Managed Species for Coastal South Carolina					
MANAGEMENT PLAN AGENCY[2]	MANAGEMENT PLAN SPECIES GROUP	COMMON NAME OF SPECIES	SCIENTIFIC NAME OF SPECIES	LIFE STAGES BY ECOSYSTEM[3] Marine	NOTES
SAFMC	Coastal Migratory Pelagics	Spanish mackerel	*Scomberomorous maculatus*	J A	
SAFMC	Coastal Migratory Pelagics	Cobia	*Rachycentron canadum*	E L P J A	
SAFMC	Red Drum	Red drum	*Sciaenops ocellatus*	E L P J S A	
SAFMC	Shrimp	White shrimp	*Lilopenaeus setiferus*	L A	
SAFMC	Shrimp	Brown shrimp	*Farfantepenaeus aztecus*	E L A	
SAFMC	Snapper Grouper	Sheepshead	*Archosargus probatocephalus*		
SAFMC	Snapper Grouper	Crevalle Jack	*Caranx hippos*		
SAFMC	Snapper Grouper	Gray snapper	*Lutjanus griseus*	L A	
SAFMC	Snapper Grouper	Gag grouper	*Mycteroperca microlepis*	A	
SAFMC	Snapper Grouper	Lane snapper	*Lutjanus synagris*	A	
SAFMC	Snapper Grouper	Black Sea Bass	*Centropristis striata*		also managed under the MAFMC Black Sea Bass FMP
MAFMC	Bluefish	Bluefish	*Pomatomus saltatrix*	L J A	
MAFMC	Summer Flounder	Summer flounder	*Paralichthys dentatus*	L J A	
SAFMC		American Shad	*Alosa sapidissima*	A	anadromous species do not have a FMP
SAFMC		Hickory Shad	*Alosa mediocris*	A	anadromous species do not have a FMP
SAFMC		Blueback Herring	*Alosa aertivalis*	A	anadromous species do not have a FMP
SAFMC		Striped Bass	*Morone saxatilis*	A	anadromous species do not have a FMP
SAFMC		Shortnose Sturgeon	*Acipenser brevirostrum*	A	anadromous species do not have a FMP
SAFMC		Atlantic Sturgeon	*Acipenser oxyrinchus*	A	anadromous species do not have a FMP
NMFS	Sharks	Atlantic sharpnose shark	*Rhizoprionodon terraenovae*	J	
NMFS	Sharks	Blacknose shark	*Carcharhinus acronotus*	J	
NMFS	Sharks	Bonnethread shark	*Sphyrna tiburo*	J A	
NMFS	Sharks	Bull shark	*Carcharhinus leucas*	J	
NMFS	Sharks	Dusky shark	*Carcharhinus obscurus*	J	
NMFS	Sharks	Finetooth shark	*Carcharhinus isodon*	E L P J S A	
NMFS	Sharks	Lemon shark	*Negaprion brevirostris*	J	
NMFS	Sharks	Sand tiger shark	*Odontaspis taurus*	J	
NMFS	Sharks	Sandbar shark	*Carcharhinus plumbeus*	J	
NMFS	Sharks	Scalloped hammerhead	*Sphyrna lewini*	J	

Table 2: Managed Species in the Project Area

Note: 1. These Essential Fish Habitat species were compiled from Essential Fish Habitat: A Marine Fish Habitat Conservation Mandate for Federal Agencies. February 1999 (Revised 10/2001)

2. Organizations responsible for Fishery Management Plans include: SAFMC = South Atlantic Fishery Management Council; MAFMC = Mid-Atlantic Fishery Management Council; NMFS = National Marine Fisheries Service. 3. Life stages include: E = Eggs, L = Larvae, P = Post-Larvae, J = Juveniles, S = Sub-Adults, A = Adults

5.0 ASSESSMENT OF IMPACTS, CONCLUSIONS AND RESEARCH MEASURES

Hurl Rocks EFH-HAPC (hereafter referred to as Hurl Rocks) has been designated in the vicinity of the Grand Strand Storm Damage Reduction Project. In fact, portions of both areas overlap. The initial construction of the berm of sand intended to protect structures along the project length was completed prior to the designation of Hurl Rocks.

While there is a designated area for Hurl Rocks, there is no formal description of the structural characteristics written by the South Atlantic Fisheries Management Council (SAFMC). Likewise, there are no formal biological surveys that iterate the species composition, age structure or distribution. Verbal communication with the SAFMC staff reveals that the area designated was chosen based on information obtained from the State of South Carolina Department of Natural Resources (SCDNR) and a survey of hard bottom structures performed jointly by the U.S. Geological Survey and the Minerals Management Service.

While the Hurl Rocks EFH-HAPC was designated after the first nourishment cycle of the 50 year Grand Strand project, knowledge of hardbottom structures in the vicinity is not new. Post nourishment sampling of the nearshore environment was performed jointly by the Corps of Engineers, SCDNR, and Coastal Carolina University. The resulting report, titled "Habitat Mapping and Sea Bottom Change Detection on the Shoreface and Inner Shelf Adjacent to the Grand Strand Beach Nourishment Project", was submitted in September 2001. The title page and executive summary can be found in Appendix A.

Based on the report contained in Appendix A and the fact that the project was in existence prior to the designation of the habitat as an area of particular concern, the Corps of Engineers Charleston District does not believe that the Grand Strand project represents a significant threat to Essential Fish Habitat. The SAFMC has issued a policy paper on large-scale coastal engineering projects that is contained in Appendix B. While the Corps of Engineers Charleston District does not agree with all of the findings contained in the paper, the policy will be followed to the maximum extent practicable.

1. Initial planning for the Grand Strand project considered a number of alternatives. Criteria for the selection of the plan were based primarily on the efficiency of the design for the purpose of protecting the economic structure of the beach front. Eliminating portions of the protective berm in order to avoid specific habitat would severely endanger the structures in the modified area.
2. Hurl Rocks EFH-HAPC has been designated, in part, on top of the existing footprint of the civil works project and in some cases on top of existing structures which makes total avoidance impossible.
3. Past investigation have shown that the habitat was not significantly altered by the Grand Strand nourishment. Therefore, mitigation is not necessary.
4. Investigations and monitoring of the environment will be performed in partnership with the SCDNR and Coastal Carolina University. The scope of the monitoring is contained in Appendix C.

APPENDIX A

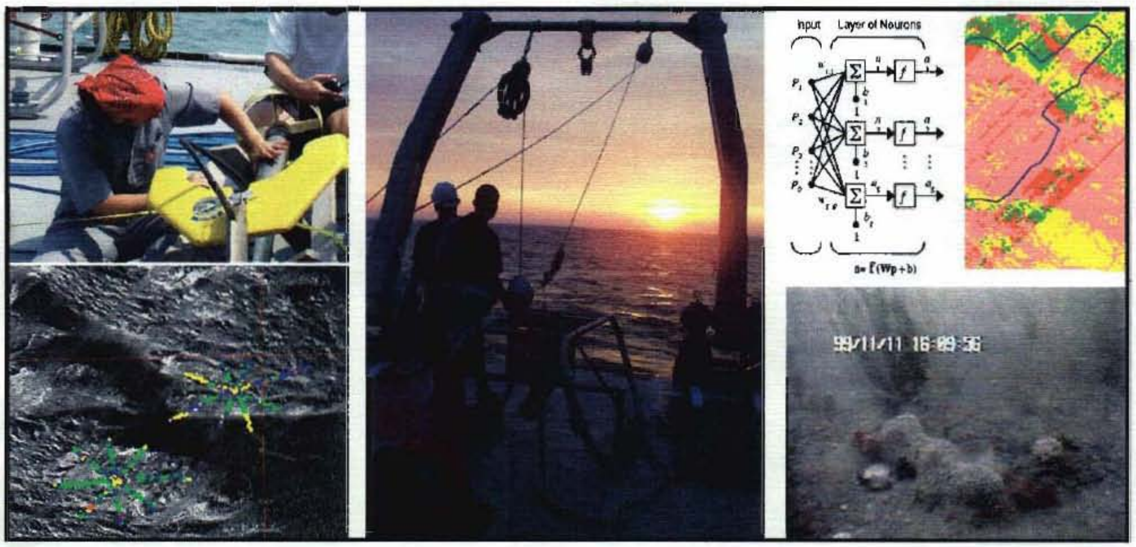
Grand Strand Beach Nourishment Project Study

Habitat Mapping and Sea Bottom Change Detection on the Shoreface and Inner Shelf Adjacent to the Grand Strand Beach Nourishment Project

(September 2001)

GRAND STRAND BEACH NOURISHMENT PROJECT STUDY

Habitat Mapping and Sea Bottom Change Detection on the Shoreface and Inner Shelf Adjacent to the Grand Strand Beach Nourishment Project



By

G.Y. Ojeda, P.T. Gayes, and A.L. Sapp
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Coastal Carolina University
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P.C. Jutte, and R.F. Van Dolah
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South Carolina Department of Natural Resources
Charleston, South Carolina 29422

Submitted to:

U.S Army Corps of Engineers
Charleston District
Charleston, South Carolina 29402

September 2001

EXECUTIVE SUMMARY

To monitor and evaluate the success of Phases I, II and III of the Grand Strand Nourishment Project, the Center for Marine and Wetland Studies in collaboration with the South Carolina Department of Natural Resources and the US Army Corps of Engineers designed and implemented an integrated approach that included (1) documentation of behavior of the beach fill over time through collection of long beach profiles along the length of the constructed projects; (2) evaluation of the impact or changes that occurred in the beach and shoreface habitats associated with the influx of additional nourished sand into the system; and (3) evaluation of the effects of excavation and physical infilling of inner-shelf borrow sites on benthic habitats.

For purposes of evaluating the effect that redistribution of nourished sand might have exerted on offshore habitats, thirteen target sites were monitored during the last four years. Five sequential side scan sonar surveys and twenty-one submarine video-transects were acquired over these sites. The sonar surveys were classified by means of a quantitative approach that involved textural analysis of images, and training of a neural network classifier. The output of this technique was a set of maps that categorized the sonar images in terms of 'hard bottom' or 'sand'. This technique facilitated tracking of habitat changes on a pixel-by-pixel basis, and quantification of changes on each site on a percent area basis.

Results of this approach indicate that offshore habitats have not been significantly impacted by effect of redistribution of nourished sand. Although changes were detected in bottom-type over the years, these changes were mainly interpreted as natural shifting of sediment within hard bottom areas. Sediment deposition and burial of hard bottom habitats were largely balanced by erosion and exhumation of new hard bottom. Such variability is expected in shallow marine settings such as the inner shelf, and was documented in this study by observation of the most distal target site, which showed an initial rapid increase in hard bottom coverage followed by a slow decrease, on a percent basis. All data available for this study and analysis of beach profiles suggest that limited nearshore loss of hard bottom habitat observed on the shoreface, seaward of the constructed beach fill, was due to localized introduction of "new" sand into the system from the beach fill, but was only marginally above the inherent variability of the system.

