosaics" the sidescan data by associating each pixel (equivalent to about 10 centimeters) of the sidescan image with its geographic location determined from the DGPS position (layback rectified) and distance from the DGPS position (Figure 30). SonarWiz.MAP is the industry standard for mosaicing capability, and the results are exported as geo-referenced TIFFs for importing to the GIS database of the project. SonarWiz.MAP can generate target reports in PDF, Word, or Excel formats (Figure 31).

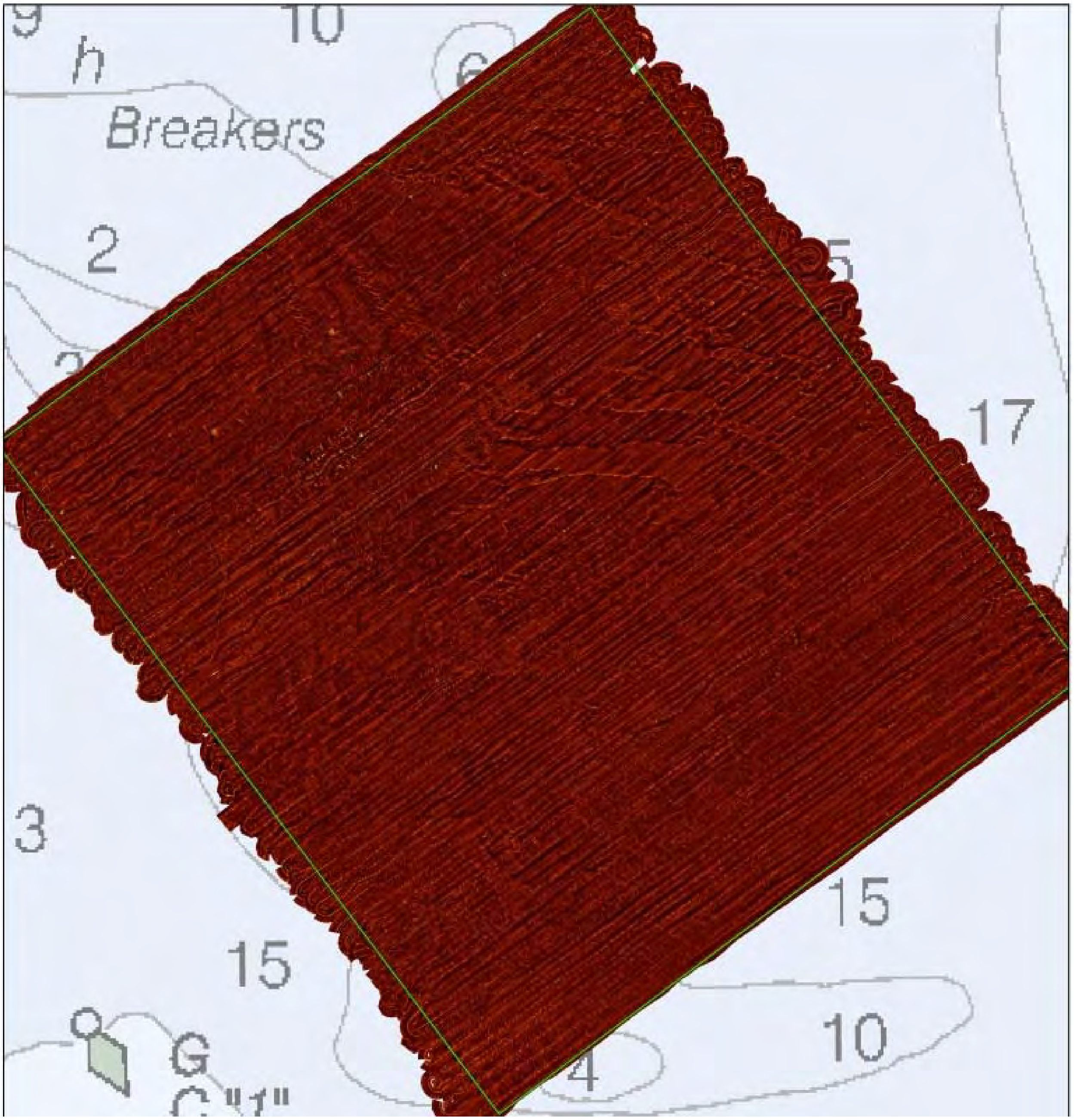


Figure 30. Sonar mosaic generated in SonarWiz.MAP showing 100% coverage of the Project Area.

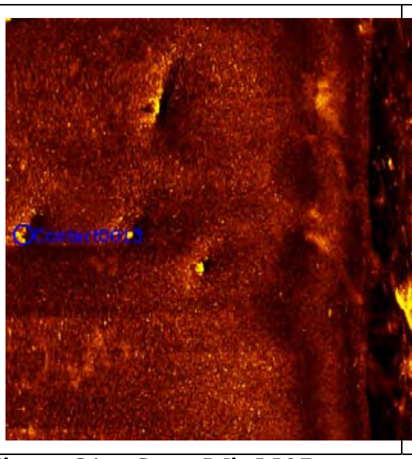
	**SS-13** • Sonar Time at Target: 02/05/2013 16:15:39 • Click Position (Projected Coordinates) (X) 2212888.24 (Y) 231916.08 • Map Proj: SC83F • Acoustic Source File: C:\SonarWiz-Projects\Edisto\05FEB234-to-05FEB250.csf • Ping Number: 11008 • Range to Target: 28.65 US Feet • Fish Height: 0.35 US Feet • Heading: 52.400 degrees • Event Number: 0 • Line Name: 05FEB234-to-05FEB250	**Dimensions** Target Height: = 0 US Feet Target Length: 0 US Feet Target Shadow: 0 US Feet Target Width: 0 US Feet Mag Anomaly: Avoidance Area: Classification 1: Classification 2: Area: Block: Description: posts or stumps??

Figure 31. SonarWiz.MAP sonar contact data automatically generated in tabular format. The target pictured here is SS-13, which lacks a magnetic signature and is likely a cluster of tree trunks or post.

3.5.4 Subbottom Profiler Data Processing and Analysis

Post processing of subbottom profiler data, like the sidescan data, was done with SonarWiz.MAP, which in this case enabled the analyst to view the subbottom data in a planar, trackline format. The analyst viewed the data in a digitizer window as a waterfall format, allowing the digitizing of subbottom features of interest, linear extent, depth, and type (Figure 32). SonarWiz.MAP batch processed waterfall images to *.JPG formats in order to generate figures (Figure 33). Sidescan mosaics and the contact databases were exported to the GIS database as *.SHP files. SonarWiz.MAP was also used to calculate the amount of sonar coverage and illuminate gaps to ensure full coverage of the Project Area.

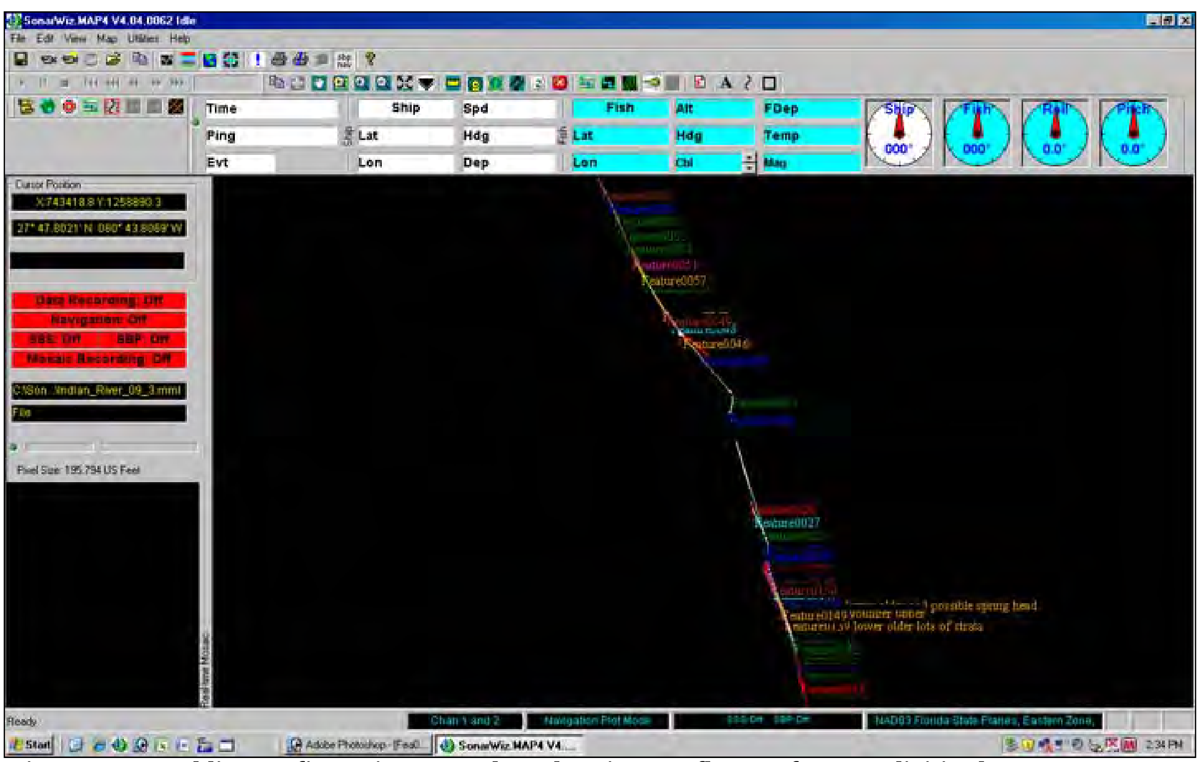


Figure 32. Trackline configuration example and various "reflector" features digitized.

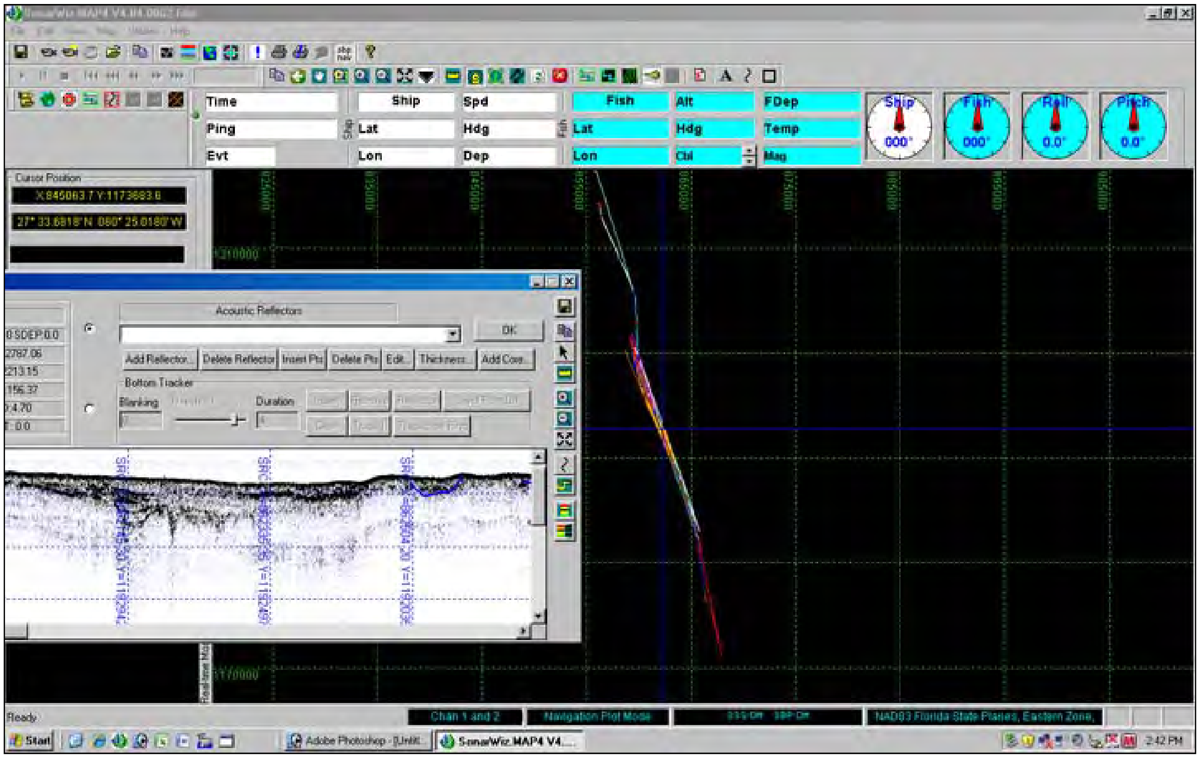


Figure 33. SonarWiz.MAP subbottom waterfall image example showing the seismic profile-digitizing window. The blue cross hairs in the background chart show the location of the cursor, which at the time of the image was directly over the peak of the positive relief feature shown.

3.5.5 Geographic Information Systems Analysis

A project GIS database was constructed using geo-referenced images and layers generated during the magnetometer, sidescan, and subbottom data analyses. Other layers can be added, such as orthophoto quads or Raster Navigation Charts (RNC). Several important things were accomplished by GIS compilation. First, the collected data were compared to one another and evaluated for accuracy and consistency of the positioning information. Second, magnetic, sidescan, and other remote sensing targets were compared for relationship (proximity analysis) (Figure 34).

3.6 Data Analysis Criteria, Theory, and Commentary

The remote sensing survey of the Edisto Beach Borrow survey area was performed to locate and identify the presence or absence of potentially significant submerged cultural resources, and if present, might be adversely affected by proposed dredging activities. However, the interpretation of remote sensing data obtained from both the magnetometer and sidescan sonar, as stated by Pearson et al. (1991), "relies on a combination of sound scientific knowledge and practical experience." The evaluation of remote sensing anomalies, with regard to a determination that the anomaly does or does not represent shipwreck remains, depends on a variety of factors. These include the detected characteristics of the individual anomalies (e.g., magnetic anomaly strength and duration, sidescan image configuration), associated with other sidescan or magnetic targets on the same or adjacent lines, and relationships to observable target sources such as channel buoys or pipeline crossings, etc.

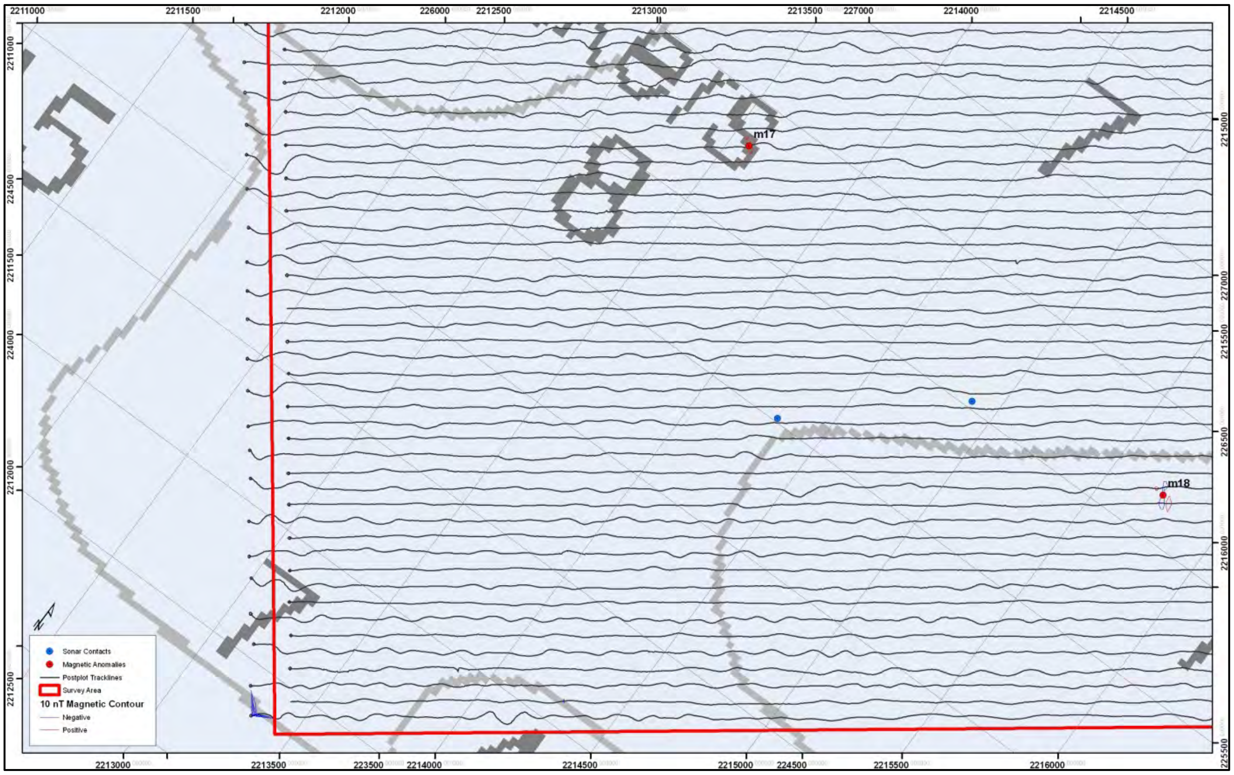


Figure 34. Magnetic contour map in GIS with the RNC chart as the background. Map presents layers of magnetic anomalies, sonar contacts, magnetic contours, and survey track lines.

3.6.1 Magnetometer

Interpretation of data collected by the magnetometer, the tool of choice by the underwater archaeologist for locating shipwrecks, is perhaps the most problematic. Magnetic anomalies are evaluated and prioritized based on magnetic amplitude or deflection of nanotesla intensity from the ambient background in concert with duration or spatial extent (distance in feet along a trackline of an anomaly influences the ambient background); they are also correlated with sidescan targets. Because the sonar record gives a visible indication of the target, identification or evaluation of potential significance is based on visible target shape, size, and presence of structure, as well as association with magnetic anomalies. Targets, such as isolated sections of pipe, can normally be immediately discarded as non-significant, while large areas of above-sediment wreckage are generally easy to identify.

The problems of differentiating between modern debris and shipwrecks, based on remote sensing data, have been discussed by a number of authors. This difficulty is particularly true in the case of magnetic data; therefore, it has received the most attention in the current body of literature dealing with the subject. Pearson and Saltus (1990:32) state, "even though a considerable body of magnetic signature data for shipwrecks is now available, it is impossible to positively associate any specific signature with a shipwreck or any other feature." There is no doubt that the only positive way to verify a magnetic source object is through physical examination. With that said, however, the size and complexity of a magnetic signature does provide a usable key for distinguishing between modern debris and shipwreck remains (see also Garrison et al. 1989; Irion and Bond 1984; Pearson et al. 1993). Specifically, the magnetic signatures of most shipwrecks tend to be large in area and tend to display multiple magnetic peaks of differing amplitude.

In a study conducted for the Burea of Ocean and Energy Management for magnetic anomalies in the northern Gulf of Mexico, Garrison et al. (1989) indicate that a shipwreck signature will cover an area between 10,000 and 50,000 square meters. Using the Garrison et al. (1989) study, as well as years of "practical experience," in an effort to assess potential significance of remote sensing targets, the Pearson et al. (1991) study developed general characteristics of magnetometer signatures most likely to represent shipwrecks. The report states that "the amplitude of magnetic anomalies associated with shipwrecks varies considerably, but in general, the signature of large watercraft or portions of watercraft, range from moderate to high intensity (greater than 50 nanoteslas) when the sensor is at distances of 20 feet or so" (Pearson et al. 1991:70). Employing a table of magnetic data from various sources as baseline data, the report goes on to state that "data suggests that at a distance of 20 feet or fewer, watercraft of moderate size are likely to produce a magnetic anomaly [this would be a complex signature (i.e., a cluster of dipoles and/or monopoles)] greater than 80 or 90 feet across the smallest dimension..." (Pearson et al. 1991:70).

While establishing baseline amounts of amplitude and duration, reflective of the magnetic characteristics for a shipwreck site, the report "recognizes that a considerable amount of variability does occur" (Pearson et al. 1991:70). Generated in an effort to test the 50-nanotesla/80-foot criteria and to determine the amount of variability, Table 4 lists numerous shipwrecks as well as single and multiple-source objects located by magnetic survey and verified by divers. All shipwrecks meet and surpass the 50-nanotesla/80-foot criteria, while the majority of single-object readings fall below the criteria (with the exception of the pipeline, the two sections of pipe, and one of the seven rocket motors). However, the signature of the pipeline should appear as a linear feature on a magnetic contour map and not be confused with a single-source object. The strengths of the two sections of pipe represent refinement readings that sought to produce the highest reading possible and should perhaps be discounted from the sample. With respect to the rocket motors, they are single objects that, because of their association with the space program, must be considered potentially significant. While the shipwrecks and most single-source objects adhere to the 50-nanotesla/80-foot criteria, the multiple-source objects do not. If all targets listed on the table required prioritization of potential significance based on the 50-nanotesla/80-foot criteria, the two multiple-source object targets would be classified as potentially significant.

While the 50-nanotesla/80-foot criteria is a good general guide for most conditions, several recent studies have suggested that a 50-nanotesla/80-foot duration applied to remote sensing data as a baseline for all wreck sites are much too low. Allowing for a larger and more focused database on which to assess signature characteristics of specific vessel classes, the findings from these investigations argue for higher nanotesla and duration criteria for specific types of sites. Table 5 indicates the sizable magnetic deviation and duration of previously recorded and located steamboat wreck sites. However, there is one exception, each of the known steamboat wrecks investigated has a magnetic deviation of at least 500 nanoteslas and a duration of no fewer than 110 feet, usually in the greater than 200-foot range. As opposed to single objects, steamboat wrecks documented during previous investigations are generally much larger in magnetic strength (although not always), tend to have a longer duration, and typically have multi-component signatures. It should be noted, however, that each steamboat wreck signature differs markedly due to environmental conditions, amount of hull/machinery remaining, and the depth of water/overburden over the wreck site. Furthermore, it should be inferred that one of the biggest influences on a wreck site's magnetic signature is directly related to the distance from the magnetometer sensor to the wreck site. As stated in Pearson and Birchett:

> "For a typical iron object, the intensity of its magnetic signature (i.e., anomaly) is inversely proportional to the cube of the distance. One pound of iron, for example, would produce an anomaly of 100 nanoteslas at a distance of 2 feet. At a distance of 10 feet the same pound of iron would produce an anomaly of only 1 nanotesla. A 1,000-ton ship could produce a 700-nanotesla anomaly at 100 feet and a barely discernible 0.7-nanotesla anomaly at 1,000 feet" [1999:4-13].

Table 4. Compilation of Magnetic Data from Various Sources.

Vessel (Object)	Type and Size	Magnetic Deviation	Duration (ft.)	Reference
Shipwrecks				
Egmont Shoal wreck	19th century wooden-hulled copper clad sailing vessel	67	160	Krivor 2005
USS Narcissus	Civil War wooden tug	582	176	Krivor 2005
J.D. Hinde	129-ft. wooden sternwheeler	573	110	Gearhart and Hoyt 1990
Utina	267-ft. wooden freighter	690	150	James and Pearson 1991; Pearson and Simmons 1995
Mary Somers	iron-hulled sidewheeler	5,000	400	Pearson et al. 1993
Gen C.B. Comstock	177-ft. wooden hopper dredge	200	200	James et al. 1991
Mary	234-ft. iron-hulled sidewheeler	1,180	200	Hoyt 1990
El Nuevo Constante	126-ft. wooden collier	65	250	Pearson et al. 1991
James Stockton	55-ft. wooden schooner	80	130	Pearson et al. 1991
Homer	148-ft. wooden side-wheeler	810	200	Pearson and Saltus 1990
modern shrimp boat	segment 27 ¥ 5 ft.	350	90	Pearson et al. 1991
Confederate Obstructions	numerous vessels with machinery removed and filled with construction rubble	110	long duration	Irion and Bond 1984
Shrimp Boat	Modern	162	110	Watts 2000
Single Objects				
pipeline	18-in. diameter	1,570	200	Duff 1996
Pipe/mast/davit	18 in. by 26 ft.	475	104	Lydecker 2007
Pipe	3 in. by 10 ft.	55	352	Krivor 2005
anchor	6-ft. shaft	30	270	Pearson et al. 1991
iron anvil	150 lbs.	598	26	Pearson et al. 1991
engine block	modern gasoline	357	60	Rogers et al. 1990
steel drum	55 gallon	191	35	Rogers et al. 1990
pipe	8 ft. long ¥ 3 in. diameter	121	40	Rogers et al. 1990
railroad rail segment	4-ft. section	216	40	Rogers et al. 1990
7 Rocket Motors	8 ft. to 34 ft. in length	61 to 422	75 to 180	Watts 2000
Multiple Objects				
anchor/wire rope	8-ft. modern stockless/large coil	910	140	Rogers et al. 1990
cable and chain	5 ft.	30	50	Pearson et al. 1991
scattered ferrous metal	14 by 3 ft.	100	110	Pearson et al. 1991

Table 5. Magnetic Data from Steamboat Wreck Sites.

Vessel (Object)	Type and Size	Magnetic Deviation	Duration (ft.)	Reference
Shipwrecks				
Star of the West	172-ton ocean-going sidewheel	8,300	400	Krivor et al. 2002
3MO69 (unidentified)	Wooden sidewheeler	2,961	299	Buchner and Krivor 2001
Caney Creek Wreck	Sidewheeler	2,790	unknown	Hedrick 1998
Mary E. Keene	236 ft. sidewheeler	1,700	220	Robinson 1998
John Walsh	275 ft. sidewheeler	1,602	280	James et al. 2002
New Mattie	130 ft. wooden sternwheeler	1,491	200	Buchner and Krivor 2001
35th Parallel	Sidewheeler	1,414	320	Saltus 1993
Scotland	Sidewheeler	1,322	200	Kane et al. 1998
"Boiler" wreck (unidentified steamboat)	Sidewheeler/sternwheeler (?)	1,164	500	Saltus 1993
Hartford City	150 ton sidewheeler	856	400	Krivor et al. 2002
Mary Somers	Iron-hulled sidewheeler	5,000	325	Pearson et al. 1993
Homer	148 ft. wooden sidewheeler	810	200	Pearson and Saltus 1993
E.F. Dix/Eastport	Sidewheeler/ironclad	800	360	Pearson and Birchett 1995
Choctaw	223 ton sternwheel towboat	797	250	Krivor et al. 2002
J.D. Hinde	129 ft. wooden sternwheeler	573	110	Gearhart and Hoyt 1990
Oklahoma Wreck	Sidewheeler	497	300	M.C. Krivor personal comm.
Undine	Sternwheeler	200	300	James and Krivor 2000

An example of a steamboat wreck that produces a magnetic signature less than 500 nanoteslas involves the purported *Undine* site investigated by Panamerican in 1999 and 2000. During 1999, remote sensing operations located a magnetic anomaly with a magnetic deflection of 193 nanoteslas with a duration of 300 feet. During the 2000 field investigations, the anomaly was identified as the remnant of a charred steamboat approximately 38 to 40 feet below the river's surface and buried 8 feet below riverbed sediments. Historic records indicate the *Undine* was extensively salvaged after the scuttling incident; whereupon, everything of value including all iron plating, machinery, and cannon were removed from the wreck, but the hull remained in place (James and Krivor 2000:16-17). While only a small portion of the wreck site was uncovered (due to the extensive amount of overburden), it was evident that little of the hull is extant, only just to the turn of the bilge.