APPENDIX B

South Atlantic Fishery Management Council

Policies for the Protection and Restoration of Essential Fish Habitats from Beach Dredging and Filling and Large-Scale Coastal Engineering

(March 2003)

SOUTH ATLANTIC FISHERY MANAGEMENT COUNCIL

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Louis Daniel, Chairman
George Geiger, Vice-Chairman

Robert K. Mahood, Executive Director
Gregg T. Waugh, Deputy Executive Director

(MARCH 2003)
POLICIES FOR THE PROTECTION AND RESTORATION OF ESSENTIAL FISH HABITATS FROM BEACH DREDGING AND FILLING AND LARGE-SCALE COASTAL ENGINEERING

Policy Context

This document establishes the policies of the South Atlantic Fishery Management Council (SAFMC) regarding protection of the essential fish habitats (EFH) and habitat areas of particular concern (EFH-HAPCs) impacted by beach dredge and fill activities, and related large-scale coastal engineering projects. The policies are designed to be consistent with the overall habitat protection policies of the SAFMC as formulated and adopted in the Habitat Plan (SAFMC, 1998a) and the Comprehensive EFH Amendment (SAFMC, 1998b).

The findings presented below assess the threats to EFH potentially posed by activities related to the large-scale dredging and disposal of sediments in the coastal ocean and adjacent habitats, and the processes whereby those resources are placed at risk. The policies established in this document are designed to avoid, minimize and offset damage caused by these activities, in accordance with the general habitat policies of the SAFMC as mandated by law.

EFH At Risk from Beach Dredge and Fill Activities

The SAFMC finds:

1) In general, the array of large-scale and long-term beach dredging projects and related disposal activities currently being considered for the United States southeast together constitute a real and significant threat to EFH under the jurisdiction of the SAFMC.

2) The cumulative effects of these projects have not been adequately assessed, including impacts on public trust marine and estuarine resources, use of public trust beaches, public access, state and federally protected species, state critical habitat, SAFMC-designated EFH and EFH-HAPCs.

3) Individual beach dredge and fill projects and related large-scale coastal engineering activities rarely provide adequate impact assessments or consideration of potential damage to fishery resources under state and federal management. Historically, emphasis has been placed on the logistics of dredging and economics, with environmental considerations dominated by compliance with the Endangered Species Act for sea turtles, piping plovers and other listed organisms. There has been little or no consideration of hundreds of other species affected, many with direct fishery value.

4) Opportunities to avoid or minimize impacts of beach dredge and fill activities on fishery resources, and offsets for unavoidable impacts have rarely been proposed or implemented. Monitoring is rarely adequate to develop statistically appropriate impact evaluations.

5) Large-scale beach dredge and fill activities have the potential to impact a variety of habitats across the shelf, including:

   a) waters and benthic habitats near the dredging sites
   b) waters between dredging and filling sites
   c) waters and benthic habitats in or near the fill sites, and
   d) waters and benthic habitats potentially affected as sediments move subsequent to deposition in fill areas.

6) Certain nearshore habitats are particularly important to the long-term viability of commercial and recreational fisheries under SAFMC management, and potentially threatened by large-scale, long-term or frequent disturbance by dredging and filling:

   a) the swash and surf zones and beach-associated bars
   b) underwater soft-sediment topographic features
   c) onshore and offshore coral reefs, hardbottom and worm reefs
   d) inlets

7) Large sections of South Atlantic waters potentially affected by these projects, both individually and collectively, have been identified as EFH or EFH-HAPC by the SAFMC, as well as the Mid-Atlantic Fishery Management Council (MAFMC) in the case of North Carolina. Potentially Affected species and their EFH under federal management include (SAFMC, 1998b):

   a) summer flounder (various nearshore waters, including the surf zone and inlets; certain offshore waters)
   b) bluefish (various nearshore waters, including the surf zone and inlets)
   c) red drum (ocean high-salinity surf zones and unconsolidated bottoms nearshore waters)
   d) many snapper and grouper species (live hardbottom from shore to 600 feet, and – for estuarine-dependent species [e.g., gag grouper and gray snapper] – unconsolidated bottoms and live hardbottoms to the 100 foot contour).

e) black sea bass (various nearshore waters, including unconsolidated bottom and live hardbottom to 100 feet, and hardbottoms to 600 feet)
f) penaeid shrimp (offshore habitats used for spawning and growth to maturity, and waters connecting to inshore nursery areas, including the surf zone and inlets)
g) coastal migratory pelagics [e.g., king mackerel, Spanish mackerel] (sandy shoals of capes and bars, barrier island ocean-side waters from the surf zone to the shelf break inshore of the Gulf Stream; all coastal inlets)
h) corals of various types (hard substrates and muddy, silt bottoms from the subtidal to the shelf break)
i) areas identified as EFH for Highly Migratory Species (HMS) managed by the Secretary of Commerce (e.g., sharks: inlets and nearshore waters, including pupping and nursery grounds)

In addition, hundreds of species of crustaceans, mollusks, and annelids that are not directly managed, but form the critical prey base for most managed species, are killed or directly affected by large dredge and fill projects.

8) Beach dredge and fill projects also potentially threaten important habitats for anadromous species under federal, interstate and state management (in particular, inlets and offshore overwintering grounds), as well as essential overwintering grounds and other critical habitats for weakfish and other species managed by the Atlantic States Marine Fisheries Commission (ASMFC) and the states. The SAFMC also identified essential habitats of anadromous and catadromous species in the region (inlets and nearshore waters).

9) Many of the habitats potentially affected by these projects have been identified as EFH-HAPCs by the SAFMC. The specific fishery management plan is provided in parentheses:

a) all nearshore hardbottom areas (SAFMC, snapper grouper).
b) all coastal inlets (SAFMC, penaeid shrimps, red drum, and snapper grouper).
c) near-shore spawning sites (SAFMC, penaeid shrimps, and red drum).
d) benthic *Sargassum* (SAFMC, snapper grouper).
e) from shore to the ends of the sandy shoals of Cape Lookout, Cape Fear, and Cape Hatteras, North Carolina; Hurl Rocks, South Carolina; *Phragmatopora* (worm reefs) reefs off the central coast of Florida and nearshore hardbottom south of Cape Canaveral (SAFMC, coastal migratory pelagics).
f) Atlantic coast estuaries with high numbers of Spanish mackerel and cobia from ELMR, to include Bogue Sound, New River, North Carolina; Broad River, South Carolina (SAFMC, coastal migratory pelagics).
g) Florida Bay, Biscayne Bay, Card Sound, and coral hardbottom habitat from Jupiter Inlet through the Dry Tortugas, Florida (SAFMC, Spiny Lobster)
h) Hurl Rocks (South Carolina), The *Phragmatopoma* (worm reefs) off central east coast of Florida, nearshore (0-4 meters; 0-12 feet) hardbottom off the east coast of Florida from Cape Canaveral to Broward County; offshore (5-30 meters; 15-90 feet) hardbottom off the east coast of Florida from Palm Beach County to Fowey

Rocks; Biscayne Bay, Florida; Biscayne National Park, Florida; and the Florida Keys National Marine Sanctuary (SAFMC, Coral, Coral Reefs and Live Hardbottom Habitat).

i) EFH-HAPCs designated for HMS species (e.g., sharks) in the South Atlantic region (NMFS, Highly Migratory Species).

10) Habitats likely to be affected by beach dredge and fill projects include many recognized in state-level fishery management plans. Examples of these habitats include Critical Habitat Areas established by the North Carolina Marine Fisheries Commission, either in FMPs or in Coastal Habitat Protection Plans (CHAs).

11) Recent work by scientists in east Florida has documented important habitat values for nearshore, hardbottom habitats often buried by beach dredging projects, is used by over 500 species of fishes and invertebrates, including juveniles of many reef fishes. Equivalent scientific work is just beginning in other South Atlantic states, but life histories suggest that similar habitat use patterns will be found.

<u>Threats to Marine and Estuarine Resources from Beach Dredge and Fill Activities and Related Large Coastal Engineering Projects</u>

The SAFMC finds that beach dredge and fill activities and related large-scale coastal engineering projects (including inlet alteration projects) and disposal of material for navigational maintenance, threaten or potentially threaten EFH through the following mechanisms:

1) Direct mortality and displacement of organisms at and near sediment dredging sites
2) Direct mortality and displacement of organisms at initial sediment fill sites
3) Elevated turbidity and deposition of fine sediments down-current from dredging sites
4) Alteration of seafloor topography and associated current and waves patterns and magnitudes at dredging areas
5) Alteration of seafloor sediment size-frequency distributions at dredging sites, with secondary effects on benthos at those sites
6) Elevated turbidity in and near initial fill sites, especially in the surf zone, and deposition of fine sediment down-current from initial fill sites (ASMFC, 2002)
7) Alteration of nearshore topography and current and wave patterns and magnitudes associated with fill
8) Movement of deposited sediment away from initial fill sites, especially onto hardbottoms
9) Alteration of large-scale sediment budgets, sediment movement patterns and feeding and other ecological relationships, including the potential for cascading disturbance effects
10) Alteration of large-scale movement patterns of water, with secondary effects on water quality and biota
11) Alteration of movement patterns and successful inlet passage for larvae, post-larvae, juveniles and adults of marine and estuarine organisms

12) Alteration of long-term shoreline migration patterns (inducing further ecological cascades with consequences that are difficult to predict)
13) Exacerbation of transport and/or biological uptake of toxicants and other pollutants released at either dredge or fill sites

In addition, the interactions between cumulative and direct (sub-lethal) effects among the above factors certainly triggers non-linear impacts that are completely unstudied.

<u>SAFMC Policies for Beach Dredge and Fill Projects and Related Large Coastal Engineering Projects</u>

The SAFMC establishes the following general policies related to large-scale beach dredge and fill and related projects, to clarify and augment the general policies already adopted in the Habitat Plan and Comprehensive Habitat Amendment (SAFMC 1998a; SAFMC 1998b):

1) Projects should avoid, minimize and where possible offset damage to EFH and EFH-HAPCs.

2) Projects requiring expanded EFH consultation should provide detailed analyses of possible impacts to each type of EFH, with careful and detailed analyses of possible impacts to EFH-HAPCs and state CHAs, including short and long-term, and population and ecosystem scale effects. Agencies with oversight authority should require expanded EFH consultation.

3) Projects requiring expanded EFH consultation should provide a full range of alternatives, along with assessments of the relative impacts of each on each type of EFH, HAPC and CHAs.

4) Projects should avoid impacts on EFH, HAPCs and CHAs that are shown to be avoidable through the alternatives analysis, and minimize impacts that are not.

5) Projects should include assessments of potential unavoidable damage to EFH and other marine resources, using conservative assumptions.

6) Projects should be conditioned on the avoidance of avoidable impacts, and should include compensatory mitigation for all reasonably predictable impacts to EFH, taking into account uncertainty about these effects. Mitigation should be local, up-front and in-kind, and should be adequately monitored, wherever possible.

7) Projects should include baseline and project-related monitoring adequate to document pre-project conditions and impacts of the projects on EFH.

8) All assessments should be based upon the best available science, and be appropriately conservative so follow and precautionary principles as developed for various federal and state policies.

9) All assessments should take into account the cumulative impacts associated with other beach dredge and fill projects in the region, and other large-scale coastal engineering projects that are geographically and ecologically related.

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Appendix 6

Archeological Survey & Coordination

THE South Carolina Archives & History Center

History & Heritage For All Generations

April 19, 2007

Mr. Richard H. Kimmel
Department of the Army
Wilmington District, Corps of Engineers
PO Box 1890
Wilmington, NC 28402-1890

RE: Draft Report, *Archaeological Remote Sensing Survey of Myrtle Beach Offshore Borrow Areas, Horry County, South Carolina*

Dear Mr. Kimmel:

We have reviewed the above referenced survey report, and find that the report meets both State and Federal standards for the identification, documentation, and assessment of cultural resources. We concur with the recommendations that the Surfside A target exhibits characteristics that may be associated with a significant submerged cultural resource and that this site should either be avoided or further investigated. Without additional information we assume that the proposed project would be an adverse effect on the resource.

If additional investigations to further evaluate the site are not an option, the we concur that the Surfside A target an avoidance buffer of at least 200 feet all around the target should be established prior to dredging activities. If additional investigations take place, we would expect that this target be given an official state site number. We would also look forward to receipt of a report on the investigations.

These comments are being provided to assist you with your responsibilities under Section 106 of the National Historic Preservation Act, as amended. I can be contacted at (803) 896-6173 if you have any questions or comments.

Sincerely,

Valerie Marcil
Staff Archaeologist
State Historic Preservation Office

cc: Keith Derting, SCIAA
Jim Spirek, SCIAA

UNIVERSITY OF SOUTH CAROLINA

SOUTH CAROLINA INSTITUTE OF ARCHAEOLOGY AND ANTHROPOLOGY

26 April 2007

Richard Kimmel
Wilmington District, Corps of Engineers
PO Box 1890
Wilmington, NC 28402-1890

Re: Myrtle Beach Offshore Borrow Areas, Horry County, South Carolina.

Dear Mr. Kimmel,

We have reviewed the report entitled "Archaeological Remote Sensing Survey of Myrtle Beach Offshore Borrow Areas, Horry County, South Carolina." This report was prepared to determine the presence or absence of submerged cultural resources in the proposed borrow areas. We find the report satisfactory in outlining the scope of work undertaken by the underwater archaeological contractor. We concur with the findings of the survey that anomaly Surfside A has potential cultural significance, and that the best course of action is avoidance of the anomaly, or if not feasible, that additional archaeological investigation occur to identify the source of the anomaly. If you have questions or comments please do not hesitate to call me or Christopher Amer.

Sincerely,

James D. Spirek

James D. Spirek
Deputy State Underwater Archaeologist
Review & Compliance

c: Valerie Marcil, SCSHPO

1321 Pendleton Street • Columbia, SC 29208-0071 • (803) 777-8170 • 734-0567 • 799-1963

DEPARTMENT OF THE ARMY
WILMINGTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1890
WILMINGTON, NORTH CAROLINA 28402-1890

IN REPLY REFER TO

March 14, 2007

Environmental Resources Section

Dr. Rodger E. Stroup, SHPO
Department of Archives and History
8301 Parklane Road
Columbia, South Carolina 29223-4905

Dear Dr. Stroup:

Enclosed for your review please find a copy of the Mid-Atlantic Technology and Environmental Research draft report, "Archaeological Remote Sensing Survey of Myrtle Beach Offshore Borrow Areas, Horry County, South Carolina." This report has been prepared per provisions of the National Historic Preservation Act of 1966, as amended, and the Abandoned Shipwreck Act.

If you have any questions about the report, please contact me at (910) 251-4994, fax (910) 251-4653, or e-mail richard.h.kimmel@usace.army.mil. I would like to receive any comments you may have by April 27, 2007.

Sincerely,

Richard H. Kimmel

Richard H. Kimmel, Archaeologist
Contracting Officer's Representative

Enclosure

Copy Furnished (w/enclosure):

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Archaeological Remote Sensing Survey of Myrtle Beach Offshore Borrow Areas, Horry County, South Carolina

Contract Number: DACW54-03-D-0002 Del. Order: CV05

Submitted to:

Department of the Army
Wilmington District, Corps of Engineers
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Submitted By:

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Wes Hall

Wes Hall
Principal Investigator

26 February 2007

Abstract

The U.S. Army Corps of Engineers Wilmington District in conjunction with Charleston District (USACE) is conducting preliminary investigations of three proposed sand borrow areas for beach re-nourishment projects at or near Myrtle Beach, in Horry County, South Carolina. As a part of these investigations, Mid-Atlantic Technology and Environmental Research, Inc. (M-AT/ER) of Castle Hayne, North Carolina, was contracted to conduct marine magnetometer, side-scan sonar and sub-bottom profiler surveys of the proposed borrow areas for the purpose of identifying any potential archaeological resources that might be impacted by the offshore dredging activities during the sand mining process. M-AT/ER conducted historical research and field investigations for the project between 10 November and 15 December 2007.

A total of five remote sensing targets were identified within the three borrow areas. One target - Surfside A exhibits characteristics that may be associated with a significant submerged cultural resource. Additional underwater investigations to identify and assess Surfside A's potential as an archaeological resource are recommended. If underwater archaeological investigations are not an option, an avoidance buffer of at least 200 feet (radius) around the target coordinates should be established prior to dredging activities.

The remainder of the remote sensing targets identified during the survey of the three borrow areas (Cane South A, and Little River A, B, C) appear to have little potential to be associated with significant cultural resources. No additional underwater investigation or mitigation is recommended.

Analysis of sub-bottom records provide no indication of stratification or protected deposition of surficial (Late Pleistocene or Holocene) sediments that would contain or support any remnant evidence of human occupation or usage. No additional underwater archaeological investigations are recommended related to sub-bottom investigations within the three borrow areas.

Minor hard bottom areas were identified within each of the three borrow areas.

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Introduction

The U.S. Army Corps of Engineers Wilmington District in conjunction with Charleston District (USACE) is conducting preliminary investigations of three proposed sand borrow areas for beach re-nourishment projects at or near Myrtle Beach, in Horry County, South Carolina. As a part of these investigations, Mid-Atlantic Technology and Environmental Research, Inc. (M-AT/ER) of Castle Hayne, North Carolina, was contracted to conduct marine magnetometer[1], side-scan sonar[2], and sub-bottom profiler[3] surveys of the proposed borrow areas for the purpose of identifying any potential archaeological resources that might be impacted by the offshore dredging activities during the sand mining process. This work was conducted pursuant to provisions of Section 106 of the National Preservation Act of 1966 (36 CFR 800, Protection of Historic Properties) and the Abandon Shipwreck Act of 1987 (Abandon Shipwreck Guidelines, National Park Service, Federal Register, Vol. 55, No. 3, 4 December 1990, pages 50116-50145)[4].

In addition to archaeological resources, M-AT/ER was required to search for and identify hard bottom/marine habitat areas using side-scan sonar record analysis as part of the remote sensing investigations. M-AT/ER conducted historical research and field investigations for the project between 10 November and 15 December 2007.

Project Location

The three survey areas were located between Murrells Inlet and Little River Inlet, in the Atlantic Ocean offshore of North Myrtle Beach, Myrtle Beach, Surfside Beach, and Garden City, South Carolina (Figure 1). The survey areas were positioned between 1.6 and 4.1 nautical miles offshore (Figure 2). Portions of the borrow areas have already been utilized for past beach re-nourishment project and portions are know to be hard bottom or live bottom areas. South Carolina State Plane coordinates (NAD 83) for the proposed borrow area are listed below:

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1. A magnetometer is an electronic instrument that measures localized changes in the earth's magnetic field. By using a magnetometer in a controlled survey, the presence of ferrous materials can be detected. Since most historically significant shipwrecks contain relatively large amounts of iron or steel in the form of fasteners, anchors, cannons, or engines, etc., their presence can frequently be detected by a magnetometer survey.

2. Side-scan sonar is an underwater acoustic instrument that by electronic means generates a graphic representation of the bottom surface. By interpretation of these graphic records, the user can identify geographic changes in the bottom or man-made objects protruding above the bottom surface.

3. A sub-bottom profiler is an acoustic instrument that typically utilizes low frequent sound pulses to to detect sedimentary and geological changes below the bottom surface.

4. A national policy for historic preservation has been established in accordance with authorization contained in Sections 106 and 110 (formerly E.O. 11593) of the National Historic Preservation Act of 1966, as amended following the Advisory Council on Historic Preservation Regulations (36 CFR 800). Executive Order 11593 and the Historic Preservation Act Amendments of 1980 specified that the Federal Government shall provide leadership in preserving, restoring, and maintaining the historic and cultural environment of the nation. In 1988, the Abandoned Shipwreck Act (Public Law 100-298) declared that the states (or territories of the U.S.) are to manage shipwrecks in state waters. As a result of these acts and other legislation, state and federal agencies are required to administer cultural properties under their control in a spirit of stewardship and trusteeship. Each agency is required to initiate such measures as are necessary to insure that policies, plans, and programs will preserve sites, structures, and objects of historical or archaeological significance that exist on properties owned by the Federal Government or that are subject to federal regulation.

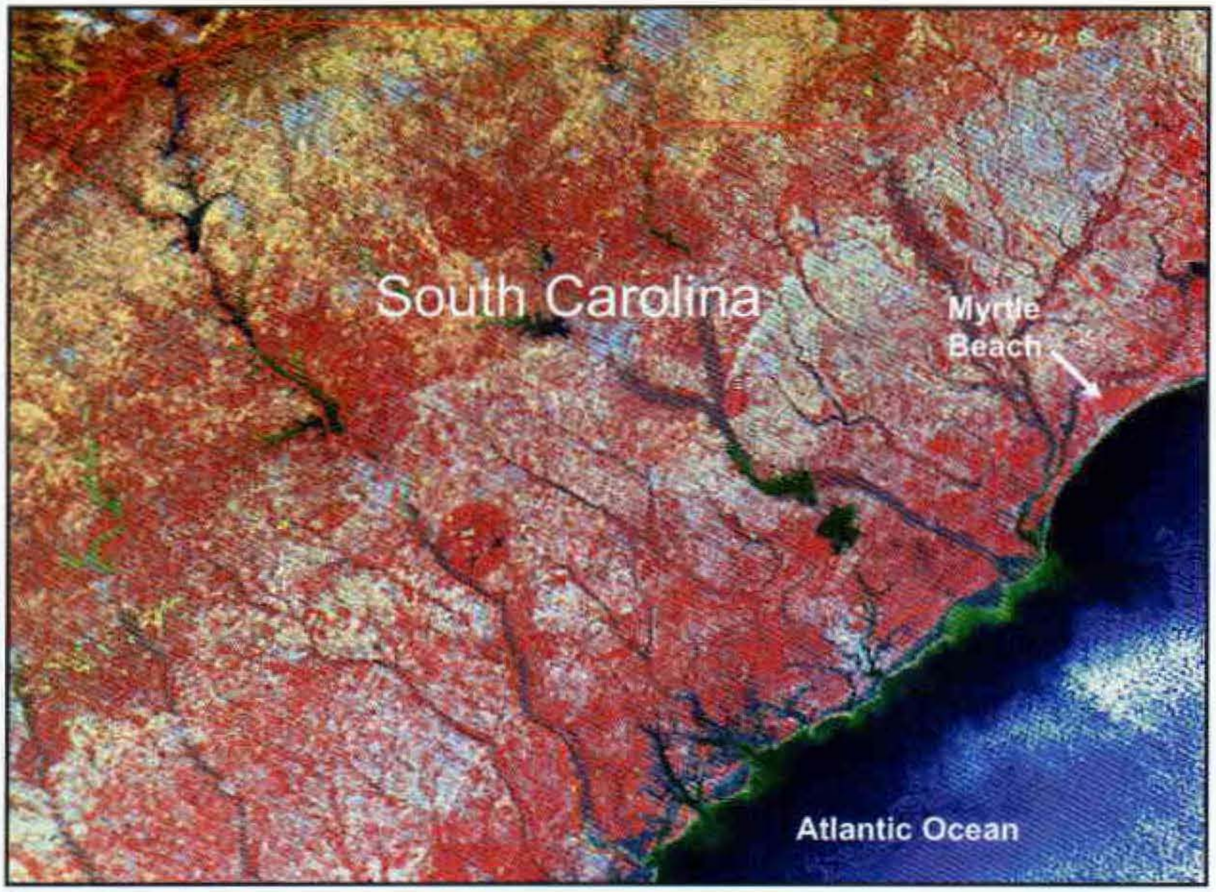

Figure 1. Project Location Map

Borrow Area Boundaries – South Carolina State Plane Coordinates NAD 1983

Surfside Borrow Area

A	x= 2616232.00	y= 629941.00
B	x= 2621710.00	y= 637200.00
C	x= 2633585.00	y= 628505.00
D	x= 2628043.00	y= 620845.00