It should also be stated that two of the wreck sites with either small areas of deviation or low nanotesla deflections, the *J.D. Hinde* and the purported *Undine*, represent either partial hull remains (*J.D. Hinde*) or were heavily burned and salvaged (*Undine*). Historic records indicate the *J.D. Hinde* was also salvaged after the wrecking process. Retaining none of her steam machinery or wheels, half of the vessel was no longer present, most likely as a result of dredging, both salvage and dredging the obvious reason for its small magnetic duration (James and Pearson 1993:22). Salvage efforts often sought to remove any cargo as well as any machinery, cannon, anchors, or other goods of value. During the Civil War, the salvage of iron for reuse was often paramount. As stated by John B. Jones on August 11, 1863, "The iron was wanted more than anything else but men" (Black 1958:200). Therefore, it may be speculated that any wreck site that: (1) has been salvaged in the past; (2) has been exposed to excessive environmental processes (i.e., current); or (3) has been impacted by channelization efforts (i.e., dredging), will produce a lower nanotesla deflection (due to less ferrous metal on site) than a wreck not exposed to similar processes.

If the signatures of all the steamboat wrecks listed in Table 5 are averaged, a magnetic deviation averaging 1,576 nanoteslas with an average duration of 234 feet is obtained. While the sensor distance, environmental factors, and the amount of ferrous metal remaining on any given steamboat site must be taken into account, previously identified wreck sites have tended to produce sizable, greater than 200-nanotesla magnetic deviations, with a minimum duration of 110 feet. While the 110-foot duration represents the lowest duration of any of the known steamboat wreck sites, it must be stated that in such cases a portion of the wreck is no longer extant due to previous salvage and dredging/channelization efforts. However, until further surveys show that this short duration is an "anomaly" so to speak, it must be employed as the baseline duration. Similarly, with the exception of the *Undine* site, which as stated previously was heavily salvaged, all other surveyed steamboats have nanotesla deviations approaching 500 nanoteslas or above, but the 200-nanotesla reading must be employed as the baseline amplitude.

While the data indicates the validity of employing specific nanotesla strength and duration criteria when assessing magnetic anomalies, other factors must be taken into account. Pearson and Hudson (1990) have argued that the past and recent use of a water body must be an important consideration in the interpretation of remote sensing data; in many cases, this should supposedly be the most important criterion. Unless the remote sensing data, the historical record, or the specific environment (i.e., harbor entrance channel) provides compelling and overriding evidence, it is otherwise believed that the history of use should be a primary consideration in the interpretation. The constitution of "compelling evidence" is, to some extent, left to the discretion of the researcher; however, in settings where modern commercial traffic and historic use have been intensive, such as the current Project Area, the presence of a large quantity of modern debris must be anticipated. In harbor, bay, or riverine situations where traffic is heavy, this debris will be scattered along the channel Right Of Way (ROW), although it may be concentrated in areas where traffic would slow or halt, and it will appear on remote sensing survey records as discrete, small objects. This is, in fact, the case for many of the anomalies recorded during the current investigation.

In addition to anomaly strength and duration considerations, all anomalies were assessed for type [monopole (negative or positive influence), dipole (negative and positive influence), or complex] and association with other magnetic anomalies (i.e., clustering) and sidescan sonar targets. With regard to analysis of these anomalies, relative to potential significance, many will be found to represent a small, single-source object (a localized deviation), and are generally identified and labeled as non-significant, especially in an area of high use, such as adjacent to a navigation channel, similar to the current environment. As seen on contour maps, the contour lines for this type of anomaly can be seen to approach, or go to but not beyond, the adjacent survey trackline on which it is located. This visual interpretation is corroborated during the analysis of the electronic magnetometer strip-chart data of each survey trackline. An examination of a strip chart will show that the target was recorded only on a single transect, and that it was not recorded (i.e., did not influence the ambient magnetic background) on adjacent lines. This is especially true when an anomaly's readings are large deviations but are recorded on only one line. This indicates the source for this target must be a small, discrete object, and the magnetometer sensor must have passed closely by or directly over the object in order to generate the large readings on this survey line, yet not be recorded or have had an influence on adjacent lines; especially relevant when employing a 50-foot transect interval. Because these anomalies represent single-source objects, they are not considered representative of a potentially significant submerged cultural resource and are not recommended for avoidance.

3.6.2 Sidescan Sonar

In contrast to magnetic data, sidescan interpretation is less problematic, as objects are reconstructed as they look to the eye. Targets, such as isolated sections of pipe, can normally be immediately discarded as non-significant, while large areas of above-sediment wreckage as well as some exposed paleofeatures are generally apparent. The chief factors considered in analyzing sidescan data, with regard to wreckage, include: linearity, height off bottom, size, associated magnetics, and environmental context. Since historic resources in the form of shipwrecks usually contain large amounts of ferrous compounds, complex sidescan targets with complex magnetic anomalies are of the greatest importance. The usual outcome of targets with no associated magnetics is items, such as rocks, trees, and other non-historic debris of limited interest to the archaeologist.

3.6.3 Clustering

Since an archaeological remote sensing survey involves the collection of several different types of data, each of which has the potential to locate significant cultural resources, attention must be given to groups of targets. These groupings, referred to as clustering, occur when a target exists that produces both a sidescan sonar return and a magnetic signature. In addition, a magnetic source that extends across several survey lines will produce an anomaly on each line, and since these anomalies are related, they will form a cluster. Previously discovered archaeological sites will also be considered as an aspect of clustering. Although criteria used to determine a cluster is somewhat subjective, anomalies, sidescan targets, and previously identified archaeological sites will generally be included in a cluster if they lie within 65 feet of one another.

3.6.4 Subbottom Profiler Analysis

Subbottom profilers generate low frequency acoustic waves that penetrate the seabed and reflect off boundaries or objects located in the subsurface. The data are then processed and reproduced as a cross section using two-way travel time to determine depth (the time taken for the pulse to travel from the source to the reflector and back to the receiver by a constant). The shapes, relationships, and extents of reflectors are used to infer bottom and subbottom geomorphological characteristics.

In general, high and low amplitude linear reflectors (light and dark lines) distinguish between sediment beds; parabolic reflectors indicate point-source objects with sound propagating out from them; and erosional or non-depositional contacts can be identified by discontinuities in extent, slope angle, and the shape of the reflector morphology. This latter fact is important when identifying buried and drowned channel systems and other relict and buried fluvial system features (e.g., estuarine, tidal, lowland, and upland areas around drainage features).

In caution, there are five spurious signals that may cause confusion in the two-dimensional records that specialists recognize: direct arrival from the sound source; reflection multiples; water surface reflection; side echoes; and point-source reflections. Judicious analysis is required to identify these sound underwater imagery phenomena. Precise inference of a sediment bed or other anomaly from the subbottom profiler data would necessitate coring or excavation.

While it is challenging to know which reflectors are significant, the intent is to identify paleolandscape features likely to be conducive to human occupation and where preservation may be enhanced based on local geology and archaeology. In analysis, seismic returns indicating positive relief features as possible mounds and negative relief features as a probable channel or other fluvial feature with margins and sediment beds indicate higher potentials for prehistoric remains.

3.7 Method and Theory for Recognition of a Submerged Prehistoric Site

The methodology used for identifying submerged prehistoric sites entails developing criteria for the discovery of a “site” in any particular setting. The criteria are based on the geology and archaeology of the Project Area and models of site submergence. Models for the presence and preservation of submerged archaeological sites are discussed by several researchers, including Waters (1992) in his chapter on coastal processes, Kraft et al. (1983), and others. Much of this has to do with the identification of landforms identifiable with remote sensing that have the potential for archaeological site presence. For instance, two models used in this project were horizontal surfaces near channel features and positive relief features considered potentially to represent midden feature(s). Causeways, fishing weirs, or other prehistoric infrastructure features are difficult to identify.

Publications are more limited that are specific to recognizing sedimentary signatures of the deposits that make up sites that have been transgressed by rising sea levels and then remained submerged, perhaps buried, until exposure. One such study specifically focused on such information is Gagliano et al.'s (1982) *Sedimentary Studies of Prehistoric Archaeological Sites: Criteria for the identification of submerged archaeological Sites of the Northern Gulf of Mexico Continental Shelf*. This document is one of high value, but limited distribution. Gagliano's group chose 15 terrestrial sites in Louisiana and Texas as analogs from eight identifiable and mappable landforms with which archaeological sites are commonly and consistently associated on land, terrestrially. Their local geomorphic features included major natural levee, minor natural levee, Chenier and accretion ridges, barrier island, salt dome margin, estuarine margin, channel on Pleistocene terrace, and lake margins. They sampled sediments with excavations and box core sampling; recorded color, bedding, and contact descriptions; sorted the sediments to particle size; conducted point count and grain size analysis; and then geochemically analyzed the samples by levels. They showed that sites were recognized most frequently by shell content, fish bones, and charred wood. Some ceramic and lithic artifacts were identified, but they were rare and often small.

Another aspect to realize about submerged prehistoric sites is that virtually all examples of inundated sites are partially, or wholly, reworked in ways somewhat analogous to deflation (Masters and Flemming 1983; Fischer 1995). This is caused by fluidization of sediments at times of inundation and the removal of fine particles that are often re-deposited with material by subsidence of the inundation or wave action. Faught (2002–2004; 1996) has shown sites with late Pleistocene, early Holocene, and middle Holocene artifacts to be reworked by sea level rise and submergence, but that artifact arrays remain cohesive as surface and near surface remains.

Because of these factors, recognition that deposits are indeed cultural is not always immediately apparent to the diver, or at first glance of the collected materials. Artifacts are important, but not always part of the site, as Gagliano et al. (1982) has systematically determined. Expectations for midden deposits include dominance of unarticulated specimens of particular mollusk species, faunal bone, and manuports (i.e., geologic items out of place). On the other hand, discovery of any artifact would be important, especially in any sediment bed below a marine bed.

4.0 INVESTIGATIVE FINDINGS

Eighteen magnetic anomalies, thirty-one sidescan sonar targets, and two subbottom impedance contrast paleolandform feature areas were recorded during the current survey. Employing the previous discussions on target analysis, magnetic anomalies were assessed for potential significance based on magnetic deviation (above and/or below ambient background), duration (distance in feet, along a trackline, an anomaly influences the ambient background), type [monopole (negative or positive influence), dipole (negative and positive influence), or complex], and association with other magnetic anomalies (i.e., clustering) and/or sidescan sonar contacts. Sidescan sonar contacts, as visual images, were assessed for linearity, height off bottom, size, associated magnetics, backscatter characteristics, and visual surface associations (i.e., buoys, etc.). Subbottom features were assessed as to feature type, and association with other subbottom features and sidescan targets.

Out of all the anomalies, sonar targets, and subbottom impedance contrast features, no anomalies were considered to potentially represent significant historic cultural resources. Several sidescan sonar contacts and subbottom features were considered to represent vestiges of paleolandforms that have the possibility of containing prehistoric cultural resources sites. From review of the sidescan records, no apparent hardbottom features were identified.

4.1 Submerged Cultural Resources

4.1.1 Magnetometer Results

As listed in Table 6 and illustrated in Figure 35 (which corresponds to *Appendix B: Magnetic Anomalies Contour Maps*), a total of 18 magnetic anomalies with variations of approximately 10 nanoteslas or higher were recorded during the investigation within the survey area. Table 2 includes target location, type (i.e., monopole, dipole, complex), anomaly deviation in nanoteslas, duration in feet, and association with other targets (both magnetic and sidescan) from the current survey. The magnetic contour maps (Appendix B) are presented at a 10-nanotesla contour.

Based in part on the anomaly signature (i.e., linearity) and/or sidescan target association, the recorded anomalies have been identified as mainly single point source anomalies, with only one unknown, M18. Many of the single-source anomaly readings have large deviations (yet were recorded on only one line); this indicates the source for these targets must be small, discrete objects. This is further evidenced by the very shallow nature of the survey area. The magnetometer sensor must have passed closely by or directly over the object to generate the large readings on a survey line, but not be recorded or have had an influence on an adjacent line. The single-source anomaly type is not considered representative of a potentially significant submerged cultural resource.

The one unknown anomaly is M18. The unknown designation means there is no readily available explanation as to its source; it has no associated acoustic image. Its signal was recorded on two lines, but more on one line than the other; indicating it sits between the two lines. With only a 30-nanotesla total deviation and of relatively short duration, this anomaly is not considered to meet criteria for a potentially significant anomaly, as discussed in Section 2.0.

4.1.2 Sidescan Sonar Results

Listed in Tables 7 and 8, and illustrated in Figure 36, thirty-one sidescan sonar contacts were recorded during the analysis of the data. Their locations are shown on the magnetic contour maps in Appendix B, these “contacts” included any object or anomalous bottom return that was not uniform sand. Of the 31 sidescan sonar contacts, none represent potentially submerged cultural resources of a historic nature (i.e., shipwrecks). They represent small isolated debris (i.e., crab pots, etc.) that do not possess characteristics indicative of vessel wreckage, and none are associated with magnetic anomalies, adding further evidence to this statement. However, and as discussed below, several are indicators of paleolandscape settings and may have prehistoric site potentials.

Table 6. Magnetic Anomalies.

Anomaly	Strength (+) nT	Strength (-) nT	Duration (ft)	Type	E	N	Associations/ Comments	Appendix B Map Number
M01	10	60	70	D	2214543	233208	SPS	2
M02	0	30	37	M	2213597	232989	SPS	2
M03	0	10	15	M	2214183	233070	SPS	2
M04	0	10	15	M	2213861	232905	SPS	2
M05	0	20	45	M	2213068	231972	SPS	2
M06	20	0	35	M	2213168	232030	SPS	2
M07	20	20	60	D	2211857	230811	SPS	1
M08	0	10	15	M	2212315	232071	SPS	2
M09	0	20	35	M	2211006	230399	SPS	1
M10	0	50	175	CM	2210683	230176	SPS	1
M11	20	20	70	D	2210373	229925	SPS	1
M12	0	20	35	M	2209440	229587	SPS	1
M13	0	30	25	M	2215023	232112	SPS	2
M14	0	10	10	M	2211260	227527	SPS	3
M15	0	20	20	M	2213796	228167	SPS	3
M16	30	10	70	D	2214924	228680	SPS	4
M17	20	0	25	M	2213575	226322	SPS	5
M18	20	10	75	D	2215729	226179	Unknown	5

M= monopole, D= dipole, C= complex; SPS = Single Point Source
Coordinates in NAD83 South Carolina State Plane U.S. Survey Feet.

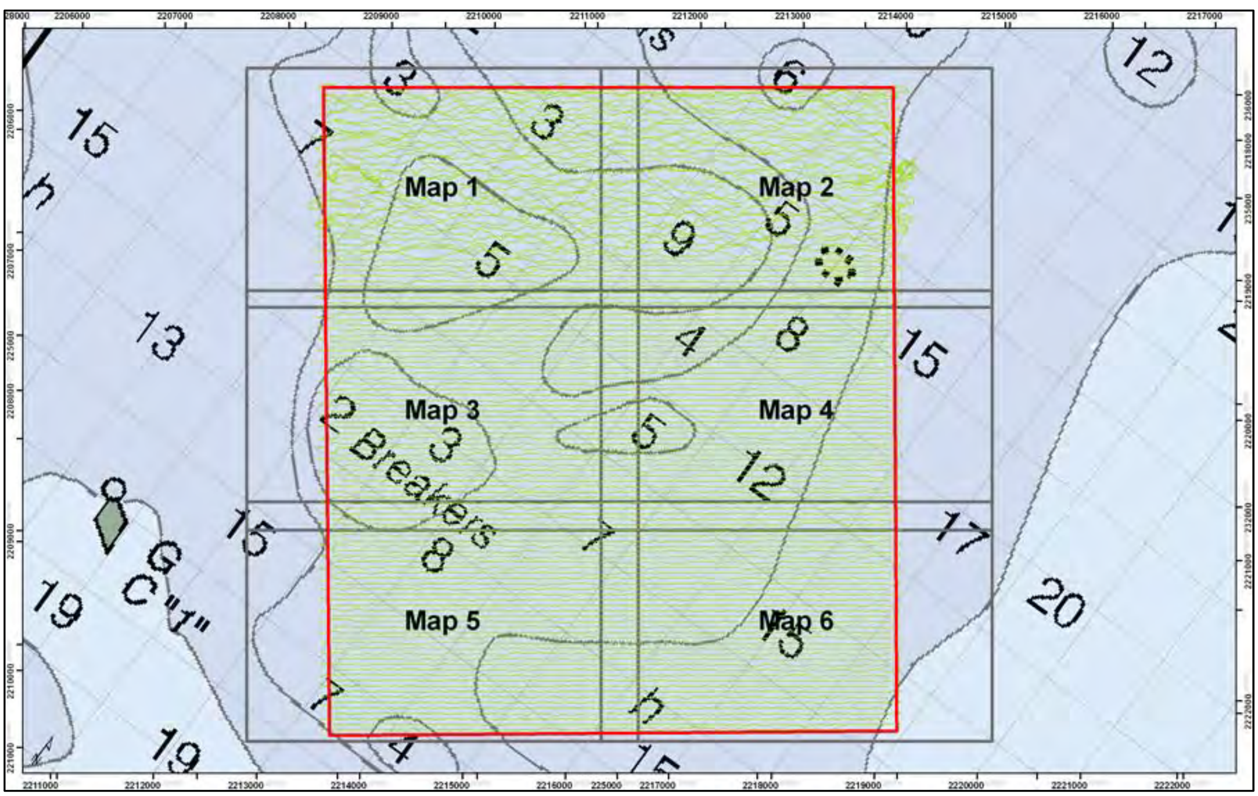


Figure 35. Map Key for Appendix B.

Table 7. Sidescan Sonar Targets within the Survey Area.

No.	Description	L (ft)	W (ft)	E	N	Association	Map No.
C-01	sediment clumps	30	20	2213206	232856		2
C-02	object in bottom, tree stump or log?	33	4	2213748	232939		2
C-03	sediment clumps measure top one	19	14	2213129	232330		2
C-04	object	10	2	2212874	231979		2
C-05	object	6	3	2212890	231889		2
C-06	object in bottom	13	7	2212925	231990		2
C-07	stump or roots or both, possible shell scatter	15	4	2213319	232095		2
C-08	object	9	6	2213610	232196		2
C-09	posts or stumps?	NA		2212907	231877	C-10, C-11, C-12	2
C-10	posts or stumps??	NA		2212903	231898	C-09, C-11, C-12	2
C-11	posts or stumps??	NA		2212931	231911	C-09, C-10, C-12	2
C-12	posts or stumps??	NA		2212888	231916	C-09, C-10, C-11	2
C-13	objects on bottom	41	8	2213948	232667		2
C-14	measure second from right	15	5	2213374	232085		2
C-15	measure largest object	10	6	2213482	232172		2
C-16	looks like wood maybe	22	11	2213537	232231		2
C-17	stumps on river margin??	12	2	2213811	232306		2
C-18	crab pot	4	4	2214250	232107		5
C-19	object on bottom	22	9	2213379	232074		2
C-20	texture difference in parallel - matting??	28	31	2213251	232149		2
C-21	cable fragment??	24		2213194	229815		2
C-22	crab pot	4	4	2215964	231228		4
C-23	object on bottom wood??	6	6	2213211	232165		2
C-24	object	6	1	2214311	225515		2
C-25	crab pot	3	3	2215946	228491		4
C-26	crab pot	3	3	2215948	228486		4
C-27	exposed sand wave? bedrock?	82	22	2213158	228191		3
C-28	vague object(s)	7	4	2216355	230356		4
C-29	crab pot	3	4	2216157	227625		6
C-30	large fish?	6		2214895	226029		5

Table 8. Sidescan Sonar Target Images.

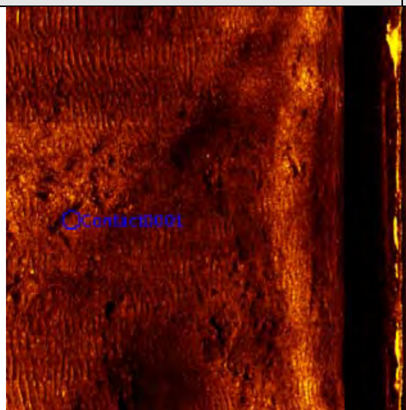
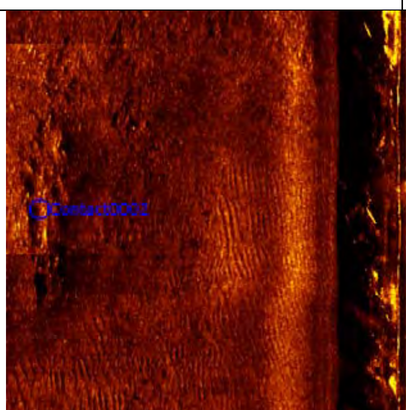
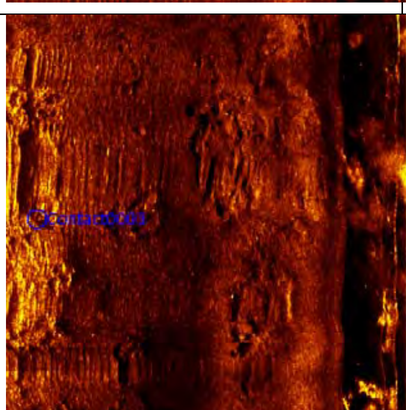
Contact Image	Contact Info	User Entered Info
	**SS-01** • Sonar Time at Target: 02/05/2013 13:30:57 • Click Position (Projected Coordinates) (X) 2213206.31 (Y) 232855.93 • Map Proj: SC83F • Acoustic Source File: C:\SonarWiz-Projects\Edisto\05FEB047-to-05FEB066.csf • Ping Number: 14151 • Range to Target: 25.08 US Feet • Fish Height: 0.29 US Feet • Heading: 52.200 degrees • Event Number: 0 • Line Name: 05FEB047-to-05FEB066	**Dimensions** Target Height: = 0 US Feet Target Length: 30 US Feet Target Shadow: 0 US Feet Target Width: 20 US Feet Mag Anomaly: Avoidance Area: Classification 1: Classification 2: Area: Block: Description: sediment clumps
	**SS-02** • Sonar Time at Target: 02/05/2013 14:35:52 • Click Position (Projected Coordinates) (X) 2213748.29 (Y) 232938.74 • Map Proj: SC83F • Acoustic Source File: C:\SonarWiz-Projects\Edisto\05FEB125-to-05FEB144.csf • Ping Number: 15809 • Range to Target: 27.42 US Feet • Fish Height: 0.12 US Feet • Heading: 45.400 degrees • Event Number: 0 • Line Name: 05FEB125-to-05FEB144	**Dimensions** Target Height: = 0 US Feet Target Length: 33 US Feet Target Shadow: 0 US Feet Target Width: 4 US Feet Mag Anomaly: Avoidance Area: Classification 1: Classification 2: Area: Block: Description: Object in bottom .. tree stump or log?
	**SS-03** • Sonar Time at Target: 02/05/2013 15:06:12 • Click Position (Projected Coordinates) (X) 2213128.86 (Y) 232330.31 • Map Proj: SC83F • Acoustic Source File: C:\SonarWiz-Projects\Edisto\05FEB165-to-05FEB183.csf • Ping Number: 12768 • Range to Target: 27.66 US Feet • Fish Height: 0.29 US Feet • Heading: 47.200 degrees • Event Number: 0 • Line Name: 05FEB165-to-05FEB183	**Dimensions** Target Height: = 0 US Feet Target Length: 19 US Feet Target Shadow: 0 US Feet Target Width: 14 US Feet Mag Anomaly: Avoidance Area: Classification 1: Classification 2: Area: Block: Description: sediment clumps measure top one

Table 8. (continued)

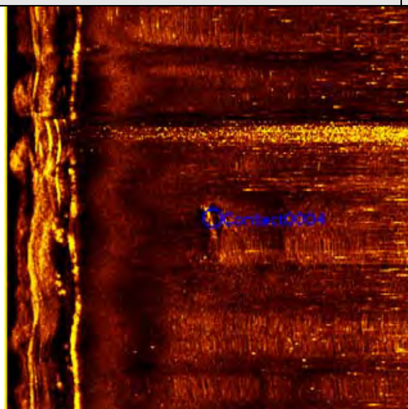
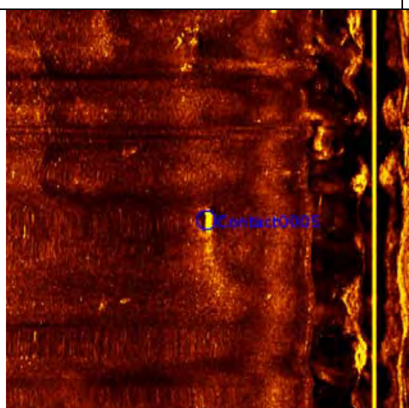
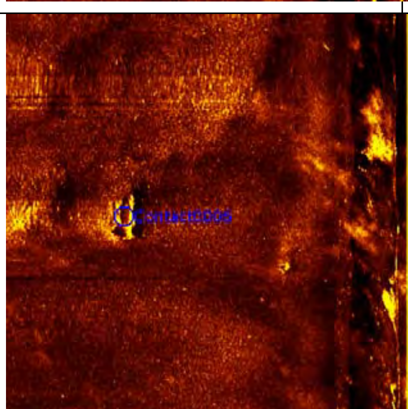
Contact Image	Contact Info	User Entered Info
	**SS-04** • Sonar Time at Target: 02/05/2013 15:17:42 • Click Position (Projected Coordinates) (X) 2212874.48 (Y) 231978.79 • Map Proj: SC83F • Acoustic Source File: C:\SonarWiz-Projects\Edisto\05FEB186-to-05FEB204.csf • Ping Number: 5777 • Range to Target: 15.47 US Feet • Fish Height: 0.29 US Feet • Heading: 260.800 degrees • Event Number: 0 • Line Name: 05FEB186-to-05FEB204	**Dimensions** Target Height: = 0 US Feet Target Length: 10 US Feet Target Shadow: 0 US Feet Target Width: 2 US Feet Mag Anomaly: Avoidance Area: Classification 1: Classification 2: Area: Block: Description: object
	**SS-05** • Sonar Time at Target: 02/05/2013 15:17:43 • Click Position (Projected Coordinates) (X) 2212889.80 (Y) 231888.55 • Map Proj: SC83F • Acoustic Source File: C:\SonarWiz-Projects\Edisto\05FEB186-to-05FEB204.csf • Ping Number: 5784 • Range to Target: 12.36 US Feet • Fish Height: 0.29 US Feet • Heading: 259.900 degrees • Event Number: 0 • Line Name: 05FEB186-to-05FEB204	**Dimensions** Target Height: = 0 US Feet Target Length: 6 US Feet Target Shadow: 0 US Feet Target Width: 3 US Feet Mag Anomaly: Avoidance Area: Classification 1: Classification 2: Area: Block: Description: Object
	**SS-06** • Sonar Time at Target: 02/05/2013 15:44:10 • Click Position (Projected Coordinates) (X) 2212924.53 (Y) 231989.83 • Map Proj: SC83F • Acoustic Source File: C:\SonarWiz-Projects\Edisto\05FEB213-to-05FEB231.csf • Ping Number: 11907 • Range to Target: 21.15 US Feet • Fish Height: 0.12 US Feet • Heading: 61.600 degrees • Event Number: 0 • Line Name: 05FEB213-to-05FEB231	**Dimensions** Target Height: = 0 US Feet Target Length: 13 US Feet Target Shadow: 0 US Feet Target Width: 7 US Feet Mag Anomaly: Avoidance Area: Classification 1: Classification 2: Area: Block: Description: object in bottom

Table 8. (continued)

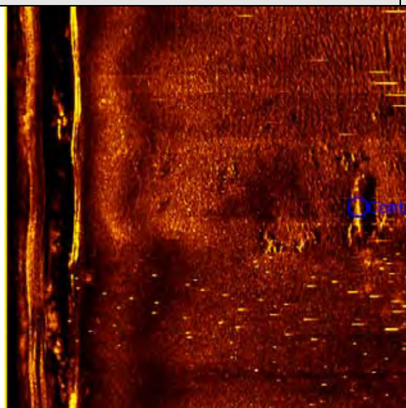
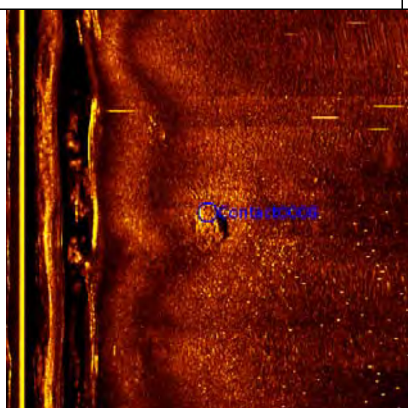
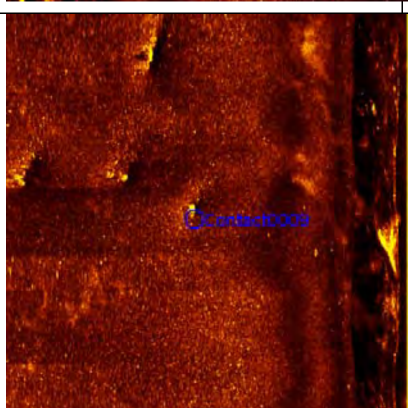
Contact Image	Contact Info	User Entered Info
	**SS-07** • Sonar Time at Target: 02/05/2013 15:44:58 • Click Position (Projected Coordinates) (X) 2213318.79 (Y) 232094.90 • Map Proj: SC83F • Acoustic Source File: C:\SonarWiz-Projects\Edisto\05FEB213-to-05FEB231.csf • Ping Number: 12837 • Range to Target: 26.31 US Feet • Fish Height: 0.12 US Feet • Heading: 35.000 degrees • Event Number: 0 • Line Name: 05FEB213-to-05FEB231	**Dimensions** Target Height: = 0 US Feet Target Length: 15 US Feet Target Shadow: 0 US Feet Target Width: 4 US Feet Mag Anomaly: Avoidance Area: Classification 1: Classification 2: Area: Block: Description: stump or roots or both possible shell scatter
	**SS-08** • Sonar Time at Target: 02/05/2013 16:47:16 • Click Position (Projected Coordinates) (X) 2213610.34 (Y) 232196.29 • Map Proj: SC83F • Acoustic Source File: C:\SonarWiz-Projects\Edisto\05FEB233-to-05FEB269.csf • Ping Number: 14523 • Range to Target: 13.77 US Feet • Fish Height: 0.76 US Feet • Heading: 43.200 degrees • Event Number: 0 • Line Name: 05FEB233-to-05FEB269	**Dimensions** Target Height: = 0 US Feet Target Length: 9 US Feet Target Shadow: 0 US Feet Target Width: 6 US Feet Mag Anomaly: Avoidance Area: Classification 1: Classification 2: Area: Block: Description: object
	**SS-09** • Sonar Time at Target: 02/05/2013 16:15:38 • Click Position (Projected Coordinates) (X) 2212906.93 (Y) 231877.37 • Map Proj: SC83F • Acoustic Source File: C:\SonarWiz-Projects\Edisto\05FEB234-to-05FEB250.csf • Ping Number: 10984 • Range to Target: 15.94 US Feet • Fish Height: 0.35 US Feet • Heading: 50.700 degrees • Event Number: 0 • Line Name: 05FEB234-to-05FEB250	**Dimensions** Target Height: = 0 US Feet Target Length: 0 US Feet Target Shadow: 0 US Feet Target Width: 0 US Feet Mag Anomaly: Avoidance Area: Classification 1: Classification 2: Area: Block: Description: posts or stumps?? buried structure

Table 8. (continued)

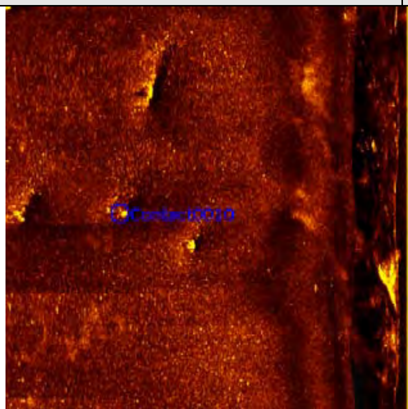
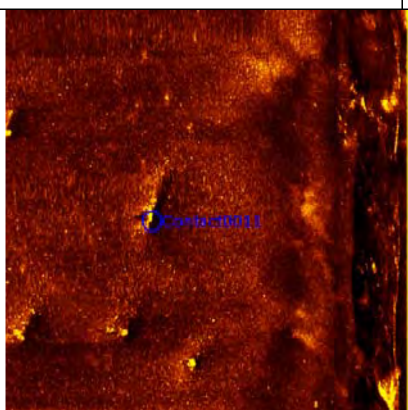
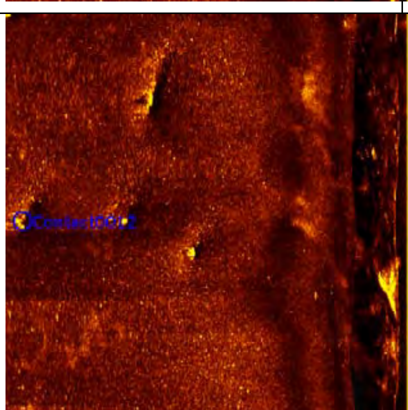
Contact Image	Contact Info	User Entered Info
	**SS-10** • Sonar Time at Target: 02/05/2013 16:15:39 • Click Position (Projected Coordinates) (X) 2212903.37 (Y) 231897.91 • Map Proj: SC83F • Acoustic Source File: C:\SonarWiz-Projects\Edisto\05FEB234-to-05FEB250.csf • Ping Number: 11008 • Range to Target: 21.45 US Feet • Fish Height: 0.35 US Feet • Heading: 52.400 degrees • Event Number: 0 • Line Name: 05FEB234-to-05FEB250	**Dimensions** Target Height: = 0 US Feet Target Length: 0 US Feet Target Shadow: 0 US Feet Target Width: 0 US Feet Mag Anomaly: Avoidance Area: Classification 1: Classification 2: Area: Block: Description: posts or stumps??
	**SS-11** • Sonar Time at Target: 02/05/2013 16:15:42 • Click Position (Projected Coordinates) (X) 2212931.18 (Y) 231910.53 • Map Proj: SC83F • Acoustic Source File: C:\SonarWiz-Projects\Edisto\05FEB234-to-05FEB250.csf • Ping Number: 11075 • Range to Target: 19.10 US Feet • Fish Height: 0.35 US Feet • Heading: 49.700 degrees • Event Number: 0 • Line Name: 05FEB234-to-05FEB250	**Dimensions** Target Height: = 0 US Feet Target Length: 0 US Feet Target Shadow: 0 US Feet Target Width: 0 US Feet Mag Anomaly: Avoidance Area: Classification 1: Classification 2: Area: Block: Description: posts or stumps??
	**SS-12** • Sonar Time at Target: 02/05/2013 16:15:39 • Click Position (Projected Coordinates) (X) 2212888.24 (Y) 231916.08 • Map Proj: SC83F • Acoustic Source File: C:\SonarWiz-Projects\Edisto\05FEB234-to-05FEB250.csf • Ping Number: 11008 • Range to Target: 28.65 US Feet • Fish Height: 0.35 US Feet • Heading: 52.400 degrees • Event Number: 0 • Line Name: 05FEB234-to-05FEB250	**Dimensions** Target Height: = 0 US Feet Target Length: 0 US Feet Target Shadow: 0 US Feet Target Width: 0 US Feet Mag Anomaly: Avoidance Area: Classification 1: Classification 2: Area: Block: Description: posts or stumps??

Table 8. (continued)

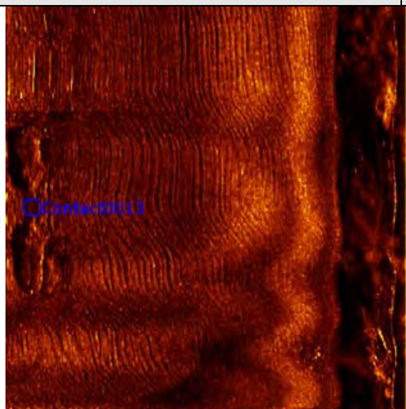
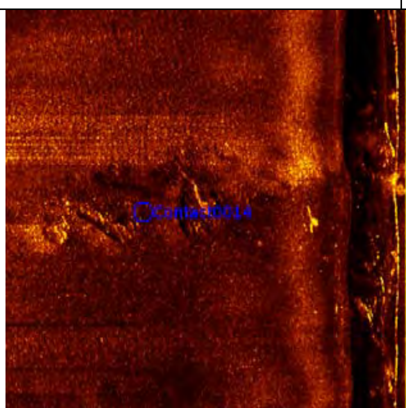
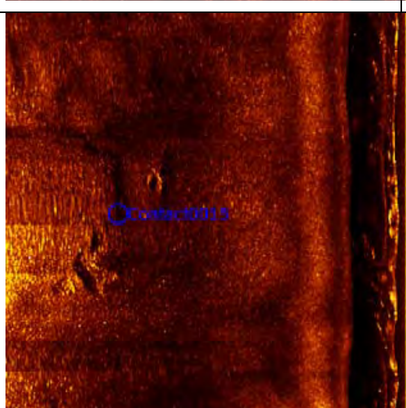
Contact Image	Contact Info	User Entered Info
	**SS-13** • Sonar Time at Target: 02/05/2013 16:18:11 • Click Position (Projected Coordinates) (X) 2213947.91 (Y) 232666.89 • Map Proj: SC83F • Acoustic Source File: C:\SonarWiz-Projects\Edisto\05FEB234-to-05FEB250.csf • Ping Number: 14103 • Range to Target: 27.95 US Feet • Fish Height: 0.35 US Feet • Heading: 61.300 degrees • Event Number: 0 • Line Name: 05FEB234-to-05FEB250	**Dimensions** Target Height: = 0 US Feet Target Length: 41 US Feet Target Shadow: 0 US Feet Target Width: 8 US Feet Mag Anomaly: Avoidance Area: Classification 1: Classification 2: Area: Block: Description: objects on bottom
	**SS-14** • Sonar Time at Target: 02/05/2013 17:19:02 • Click Position (Projected Coordinates) (X) 2213374.41 (Y) 232085.50 • Map Proj: SC83F • Acoustic Source File: C:\SonarWiz-Projects\Edisto\05FEB271-to-05FEB287.csf • Ping Number: 12585 • Range to Target: 19.69 US Feet • Fish Height: 0.47 US Feet • Heading: 51.800 degrees • Event Number: 0 • Line Name: 05FEB271-to-05FEB287	**Dimensions** Target Height: = 0 US Feet Target Length: 15 US Feet Target Shadow: 0 US Feet Target Width: 5 US Feet Mag Anomaly: Avoidance Area: Classification 1: Classification 2: Area: Block: Description: objects on bottom
	**SS-15** • Sonar Time at Target: 02/05/2013 17:19:17 • Click Position (Projected Coordinates) (X) 2213482.15 (Y) 232172.32 • Map Proj: SC83F • Acoustic Source File: C:\SonarWiz-Projects\Edisto\05FEB271-to-05FEB287.csf • Ping Number: 12901 • Range to Target: 21.56 US Feet • Fish Height: 0.47 US Feet • Heading: 57.100 degrees • Event Number: 0 • Line Name: 05FEB271-to-05FEB287	**Dimensions** Target Height: = 0 US Feet Target Length: 10 US Feet Target Shadow: 0 US Feet Target Width: 6 US Feet Mag Anomaly: Avoidance Area: Classification 1: Classification 2: Area: Block: Description: objects on bottom

Table 8. (continued)

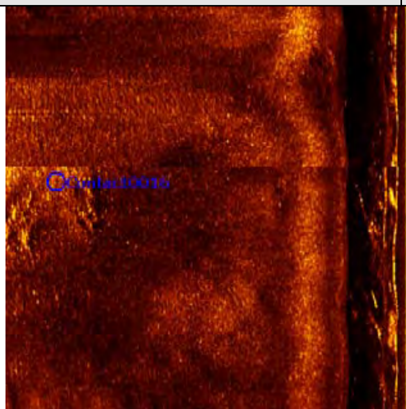
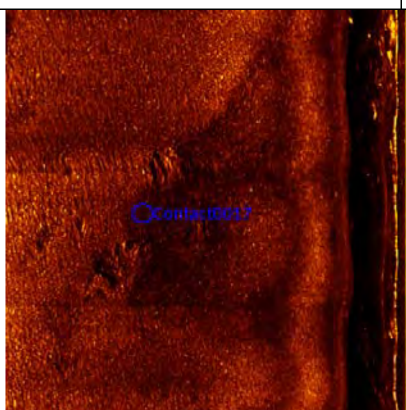
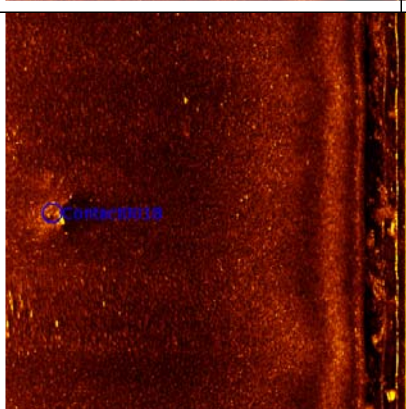
Contact Image	Contact Info	User Entered Info
	**SS-16** • Sonar Time at Target: 02/05/2013 17:19:27 • Click Position (Projected Coordinates) (X) 2213536.97 (Y) 232231.00 • Map Proj: SC83F • Acoustic Source File: C:\SonarWiz-Projects\Edisto\05FEB271-to-05FEB287.csf • Ping Number: 13114 • Range to Target: 26.19 US Feet • Fish Height: 0.47 US Feet • Heading: 56.100 degrees • Event Number: 0 • Line Name: 05FEB271-to-05FEB287	**Dimensions** Target Height: = 0 US Feet Target Length: 22 US Feet Target Shadow: 0 US Feet Target Width: 11 US Feet Mag Anomaly: Avoidance Area: Classification 1: Classification 2: Area: Block: Description: looks like wood maybe
	**SS-17** • Sonar Time at Target: 02/05/2013 17:50:30 • Click Position (Projected Coordinates) (X) 2213811.35 (Y) 232306.40 • Map Proj: SC83F • Acoustic Source File: C:\SonarWiz-Projects\Edisto\05FEB289-to-05FEB307.csf • Ping Number: 14656 • Range to Target: 19.75 US Feet • Fish Height: 0.35 US Feet • Heading: 58.800 degrees • Event Number: 0 • Line Name: 05FEB289-to-05FEB307	**Dimensions** Target Height: = 0 US Feet Target Length: 12 US Feet Target Shadow: 0 US Feet Target Width: 12 US Feet Mag Anomaly: Avoidance Area: Classification 1: Classification 2: Area: Block: Description: stumps on river margin??
	**SS-18** • Sonar Time at Target: 02/05/2013 20:16:28 • Click Position (Projected Coordinates) (X) 2214250.00 (Y) 232106.87 • Map Proj: SC83F • Acoustic Source File: C:\SonarWiz-Projects\Edisto\05FEB446-to-05FEB464.csf • Ping Number: 14547 • Range to Target: 26.43 US Feet • Fish Height: 0.35 US Feet • Heading: 50.600 degrees • Event Number: 0 • Line Name: 05FEB446-to-05FEB464	**Dimensions** Target Height: = 0 US Feet Target Length: 4 US Feet Target Shadow: 0 US Feet Target Width: 4 US Feet Mag Anomaly: Avoidance Area: Classification 1: Classification 2: Area: Block: Description: Crab Pot

Table 8. (continued)

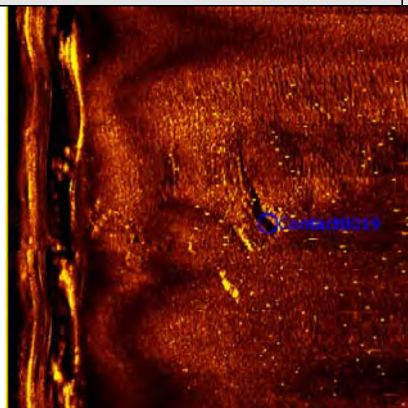
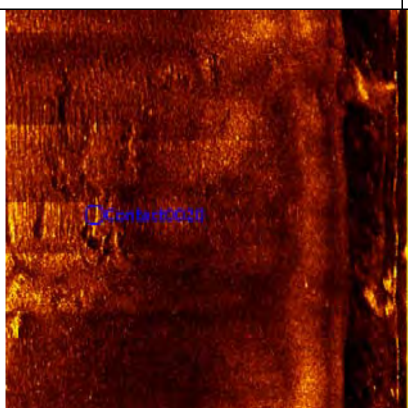
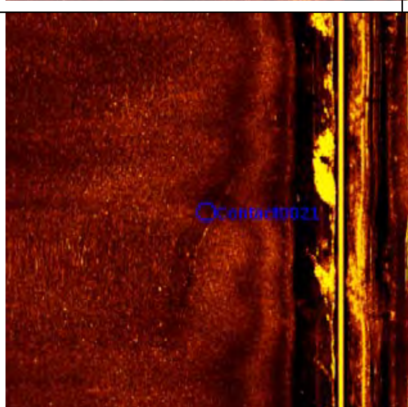
Contact Image	Contact Info	User Entered Info
	**SS-19** • Sonar Time at Target: 02/05/2013 16:16:34 • Click Position (Projected Coordinates) (X) 2213379.06 (Y) 232074.21 • Map Proj: SC83F • Acoustic Source File: C:\SonarWiz-Projects\Edisto\05FEB234-to-05FEB250.csf • Ping Number: 12138 • Range to Target: 19.51 US Feet • Fish Height: 0.35 US Feet • Heading: 51.900 degrees • Event Number: 0 • Line Name: 05FEB234-to-05FEB250	**Dimensions** Target Height: = 0 US Feet Target Length: 22 US Feet Target Shadow: 0 US Feet Target Width: 9 US Feet Mag Anomaly: Avoidance Area: Classification 1: Classification 2: Area: Block: Description: Object on bottom
	**SS-20** • Sonar Time at Target: 02/05/2013 16:16:27 • Click Position (Projected Coordinates) (X) 2213250.53 (Y) 232149.44 • Map Proj: SC83F • Acoustic Source File: C:\SonarWiz-Projects\Edisto\05FEB234-to-05FEB250.csf • Ping Number: 11992 • Range to Target: 23.32 US Feet • Fish Height: 0.35 US Feet • Heading: 65.700 degrees • Event Number: 0 • Line Name: 05FEB234-to-05FEB250	**Dimensions** Target Height: = 0 US Feet Target Length: 28 US Feet Target Shadow: 0 US Feet Target Width: 31 US Feet Mag Anomaly: Avoidance Area: Classification 1: Classification 2: Area: Block: Description: texture difference in parallel - matting??
	**SS-21** • Sonar Time at Target: 02/06/2013 17:24:01 • Click Position (Projected Coordinates) (X) 2213194.12 (Y) 229815.08 • Map Proj: SC83F • Acoustic Source File: C:\SonarWiz-Projects\Edisto2\06FEB417-to-06FEB434.csf • Ping Number: 9006 • Range to Target: 9.90 US Feet • Fish Height: 0.41 US Feet • Heading: 52.600 degrees • Event Number: 0 • Line Name: 06FEB417-to-06FEB434	**Dimensions** Target Height: = 0 US Feet Target Length: 24 US Feet Target Shadow: 0 US Feet Target Width: 0 US Feet Mag Anomaly: Avoidance Area: Classification 1: Classification 2: Area: Block: Description: teeny piece of cable??