Cane South Borrow Area

A	x= 2641959.00	y= 666291.00
B	x= 2643046.00	y= 667436.00
C	x= 2643904.00	y= 666161.00
D	x= 2643766.00	y= 665187.00
E	x= 2643300.00	y= 664552.00

Little River Borrow Area

A	x= 2721065.00	y= 721850.00
B	x= 2741655.00	y= 730855.00
C	x =2747711.00	y= 725110.00
D	x =2726165.00	y= 714950.00

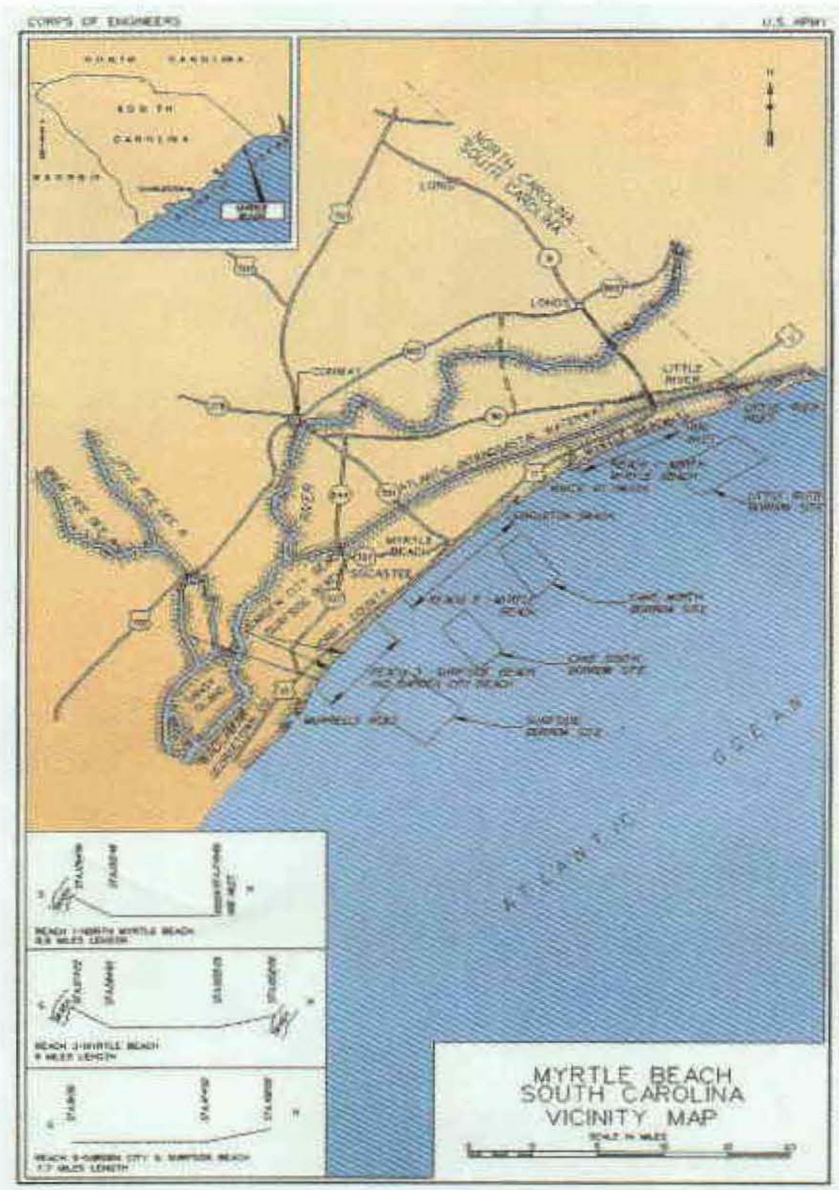

Figure 2. Project Area Location Map (US Army Corps of Engineers).

Myrtle Beach Vicinity Historical Background

Early Settlement and Colonial Periods. European colonization of South Carolina began with temporary Spanish and French settlements in the sixteenth century. These settlements were in the Beaufort area at the southern end of the coast. The English, however, were the first Europeans to establish permanent colonies. In 1663, King Charles II made a proprietary grant to a group of powerful English courtiers who had supported his return to the throne in 1660, and who sought to profit from the sale of the new lands. These Lords Proprietors, including Sir John Colleton, Sir William Berkeley, and Sir Anthony Ashley Cooper, provided the basic rules of governance for the new colony. They also sought to encourage settlers, many of whom came from the overcrowded island of Barbados in the early years. These Englishmen from Barbados first settled at Albemarle Point on the west bank of the Ashley River in 1670. By 1680, they moved their town down the river to Oyster Point, the present location of Charleston, and called it Charles Towne. These initial settlers, and more who followed them, quickly spread along the central South Carolina coast. By the second decade of the eighteenth century, they had established settlements from Port Royal Harbor in Beaufort County northward to the Santee River in Georgetown County.

The initial settlements in the region took advantage of the extensive woodlands of the region, harvesting the timber cleared from the land for the production of naval stores. Lumber, tar, turpentine, and resin all were produced from the forests cleared for agricultural lands (Gregorie 1961:20). Evidence of these harvesting activities includes many small circular tar kilns found throughout the region (Hart 1986), as well as site 38GE548 found on the Allston Bluffs tract (Baluha and Hendrix 2001). The lumber industry has continued to be very important in the economy of region.

The early economic development of the region also focused on the Native fur trade. However, agricultural industries soon replaced the fur trade. Trade with the Native Americans was pursued aggressively through the beginning of the eighteenth century, but by 1716, conflicts with the Europeans and disease had drastically reduced or displaced the local native population.

One of the important commercial ventures in the early settlements of the northeastern South Carolina was the raising of cattle. The climate in South Carolina permitted year-round grazing, and the many necks of land surrounded by rivers and creeks along the coast provided naturally bounded cowpens that allowed the cattle to range freely. Cattle ranching was a low-capital industry, with a natural market in the West Indies sugar plantations. Cattle ranching in South Carolina began in the late seventeenth century in the Charleston area, and by the early eighteenth century it had extended south into what is now Colleton County, between the Edisto and Combahee Rivers and north into Georgetown County (Rowland et al. 1997: 85-88).

While cattle ranching was an ideal frontier industry, it required great amounts of open land. Large purchases of land throughout the Lowcountry created problems between the white settlers and the Yamasee natives, whose lands were steadily and rapidly encroached upon. Angered by a combination of mistreatment from traders and encroachments on their land, the Native Americans attacked, resulting in the Yamasee War in 1715. While the Yamasee staged a number of successful raids throughout the 1720s, by 1728 the English had routed them and made the area more accessible for renewed English settlement (Covington 1978: 12).

Lowcountry colonists began to experiment with rice cultivation by the end of the seventeenth century. The regular flood conditions of the immediate tidal area proved valuable. Production for export increased rapidly, by 1715, Charles Towne exported more than 8,000 barrels of rice annually. This number increased to 40,000 by the 1730s. In the 1740s, residents in the Lowcountry also began to experiment with growing and processing indigo, a blue dye that was very popular in Europe and which became one of South Carolina's principal exports during the second half of the eighteenth century. Indigo and rice, both labor-intensive, laid the basis for South Carolina's dependence on African slave labor, much as tobacco had done in the Virginia colony (Coclanis 1989; Wood 1974). The British government, dependent on French colonies for this dye, heavily subsidized the crop in 1748. The Revolutionary War ended the bounty on indigo, making it unprofitable (Lawson 1975).

With the rapidly increasing wealth in the South Carolina Lowcounty, and with the Yamasee War largely behind them, the population began to swell. By 1730 the colony had 30,000 residents, at least half of whom were black slaves. A 1755 magazine, cited by Peter Wood, estimates that South Carolina residents had imported over 32,000 slaves by 1723 (Wood 1974:151). The growing population increased pressure for territorial expansion, which was compounded by the growing black majority in the Lowcountry. Fears of a slave rebellion, along with fears of attack from the Native Americans such as in the Yamasee War in 1715, led Charles Town residents to encourage settlement in the backcountry.

The capacity of the Lords Proprietors to govern the colony effectively declined in the early years of the eighteenth century. Governance under the Lords Proprietors became increasingly arbitrary, while wars with Native Americans rose and the colonial currency went into steep depreciation. According to a historian of colonial South Carolina, "proprietary attitudes and behavior. . .convinced many of the dissenters—who at one time had composed the most loyal faction—that the crown was a more reliable source of protection against arbitrary rule" (Weir 1983:94). South Carolina's legislature sent a petition to Parliament in 1719, requesting that royal rule supplant that of the Lords Proprietors. After several years in limbo, South Carolinians received a degree of certainty in 1729 when the crown purchased the Proprietors' interests, and in 1730 when the new royal governor, Robert Johnson, arrived in the colony.

Settlement in northeastern South Carolina proceeded slowly during the late seventeenth and early eighteenth centuries. Robert Johnson, South Carolina's first Royal Governor after the end of proprietary rule in 1719, directed the establishment of several townships in the interior of the state under his "Township Scheme." The purpose of these townships was to encourage settlement by white Europeans. These settlers would act as a buffer between the plantations around Charleston and the Native Americans and Spanish. Of equal if not greater concern to the Colonial Government was the dramatic rise in slave importation that accompanied the growth of rice agriculture. The settlement of free, white Europeans increased the tax base and strengthened the colony (Wallace 1951:154; Bedford 1989).

As settlement in the region grew, so did the need for the colony's civil and religious establishment. The Church Act of 1706 established the parish as the local unit of government. Counties or districts within Carolina were divided into parishes, with the local church serving as the administrative center. The project area was not within one of the original ten parishes; St. James Santee was the northernmost parish, and stopped at the Santee River. Between 1682 and 1721, the area above Winyah Bay represented the northern fringe of Craven County. The parish of Prince George Winyah was created in the early 1720s, and stretched from the Santee River to the Cape Fear River. There were several divisions of the original Prince George Winyah Parish from the 1730s to the 1750s, as the parishes of Prince Frederick, St. Mark's, and St. David's were created. In 1767 the Parish of All Saint's was created, which included the land between the Atlantic Ocean and the Waccamaw River, as far north as the boundary of North Carolina (Rogers 1970:3-4). The project area lies within All Saint's Parish.

As the delay in naming a parish suggests, the project area did not see early settlement. Indeed, during the seventeenth century settlement was discouraged above the Santee River. However, Native American traders, trappers, and particularly French Huguenots began to filter into this northeastern area of the colony. By 1705, a number of influential persons in Charleston received land grants in the area. European activities in the area during the late seventeenth and early eighteenth centuries focused on trade with the Native Americans. The Waccamaw and the Winyah represented the major aboriginal groups in the Winyah Bay area in the early eighteenth century, with a population estimated at 900. The Winyah had one village with a population of just over 100 people (Swanton 1946:207).