Table 8. (continued)

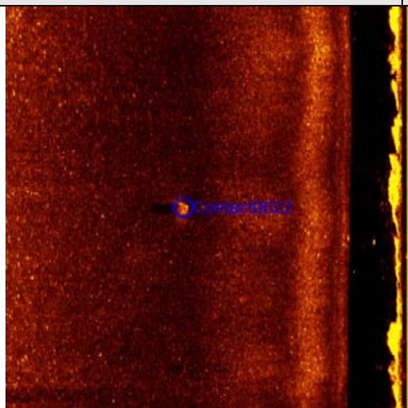
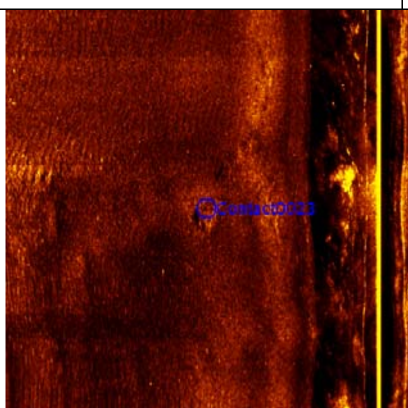
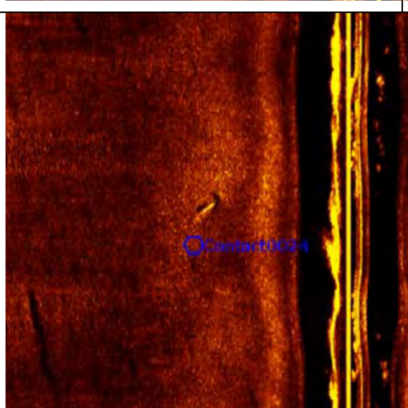
Contact Image	Contact Info	User Entered Info
	**SS-22** • Sonar Time at Target: 02/06/2013 20:03:49 • Click Position (Projected Coordinates) (X) 2215964.02 (Y) 231228.08 • Map Proj: SC83F • Acoustic Source File: C:\SonarWiz-Projects\Edisto2\06FEB577-to-06FEB595.csf • Ping Number: 16972 • Range to Target: 16.76 US Feet • Fish Height: 0.00 US Feet • Heading: 47.700 degrees • Event Number: 0 • Line Name: 06FEB577-to-06FEB595	**Dimensions** Target Height: = 0 US Feet Target Length: 4 US Feet Target Shadow: 0 US Feet Target Width: 4 US Feet Mag Anomaly: Avoidance Area: Classification 1: Classification 2: Area: Block: Description: crab pot
	**SS-23** • Sonar Time at Target: 02/05/2013 15:44:57 • Click Position (Projected Coordinates) (X) 2213210.93 (Y) 232164.99 • Map Proj: SC83F • Acoustic Source File: C:\SonarWiz-Projects\Edisto\05FEB213-to-05FEB231.csf • Ping Number: 12800 • Range to Target: 12.71 US Feet • Fish Height: 0.12 US Feet • Heading: 35.600 degrees • Event Number: 0 • Line Name: 05FEB213-to-05FEB231	**Dimensions** Target Height: = 0 US Feet Target Length:6 US Feet Target Shadow: 0 US Feet Target Width:6 US Feet Mag Anomaly: Avoidance Area: Classification 1: Classification 2: Area: Block: Description: object on bottom, wood??
	**SS-24** • Sonar Time at Target: 02/14/2013 17:41:47 • Click Position (Projected Coordinates) (X) 2214311.31 (Y) 225515.04 • Map Proj: SC83F • Acoustic Source File: C:\SonarWiz-Projects\Edisto\14FEB213-to-14FEB229.csf • Ping Number: 10908 • Range to Target: 11.48 US Feet • Fish Height: 0.00 US Feet • Heading: 234.700 degrees • Event Number: 0 • Line Name: 14FEB213-to-14FEB229	**Dimensions** Target Height: = 0 US Feet Target Length: 6 US Feet Target Shadow: 0 US Feet Target Width: 1 US Feet Mag Anomaly: Avoidance Area: Classification 1: Classification 2: Area: Block: Description: object

Table 8. (continued)

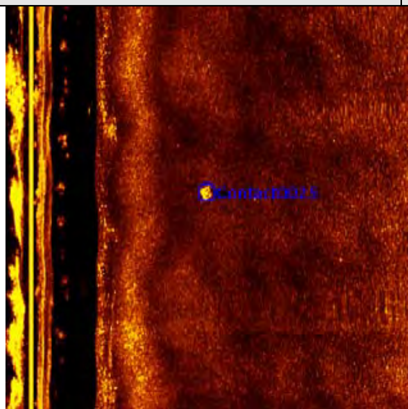
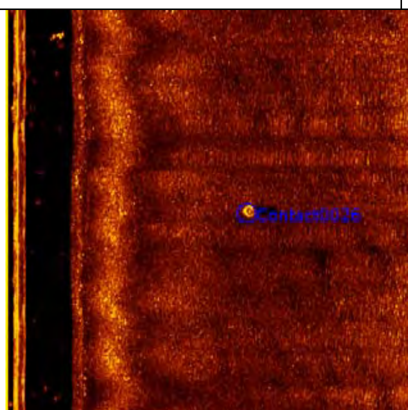
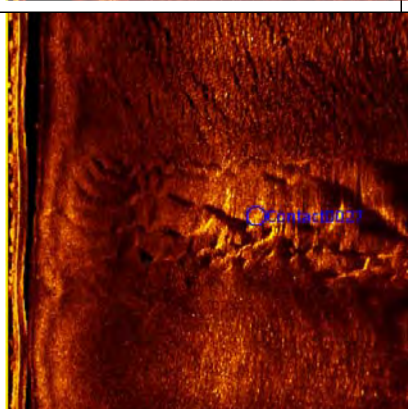
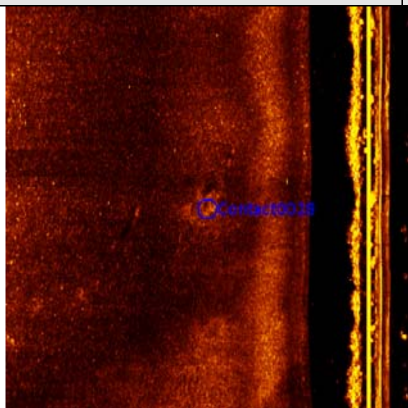
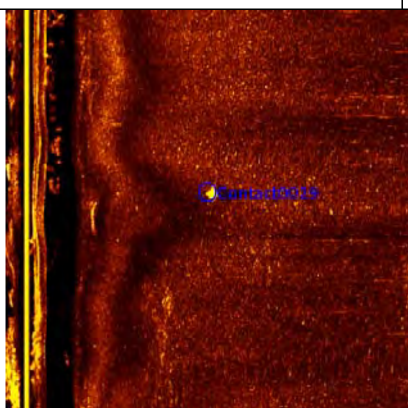
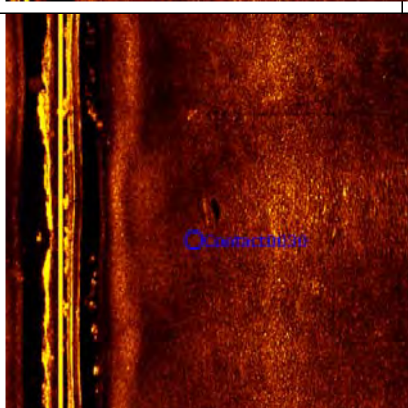
Contact Image	Contact Info	User Entered Info
	**SS-25** • Sonar Time at Target: 02/07/2013 04:38:32 • Click Position (Projected Coordinates) (X) 2215945.56 (Y) 228491.46 • Map Proj: SC83F • Acoustic Source File: C:\SonarWiz-Projects\Edisto3\06FE1216-to-06FE1234.csf • Ping Number: 4256 • Range to Target: 13.07 US Feet • Fish Height: 0.00 US Feet • Heading: 230.900 degrees • Event Number: 0 • Line Name: 06FE1216-to-06FE1234	**Dimensions** Target Height: = 0 US Feet Target Length: 3 US Feet Target Shadow: 0 US Feet Target Width: 3 US Feet Mag Anomaly: Avoidance Area: Classification 1: Classification 2: Area: Block: Description: crab pot
	**SS-26** • Sonar Time at Target: 02/07/2013 04:30:13 • Click Position (Projected Coordinates) (X) 2215948.11 (Y) 228486.05 • Map Proj: SC83F • Acoustic Source File: C:\SonarWiz-Projects\Edisto3\06FE1196-to-06FE1215.csf • Ping Number: 13676 • Range to Target: 17.99 US Feet • Fish Height: 0.00 US Feet • Heading: 57.900 degrees • Event Number: 0 • Line Name: 06FE1196-to-06FE1215	**Dimensions** Target Height: = 0 US Feet Target Length: 3 US Feet Target Shadow: 0 US Feet Target Width: 3 US Feet Mag Anomaly: Avoidance Area: Classification 1: Classification 2: Area: Block: Description: Crab pot
	**SS-27** • Sonar Time at Target: 02/06/2013 22:44:20 • Click Position (Projected Coordinates) (X) 2213157.92 (Y) 228191.12 • Map Proj: SC83F • Acoustic Source File: C:\SonarWiz-Projects\Edisto3\06FEB776-to-06FEB794.csf • Ping Number: 7036 • Range to Target: 18.63 US Feet • Fish Height: 0.00 US Feet • Heading: 55.000 degrees • Event Number: 0 • Line Name: 06FEB776-to-06FEB794	**Dimensions** Target Height: = 0 US Feet Target Length: 82 US Feet Target Shadow: 0 US Feet Target Width: 22 US Feet Mag Anomaly: Avoidance Area: Classification 1: Classification 2: Area: Block: Description: Exposed sand wave? Bedrock?

Table 8. (concluded)

Contact Image	Contact Info	User Entered Info
	**SS-28** • Sonar Time at Target: 02/06/2013 23:56:29 • Click Position (Projected Coordinates) (X) 2216354.84 (Y) 230356.08 • Map Proj: SC83F • Acoustic Source File: C:\SonarWiz-Projects\Edisto3\06FEB854-to-06FEB872.csf • Ping Number: 16588 • Range to Target: 11.95 US Feet • Fish Height: 0.00 US Feet • Heading: 52.600 degrees • Event Number: 0 • Line Name: 06FEB854-to-06FEB872	**Dimensions** Target Height: = 0 US Feet Target Length: 7 US Feet Target Shadow: 0 US Feet Target Width: 4 US Feet Mag Anomaly: Avoidance Area: Classification 1: Classification 2: Area: Block: Description: vague object(s)
	**SS-29** • Sonar Time at Target: 02/14/2013 15:39:23 • Click Position (Projected Coordinates) (X) 2216157.30 (Y) 227624.50 • Map Proj: SC83F • Acoustic Source File: C:\SonarWiz-Projects\Edisto\14FEB063-to-14FEB081.csf • Ping Number: 5651 • Range to Target: 13.42 US Feet • Fish Height: 0.00 US Feet • Heading: 250.900 degrees • Event Number: 0 • Line Name: 14FEB063-to-14FEB081	**Dimensions** Target Height: = 0 US Feet Target Length: 3 US Feet Target Shadow: 0 US Feet Target Width: 4 US Feet Mag Anomaly: Avoidance Area: Classification 1: Classification 2: Area: Block: Description: Crab pot
	**SS-30** • Sonar Time at Target: 02/14/2013 17:40:26 • Click Position (Projected Coordinates) (X) 2214894.54 (Y) 226029.01 • Map Proj: SC83F • Acoustic Source File: C:\SonarWiz-Projects\Edisto\14FEB213-to-14FEB229.csf • Ping Number: 9194 • Range to Target: 9.91 US Feet • Fish Height: 0.00 US Feet • Heading: 237.000 degrees • Event Number: 0 • Line Name: 14FEB213-to-14FEB229	**Dimensions** Target Height: = 0 US Feet Target Length: 6 US Feet Target Shadow: 0 US Feet Target Width: 0 US Feet Mag Anomaly: Avoidance Area: Classification 1: Classification 2: Area: Block: Description: large fish?

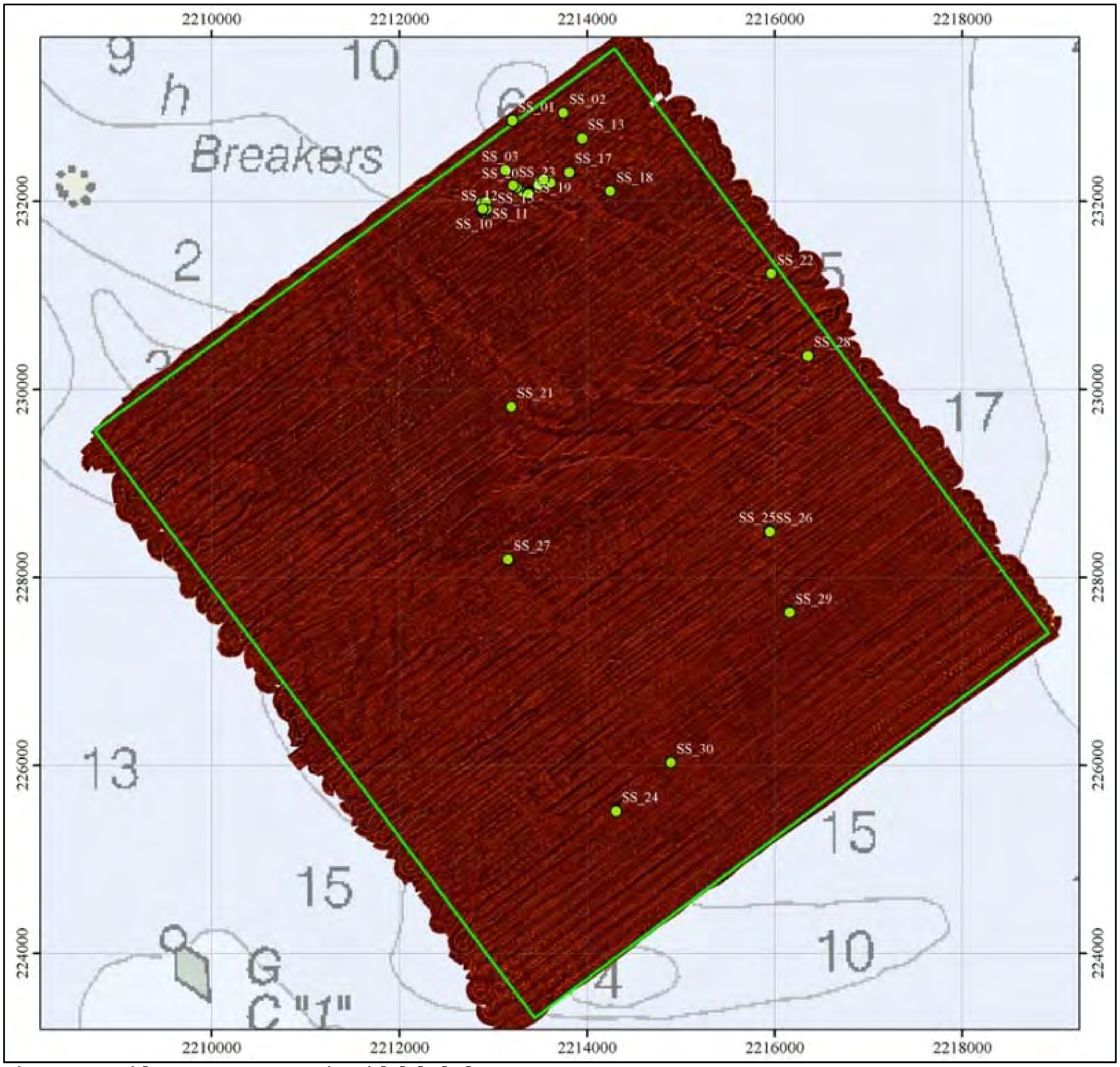


Figure 36. Sidescan sonar mosaic with labeled contacts.

4.1.3 Sidescan Sonar and Subbottom Profiler Results With Respect to Submerged Prehistoric Potentials

4.1.3.1 Sidescan Sonar Results

In addition to analyzing the acoustic images for evidence of historic shipwrecks, or other objects sitting on or in the marine sediments, the record was scrutinized for evidence of former landscape features or other evidence of pre-inundation paleolandscape settings where human activities might have taken place. Figure 36 above shows the locations of contacts recorded during the analysis of the sidescan data on a mosaiced geo-referenced image, including a cluster of 20 in the northeastern quadrant that record portions of a blocky, rugged area of apparently disintegrating topography, an example of which is shown in Figure 37.

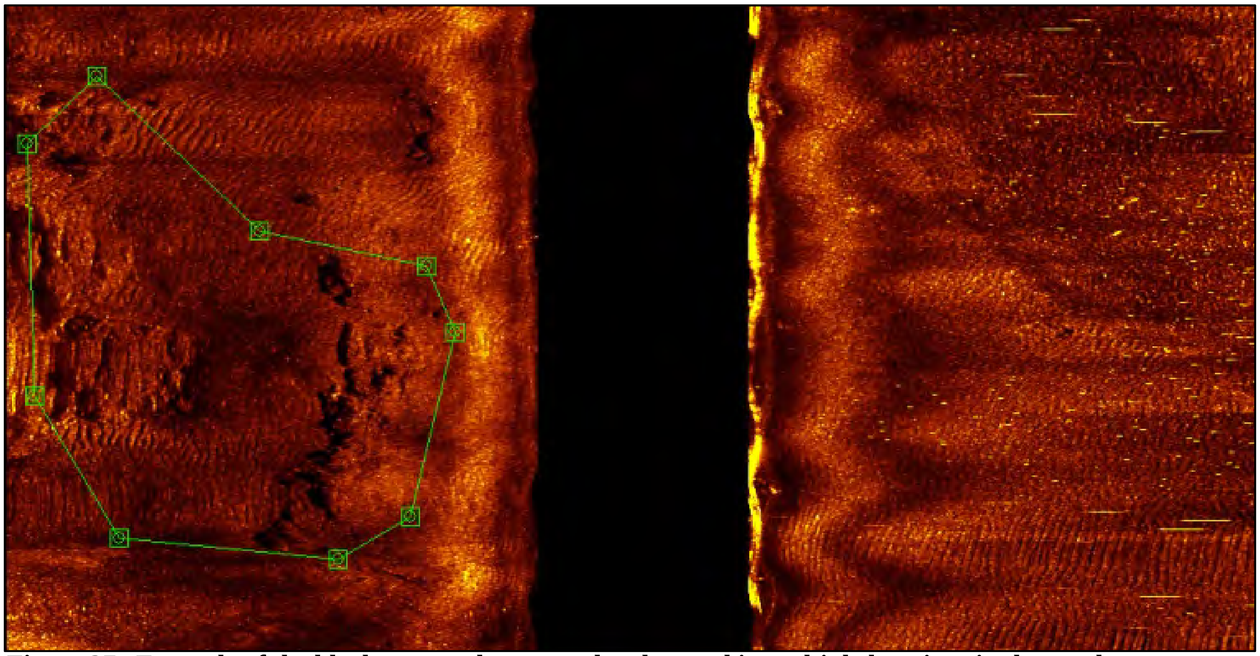


Figure 37. Example of the blocky, rugged topography observed in multiple locations in the northern corner.

These contacts (see SS-01 to SS-20 with the exception of crab pots, etc.) include blocky textures, stumps, and other evidence for wood or reworked paleolandscape (see Table 8). This area is highly potential for prehistoric archaeological sites from times when this area would have been tidal marsh or even coastal environment, before inundation.

SS-05 and SS-09 to SS-12, in particular, represent five posts or stumps that protrude from the bottom. These objects are apparently vertical, but their depth and overall lengths are unknown, as is their age and formation. It is considered possible that these could represent a pile dwelling or other infrastructure construction *sensu* Crook (2007) preserved in the sediments and therefore the feature, and the surrounding paleolandscape, should be avoided or investigated in more detail.

Based on the subbottom profiler record, the exposed possible surface may continue into the sediment bank to the west, away from the exposure. Because this may be an area that could potentially contain pre-Contact era cultural resource sites, it should be avoided by a distance of 1,500 feet around an arbitrary point at E2213373, N232446.

Another apparent feature that covers much of the study area is bounded units of change in the surface expression of the bottom. These were assumed to be textural changes more than changes in relief of unknown significance to reconstructing the paleolandscapes of the study area. Several of these features and their orientation are shown in Figure 38 by white arrows. In general, less distinct bottom returns characterized the western half of the study area and more distinct bottom returns were observed in the eastern, particularly the northeastern portions of the study area.

Farther south, sand waves transition to featureless, less reflective areas. It was also noted that different sand wave configurations included changes in wave height and size, as well as the apparent angularity, which probably indicates that these areas are controlled by different local tidal flow regimes.

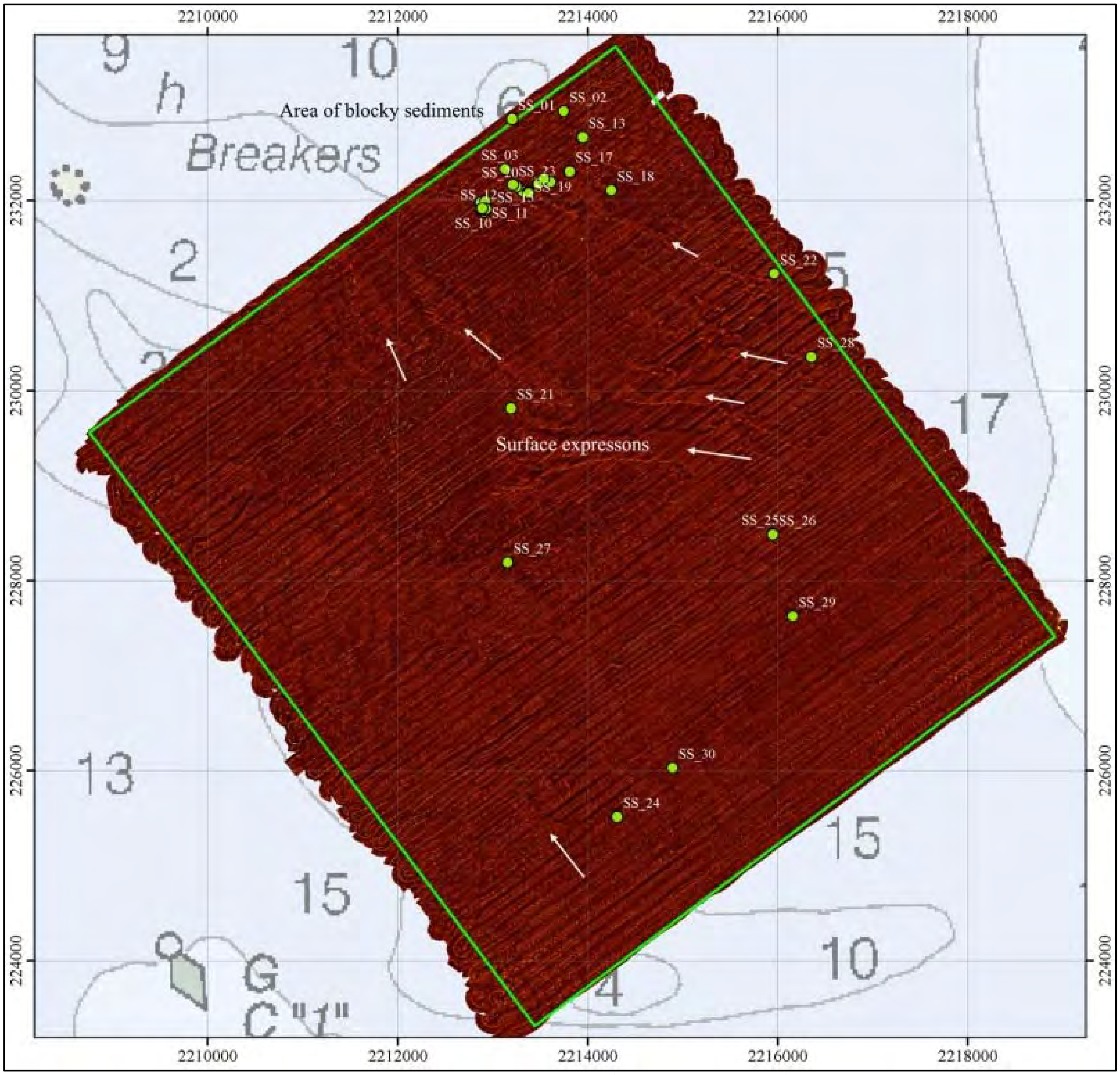


Figure 38. Mosaic with arrows marking changes in the surface expression of the bottom.

4.1.3.2 Subbottom Profiler Results

With respect to subbottom profiler data for the survey, Figure 39 shows the trackline record ghosted and the extent of features mapped in SonarWiz.MAp during the analysis of the data. The bolded tracklines are the example profiles presented in Figure 40.

In general, there were areas of higher relief, i.e., shallower portions that were less reflective overall, with a zone of 6 to 7 feet of somewhat darker reflection, with an abrupt transition to less reflectivity at approximately 18 feet depth, as if there were a horizon or horizontal transition. Lower swale areas exhibited increased reflectivity; possibly indicating finer, possibly organic material; although without coring or other sampling, these remain explanations for the data in need of testing.

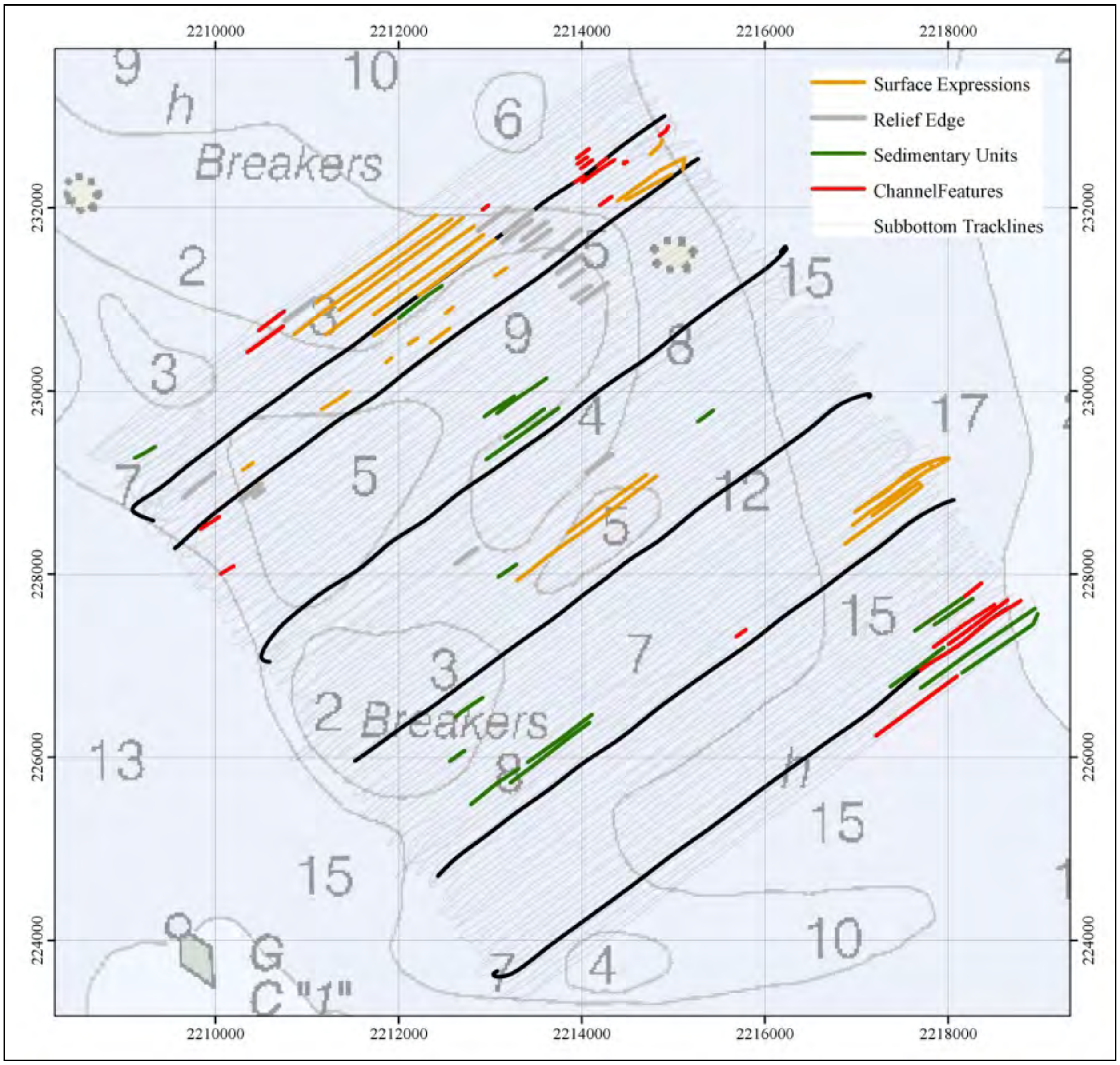


Figure 39. Subbottom trackline record ghosted, bolded tracklines shown in the profile composite in Figure 40. Features were mapped in SonarWiz.MAp during the analysis of the data.