During the early 1700s, land grants were obtained and plantations were established in the area of present day Georgetown County. Along Winyah Bay and the Pee Dee and Black Rivers to the west, most of these landholdings were long and narrow. This configuration provided access to the river marshes, the interior uplands on the peninsulas between the rivers, and (to the east) the salt marshes and sea islands on the coast. Main plantation residences and facilities were established on the low bluffs of the Santee, Sampit, Waccamaw, Pee Dee, and Black Rivers; summer houses often were placed near the Atlantic shore. Though early experimentation occurred in the 1730s with using marshes for growing rice, by the 1760s planters were locating their fields in the river marshes. The central upland portions of most plantations were used for growing indigo, gardening and pasturage. Meanwhile communication with Charles Town to the south and other colonies to the north was established primarily by boat.

The South Carolina Commissioners of Trade established a post at Yauhannah on the Pee Dee River in 1716. This post served the Winyah who resided on the west bank of the Pee Dee River, the Waccamaw on the east bank of the river, and the Peedee who lived further upstream on the Pee Dee. At least one of the villages associated with the Waccamaw was located at the present-day Wachesaw Landing (Trinkley 1983). By the 1730s, however, much of the Native American population had been destroyed, enslaved, or driven from the region.

Myrtle Beach and Horry County

During the 18th century settlement came slowly into northeastern South Carolina. Most of the settlement occurred to the south along waterways with access to the ocean. A few fishermen settled along the coast of the Atlantic Ocean. The fur trade continued but declined through the century and farming became far more prevalent. Cattle and pigs free ranged in Horry County before the 1800s. The hides were more valuable than the meat which could not be preserved. Round-ups were not unusual during which time thousands of cows were regularly driven through forest and swamp to the slaughter houses in Charleston. The Horry County area could not have been founded, however, without its considerable naval stores. This seemingly inexhaustible supply of pitch, pine tar, turpentine, and a variety of other naval products supplied the average Horry County citizen with the majority of their income until the 1900s (Brosky 2007:1).

As the late 18th century approached, Horry County (then known as Kingston) residents separated into three political groups. The Patriots wanted to break all ties with England, the Tories remained loyal to England, and a third group comprised mostly of frontiersmen had no political preference.

The relatively isolated Horry County region experienced very little war related activity during the Revolutionary War. General Francis Marion, known as the "Swamp Fox" for his ability to disappear into the swamps, may have retreated into the area to avoid British troops. Brigadier General Peter Horry served under General Marion, and the two combined to help discourage British troops from gaining a foothold in the area.

Brigadier General Horry was born in South Carolina sometime around 1743. He started his military career in 1775 as one of 20 captains the Provincial Congress of South Carolina elected to serve the 1st and 2nd Regiments. In 1801 residents of Kingston County successfully petitioned the South Carolina Legislature to change the name of the county from Kingston to Horry (Brosky 2007:1).

The period between the Revolutionary War and Civil War were relatively uneventful in Horry County's History. Although the population of Horry County grew through this period most of the population was found along the Waccamaw River and in the vicinity of Conway. Coastal areas were sparsely populated (Figure 3).

In 1860, the southern states sent delegates to a convention to discuss the issue of Secession. South Carolina, always a staunch state's rights supporter, was first to adopt the Ordinance of Secession in December of that year. Horry County, not aggressively Secessionist, joined the "Cause" as soon as the War started, April 12, 1861, when the Confederate States of America fired on the Federals at Fort Sumter in Charleston harbor (Brosky 2007:2)

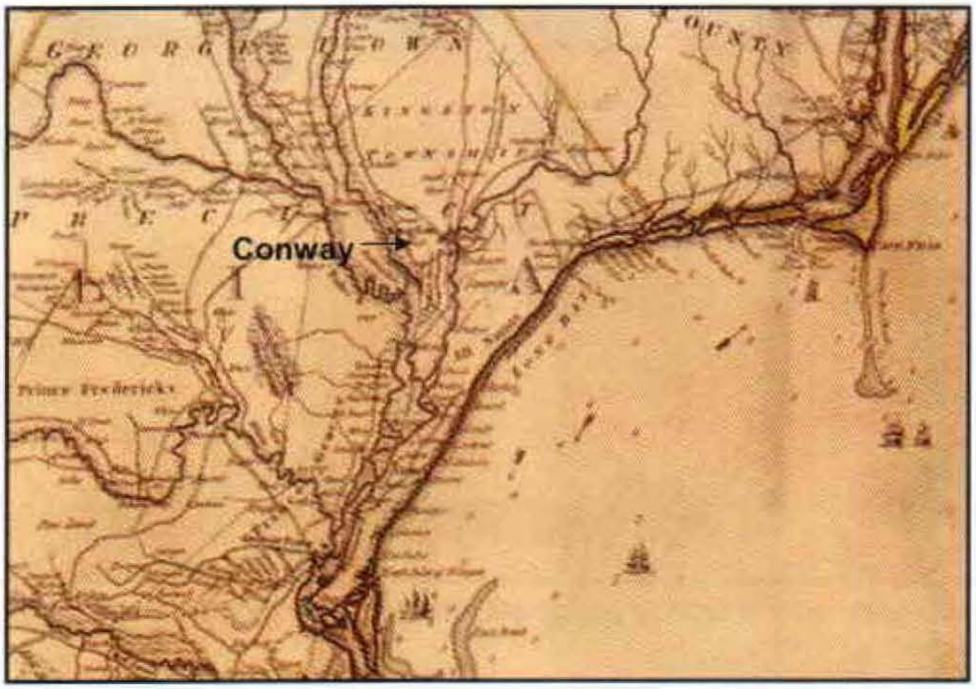

Figure 3. A portion of Mouzon's Map of North and South Carolina in 1775.

No major battles were fought in Horry County during the Civil War however the war had a major impact. It's reported that as much as 90 percent of the county's white male population were involved in the war. Horry soldiers saw fighting on battlefields such as Chickamauga, Kennesaw Mountain, and at the Battle of the Crater.

The county seat, Conwayborough, named after another Revolutionary War figure, Robert Conway, was occupied by Union force brought by gunboats on the Waccamaw River early in 1865. It was rumored that residents actually welcomed the Union forces as they represented the only real law in the county. Roving bands of deserters and outlaws frequently preyed upon the town during the later part of the War (Brosky 2007:2).

Southern economic progress was slow following the Civil War. The first real economic advancement within Horry County occurred when the railroad was built to Conway in mid-December of 1887 (Figure 4). Tobacco began to replace naval

However, no great fleet of barges or other shipping ever utilized the waterway to the degree that was originally anticipated (Brosky 2007:3).

Myrtle Beach continued to be popular destination and continued to grow. In early 1934 Myrtle Beach State Park was opened, thanks in part to the Civilian Conservation Corps. Roads and bridges were developed and the town was incorporated in 1938.

During World War Two, German submarines once again patrolled the South Carolina coast. The Intracoastal Waterway finally became an important means of marine transportation as it was too shallow and protected for submarines.

Myrtle Beach began to influence the region's economy as it developed into an increasingly popular summertime tourist destination during the late 1940s. Tobacco and tourism were the mainstays of Horry County's economy until the 1980s when the Tobacco market collapsed.

The tourism economy was stunted, at least temporarily, by Hurricane Hazel in October of 1954. The devastation of this Category 4 hurricane was compounded by its arrival during a high tide. Myrtle Beach was in ruin. However, Hurricane Hazel marked a new beginning for Myrtle Beach. Hazel helped to acquaint the beautiful beaches of Horry County to a larger audience. Capital investors rebuilt the "Grand Strand" establishing large resorts, hotels, and golf courses (Brosky 2007:4).

From the mid 1950s until present, Myrtle Beach has developed into one to the largest areas for tourism in the world. Today there are over 1,400 restaurants, 7,000 campsites, and over 50,000 hotel rooms. Myrtle Beach attracts over 13 million visitors annually and is ranked as one of the 20 fastest growing communities in the United States (Brosky 2007:4).

Description of Work

Historical Research

M-AT/ER conducted a literature search as part of the investigative effort for the Myrtle Beach Borrow Areas Survey. This research helped document man's activities in the vicinity, thereby providing an understanding of local resource use and human activities. This research focused on primary and secondary materials as compiled by environmental and archeological agencies responsible for managing the local cultural resources and depositories such as libraries and museums. In addition, research included interviews with local historians. Resources used are as follows:

- Charleston Public Library
- South Carolina Historical Society
- Institute of Archaeology and Anthropology, University of South Carolina
- Horry County Historical Society, Conway, South Carolina

Preliminary secondary sources reviewed are as follows:

- The Encyclopedia of American Shipwrecks
- Merchant Steam Vessels of the United States 1807 - 1868
- Shipwrecks of the Western Hemisphere
- Shipwrecks of the Civil War
- Official Records of the Union and Confederate Navies in the War of the Rebellion
- Automated Wreck and Obstruction Information System of the National Oceanic and Atmospheric Administration

Researchers reviewed source materials at each institution, and conducted interviews with librarians to determine the best potential sources for background information on the Myrtle Beach vicinity and potential shipwrecks in the region.

Remote Sensing Survey

M-AT/ER's underwater archaeology team conducted the survey from two equally equipped survey vessels. One vessel was 25-feet in length and the other was 36-feet in length. Three primary remote sensing devices were used: 1) a Geometrics 881 cesium marine magnetometer, 2) a Marine Sonic 600 kHz digital, side-scan sonar and 3) an Ocean Data Equipment Corporation 10 Hz Stratabox sub-bottom profiler system. Each instrument was interfaced with a Starlink Differential Global Positioning System.

Data was collected along parallel lines spaced at 95-foot intervals. Magnetic data, along with corresponding positioning data, was recorded at .5-second sample intervals (or approximately every 5 feet along a track line at 6 knots) using HYPACK™ data acquisition software. Acoustic data was recorded with Marine Sonic Sea Scan® acoustic data acquisition software using an onboard PC computer system. Sub-bottom data was recorded using Stratabox software and Chesapeake Technology, Inc. SonarWiz.Map for post processing. At the end of each day, all remote sensing data was backed up on 180 gigabyte external hard drives.

Data Analysis / Cultural Resources

During field investigations, data being produced by the magnetometer, side-scan sonar and sub-bottom profiler were closely monitored. Targets (magnetic or acoustic) were identified and recorded as they were generated. Also noted on field records was information about the local environment, which included man-made features such as pipelines, channel markers, crab traps, and conditions that could influence magnetic or acoustic data.

After a survey area had been completed, archaeologists edited the magnetic data for detailed analysis and comparison to acoustic data. Editing was performed in three phases. The initial phase consisted of using HYPACK's single-beam editing program to review raw data (of individual survey lines) and to delete any artificially induced noise or data spikes. While editing survey lines, a preliminary target table was developed that included individual target coordinates, signature characteristics, intensity, and duration. Once all survey lines for an area were edited, the edited data was converted to an XYZ file (Easting and Northing State Plane Coordinates, and magnetometer data – measured in gamma), also using HYPACK. Next, the XYZ files were imported into a Triangular Irregular Network (TIN) modeling program (HYPACK) that was used to contour the data in 10-gamma intervals. Once the data was contoured, the contour graphic was converted to a DXF file and imported into AutoCAD in order to clearly view individual magnetic anomalies and their association with acoustic target signatures. Once in AutoCAD, additional editing of the total magnetic intensity was performed without affecting individual magnetic anomalies. For example, dramatic or pronounced diurnal changes that frequently will create a "striped," "zigzag," or "herring bone" pattern in the contour lines can be edited out and averaged across a survey area to create a more realistic and accurate contour map.

A second major analytical technique employed included the subtraction of general background from each successive data sample to develop the actual field gradient. The gradient is the vertical difference (z) between samples. By subtracting successive data samples one from the other the effects of diurnal change is completely eliminated. The resulting data represents only the localized changes in the magnetic background created by ferrous object(s) (i.e. anomalies). When graphically represented by contouring (using the same method described above), only the intensity of variation is represented.

During the analysis process, magnetic anomalies were categorized using the anomaly intensity, duration and/or extent, and signature characteristics. In addition, the anomaly's geographic location was taken into consideration, as well as its association with acoustic target signatures.

After magnetic data was developed into a target list, acoustic data was examined using SeaScan™ acoustic data review software to identify any unnatural or man-made features in the records. Once identified, acoustic features were described using visible length, width, and height from the bottom surface. The coordinates of the acoustic features also were recorded.

Data Assessment (General)

Target signatures were evaluated using the National Register of Historic Places criteria[5] as a basis for the assessment. For example, although a historic object

5 To qualify for the National Register, a historic shipwreck must "meet one or more of the National Register criteria A, B, C, and D. Determining the significance of a historic vessel depends on establishing whether the vessel is 1) the sole, best, or a good representative of a specific vessel type; 2) is associated with a significant designer or builder; or 3) was involved in important maritime trade, naval, recreational, government, or commercial activities" The criteria is described thusly:

A. [B]e associated with events that have made a significant contribution to the broad patterns of our history; or

B. be associated with the lives of persons significant in our past;

C. embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

D. have yielded, or may be likely to yield, information important in prehistory or history.

(National Register Bulletin, U.S. Department of the Interior, National Park Service, Interagency Resources Division) might produce a remote sensing target signature, it is unlikely that a single object (such as a cannon ball) has the potential to meet the criteria for nomination to the National Register of Historic Places.

Target assessment was based primarily on the nature and characteristics of the acoustic and magnetic signatures. Shipwrecks – large or small – often have distinctive acoustic signatures, which are characterized by geometrical features typically found only in a floating craft. Most <u>geometrical</u> features identified on the bottom (in open water) are manmade objects. Often an acoustic signature will have an associated magnetic signature. Generally, if the acoustic signature demonstrates geometric forms or intersecting lines with some relief above the bottom surface <u>and</u> have a magnetic signature of any sort; it can be categorized as a potentially significant target. Often, modern debris near docks, bridges, or an anchorage is easily identified solely based on the characteristics of its acoustic signature. However, it is more common to find material partially exposed. Frequently, these objects produce a record that obviously indicates a man-made object, but the object is impossible to identify or date. In making an archaeological assessment of any sonogram record, the history and modern use of the waterway must be taken into consideration. Naturally, historically active areas tend to have greater potential for submerged cultural resources. The assessment process prioritizes targets for further underwater archaeological investigations.

Magnetic target signatures alone are more difficult to assess. Without any supporting sonogram record, the nature of the bottom sediments and the water currents become more important to the assessment process. A small, single-source magnetic signature has the <u>least</u> potential to be a significant cultural resource. Although it might represent a cannon ball or historic anchor, this type of signature has little potential to meet National Register criteria.

A more complex magnetic anomaly, represented by a broad monopolar or dipolar type signature, has a greater potential to be a significant cultural resource, depending on bottom type. Shipwrecks that occur in regions with hard bottoms, with little migrating sand, tend to remain exposed and are often visible on sonogram records. A magnetic anomaly that is identified in a hard bottom area and has no associated acoustic signature frequently can be discounted as being a historic shipwreck. Most likely, such an anomaly is modern debris, such as wire rope, chain, or other ferrous material.

Soft migrating sand or mud can bury large wrecks, leaving little or no indication of their presence on the bottom surface. The types of magnetic signatures that a boat or ship might produce are infinite, because of the large number of variables including location, position, chemical environment, other metals, vessel type, cargo, sea state, etc. These variables are what determine the characteristics of every magnetic target signature. Since shipwrecks occur in a dynamic environment, many of the variables are subject to constant change. Thus, in making an assessment of a magnetic anomaly's potential to represent a significant cultural resource, investigators must be circumspect in their predictions.

Broad, multi-component signatures (again, depending on bottom characteristics and other factors) often have the greatest potential to represent a shipwreck. On the other hand, high-intensity, multi-component, magnetic signatures (without an accompanying acoustic signature) in areas of relatively high velocity currents can be discounted as a historic resource. Eddies created by the high-velocity currents almost always keep some portion of a wreck exposed. Generally, wire rope or some other low-profile ferrous debris produces this type of signature in these circumstances. Many types of magnetic anomalies display characteristics that are not easily interpreted. The only definitive method of determining the nature of the object creating these anomalies is by physical examination.

Description of Findings and Recommendations

Identification of Submerged Cultural Resources

A total of five targets were identified within the three areas. Only one (1) magnetometer anomaly with corresponding sonar target signature was found in the Surfside borrow area. One (1) magnetic anomaly was identified in the Cane South borrow area and two (2) magnetic anomalies were found in Little River borrow area. None of the magnetic anomalies in Cane South or Little River Borrow Area had corresponding sonar target signatures. There was one sonar target signature in Little River borrow area that had no associated magnetic signature (Figures 5, 6, and 7).

Surfside A

SC State Plane x=2626302 y=631752

Surfside A has a dipolar magnetic signature with an intensity of more than 120 nT. An acoustic target signature with three aligned objects protruding approximately 1-foot above the bottom over 27 feet in length was associated with the magnetic signature (Figures 8 and 9). Target Surfside A is recommended for additional underwater investigations to identify and assess its potential as an archaeological resource. If underwater archaeological investigations are not an option, an avoidance buffer of at least 200 feet (radius) around the target coordinates should be establish prior to dredging activities.

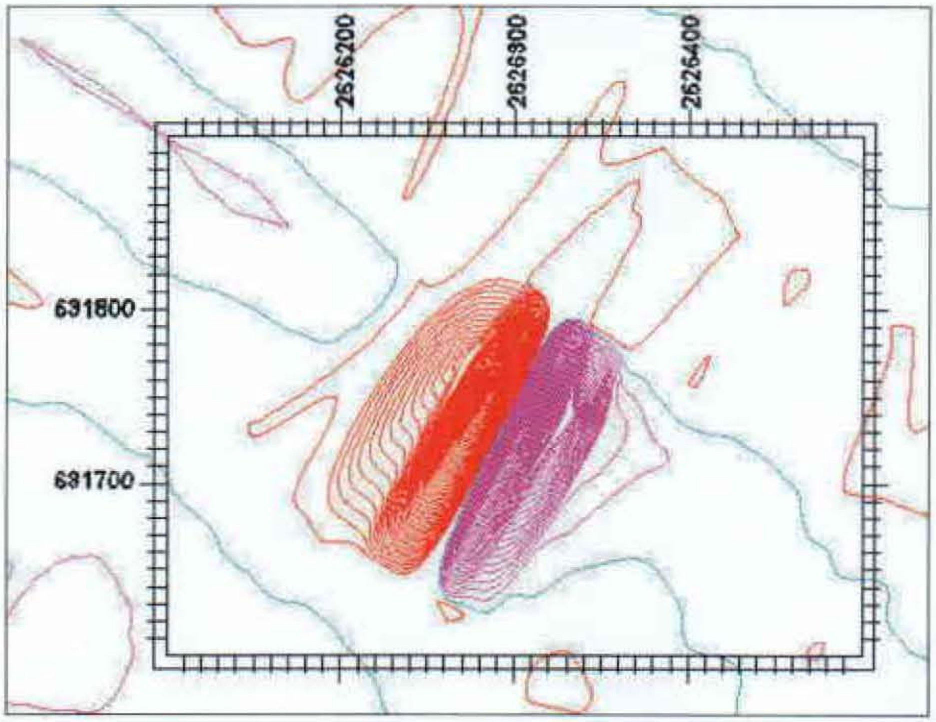

Figure 5. Target Surfside A Magnetic Signature

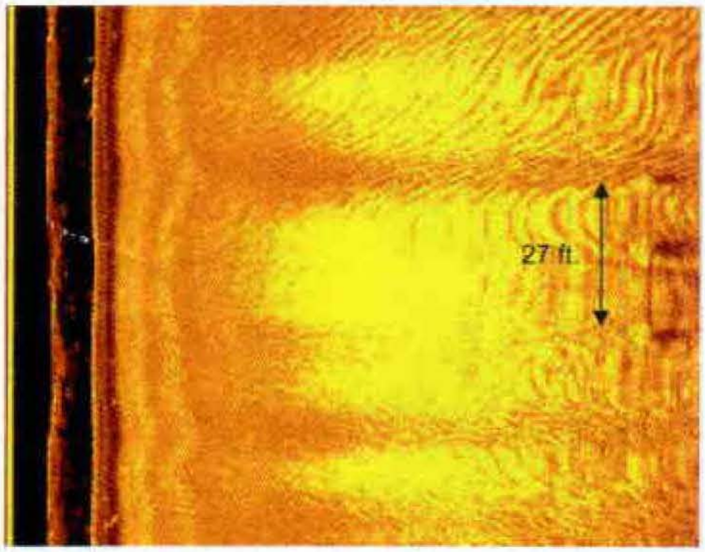

Figure 6.Target Surfside A Sonar Signature.