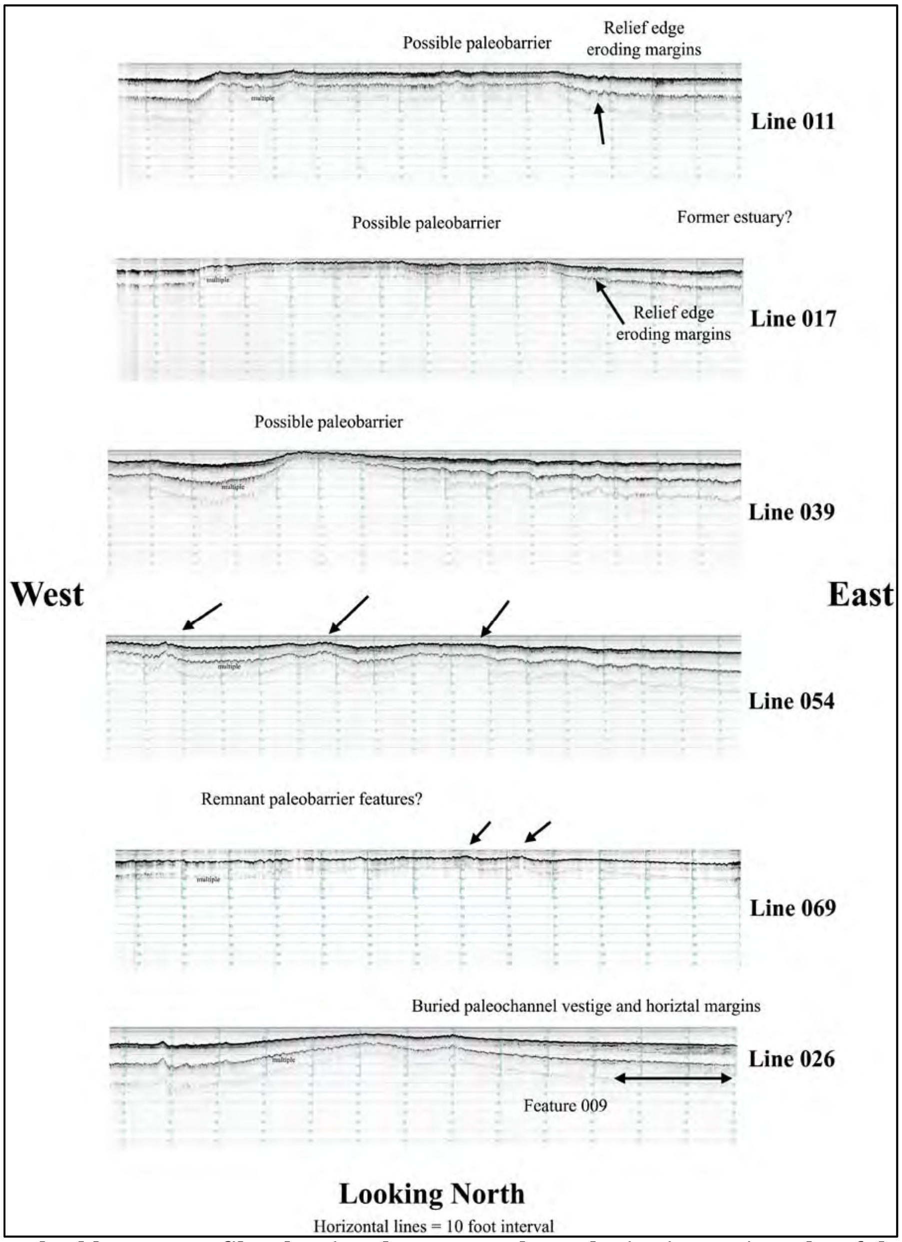


Figure 40. Selected subbottom profiles showing the topography and seismic stratigraphy of the study area.

Features mapped included possible paleochannels (areas of increased reflectivity and apparent stratification) as well areas of horizontal facies (strata). Both of these can be useful paleoenvironmental records for the geologist, but not necessarily indicative of potential archaeological site locations for the culture resources manager. On the other hand, horizontal surfaces or horizons of sediments on the margins of paleochannels are highly potential for archaeological sites, depending on the age of the horizontal strata being latest Pleistocene or Holocene (i.e. recent).

Based on the subbottom record, there is one such situation that was crossed over several trackline passes in the southeastern corner of the study area, an example of which is shown in Figure 41. Because the age of this feature is unknown, we recommend that it be avoided by a radius of 1,500 feet around an arbitrary center point at E2218203, N227338, or studied in more detail.

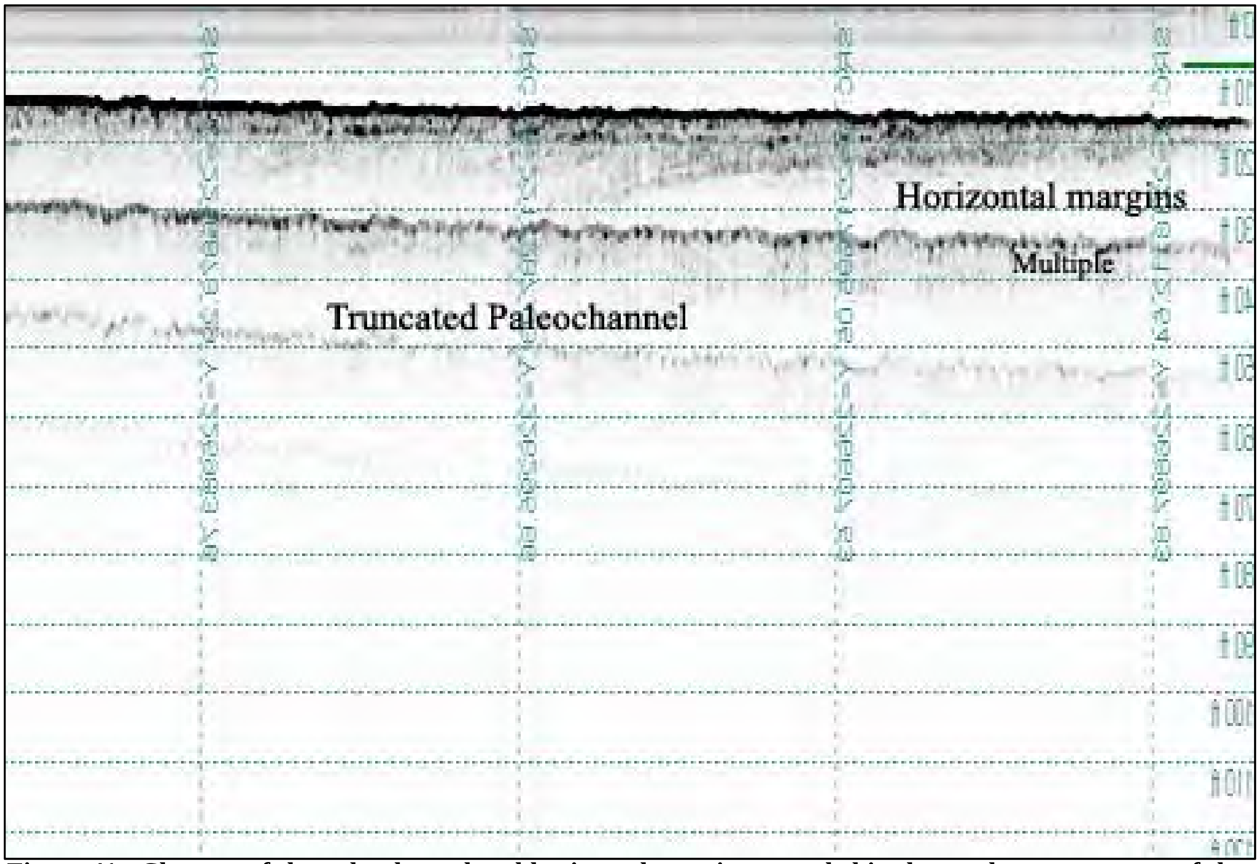


Figure 41. Close up of the paleochannel and horizontal margins recorded in the southeastern corner of the study area.

Since the sidescan sonar record indicated potential exposed and shallowly buried paleolandscapes in the northeastern portion of the study area, additional effort was placed there to understand the sidescan configurations and investigate the possibility of additional understanding of the remote sensing record with regard to submerged prehistoric sites. Figure 39 shows that this resulted in mapping a change of elevation that may be the transition from paleobarrier to paleosubmerged conditions, where both are now submerged. Some small areas of increased reflectivity were mapped to the east of the change in slope in the lower, deeper portion as vestiges of small paleochannels, as well as the aforementioned zone of increased reflection to the west in the shallower, higher relief, paleobarrier. These can be seen with close inspection of Figure 40, Lines 011 and 017.

4.1.4 Summary

In general, the entire Edisto Beach study area has the possibility, albeit slight, to contain eroded prehistoric archaeological sites, particularly Middle Archaic sites because the area was an exposed paleocoastal or paleoestuarine configuration at times when people may have been in the area. However, determining the specific location of any particular locus of activity is beyond the capabilities of the state of the art and industry standard remote sensing regime used in this report. Other strategies of cultural resources management could be utilized in this large area such as determining the age of the features or monitoring the dredge spoil on the dredge or once it is deposited on the beach.

On the other hand, there are two areas of potential paleolandscape settings that should be avoided or studied in greater detail. One area includes an exposed paleolandscape with multiple logs (or stumps) that has one feature of possible upright posts indicating a possible shallowly buried structure (Crook 2007) in the northeastern quadrant of the study area, as indicated by the sidescan sonar data. Subbottom profiler data indicate that the exposed and shallowly buried landscape sediments may continue into the inferred paleobarrier sediments to the west, away from the exposed portions. Because this may contain potentially eligible pre-Contact cultural resources, it should be avoided by a distance of 1,500 feet around an arbitrary point at E2213373, N232446 (Figure 42).

The second area, based on the subbottom record, is a buried paleochannel feature with horizontal margins within the study area at the far southeastern corner. Because the age of this feature is unknown, we recommend that it should be avoided by a radius of 1,500 feet around an arbitrary center point at E2218203, N227338, or studied in more detail (see Figure 42).

4.2 Hardbottom Resources

Review of existing data sources for the Edisto borrow area survey included the South Carolina Department of Natural Resources, NOAA Digital Coast, and the U.S. Navy (Atlantic GIS data set). All data sources consisted of the same Southeast Area Monitoring and Assessment Program (SEAMAP) coverage, which was supplemented by U.S. Navy-Atlantic GIS artificial reef and shipwreck location data.

The SEAMAP project began in 1985 and was finalized in 2001 with the goal of classifying the coastal ocean bottom along the Southeastern U.S. (North Carolina to Florida) out to a 200-meter depth. The SEAMAP data were structured into one-minute latitude by one-minute longitude grid cells, where each cell was ultimately determined to represent hardbottom, possible hardbottom, or not hardbottom habitat. Over 65,000 data records (scientific diver observations, video and still camera, dredge data, and sidescan data) were analyzed and integrated to develop the SEAMAP bottom mapping classifications (Van Dolah et al. 1994:46). Based on review of this information, there are no known documented hardbottom occurrences within the proximity of the survey area. All sidescan records were reviewed by our remote sensing analyst who is experienced in identifying hardbottom signatures. Based on the background research, sidescan survey performed, and interpretation of the survey records, no hardbottom habitat is likely to occur within the defined survey area. National Marine Fisheries Service (NMFS) review and concurrence on these findings is required for compliance with the Magnuson-Stevens Fisheries Conservation and Management Act. Since no hardbottom signatures were identified from sidescan records, the USACE has determined that implementation of Phase 2 of the SOW (towed video and habitat characterization) is not required.

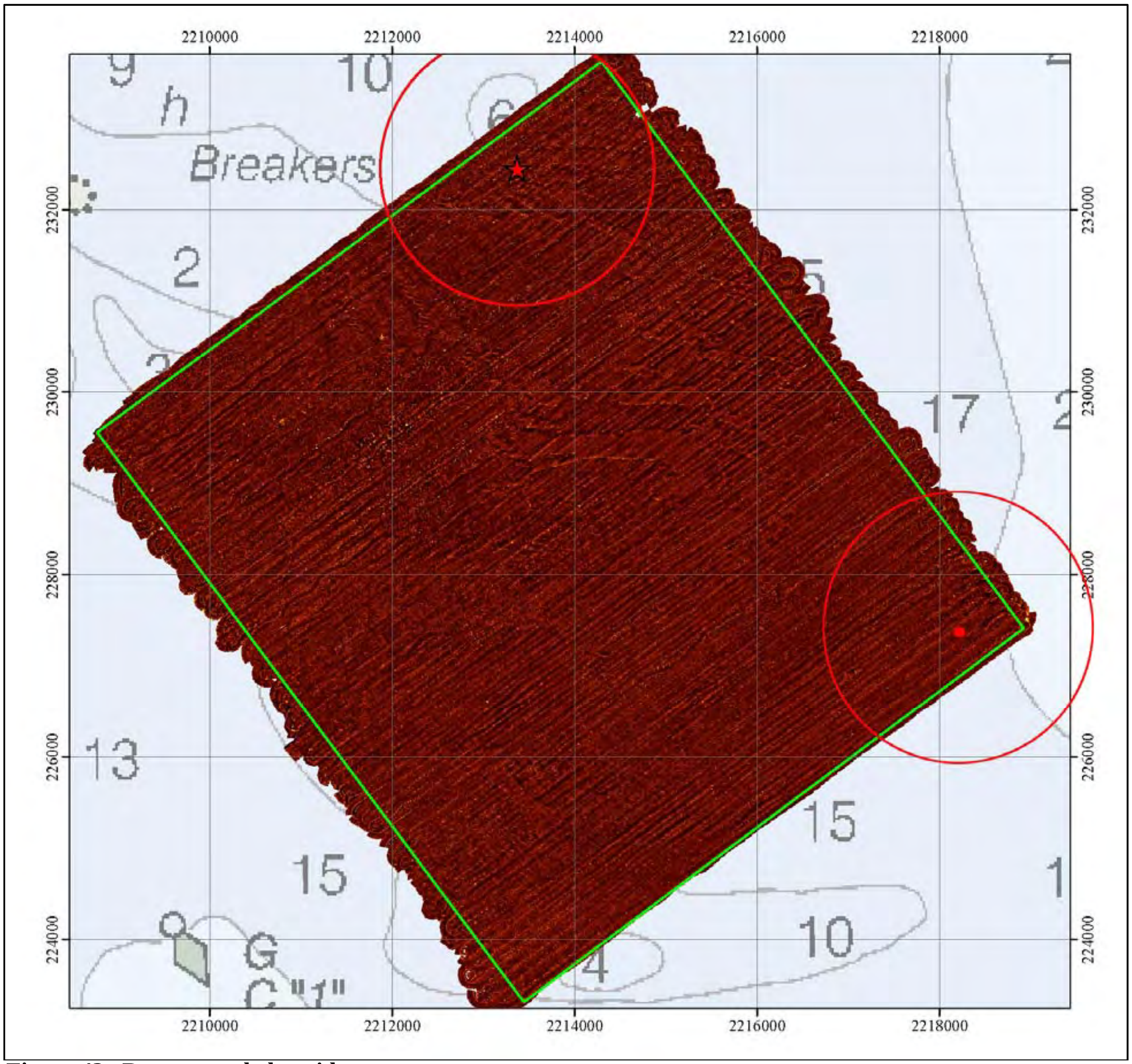


Figure 42. Recommended avoidance zones.

5.0 CONCLUSIONS

5.1 Cultural Resources

Eighteen magnetic anomalies, thirty-one sidescan sonar targets, and two subbottom impedance contrast features in the form of paleolandform areas were recorded during the current survey. Out of all the anomalies, sonar targets, and subbottom impedance contrast features, no anomalies were considered to potentially represent significant historic cultural resources. Several sidescan sonar contacts and subbottom features were considered to represent vestiges of paleolandforms that have the possibility of containing prehistoric cultural resources sites. Illustrated in Figure 43, the two areas of potential paleolandscape settings that should be avoided include an area of exposed paleolandscape with multiple logs (or stumps) that has one feature of possible upright posts indicating a possible structure. Because this may contain potentially eligible pre-Contact cultural resources, it should be avoided by a distance of 1,500 feet around an arbitrary point at

E2213373, N232446 (see Figure 43). The second area, based on the subbottom record, is a buried paleochannel feature with horizontal margins within the study area at the far southeastern corner. Because the age of this feature is unknown, it is recommended that it should be avoided by a radius of 1,500 feet around an arbitrary center point at E2218203, N227338, or studied in more detail (see Figure 43).

A letter of concurrence from the SCIAA (Mr. James Spirek) is provided in Appendix C. The agency did, however, request that any inadvertent discovery of potential archaeological materials, i.e., wood structure, prehistoric lithics, ceramics, etc. during dredging operations cease from that area until inspections may reveal the source of this material. Further, the agency had no objections from a submerged cultural resources viewpoint for dredging to occur within the proposed borrow area.

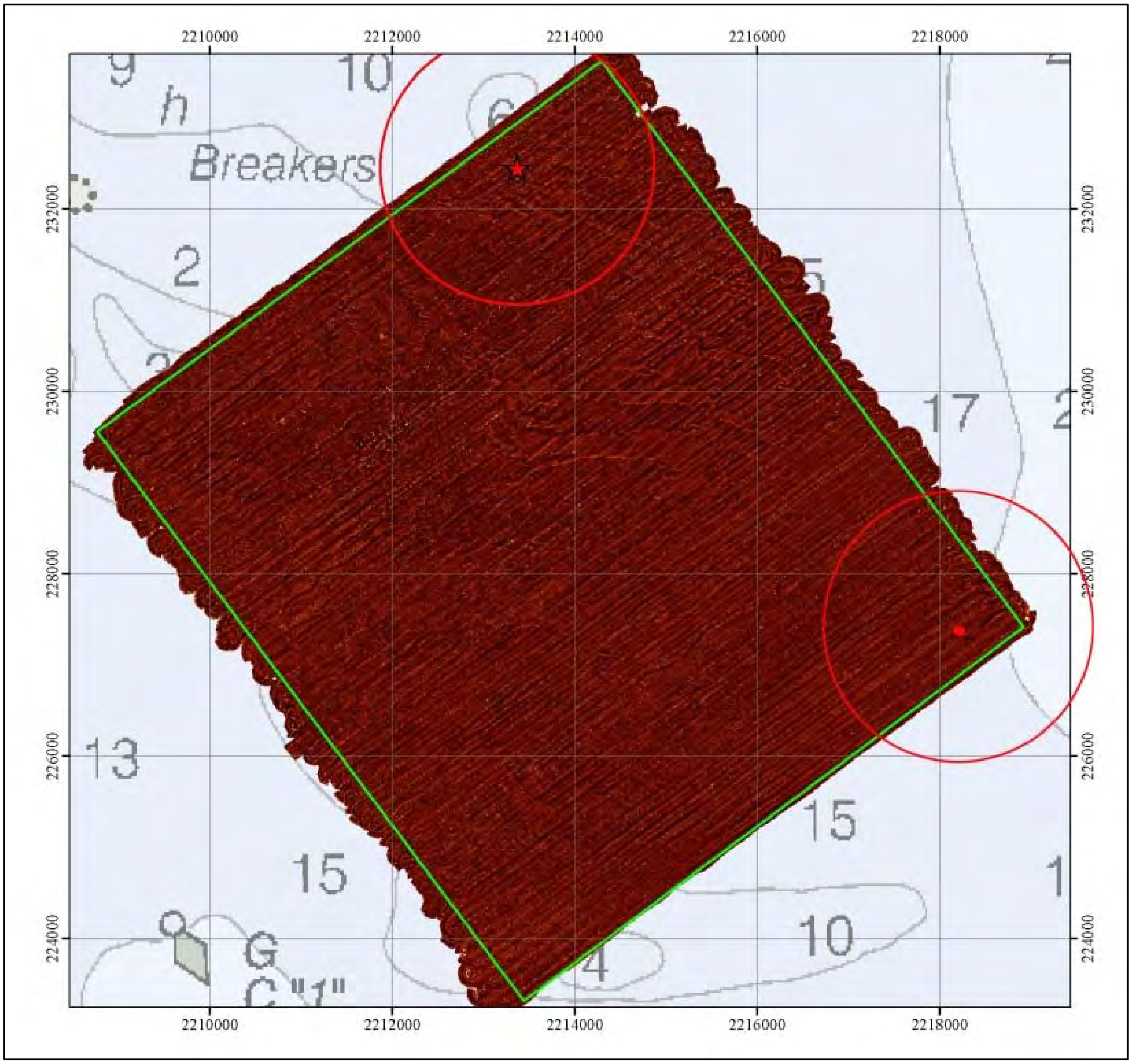


Figure 43. Two recommended avoidance zones.

5.2 Hardbottom Resources

Based on review of available marine resource GIS data sources and review of the collected sidescan records, there is not likely to be any hardbottom habitat within the borrow site survey area. No further investigation is deemed necessary. Review and concurrence with the NMFS (Pace Wilber) is required to conclude consultation on this Essential Fish Habitat resource type.

6.0 REFERENCES

Anderson, David G., R. Jerald Ledbetter, and Lisa O'Steen
1990 *Paleoindian Period Archaeology of Georgia*. University of Georgia Laboratory of Archaeology Series Report 28.

Anderson, David G., Lisa D. O'Steen, and Kenneth E. Sassaman
1996 Environmental and Chronological Considerations. In *The Paleoindian and Early Archaic Southeast*, edited by David G. Anderson and Kenneth E. Sassaman, pp. 3-15. The University of Alabama Press. Tuscaloosa.

Baldwin, Wayne E., Robert A Morton, Thomas R. Putney, Michael P. Katuna, M. Schott Harris, Paul T. Gayes, Neal W. Driscoll, Jane F. Denny, and William C. Schwab
2006 Migration of the Pee Dee River System inferred from ancestral paleochannels underlying the South Carolina Grand Strand and Long Bay inner shelf. *Geological Society of America Bulletin* 118(5-6):533-549.

Balsillie, James and J.F. Donoghue
2004 *High Resolution Sea Level History for the Gulf of Mexico Since the Last Glacial Maximum.* Florida Geological Survey, Report of Investigations #103. Website available at http://www.dep.state.fl.us/geology/publications/ri/ri103.pdf.

Black, Robert C., III
1958 *A History of Fort Wadsworth, New York Harbor. Cultural Resources Management Study #7*. Submitted to the Division of Cultural Resources, North Atlantic Regional Office, National Park Service, U.S. Department of the Interior.

Blanchon, Paul
2011 Meltwater Pulses. In *Encyclopedia of Modern Coral Reefs: Structure, form and process.*, edited by D. Hopley, pp. 683-690. vol. Earth Science Series. Springer-Verlag

Blanchon, Paul and John Shaw
1995 Reef drowning during the last deglaciation: Evidence for catastrophic sea-level rise and ice-sheet collapse. *Geology* 23(1):4-8.

Booth, Robert K. and Fredrick J. Rich
1999 Identification and Paleoecological Impliations of a Late Pleistocene Pteridophyte-dominated Assemblage Preserved in Brown Peat from St. Catherines Island, Georgia. Castanea 64(2):120-129.

Braley, Chad O., Roy R. Doyon, and J. Mark Williams
1985 The Archaeological Confirmation of Fort Argyle (9Bry28), Bryan County, Georgia. Southeastern Archaeological Services, Inc., Athens, Georgia.

Breiner, S.
1973 *Applications Manual to Portable Magnetometers*. Geometrics, Inc. (available at geometrics.com).

Buchner, C. Andrew and Michael Krivor
2001 *Cultural Resources Reconnaissance Study of the White River Navigation Project*. Prepared for the USACE, Memphis District by Panamerican Consultants, Inc.

Butler, Carroll B.
1998 *Treasures of the Long Leaf Pine: Naval Stores*. Tarkel Publishing. Shalimar, Florida.

Chapman, Jefferson
1985 Archaeology and the Archaic Period in the Southern Ridge-and-Valley Province. In Structure and Process in Southeastern Archaeology, edited by Roy S. Dickens, Jr. and H. Trawick Ward, pp. 137-153. The University of Alabama Press. Tuscaloosa.

Clifton, James M.
1978 *Life and Labor on Argyle Island.* The Beehive Press, Savannah.

Coker, P.C., III
1987 *Charleston's Maritime Heritage 1670-1865*. Coker Craft Press Charleston, South Carolina.

Coleman, Kenneth
1991 *A History of Georgia.* 2nd edition. University of Georgia Press. Athens.

Colquhoun, D.J. and M.J. Brooks
1986 New Evidence from the Southeastern U.S. for Eustatic Components in the Late Holocene Sea Levels. *Geoarchaeology* 1(3):275-291.

Colquhoun, Donald J., Mark J. Brooks and Peter A. Stone
1995 Sea-Level Fluctuation: Emphasis on Temporal Correlations with Records from Areas with Strong Hydrologic Influences in the Southeastern United States. *Journal of Coastal Research* (ArticleType: research-article / Issue Title: Special Issue No. 17. HOLOCENE CYCLES: CLIMATE, SEA LEVELS, AND SEDIMENTATION / Full publication date: 1995 / Copyright © 1995 Coastal Education & Research Foundation, Inc.):191-196.

Cordingly, David
1995 *Under the Black Flag: The Romance and the Reality of Life Among the Pirates.* Random House, New York.

Crook, Morgan R Jr.
2007 Prehistoric Pile Dwellers within an Emergent Ecosystem: An Archaeological Case of Hunters and Gatherers at the Mouth of the Savannah River During the Mid-Holocene. *Human Ecology* 35:223-237.

DePratter, Chester B. and James D. Howard
1981 Evidence for a sea level lowstand between 4500 and 2400 years B.P. on the southeast coast of the United States. *Journal of Sedimentary Research* 51(4):1287-1295.

Divine, Robert A., T.H. Breen, George M. Fredrickson, and R. Hal Williams
1995 *America Past and Present, Volume* 1, 4th edition. HarperCollins Publishers. New York.

Duff, Jim A.
1996 *Underwater Archaeological Investigation and Documentation of Three Anomaly Clusters Within Three Segments of Proposed Preferred Corridor for Replacement of Bonner Bridge, Oregon Inlet, North Carolina*. Panamerican Consultants, Inc.,

Memphis, Tennessee, under subcontract to Parsons, Brinckerhoff, Quade & Douglas, Inc., Morrisville, North Carolina. Submitted to the Federal Highway Administration and the North Carolina Department of Transportation.

Dunbar, James S.
2006 Paleoindian Archaeology. In *First Floridians and Last Mastodons: The Page-Ladson Site in the Aucilla River*, edited by David S. Webb, pp. 403-435. Springer, Dordrecht.

Dunbar, James S. and S. David Webb
1996 Bone and Ivory Tools from Submerged Paleoindian Sites in Florida. In *The Paleoindian and Early Archaic Southeast*, edited by David G. Anderson and Kenneth E. Sassaman, pp. 331-353. The University of Alabama Press. Tuscaloosa.