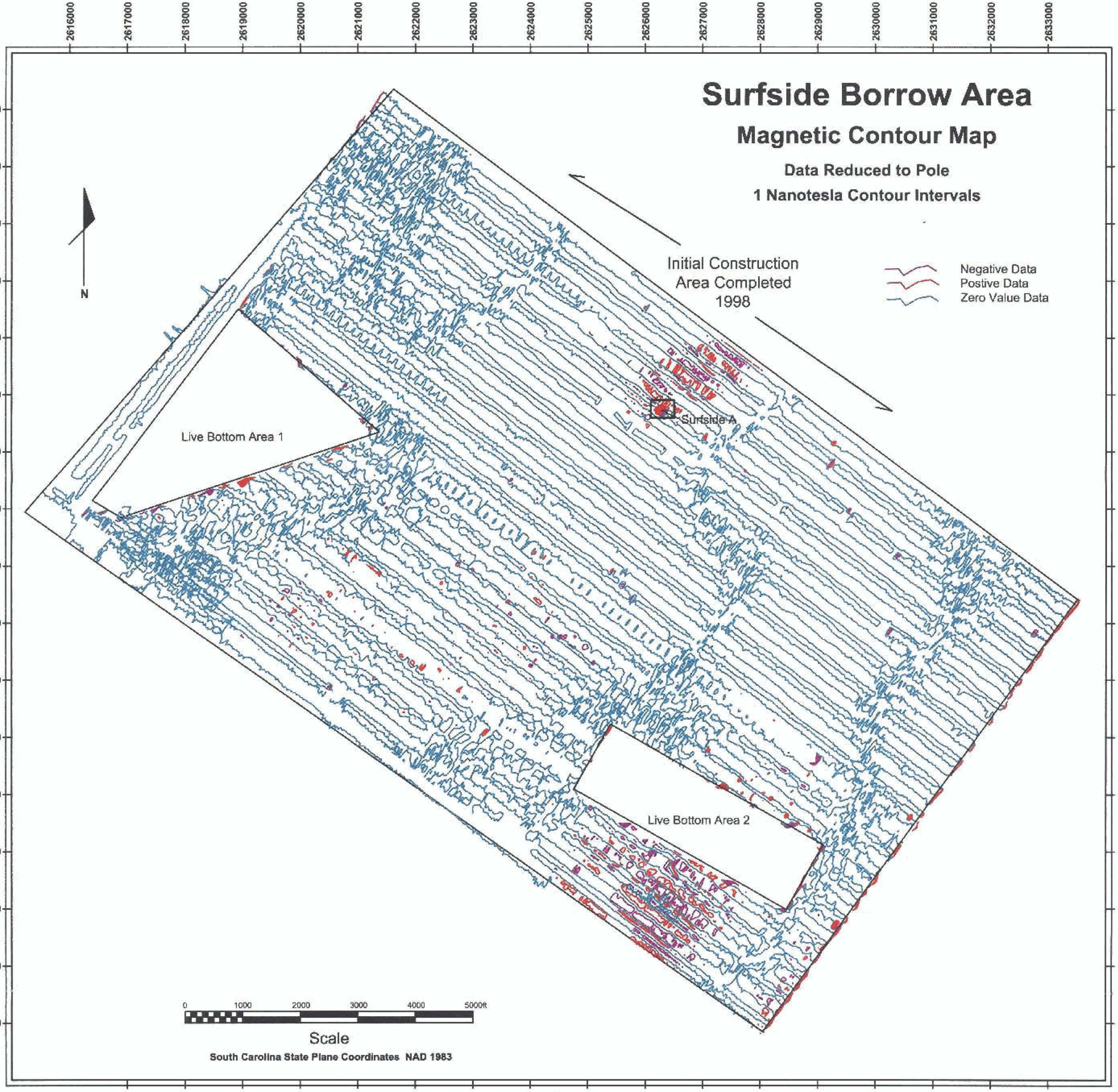

Figure 7. Surfside Borrow Area Magnetic Contour and Target Location Map.

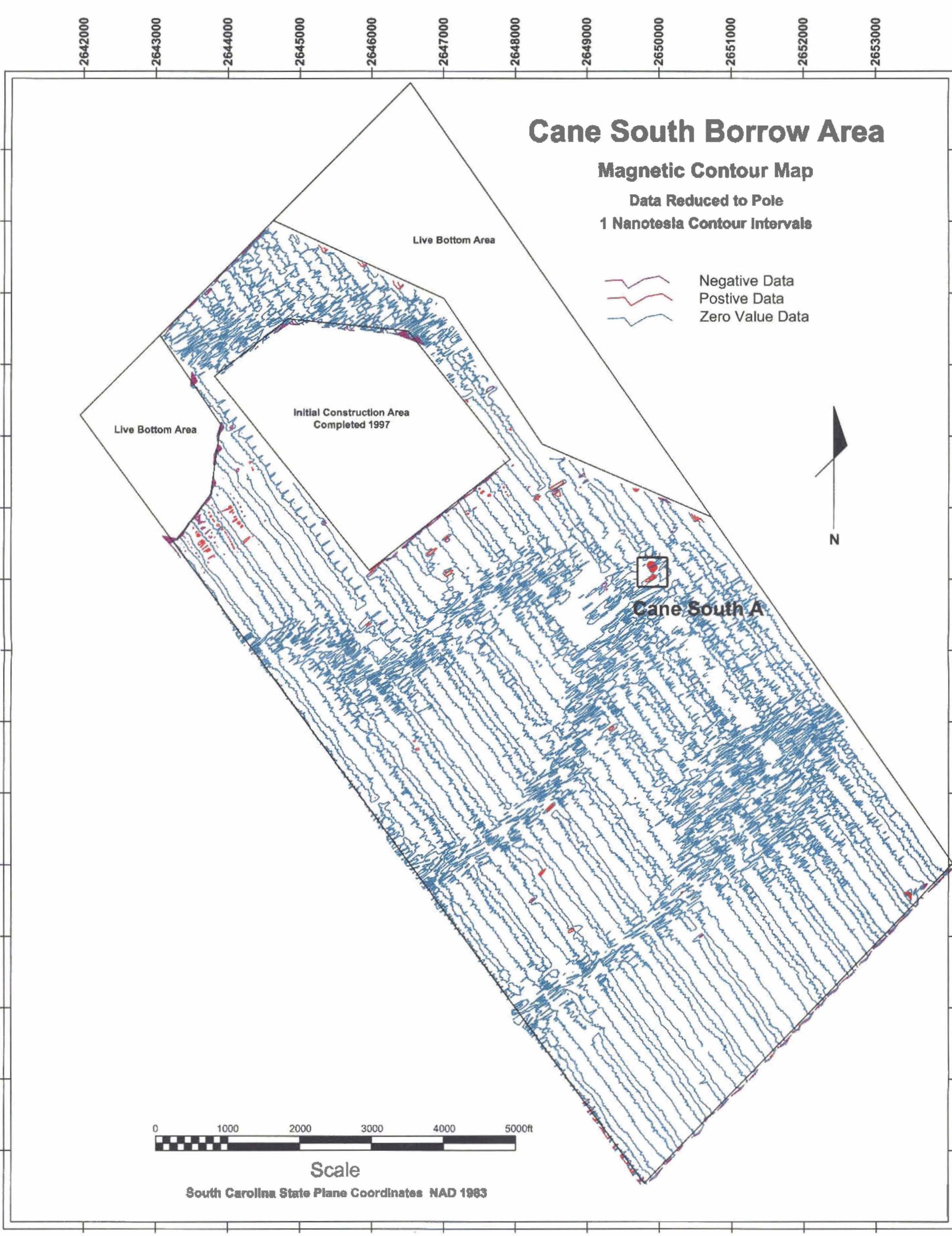

Figure 8. Cane South Borrow Area Magnetic Contour and Target Location Map.

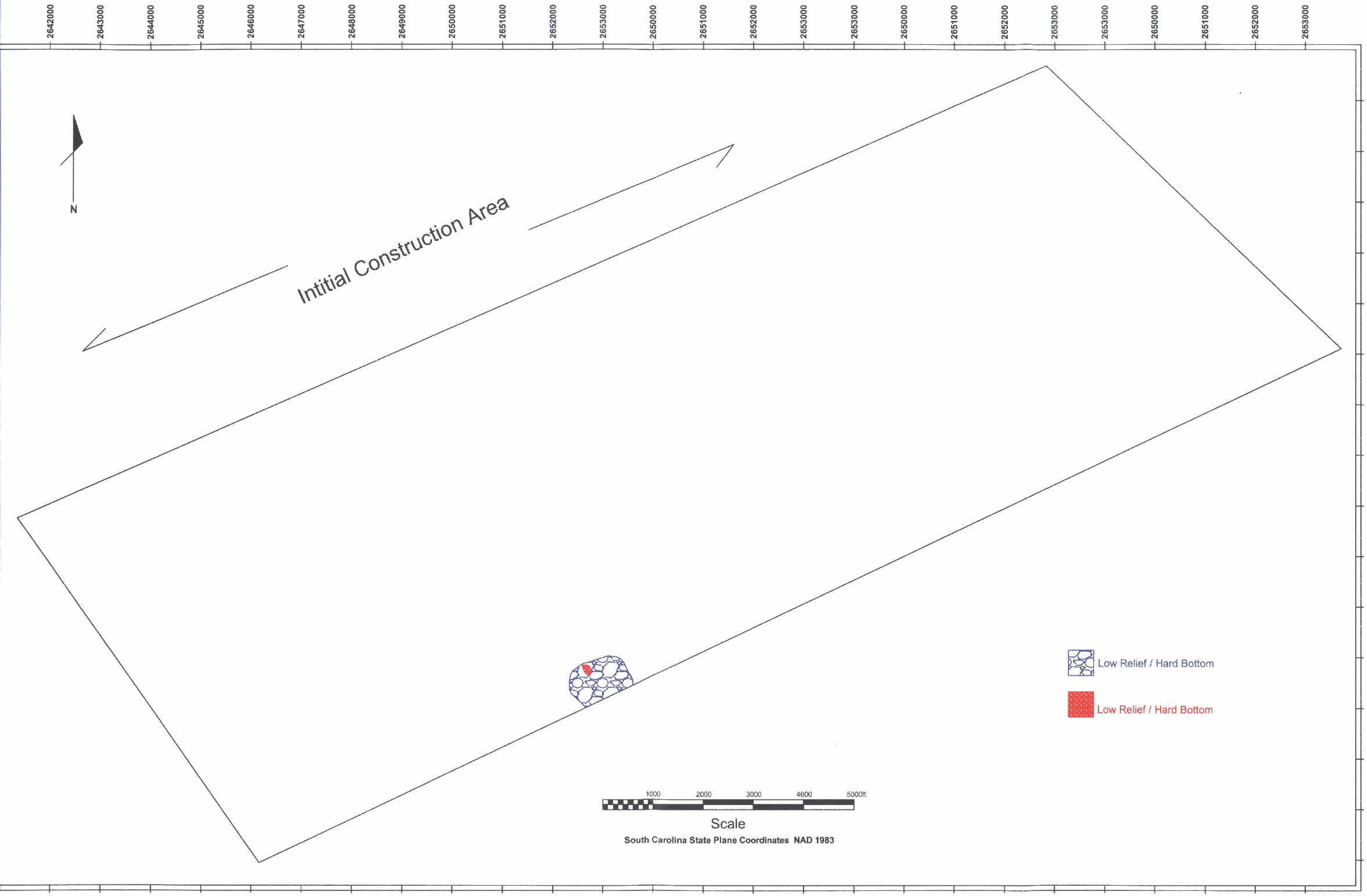

Figure 26. Little River Borrow Area Har Bottom Map.

Cane South A

SC State Plane x=2626302 y=631752

Cane South A has a multi-component magnetic signature with an intensity of more than 32 nT. No acoustic target signature found in association with the magnetic signature (Figure 10). Target Cane South A appears to be a small single source anomaly. The target has little potential to be associated with a significant cultural resource. No additional underwater archaeological investigations are recommended.