Edgar, Walter
1998 *South Carolina: A History*. University of South Carolina Press. Columbia, South Carolina.

Elliott, Daniel T. and Kenneth E. Sassaman
1995 *Archaic Period Archaeology on the Georgia Coastal Plain and Coastal Zone*. University of Georgia, Laboratory of Archaeology Series Report 35. Athens.

Emiliani, C., S. Gartner, B. Lidz, K. Eldridge, D.K. Elvey, P.C. Huang, J.J. Stipp and M. Swanson
1975 Paleoclimatological analysis of late Quaternary cores from the northwestern Gulf of Mexico. *Science* 189:1083-1088.

Faught, Michael K., Ph.D.
1996 *Clovis Origins and Underwater Prehistoric Archaeology in Northwestern Florida,* Ph.D. Dissertation University of Arizona, Tucson.

2002-04 Submerged Paleoindian and Archaic sites of the Big Bend, Florida. *Journal of Field Archaeology* 29(3-4):273-290.

Faught, M.K., and J.F. Donoghue
1997 Marine Inundated Archaeological Sites and Paleofluvial Systems: Examples From a Karst-Controlled Continental Shelf Setting in Apalachee Bay. *Geoarchaeology* 12(5):417-458.

Fischer, Anders
1995 *Man & Sea in the Mesolithic: Coastal Settlement Above and Below Present Sea Level* 53. Oxbow Monograph.

Gagliano, S.M., C.E. Pearson, R.A. Weinstein, D.E. Wiseman and C.M. McClendon
1982 Sedimentary Studies of Prehistoric Archaeological Sites: Criteria for the Identification of Submerged Archaeological. Sites of the Northern GOM Continental Shelf, Prepared for the U.S. Department of the Interior National Park Service, Division of State Plans and Grants, Contract No. C35003(79).

Garrison, E., C.P. Giammona, F.J. Kelly, A.R. Trip, and G.A. Wolff
1989 *Historic Shipwrecks and Magnetic Anomalies of the Northern Gulf of Mexico: Reevaluation of Archaeological Resource Management Zone 1. Volume II: Technical Narrative.* OCS Study/MMS 89-0024. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office, New Orleans.

Garrison, E.G., G. McFall and S. E. Noakes
2008 Shallow Marine Margin Sediments, Modern Marine Erosion and the Fate of Sequence Boundaries–Georgia Bight (USA). *Southeastern Geology* 45:127–142.

Garrison, Ervan G. and James S. Tribble
1981 *A Reconnaissance Survey of the Atlantic Intracoastal Waterway, Georgia.* Prepared for the U.S. Army Corps of Engineers, Savannah District. Prepared by Texas A&M University.

Garrison, Ervin and Others
2012 *Inventory and analysis of archaeological site occurrence on the Atlantic outer continental shelf*. U.S. Dept. of the Interior, Bureau of Ocean Energy, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study BOEM 2012-008. Prepared by TRC Corporation.

Gayes, Paul T., David B. Scott, Eric S. Collins and Douglas D. Nelson
1992 A Late Holocene Sea-Level Fluctuation In South Carolina. In *Quaternary Coasts of the United States*, edited by C.H. Fletcher and J.F. Wehmiller, pp. 155-160. vol. 48. Society for Sedimentary Geology.

Gearhart, R.L., and S.A. Hoyt
1990 *Channel to Liberty: Underwater Archaeological Investigations, Liberty County, Texas*. Espey, Huston & Associates, Austin, Texas. Submitted to the U.S. Army Corps of Engineers, Galveston District.

Ginn, Edwin H.
1987 *Recollections of Glynn*. The Glover Printing Company, Brunswick, Georgia.

Goodyear, Albert C., III, James L. Michie, and Tommy Charles
1989 The Earliest South Carolinians. In *Studies in South Carolina Archaeology: Essays in Honor of Robert L. Stephenson*, edited by Albert C. Goodyear, III and Glen T. Hanson, pp. 19-52. Anthropological Studies 9, Occasional Papers of the South Carolina Institute of Archaeology and Anthropology, The University of South Carolina. Columbia.

Hall, Wes
2005 *Archaeological Remote Sensing Survey of Folly Beach Offshore Borrow Areas, Folly Beach, South Carolina*. Prepared for the Department of the Army, Wilmington District, Corps of Engineers by Mid-Atlantic Technology and Environmental Research, Inc. Castle Hayne, North Carolina.

2007 *Archaeological Remote Sensing Survey of Pawleys Island Offshore Borrow Areas, Pawleys Island, South Carolina*. Prepared for the Department of the Army, Wilmington District, Corps of Engineers by Mid-Atlantic Technology and Environmental Research, Inc. Castle Hayne, North Carolina.

Harris, M. Schott, Paul T. Gayes, Jack L. Kindinger, James G. Flocks, David E. Krantz, and Patricia Donovan
2005 Quaternary Geomorphology and Modern Coastal Development in Response to an Inherent Geologic Framework: An Example from Charleston, South Carolina. *Journal of Coastal Research* 21(1):49-64.

Haunton, R.H.
1968 *Savannah in the 1850s*. Ph.D. dissertation. University Microfilms, Ann Arbor, Michigan.

Hedrick, David Layne
1998 "The Investigation Of The Caney Creek Shipwreck Archaeological Site 41MG32." Unpublished Master's Thesis, Department of Anthropology, Texas A&M University. On file at Panamerican Maritime, L.L.C., Memphis, Tennessee.

Hoyt, Steven D.
1990 *National Register Assessment of the* SS Mary, *Port Aransas, Nueces County, Texas*. Espey, Huston & Associates, Austin, Texas. Submitted to the U.S. Army Corps of Engineers, Galveston District.

Irion, J.B., and C.L. Bond
1984 *Identification and Evaluation of Submerged Anomalies, Mobile Harbor, Alabama*. Espey, Huston & Associates, Austin, Texas. Submitted to the U.S. Army Corps of Engineers, Mobile District.

James, Jr., Stephen R., Michael K. Faught, and Andrew D.W. Lydecker
2012 *Remote Sensing Survey and Diver Investigations Atlantic Intracoastal Waterway Chatham, Bryan, Liberty, McIntosh, Glynn, and Camden Counties, Georgia, and Portions of Beaufort County, South Carolina*. Draft prepared for U.S. Army Corps of Engineers, Savannah District under contract to DCA/GEC A Joint Venture, LLC, Jacksonville Beach, Florida. Draft submitted by Panamerican Consultants, Inc., Memphis, Tennessee.

James, Stephen R., Jr., Michael C. Krivor, Alan Whitehead, Kristen Zoelmer and Michael C. Tuttle
2002 *National Register of Historic Places Eligibility Evaluations of Targets 3B-2-2 and 3B-2-6 Located Within Item 3B-2 of the Upper Yazoo Projects and Limited Survey and National Register of Historic Places Eligibility Evaluations of All Bridges, Structures, and Targets 4-6, 4-7, 4-11, 4-12, 4-15, and 4-16 Located Within Item 4B of the Upper Yazoo Projects, Leflore County, Mississippi*. Submitted to the USACE, Vicksburg District by Panamerican Consultants, Inc., Memphis, Tennessee.

James, Stephen R., Jr., and Michael C. Krivor
2000 *Submerged Cultural Resources Associated with the Battle of Johnsonville: The 2000 Season*. Prepared for the Tennessee Historical Commission by Panamerican Consultants, Inc., Memphis, Tennessee.

James, Stephen R., Jr., and Charles E. Pearson

1991 *Magnetometer Survey and Ground Truthing Anomalies, Corpus Christi Ship Channel, Aransas and Nueces Counties, Texas.* Coastal Environments, Inc., Baton Rouge, Louisiana. Submitted to the U.S. Army Corps of Engineers, Galveston District.

1993 *Submerged Cultural Resources Investigations of the Steamboat J.D. Hinde (41LB85) Channel to Liberty, Liberty County Texas*. Prepared for the U. S. Army Corps of Engineers, Galveston District by Panamerican Consultants, Inc., Tuscaloosa, Alabama and Coastal Environments, Inc.

James, Stephen R., Jr., Charles E. Pearson, Kay Hudson, and Jack Hudson

1991 *Archaeological and Historical Investigations of the Wreck of the General C.B. Comstock, Brazoria County, Texas*. Submitted to the Galveston District by Coastal Environments, Inc., Baton Rouge, Louisiana.

Kane, A.I., J.B. Pelletier, M. Williams, D.S. Robinson, and R. Saucier.

1998 *A Cultural Resources Survey of Items 3B and 4 of the Upper Yazoo River Projects, Leflore County, Mississippi*. Prepared for the U.S. Army Corps of Engineers, Vicksburg District, by R. Christopher Goodwin & Associates, Inc., Frederick, Maryland.

Kimball, Larry R.

1996 Early Archaic Settlement and Technology: Lessons from Tellico. In *The Paleoindian and Early Archaic Southeast*, edited by David G. Anderson and Kenneth E. Sassaman, pp. 149-186. University of Alabama Press, Tuscaloosa.

Kraft, J.C., D.F. Belknap and I. Kayan

1983 Potential of the Discovery of Human Occupation Sties on the Continental Shelves and Nearshore Coastal Zone. In *Quaternary Coastlines and Marine Archaeology,* edited by P. M. Master and N. C. Flemming, pp. 87-120. Academic Press.

Krivor, Michael C.

2005 *Remote Sensing Survey, Data Analysis, and Diver Investigations of Savannah Harbor, Chatham County, Georgia, and Jasper County, South Carolina*. Submitted to the U.S. Army Corps of Engineers, Savannah District by Panamerican Consultants, Inc., Memphis, Tennessee.

Krivor, Michael C., Stephen R. James, Jr., and Alan Whitehead

2002 *National Register of Historic Places Eligibility Evaluations of 13 Potential Watercraft Targets within the Upper Yazoo Projects Items 5 through 9 Quitman, Tallahatchie and Leflore Counties, Mississippi*. Prepared for the U.S. Army Corps of Engineers, Vicksburg District. Panamerican Consultants, Inc., Memphis, TN.

Labaree, Benjamin W., William M. Fowler, Jr., John B. Hattendorf, Jeffrey J. Safford, Edward W. Sloan, and Andrew W. German

1999 *America and the Sea: A Maritime History*. Mystic Seaport, Mystic, Connecticut.

Ledbetter, R. Jerald, David G. Anderson, Lisa D. O'Steen, and Daniel T. Elliott

1996 Paleoindian and Early Archaic Research in Georgia. In *The Paleoindian and Early Archaic Southeast*, edited by David G. Anderson and Kenneth E. Sassaman, pp. 270-287. The University of Alabama Press. Tuscaloosa

Lowery, Darrin L., Michael A. O'Neal, John S. Wah, Daniel P. Wagner, and Dennis J. Stanford
2010 Late Pleistocene Upland Stratigraphy of the Western Delmarva Peninsula, USA. *Quaternary Science Reviews* 29(11-12):1472-1480

Lowery, Darrin, Margaret Jodry and Dennis Stanford
2012 Clovis Coastal Zone Width Variation: A Possible Solution for Early Paleoindian Population Disparity Along the Mid-Atlantic Coast, USA. *The Journal of Island and Coastal Archaeology* 7(1):53-63.

Lydecker, Andrew D.W.
2007 *Historic Assessment and Diver Evaluations of Two Magnetic Anomalies Near Sand Key, Pinellas County, Florida.* Prepared for the U.S. Army Corps of Engineers, Jacksonville District, under subcontract to the U.S. Army Corps of Engineers, Memphis District. Panamerican Consultants, Inc., Memphis, TN.

Masters, P.M., and N.C. Flemming
1983 *Quaternary Coastlines*. Academic Press, New York.

McKivergan, David and Mildred Fryman
1996 Culture History and Associated Sites. In *Fort Stewart and Hunter Army Airfield Historic Preservation Plan, Technical Synthesis Volume: Bryan, Chatham, Evans, Long, Liberty and Tattnall, Counties Georgia*, edited by L. Janice Cambell, Mathilda Cox, and Prentice M. Thomas, Jr., pp. 44-169. Prentice Thomas and Associates, Inc., Report of Investigations, 261.

Morison, Samuel Elliot
1971 *The European Discovery of America: The Northers Voyages A.D. 500-16,000*. The Oxford University Press, New York.

Nordfjord, Sylvia
2006 Late Quaternary Geologic History of New Jersey Middle and Outer Continental Shelf Marine Geology, PhD dissertation, University of Texas at Austin.

O'Steen, Lisa D.
1996 Paleoindian and Early Archaic Settlement Along the Oconee Drainage. In *The Paleoindian and Early Archaic Southeast*, edited by David G. Anderson and Kenneth E. Sassaman, pp. 92-106. The University of Alabama Press. Tuscaloosa.

Pearson, Charles E.
1991 Captain Charles Stevens and the Antebellum Georgia Coasting Trade. *The Georgia Historical Quarterly*, Volume 75, Number 3. Savannah, Georgia.

Pearson, Charles E., and Thomas C.C. Birchette
1999 *The History And Archaeology Of Two Civil War Steamboats: The Ironclad Gunboat USS Eastport and The Steamer Ed. F. Dix*. Coastal Environments, Inc., Baton Rouge, Louisiana. Submitted to the U.S. Army Corps of Engineers, Vicksburg District.

Pearson, Charles E., Bryan L. Guevin, and Allen R. Saltus, Jr.
1991 *Remote-Sensing Survey of the Lower Pearl and West Pearl Rivers, Louisiana and Mississippi*. Coastal Environments, Inc., Baton Rouge, Louisiana. Prepared for the U.S. Army Corps of Engineers, Vicksburg District.

Pearson, C.E., and K.G. Hudson

1990 *Magnetometer Survey of the Matagorda Ship Channel: Matagorda Peninsula to Point Comfort, Calhoun and Matagorda Counties, Texas.* Submitted to the U.S. Army Corps of Engineers, Galveston District by Coastal Environments, Inc., Baton Rouge, Louisiana.

Pearson, C.E., S.R. James, Jr., K.G. Hudson, and J. Duff

1993 *Underwater Archaeology Along the Lower Navidad and Lavaca Rivers, Jackson County, Texas*. Coastal Environments, Inc., Baton Rouge, Louisiana. Submitted to the U.S. Army Corps of Engineers, Galveston District.

Pearson, C.E., and A.R. Saltus, Jr.

1990 *Cultural Resources Investigation at Island 86, Mississippi River, Arkansas-Mississippi.* Coastal Environments, Inc., Baton Rouge, Louisiana. Submitted to the U.S. Army Corps of Engineers, Vicksburg District.

Pearson, C.E., and J.J. Simmons III

1995 *Underwater Archaeology of the Wreck of the Steamship Mary (41NU252) and Assessment of Seven Anomalies, Corpus Christi Entrance Channel, Nueces County, Texas*. Submitted to U.S. Army Corps of Engineers, Galveston District by Coastal Environments, Inc., Baton Rouge, Louisiana.

Ray, Sargent Charles

1986 Ossabaw Sound Clovis Point. *The Chesopiean* 24(1):12-13.

Rich, Fredrick J. and Robert K. Booth

2011 Quaternary Vegetation and Depositonal History of St. Catherines Island. In *Geoarchaeology of St. Catherines Island*, edited by Gale A. Bishop, Harold B. Rollins and David Hurst Thomas, pp. 129-141. Anthropological Papers of the American Museum of Natural History, Number 94.

Ritchie, Robert C.

1986 *Captain Kidd and the War Against the Pirates.* Harvard University Press. Cambridge, Massachusetts.

Robinson, David S.

1998 *Management Summary: Cultural Resources Survey of Items 3B-2 and 4 of the Upper Yazoo River Projects, Mississippi. Contract DACW29-97-D-0018*. R. Christopher Goodwin & Associates, Inc., Frederick, Maryland. Submitted to the U.S. Army Corps of Engineers, Vicksburg District.

Rogers, R., S.D. Hoyt, C.L. Bond, L. Voellinger, and S.R. James, Jr.

1990 *Cultural Resources Investigations, Virginia Point, Galveston County, Texas.* Espey, Huston and Associates, Inc., Austin, Texas. Submitted to the U.S. Army Corps of Engineers, Galveston District.

Rowland, Lawrence S., Alexander Moore and George C. Rogers, Jr.

1996 *The History of Beaufort County, South Carolina: Volume I, 1514-1861*. University of South Carolina Press, Columbia.

Saltus, Allen R., Jr.
1993 *Scow from Watercraft in Louisiana's Inland Waters.* Unpublished paper presented at the 1993 Society for Historical Archaeology and Conference on Underwater Archaeology, Kansas City, Missouri. On file, Panamerican Maritime, L.L.C., Memphis, Tennessee.

Sassaman, Kenneth E.
2010 Getting from the Late Archaic to Early Woodland in Three Middle Valleys (those being the Savannah, St. Johns, nd Tennessee. In *Trend, Tradition, and Turmoil: What Happened to the Southeastern Archaic?* edited by Davis Hurst Thomas and Matthew C. Sanger, pp. 229-235. Anthropological Papers of the American Museum of Natural History, Number 93.

Sassaman, Kenneth E. and David G. Anderson
1990 Typology and Chronology. In *Native American Prehistory of the Middle Savannah River Valley: A Synthesis of Archaeological Investigations on the Savannah River Site, Aiken and Barnwell Counties, South Carolina*, by Kenneth E. Sassaman, Mark J. Brooks, Glen T. Hanson, and David G. Anderson, pp. 143-215. Occasional Papers of the Savannah River Archaeological Research Program, South Carolina Institute of Archaeology and Anthropology, University of South Carolina. Columbia.

1995 *Middle and Late Archaic Archaeological Records of South Carolina: A Synthesis for Research and Resource Management.* Occasional Papers of the Savannah River Archaeological Research Program, South Carolina Institute of Archaeology and Anthropology, University of South Carolina. Columbia.

Savage, Henry
1956 *Rivers of America, River of the Carolinas: The Santee.* Rinehart & Company, New York.

Sexton, W.J., M.O. Hayes, and D.J. Colquhoun,
1992 Evolution of Quaternary shoal complexes of the south central South Carolina coast. Quaternary Coasts of the United States: marine and Lacustrine Systems: SEPM Special Publication No. 48. SEPM Tulsa, OK, p. 160-172.

Sherwood, Sarah C., Boyce N Driskell, Asa Randall and Scott C. Meeks
2004 Chronology and Stratigraphy at Dust Cave, Alabama. *American Antiquity* 69(3):533-554.

Siddall, M., E.J. Rohling, A. Almogi-Labin, C. Hemleben, D. Meischner, I. Schmetzer, and D.A. Smeed
2003 Sea-level fluctuations during the last glacial cycle. *Nature* 423:853-858.

Spirek, James D. and Christopher F. Amer, editors
2004 *A Management Plan for Known and Potential United States Navy Shipwrecks in South Carolina.* Prepared by the Maritime Research Division, South Carolina Institute of Archaeology and Anthropology, University of South Carolina, Columbia. Christopher F. Amer, Joseph Beatty III, Lynn B. Harris, Carleton Naylor, James D. Spirek, and Mark K. Ragan authors.

Stevenson, I. R., C. McCann and P. B. Runciman
2002 An attenuation-based sediment classification technique using Chirp sub-bottom profiler data and laboratory acoustic analysis. *Marine Geophysical Research* 23(4):277-298.

Thomas, David Hurst
2008 Native American Landscapes of St. Catherines Island, Georgia Anthropological Papers of the American Museum of Natural History 88.

Trimble Navigation Limited
1998 *DSM12/212 Operation Manual*. Trimble Navigation Limited, Sunnyvale, California.

Turck, John A., Mark Williams and John F. Chamblee
2011 Examining Variation in the Human Settlement of Prehistoric Georgia. *Early Georgia* 39(1):5-26.

Van Dolah, B. and D. Bergquist
2006 SEAMAP and INTERMAR Bottom Mapping Projects and SCDNR Historical Data Study on Beach Nourishment Projects.

Wallace, David D.
1951 *South Carolina: A Short History 1520-1948*. University of South Carolina Press, Columbia, South Carolina.

Waring, Antonio J., Jr.
1968 The Archaic Hunting and Gathering Cultures: The Archaic and Some Shell Rings. In *The Waring Papers*, edited by Stephen Williams, pp. 243-246. Harvard University, Papers of the Peabody Museum of Archaeology and Ethnology 58. Cambridge.

Waters, Michael
1992 *Principles of Geoarchaeology: A North American Perspective.* University of Arizona Press, Tucson.

Waters, Michael R., Steven L. Forman, Thomas A. Jennings, Lee C. Nordt, Steven G. Driese, Joshua M. Feinberg, Joshua L. Keene, Jessi Halligan, Anna Lindquist, James Pierson, Charles T. Hallmark, Michael B. Collins and James E. Wiederhold
2011 The Buttermilk Creek Complex and the Origins of Clovis at the Debra L. Friedkin Site, Texas. *Science* 331(6024):1599-1603.

Watts, Gordon P.
1998 *A Remote Sensing Survey of the Daufuskie Island Beach Nourishment Project Borrow Areas, Beaufort County, South Carolina*. Submitted to Applied Technology & Management, Inc. by by Tidewater Atlantic Research, Inc., Washington, North Carolina.

2000 *Phase I Archaeological Remote Survey of the Virginia Beach and Fort Story Hurricane Protection Borrow Areas, Virginia*. Prepared for the U.S. Army Corps of Engineers, Wilmington District by Tidewater Atlantic Research, Washington, North Carolina.

2005 *Submerged Cultural Resources Survey of a Sand Borrow Area for Hunting Island Beach Restoration Project, Beaufort County, South Carolina*. Conducted for the South Carolina Department of Parks, Recreation and Tourism by Tidewater Atlantic Research, Inc., Washington, North Carolina.

Webb, S. David, Jerald T. Milanich, Roger Alexon, and James S. Dunbar
1984 A *Bison Antiquus* Kill Site, Wacissa River, Jefferson County, Florida. *American Antiquity* 49(2):384-392.

Wright, Newell
1976 The Surside Springs Site: A Possible Association Between Early Man and Extinct Fauna. *South Carolina Antiquities* 8(2):318-321.

APPENDIX A

SCOPE OF WORK HARDBOTTOM AND CULTURAL RESOURCE SURVEYS
EDISTO BEACH OFFSHORE BORROW SITE,
EDISTO BEACH, SOUTH CAROLINA

SCOPE OF WORK
HARDBOTTOM AND CULTURAL RESOURCE SURVEYS OF THE EDISTO BEACH OFFSHORE BORROW SITE, EDISTO BEACH, SOUTH CAROLINA

11 December 2012

1. **Background.** The U.S. Army Corps of Engineers, Charleston District requires magnetometer, sub-bottom profiling, and side-scan sonar survey over a 1.25 x 1.13 nautical mile area located offshore of Edisto Beach, Colleton County, South Carolina. The purpose of this work is to discover magnetic and/or sonar anomalies that might represent cultural resources or other objects that would impact the use of the proposed area as a source of borrow material for hurricane and storm damage reduction along Edisto Beach. In addition, the contractor will identify and map areas of hard bottom habitat as identified from side-scan sonar analysis. The data collected from this work is required in order to establish baseline conditions and subsequently refine the proposed study improvements areas and to avoid impacts to significant cultural and environmental resources from dredging activities. This Description of Services reflects 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 (*Abandoned Shipwreck Act Guidelines*, National Park Service, *Federal Register*, Vol. 55, No. 3, December 4, 1990, pages 50116-50145). All work shall be conducted in accordance with this Description of Services, the contract Scope of Work, and the instructions of the Charleston District Contracting Officer or his/her authorized representative.

2. **Project Site Description.** The survey areas are located offshore of Edisto Beach, SC and are shown in Figure 1 together with NAD-83 SC State Plane coordinates. The approximate acreage for the survey area is approximately 1.41 NM^2.

3. **Description of Supplies/Services.** This work will be accomplished in a phased approach in order to (1) acquire survey data of the project area and interpret the data for potential hardbottom and cultural resources, and (2) ground truth selected sites to confirm the presence or absence of hardbottom resources using benthic grab sample techniques.

   Phase 1. The survey team shall conduct a remote sensing survey of the study area (see Appendix A). Prior to commencement of survey work, the survey team shall provide the Corps with the proposed survey plan for their review and approval. Additionally, prior to initiating any fieldwork, the survey team shall conduct sufficient background research to develop a current historic overview, review previous archaeological investigations, and document vessel losses and known shipwrecks in the vicinity of the project areas. The background research shall include, but is not limited to, research of the state archaeological site files at the South Carolina Institute of Archaeology and Anthropology. This information shall be used to model the potential database so that discovered magnetic and sonar signatures can be more thoughtfully inventoried and analyzed. A list and description of all relevant vessel losses for the project area shall be included in the report. The survey team shall also conduct sufficient background documentation to summarize previous work conducted in the area as well as avoid duplication of survey collection efforts.

   Side Scan Sonar - The survey vessel will be equipped with a side-scan sonar with 500-700 kHz capability to achieve detailed geo-referenced morphologic mosaic maps. The instrument will be interfaced with a Differential Global Positioning System (DGPS) with less than 1m accuracy. HYPACK (or technical equivalent) navigation software should be used to develop the survey transects and maintain vessel track during data collection. To assist in data analysis a complete record of hydrographic data should be recorded in HYPACK. The survey team shall be experienced in the post processing and interpretation of side-scan sonar for hardbottom resources and shall provide shape files of areas identified as potential hardbottom resources. Side-scan sonar data should be collected along parallel transects spaced at appropriate intervals to ensure at least 25% percent overlapping coverage of adjacent survey lines. The side-scan sonar towfish will be maintained at a height above the bottom that provides for the most accurate data collection (generally 10 to 30 feet). The side-scan sonar will be run concurrently with the magnetometer (discussed below).

<u>Sub-Bottom Profiling -</u> The survey team shall utilize a CHIRP dual frequency sub-bottom profiler and not more than 8-second registration interval to establish the depth and nature of the potential hardbottom or cultural resource at individually potentially significant magnetic anomalies. All data collection should meet, or exceed the recommended specifications in USACE Engineering Manual (EM) 1110-2-1003. All acoustic data shall be backed up on external hard-drives at the end of each day.

<u>Magnetometer -</u> The survey team shall utilize a digital cesium vapor magnetometer with 0.1-nT sensitivity and 0.5-second registration interval. The magnetometer shall be towed at a speed of 5 - 7 knots. The magnetometer sensor shall employ a depressor or other device capable of maintaining a tow height of not more than 6-meters above the sea floor. Survey lanes for the magnetometer shall be placed at not greater than 20-meter intervals. The magnetic data shall be contoured to produce a magnetic contour map of the project area. The magnetometer will be run concurrently with the side-scan sonar (discussed above).

<u>General Requirements -</u> All survey instrumentation shall be electronically interfaced with an electronic navigation-positioning system offering repositioning accuracy of not more than 1 meter. Positioning must be by corrected DGPS. All hard-copy analog and image records shall be annotated at not more than 30 meter intervals with real time, absolute (e.g. lat./long.) and relative position (transect number and distance), and event numbers.

At the completion of Phase 1, the survey team will produce a graphically illustrated letter report with preliminary findings of the side-scan survey, including a side-scan mosaic of recorded signatures and a magnetic contour map. Any potentially significant biological or cultural resources will be reported. Recommendations for further study, as defined for Phase 2 shall be provided.

<u>Hardbottom Analysis -</u> The survey team will review acoustic records (side-scan sonar and depth) to identify and define areas that are "hardbottom" or habitat for marine animals. Hardbottom areas will be defined as areas of any size that demonstrate low, medium and high protrusions (aka "targets"). Low protrusions will be defined as areas less than 0.5-meters above the bottom, "moderate" protrusions - the majority of the area 1 to 2-meters above the bottom, and "high" protrusions - over 2 meters above the bottom. Acoustic data will be graphically illustrated and will include SC State Plane NAD 83 coordinates for the boundaries. Results of this mapping effort will be used to select and recommend sites for the Phase 2 ground-truthing video survey. As part of the draft and final report, the survey team will produce a geo-referenced mosaic of the side-scan sonar survey. In addition, raster data shall depict information used to define potential hardbottom areas within the project area. The remote sensing data also shall be developed into polygon shapefiles compatible with ESRI ArcView/ArcInfo Version 10.0. Detailed recommendations will be included as part of the draft and final report. The potential significance of targets will be defined clearly. Any recommendations for additional investigations will be discussed in detail.

<u>Cultural Resources Analysis</u>. The survey team's report shall completely describe each target's magnetic and/or sonar characteristics including intensity, duration, estimated mass, height, length, water depth, position relative to the bottom, and absolute position. When possible, the analysis and description will relate the discovered sites to any potential features or sites derived from project archival documentation. All magnetic and side-scan sonar data shall be summarized in a table that also indicates recommendations for each discovered target. All targets shall be delivered in point shapefiles identifying potential sites within the project area. The shapefiles shall be in a format compatible with ESRI ArcView/ArcInfo Version 10.0.

Recommendations. The survey team shall prepare or update state site forms for all sites identified within the project area and provide recommendations for each potentially significant site's National Register of Historic Places eligibility. The survey team shall prepare detailed recommendations for any future investigations of discovered cultural resource targets or sites. It must be clear why certain targets are included or excluded from recommendations for further investigation. It should also be clear what types of information should be sought at each site and what methods might be employed to retrieve that information. If sampling is recommended, the reasons for recommending a particular sampling strategy should be made clear in the report. The final report shall include the assigned state archaeological site numbers of significant cultural resources located during the survey.

Phase 2. The survey team shall utilize a towed video camera to ground truth and confirm the presence and/or absence of hardbottom and/or cultural/historic resources within the areas previously identified in Phase 1 as potential hardbottom from the side-scan sonar interpretation. Videography with DGPS annotation shall be used at a select number of interpreted potential hardbottom sites to confirm the presence or absence of hardbottom features associated with interpreted side-scan sonar signature returns. If the towed video camera is unable to produce adequate results to determine hard bottom resources, then the survey team will use diving operations to obtain better quality video. A Phase 2 survey plan shall be submitted to the Corps for approval prior to commencement of work. The plan shall discuss the rationale for selection of ground truth sites as well as transect locations within each site. Positioning shall be performed with an accuracy of ± 1-meter, or other system of equivalent accuracy. The distribution of sites shall consider factors such as: (1) the diversity of bottom type (i.e. differences in backscatter return) and (2) diversity of interpreted relief. The videography transect lines shall traverse benthic habitat transitional points identified by side-scan sonar backscatter differences. Real time coordinates shall be clearly visible in the video to determine location along the video transect. Additionally, benthic grab samples (N=2/site; Total = 10), correlated with select transect locations, shall be obtained to assess the sediment characteristics for each site. The sediment samples will be described using visual classifications and the Unified Soil Classification System. Adjustments to locations may be made based on information gathered in the field and with approval from the Corps. All coordinates shall be in South Carolina State Plane coordinates based on 1983 North American Datum coordinate system. For budget purposes the survey team will assume that up to ten sites will require video confirmation.

Additional Phase 2 ground truth sites are a separately priced optional bid item (priced by day, but not to exceed 3 days) to be exercised by the Contracting Officer if necessary to adequately ground truth the diversity of side-scan signature returns in the project area. The video observations will be used to provide a rational for back-scatter differences previously identified through side-scan imagery which suggested potential hardbottom.

The correlation of ground truth data to specific side-scan sonar signature returns shall be used to interpolate and refine bottom mapping results within the rest of the project area. All confirmed hardbottom areas from ground truth efforts, as well as interpolated sites, shall be characterized as being of low, moderate, and/or high relief, as described above.

4. **Required Deliverables**. The survey team is required to deliver side-scan mosaic, Interim letter report and mosaic and list of targets, Raster data sets, shapefiles, metadata records, survey plan, videography records, weekly status reports, and a Draft and Final Report.

Side-scan Mosaic Raster Data Sets. The survey team shall deliver Georeferenced Mosaics of the Raster Data sets from the Side-scan Survey. The Raster Data sets shall depict the backscatter information used to map the potential hardbottom areas in the project area and shall be in a format compatible with ESRI ArcView/ArcInfo Version 10.0.

Magnetic Contour Map. The survey team shall deliver magnetic contour maps of potential cultural/historic resource anomalies.

ESRI File Geodatabase. The survey team shall deliver all data collected in a File Geodatabase that is compliant with SDSFIE. Guidance on format of SDSFIE compliance is http://www.sdsfie.org and https://tsc.wes.army.mil/products/tssds-tsfms/tssds/projects/sds/default.asp. The Geodatabase shall contain files defining the areas of confirmed hard bottom features, associated relief classification within the project area based on ground truth efforts, all metadata records as well as areas of interpolated hardbottom areas that were mapped based on similar backscatter characteristics to ground truthed areas. The Geodatabase shall be named "Edisto_Beach_Borrow_HB_CS_Phase_1_2012".

Metadata Record. An FGDC compliant metadata record for each spatial data deliverable shall be created using ESRI ArcView/ArcInfo ArcCatalog version 10.0 or better. Appropriate information shall be entered in all required fields. The survey team shall attach the appropriate metadata record to each spatial data file using ArcCatalog so that no importing or formatting of the metadata record is required by the Government.

Videography Data. All videography ground truth data shall be provided on a DVD and shall be organized and labeled by site location.

Reports. The following reports must be submitted: (1) Work Plan and Quality Assurance Project Plan, (2) Field appraisal reports in accordance with fieldwork progress, (3) Site Specific Safety and Health Plan – Accident Prevention Plan), (4) Interim letter report, including mosaic and list of targets, and (5) Draft Report and Final reports.

Draft and Final Report. A written report summarizing all data collection activities shall be submitted as a Portable Document File (PDF) and in bound hardcopy. The survey report shall include a technical approach, results (including side-scan mosaic and screen captures), and recommendations sections, as well as the following items:

- Written description of workflow to complete task order
- Dates and times of each data collection activity
- Atmospheric Conditions for each day of data collection activity
- All Horizontal and Vertical Control used including monument name, establishing agency, date established, description, and published horizontal and vertical values
- Temporary Bench Mark (TBM) descriptions with vertical values
- Copy of all field notes
- Complete and detailed list of all survey equipment used
- Rational for identification and mapping of select hardbottom features shall be provided based on a combination of videography ground truth data and side-scan sonar interpretive expertise
- Qualitative characterization of the general biological communities associated with any hard ground or other benthic resources identified.

Reports. The survey team shall prepare an initial field appraisal of data deemed relevant for the proposed study area. This appraisal shall be in the form of a management summary or letter report. This appraisal shall be developed as fieldwork progresses so that it is available as soon as possible after completion of the fieldwork. The survey team shall also prepare a draft and final research report of the investigations. The report shall discuss all aspects of the investigation and shall identify the methods used in the survey. The report shall contain this Description of Services as an appendix. The survey team shall assure that the report meets the standards of the South Carolina State Historic Preservation Office.

For marine cultural resource targets identified as potentially significant, ground truthing of these sites may be required if they are deemed to be potentially impacted from future dredging activities. For purposes of this initial study, no dive confirmation is proposed. In the event ground truthing is needed, a modification to this task order would be required.

5. **Report Format.** The report shall adhere to the standards of the SC SHPO and the contract scope of work. Draft and Final reports shall contain at least the following sections/chapters:

a. *Cover and title page*. The cover and title page shall indicate the title of the project report, the authors, the contract number, the sponsoring agencies, and date. The title page must also have the signature of the Principal Investigator or other individual responsible for actual completion of the project.

b. *Abstract*. The abstract shall be a brief summary of where and why the survey took place, study results, and recommendations for further work. Abstracts are generally ½ page or less in length.

c. *Acknowledgements*. This section should mention all individuals or organizations that contributed to successful project fulfillment.

d. *Table of Contents, List of Figures and Tables*. It is important that the contents accurately reflect page numbers in both the Draft and Final reports.

e. *Introduction or Project Background*. This section should explain why the survey is necessary and should refer to the legal requirements.

f. *Prehistoric and Historic Overviews*. The historic overview should develop the context within which any anomalies and shipwrecks will be evaluated. Past USACE reports will be used extensively for this section.

g. *Documentation of Vessel Losses*. A listing of past vessel losses is required. The report shall include a table of vessel losses that includes vessel name, type of vessel, date and place of loss, and disposition (salvaged, burned, unknown, etc.).

h. *Past Investigations*. Knowledge of the local history, vessel losses, and past investigations shall be used as a guide to developing criteria for lane interval and evaluation of targets.

i. *Field and Analytical Methods*. This section shall include a description of the equipment that was used in the field survey and how it was operated. This section should note restrictions, shortcomings, or problems of the research and how they have been overcome or controlled.

j. *Analysis and Results*. This section should include a full verbal description of each anomaly. In addition, a table or tables shall be included that summarizes magnetic and sonar target characteristics. The narrative description should make clear what factors were considered in the evaluation of anomaly characteristics and how those factors bear in selecting or eliminating an anomaly for inclusion in recommendations for further sampling. The table shall identify each anomaly or target by at least number, location, amplitude, shape (monopole, dipole), depth, position relative to the bottom, and recommendation.

k. *Recommendations.* The survey team shall prepare as appropriate, recommendations for further work, or for no further work. It is important that all recommendations be justified. That is, individual anomalies that are suggestive of shipwrecks shall be so noted and described. For large numbers of suspicious anomalies or anomalies that cannot be eliminated by other means, dive sampling may be appropriate.

l. *References.* The report shall contain references for work cited in the report. The references shall follow the style of the journal *Historical Archaeology.*

m. *Description of Services.* This Description of Services shall be included as an appendix to the report.

6. **Daily Field Operations.** A pre-departure safety meeting will be held dockside to review potential safety hazards and protocols each day field surveys are undertaken. Vessels will be inspected to ensure all safety equipment is present and functional. Staff will maintain field logbooks daily to record dates, times, and other information pertinent to survey efforts to serve as a basis for written reports. A Daily Quality Control Report will be generated each day by field personnel describing the work performed and deviations from submitted work plans. A weekly status report will be generated by field personnel and forwarded electronically from the field station to the Contracting Officer's Representative (COR) and the Technical Point of Contact (POC).

7. **Quality Assurance Project Plan.** A QA/QC Plan shall be prepared as part of the Phase 1 Work plan. The purpose of this plan is to identify normal operating procedures used to insure the quality of the data collected, analyzed and reported upon in the draft and final reports for Phase 1 activities.

Quality control measures will include daily QA of survey instrumentation as defined in EM 1110-2-1003, as well as real time log keeping, and daily backup of all remote sensing data. During data collection all incoming data will be monitored to insure that acoustic and magnetic records are of the best quality. Data collection will be suspended if noise created by the electronic background (RF), and, or weather or sea conditions significantly reduce the quality of remote sensing records.

Interpretation of acoustic and magnetic records will be based upon professional experience of the marine archeologist. The Phase 1(a) report will include mapped records to support draft and final report findings and recommendations. As part of normal QA/QC procedures, reports will be technically edited to ensure all data cited is accurately presented and referenced.

8. **Compliance**. Surveying and Mapping shall be in strict compliance with EM-1110-1-1002 Survey Markers and Monumentation, EM-1110-1-1003 NAVSTAR Global Positioning System Surveying, EM-1110-1-1005 Topographic Surveying, EM-1110-2-1003 Hydrographic Surveying and change 1 April 1, 2004, EM 1110-2-6056 Standards and Procedures for Referencing Project Elevation Grades to Nationwide Vertical Datums (Draft, Finalized Sept 30, 2010), EM-1110-1-2909 Geospatial Data and System.

9. **Survey Control**. All horizontal and vertical control used for this survey shall be from South Carolina or a Federal Agency Network and be of third order accuracy or better. All control loops must be tied to at least two or more control points. The survey team shall furnish a list of all points used to the Government. All work shall be relative to State Plane NAD 1983 (2007) SC-3900 South Carolina International Feet in the horizontal plane and NAVD 88 feet in the vertical plane. The Government will provide control information for previously established Control Points along the length of the project area.

10. **Weekly Status Report**. The survey team is required to submit a Weekly Status Report each week, beginning on the Task Order Award Date, until all deliverables are received and accepted by the Government. The Weekly Status Report shall be delivered via e-mail no later than 8:00 AM each Monday

and shall document the survey team's progress from the previous Monday through the previous Sunday. The status report shall itemize each scope item with percent of work complete and an estimated date of completion. The report shall also include the number and type of field crews working, a description of any problems and/or delays encountered, and any photographs of the site and/or significant site features and/or specialized data collection activities. A weekly status report will be generated by field personnel and forwarded electronically from the field station to the COR and Technical POC.

11. **Requirements for Report Submission.** The data obtained shall be presented in graphical, tabular, and written text as appropriate. The draft and final reports shall undergo internal technical review and quality assurance review by persons with appropriate technical qualifications to ensure that the report meets the project requirements specified in the technical work plan and the QA goals.

The draft and final reports shall consist of 8 1/2" by 11" pages with drawings folded, if necessary to this size. The report margins shall be suitable for use in a durable 3-ring binder. A decimal numbering system shall be used with each section having a unique decimal designation. Reports that require extensive editing, have extensive errors, or are not in the required formats shall be rejected and re-submittal shall be required. Any maps, drawings, figures, sketches, databases, spreadsheets, or text files prepared for this report shall be provided in both hard copy and digital form.

The digital copies of reports and other text documents shall be provided in Microsoft Word 2000. Spreadsheet files and data files shall be provided in Microsoft Excel 2000 format. All text, spreadsheet, and database files shall be delivered compact disk read-only memory (CD-ROM) with ISO-9660 format.

A copy of the report must also be provided as an Adobe Acrobat .pdf file. Geographic data shall be provided in feet and projected into the NAD 83 South Carolina State Plane coordinate system. All digital files, final hard-copy products, source data acquired for this project, and related materials shall become the property of the US Army Corps of Engineers, Charleston District and shall not be issued, distributed, or published by the survey team without prior approval.

Three hard copies of the draft and final reports and five electronic copies of the draft and final reports shall be submitted to the Charleston District.

Field Logbook. Personnel conducting the survey and collecting required data shall record all necessary documentation in appropriate field logbooks. All entries shall be dated and time of entry recorded. For sediment grab samples, water depth, sample location, sample penetration, and descriptive characteristics of collected sediments should also be documented. Field records are a basis for later written reports and therefore should be complete and factual.

Daily Quality Control Report. A daily quality control report (DQCR) shall be prepared for each day activities are conducted. The DQCR shall contain at a minimum the following information:

(1) Work Performed. Relevant information regarding the surveys performed and associated data collection efforts (i.e. videography, grab samples, etc.) shall be included. (2) Departures from Submitted Plans. Any departure from the previously approved plans or corrective actions required should be identified in the DQCR. Verbal or written changes to the plan should be documented.

12. **Safety.** The U.S. Army Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1, is available on line at:

http://www.usace.army.mil/net/usace-docs/eng-manuals/em385-1-1/toc.htm.

The survey team is responsible for maintaining a safe and healthy work environment for all employees at all times. This includes reasonable provisions for proper lighting, seating, and shelter from weather, and access to accommodations for adequate rest, food, and water. The survey team shall provide all personnel and equipment necessary for safe and effective completion of all archaeological and related services as detailed in this Description of Services. In addition, the following terms shall be met:

a. *Safety and Activity Hazard Analysis Plan.* In consultation with the Charleston District COR, the survey team shall determine the need for a Safety and Hazard Analysis Plan. This plan shall be required if the work environment or the work itself is found to be atypical of the work normally performed under this contract, and if that work presents hazards not normally encountered and accounted for as a routine part of task orders issued pursuant to the basic contract. When consultation determines that a Safety and Hazard Analysis Plan is required, the survey team shall adhere to applicable sections of EM 3851-1, "Safety and Health Requirements Manual," Appendix A, and the activity hazard analysis shall identify potential hazards that are specific to the work being conducted under this Description of Services. Requirements for the activity hazard analysis are presented in EM 3851-1 at Section 19, *Floating Plant and Marine Activities.* All employees shall be made aware of these hazards and the appropriate preventative, remedial, and first aid measures. The survey team's proposed Safety and Hazard Analysis Plan shall be submitted not later than 10 working days after receipt of notification of award. The Plan must include a tentative fieldwork schedule.

b. *Survey Vessel.* The survey vessel shall be supplied by the survey team and shall be of sufficient size to contain all required survey and safety equipment, and provide temporary shelter to the field crew. The survey vessel shall meet all relevant U.S. Coast Guard safety criteria for the crew size, equipment, and tasks being performed. The survey vessel shall have available a litter, emergency oxygen, first aid supplies, personal floatation devices, marine VHF radio, and cellular telephone.

c. *CPR and First Aid.* All field crew personnel shall have current and valid certification in CPR and First Aid.

12. **Project Points of Contact**

The USACE points of contact are provided below:

Technical Manager

Mr. Mark Messersmith (CESAC-PM-PL)
U.S. Army Corps of Engineers
69 A Hagood Ave
Charleston, SC 29412
Phone: 910/251-4696

Mark.J.Messersmith@usace.army.mil

GIS Coordinator

U.S. Army Corps of Engineers

Phil Wolf
69-A Hagood Ave
Charleston, SC 29403

Phone: 843/329-8069
Phillip.M.Wolf@usace.army.mil

Contracting Specialist

U.S. Army Corps of Engineers

Rose Smalls
69-A Hagood Ave
Charleston, SC 29403

Phone: 843/329-8193
Rose.Smalls@usace.army.mil

12. **Payment / Request for Proposal.** The survey team's offer shall include all provisions for weather delays, equipment repair and adjustment, holidays, etc. Payments shall be made on a monthly basis upon receipt and acceptance by the COR of a monthly progress letter and invoice. Invoices shall not be processed unless a progress letter has been provided that indicates in detail the progress of work during the billing period. Payment of partial or final invoices may be withheld until all deliverables are received and accepted by the Charleston District.

Contract Line Item Number (CLIN)

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE
0001	Hardbottom and Cultural	1	LS	$__________
0002	Resource Survey, Phase 1 Hardbottom and Cultural Survey, Phase 2 (N=5)	1	LS	$__________
Option	Additional Phase 2 survey day(s) NTE 3 days	1	Survey Day	$__________

13. **Ownership.** All survey team submittals including digital files, compact disks, hard-copy products, and source data acquired for this project, and related materials, including that furnished by the Government, shall become the property of the Government and shall not be issued, distributed, or published by the survey team without permission from the Grants Officer.

14. **Quality Control.** If work is found to be in error, incomplete, illegible or unsatisfactory after assignment is completed, the survey team shall be liable for all cost in connection with correcting such errors. Corrective work may be performed by Government personnel or survey team personnel at the discretion of the Grants Officer. In any event, the survey team shall be responsible for all costs incurred for correction of such errors, including salaries, transportation expenses, equipment rental, supervision, and any other costs in connection therewith.

15. **Government Provided Data**. All hydrographic survey data that has recently been collected by the Corps within the project area will be provided to the survey team.

16. **Schedules**. The tasks contained in this Description of Services shall be completed according to the Table 1 schedule. Adjustments to the schedule must be previously approved by the Contracting Officer. The work shall proceed in a continuous stepwise manner until complete.

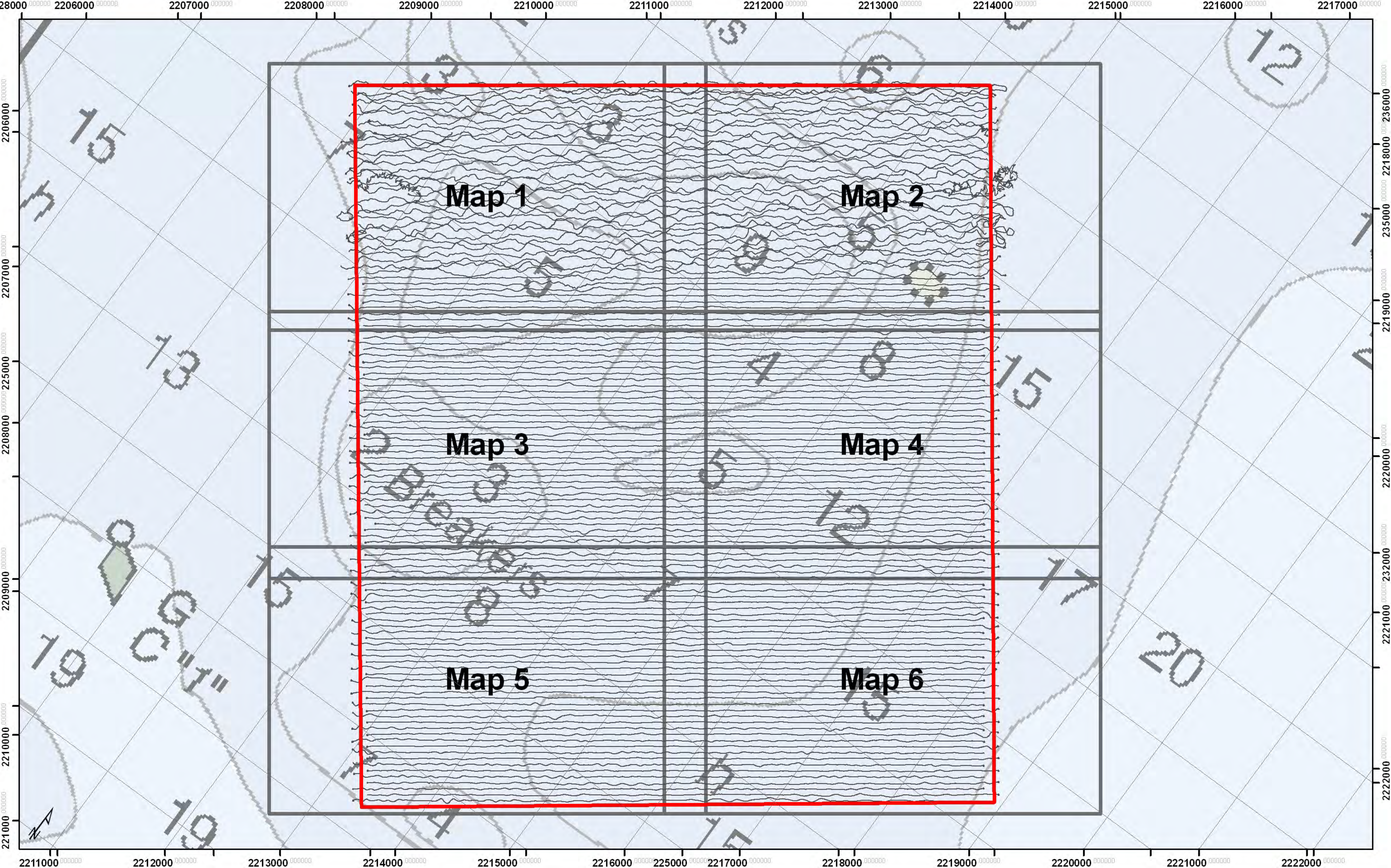
Table 1
Schedule
Estimated Schedule
Work Days After Award

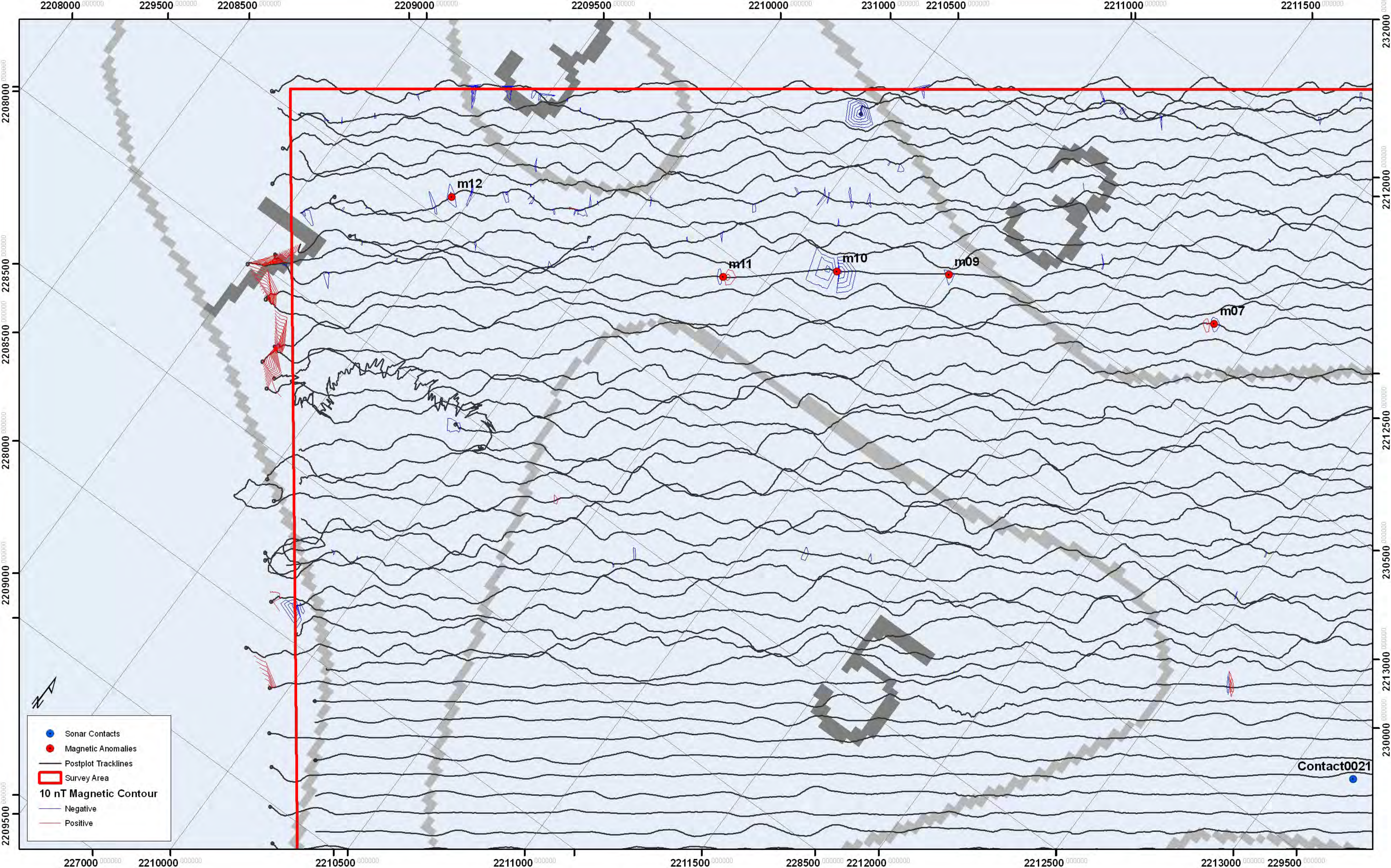
Kick-off Meeting	2
Submit Draft Work/QAPP/APP	7
CESAC Comments on Work Plan/QAPP/APP	9
Begin Field Work/Assessment	10
Complete Field Work	20
Initial Field Appraisal	25
Submit Draft Report	30
Submit Final Report	50

17. **Quality Control.** If work is found to be in error, incomplete, illegible or unsatisfactory after assignment is completed, the survey team shall be liable for all cost in connection with correcting such errors. Corrective work may be performed by Government personnel or survey team personnel at the discretion of the Grants Officer. In any event, the survey team shall be responsible for all costs incurred for correction of such errors, including salaries, automotive expenses, equipment rental, supervision, and any other costs in connection therewith.

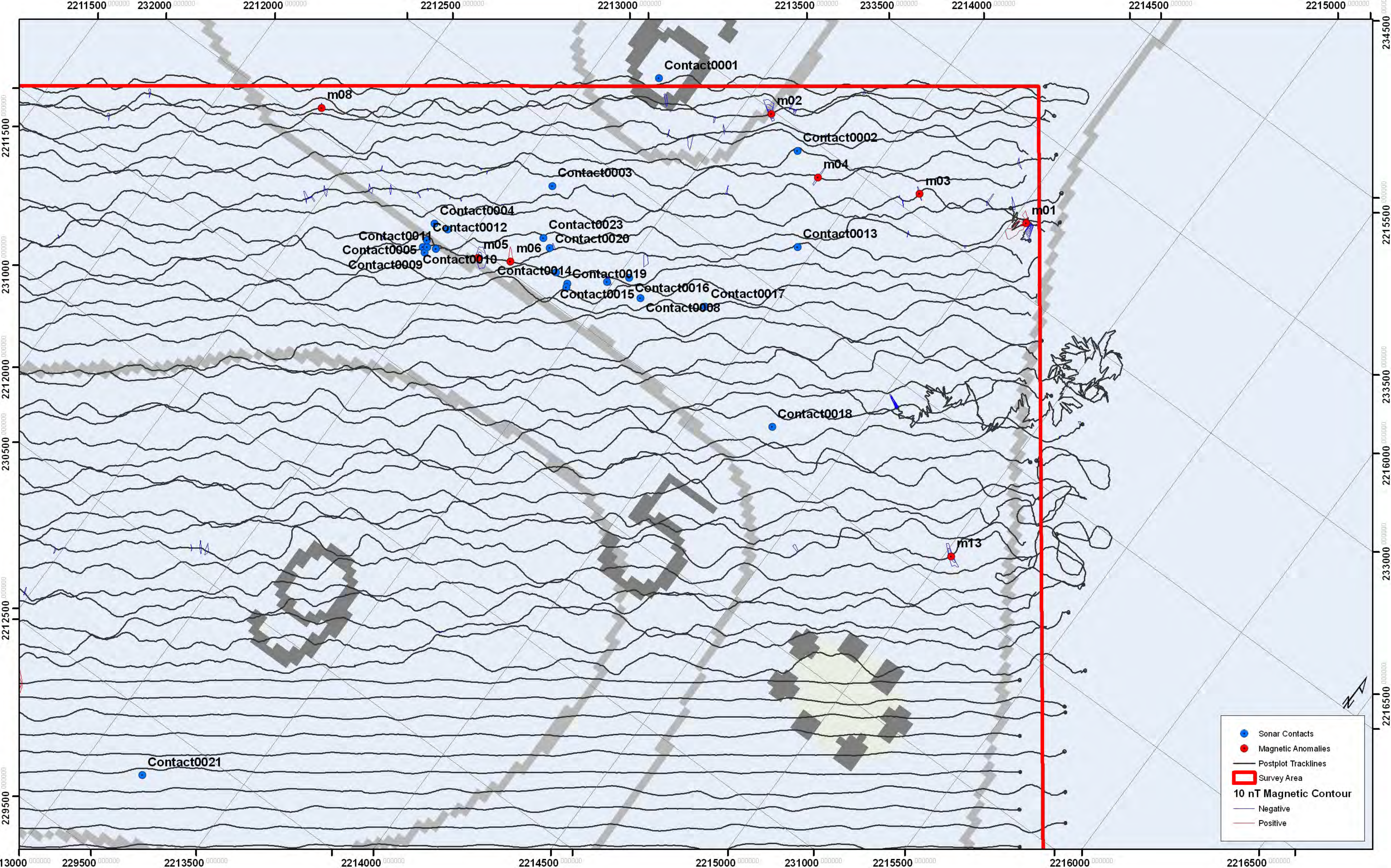
APPENDIX B

MAGNETIC ANOMALIES CONTOUR MAPS

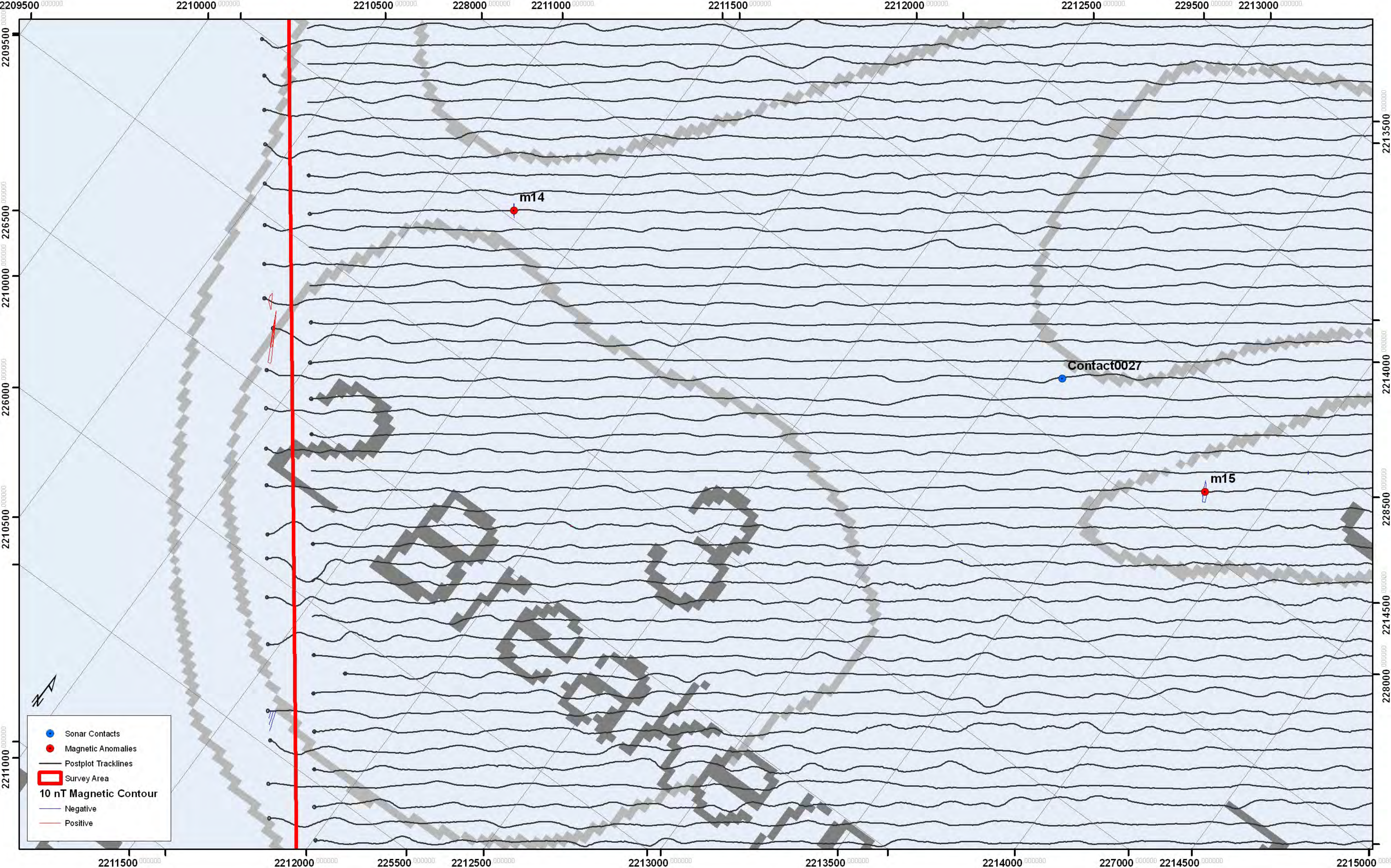

Map 1
Map 2
Map 3
Map 4
Map 5
Map 6
Breakers



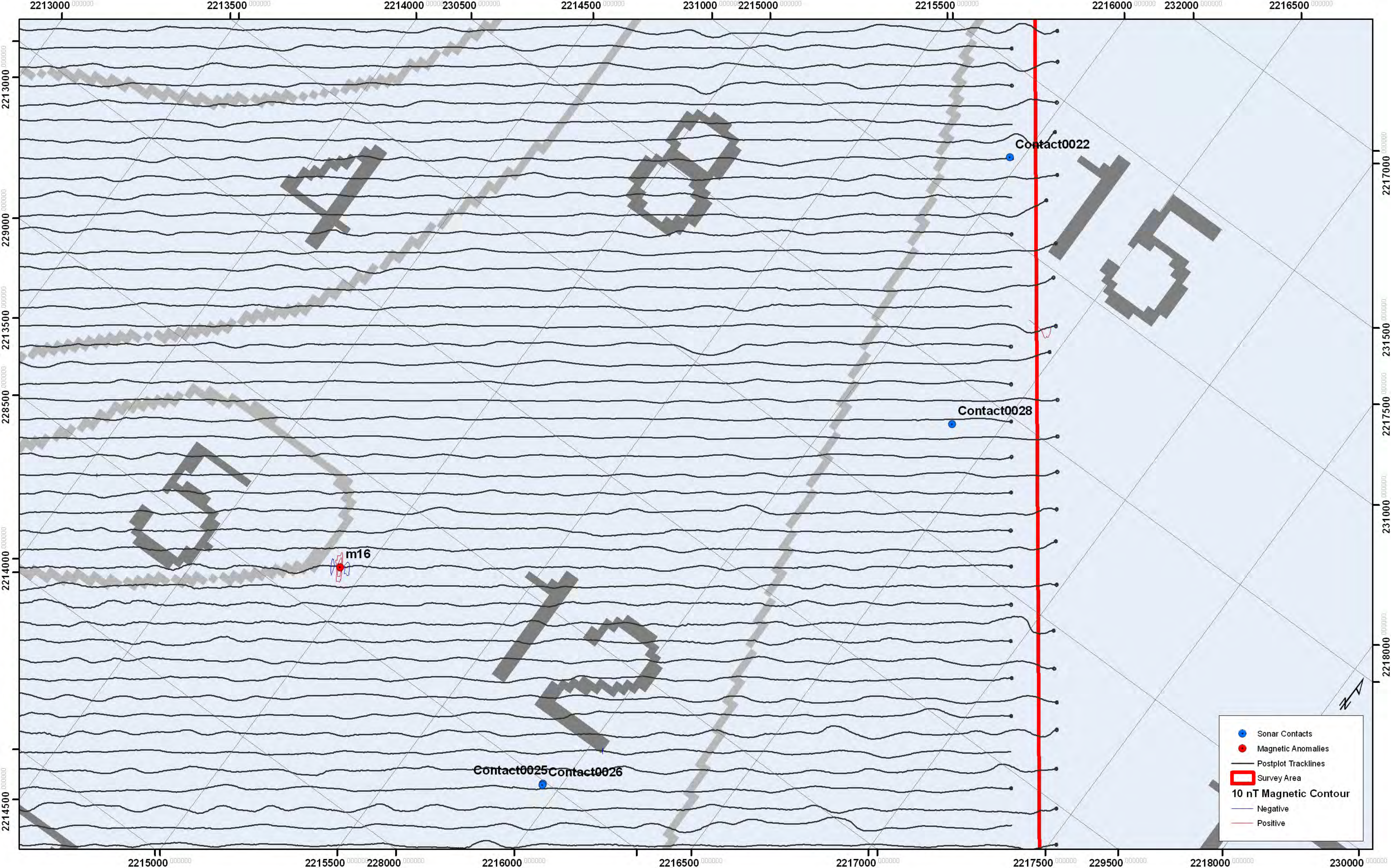
2208000.000000
229500.000000
2208500.000000
2209000.000000
2209500.000000
2210000.000000
231000.000000
2210500.000000
2211000.000000
2211500.000000
227000.000000
2210000.000000
2210500.000000
2211000.000000
2211500.000000
228500.000000
2212000.000000
2212500.000000
2213000.000000
229500.000000
232000
2212000
2212500
230500
2213000
230000
2208000
228500
2208500
228000
2209000
229500
m12
m11
m10
m09
m07
Contact0021
Sonar Contacts
Magnetic Anomalies
Postplot Tracklines
Survey Area
10 nT Magnetic Contour
Negative
Positive



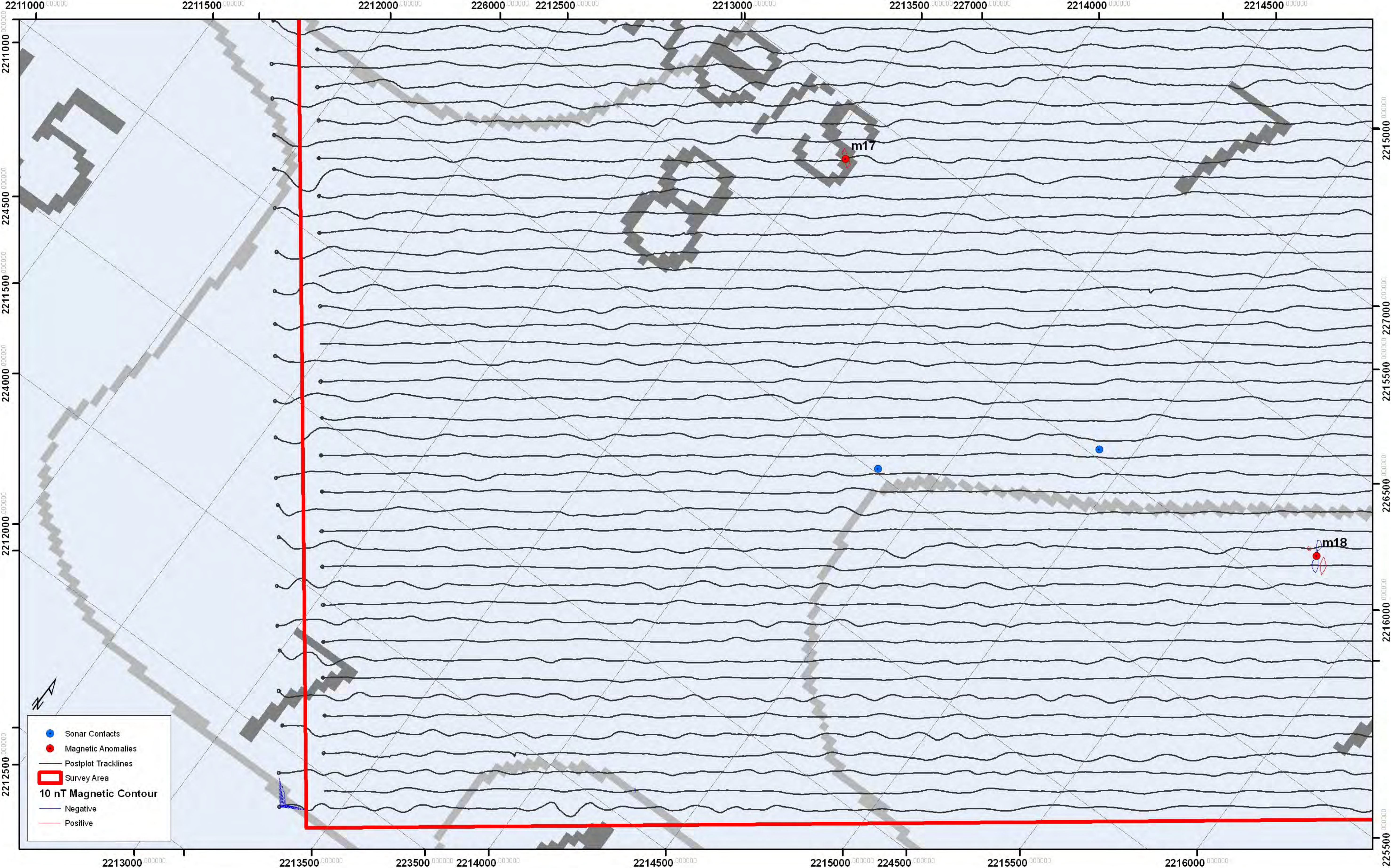
Contact0001
m08
m02
Contact0002
m04
Contact0003
m03
m01
Contact0004
Contact0012
Contact0023
Contact0011
Contact0020
Contact0013
Contact0005
m05
m06
Contact0010
Contact0009
Contact0014
Contact0019
Contact0016
Contact0017
Contact0015
Contact0008
Contact0018
m13
Contact0021
Sonar Contacts
Magnetic Anomalies
Postplot Tracklines
Survey Area
10 nT Magnetic Contour
Negative
Positive



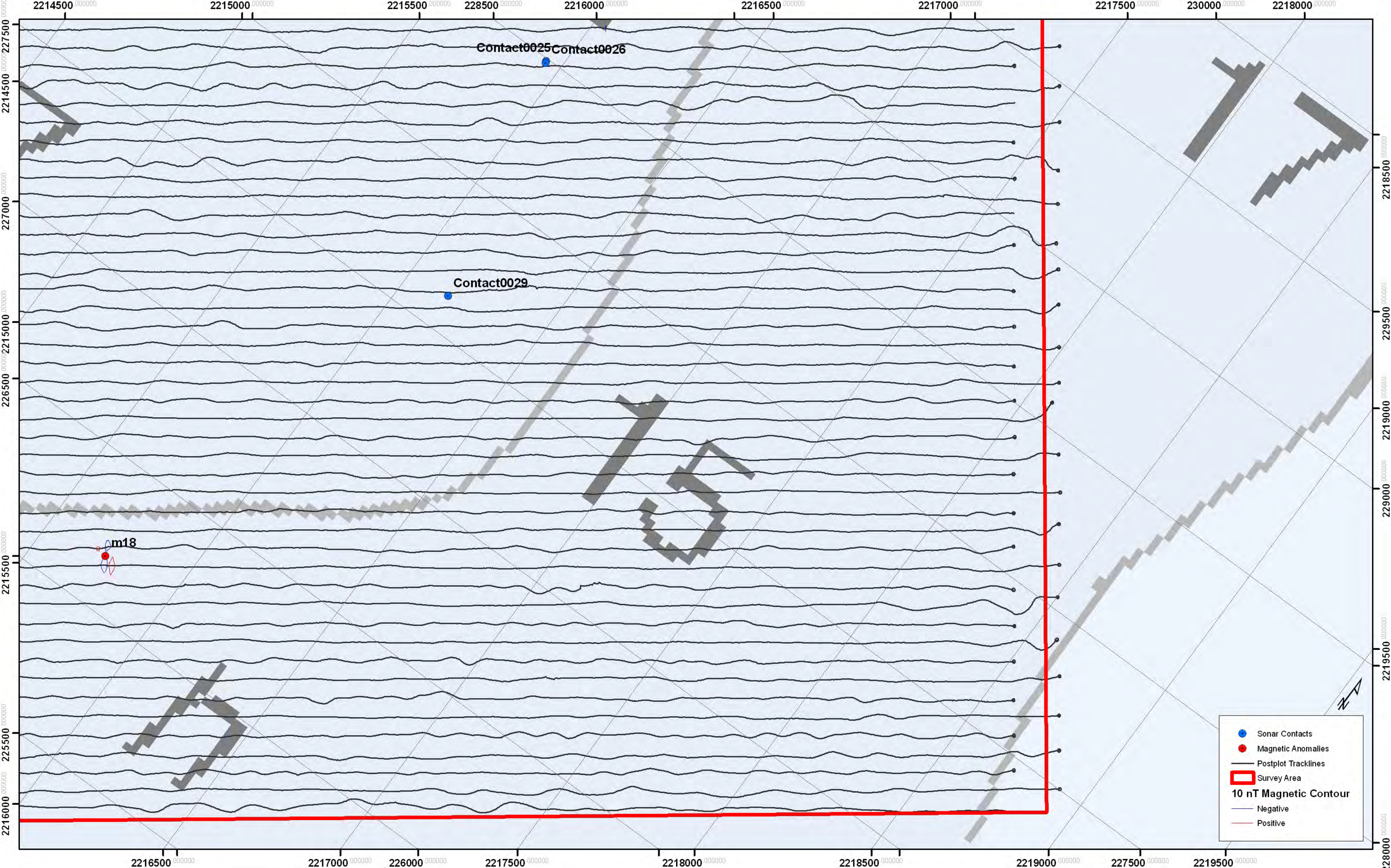
m14
Contact0027
m15
Sonar Contacts
Magnetic Anomalies
Postplot Tracklines
Survey Area
10 nT Magnetic Contour
Negative
Positive



Contact0022
Contact0028
m16
Contact0025
Contact0026
Sonar Contacts
Magnetic Anomalies
Postplot Tracklines
Survey Area
10 nT Magnetic Contour
Negative
Positive



m17
m18
Sonar Contacts
Magnetic Anomalies
Postplot Tracklines
Survey Area
10 nT Magnetic Contour
Negative
Positive



Contact0025
Contact0026
Contact0029
m18
Sonar Contacts
Magnetic Anomalies
Postplot Tracklines
Survey Area
10 nT Magnetic Contour
Negative
Positive

APPENDIX C

LETTER OF CONCURRENCE FROM THE SOUTH CAROLINA INSTITUTE OF ARCHAEOLOGY AND ANTHROPOLOGY

UNIVERSITY OF SOUTH CAROLINA
SOUTH CAROLINA INSTITUTE OF ARCHAEOLOGY AND ANTHROPOLOGY

12 April 2013

Alisha N. Means
Biologist
Planning & Environmental Branch
US Army Corps of Engineers-Charleston District
69A Hagood Avenue
Charleston SC 29403-5107

Re: Review of Edisto Beach Renourishment Project report.

Dear Ms. Means,

Our office has reviewed the draft report of the *Hardbottom and Cultural Resource Surveys, Edisto Beach Offshore Borrow Site, Edisto Beach, South Carolina*, prepared by Dial Cordy and Associates, Inc. for the Edisto Beach hurricane and storm damage protection project. Our review is focused on the submerged cultural resources aspects of the project. The report is a solid discussion of the scope, methods, research, and findings, especially in its awareness of inundated paleolandscapes bearing the potential of prehistoric cultural materials along the South Carolina coast.

We concur with the contractor's recommendations to place a 1,500 ft. buffer zone around the two arbitrary center points: Site 1—E2213373, N232446; and Site 2--E2218203, N227338 (NAD83 South Carolina State Plane East U.S. Survey Feet) as potential paleolandscape features. We also agree that no additional inspections of the magnetic, acoustic, or sub-bottom reflectors is warranted in the designated borrow site. We do, however, request that any inadvertent discovery of potential archaeological materials, i.e., wood structure, prehistoric lithics, ceramics, etc. during dredging operations cease from that area until inspections may reveal the source of this material. Please contact my office or the SHPO for further guidance in this instance. Our office has no objections from a submerged cultural resources viewpoint for dredging operations to occur in this borrow site. If plans change, please consult with our office for additional guidance.

We do though offer several editorial comments to improve the graphics for the final report:

1. Fig. 34, p. 47—please choose a color scheme to more fully reveal the trackline points, as well as to bring out the contours.
2. The above recommendation would also go for the Appendix B contour maps.
3. Please ensure the PDF images are of good quality in 100% zoom.

Thank you for this opportunity to review the report and your support of preserving the submerged archeological legacy in South Carolina waters. If you have any questions, comments, etc. about this matter please contact me.

Sincerely,

James D. Spirek
State Underwater Archaeologist
Maritime Research Division

Cc: Rebekah Dobrasko, SC SHPO