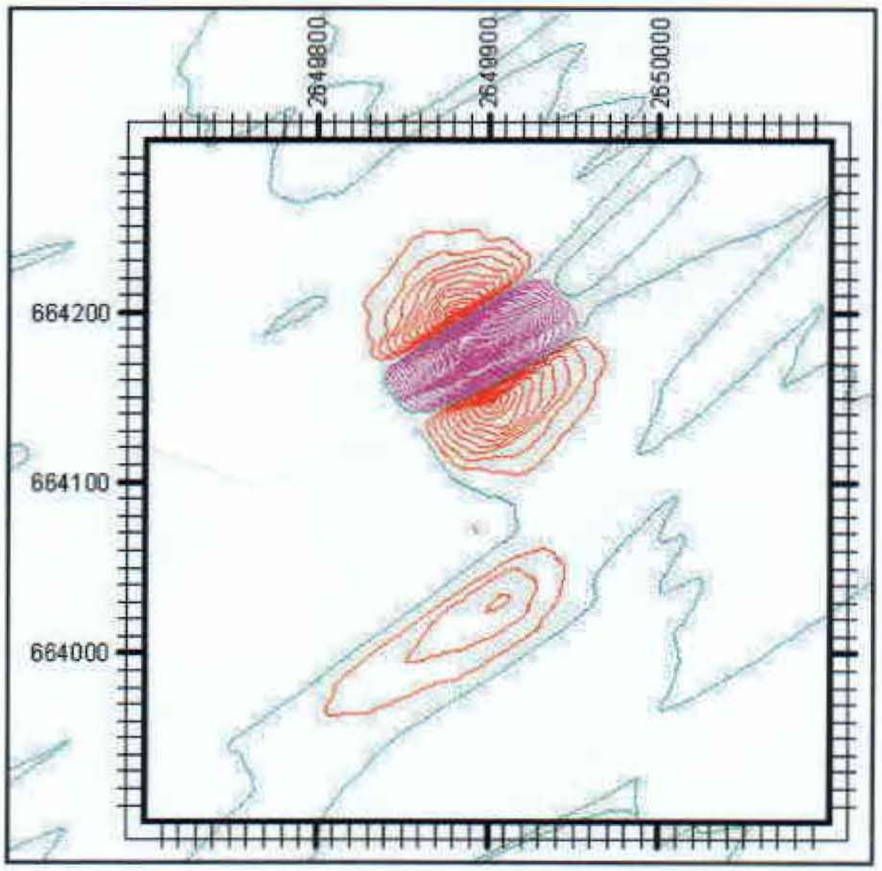

Figure 10. Target Cane South A Magnetic Signature

Little River A

SC State Plane x=2626302 y=631752

Little River A has a multi-component magnetic signature with an intensity of more than 21 nT. No acoustic target signature found in association with the magnetic signature (Figures 11). Target Little River A appears to be a small single source anomaly. The target has little potential to be associated with a significant cultural resource. No additional underwater archaeological investigations are recommended.

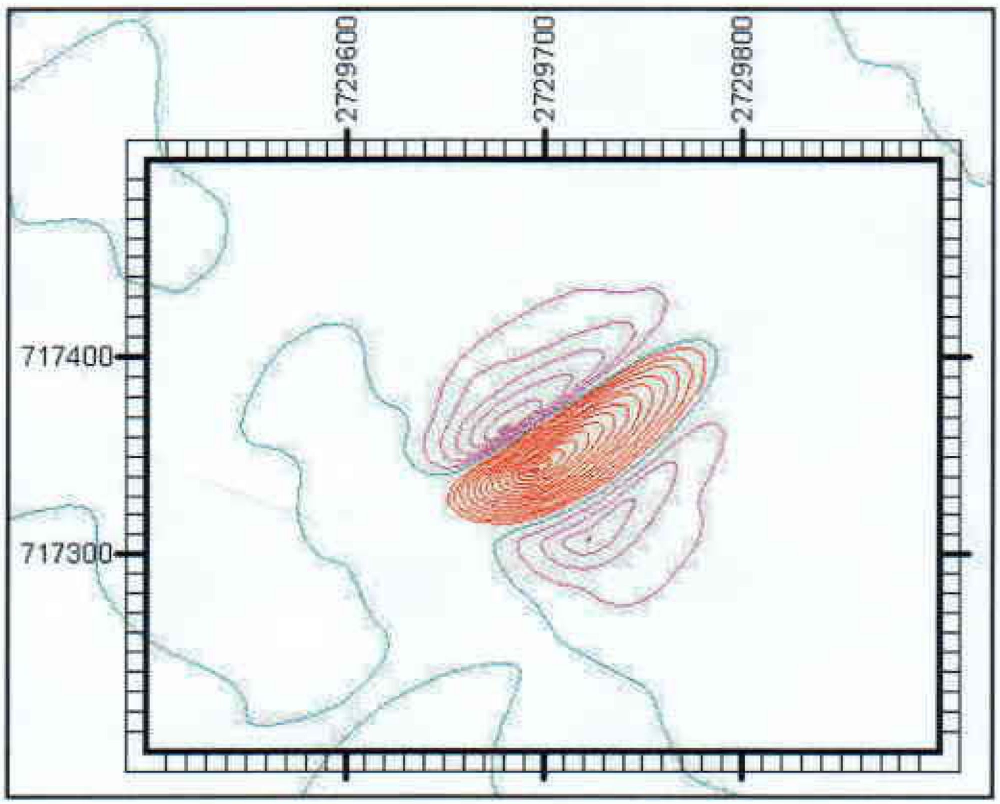

Figure 11. Little River A Magnetic Contour Signature

Little River B
SC State Plane x=2626302 y=631752
Little River B. No Magnetic signature was detected in association with Little River B Side scan records identified an 8-foot wide by 12- foot long rectangular object with other associated linear objects (Figures 12). Target Little River B does not exhibit characteristic associated with a shipwreck. It may be associated with modern fishing tackle or other miscellaneous debris. No additional underwater archaeological investigations are recommended.

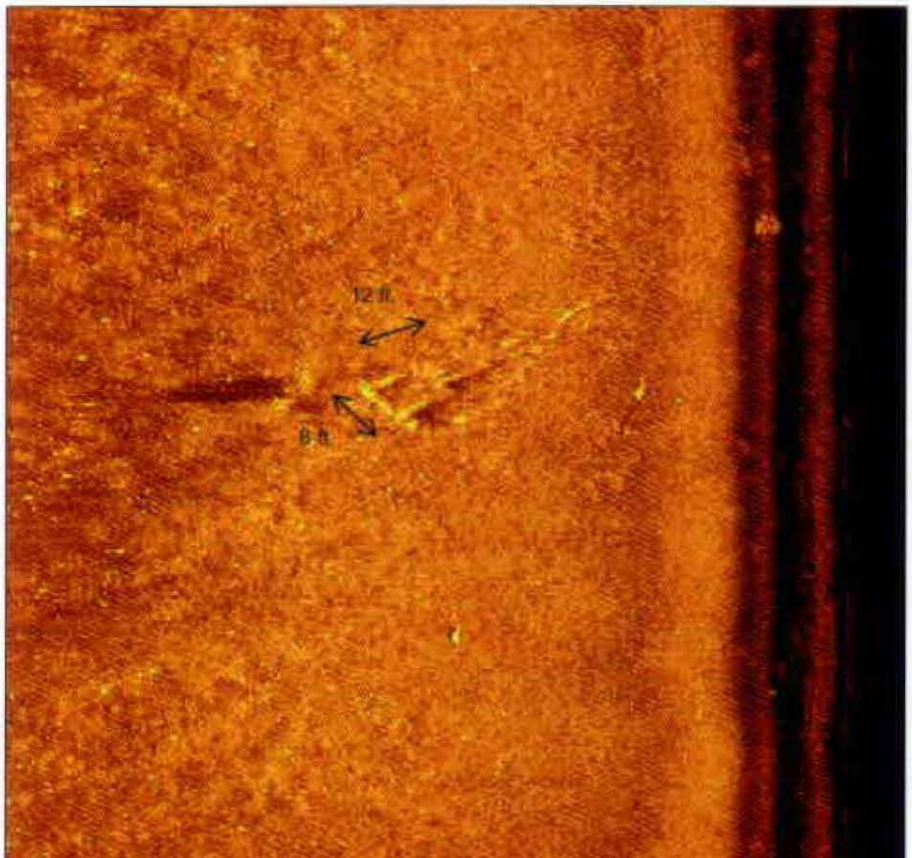

Figure 12. Little River B Acoustic Target Signature

Little River C
SC State Plane x=2626302 y=631752

Little River A has a multi-component magnetic signature with an intensity of more than 18 nT. No acoustic target signature found in association with the magnetic signature (Figure 13). Target Little River C appears to be a small single source anomaly. The target has little potential to be associated with a significant cultural resource. No additional underwater archaeological investigations are recommended.

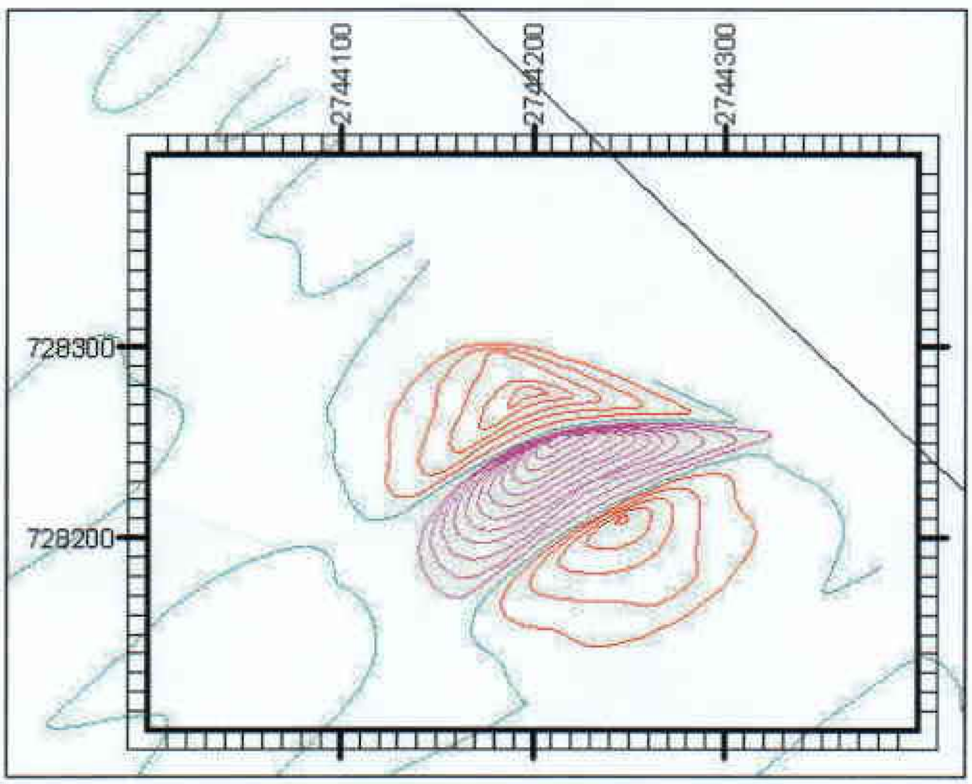

Figure 13. Little River C Magnetic Contour Signature.

Sub-bottom Survey

The sub-bottom profile survey was carried out in concert with the magnetometer and side scan sonar surveys. The purpose of the sub-bottom survey was to identify any potential Late Pleistocene or Holocene deposits that may still support direct evidence of prehistoric occupation within the proposed borrow areas. In addition to the sub-bottom investigations M-AT/ER also examined coring data collected within each borrow area and reviewed past geophysical studies conducted in the region.

Vibracoring was conducted in each borrow area by Athena Technologies, Inc. in 1991. Coring was accomplished using 21 foot long samplers vibrated from a deck operated system aboard the research vessel *Lady Athena*. Cores were vibrated to a depth of 20 feet or less if refusal was met, in which case coring was stopped after five minutes had elapsed.

Also, extensive marine geophysical investigations have been carried out in the Long Bay region between the North Carolina border and Winyah Bay as part of the South Carolina Coastal Erosion Study (SCCES). The study is an ongoing cooperative research program funded by the U.S. Geological Survey Coastal and Marine Geology Program and managed by the South Carolina Sea Grant Consortium (Voulgaris, G. et al. 2004:1).

As part of the SCCES project, geological mapping was conducted in 1999 through 2004 in the region between Little River to Winyah Bay using boomer and Chirp sub-bottom profilers. As a result of these investigations, reflection profiles demonstrate a shallow geologic framework within Long Bay. Bedding planes were formed from eroded and incised Cretaceous and Tertiary strata (reflectors) with an overlying marine transgressive unconformity that is composed of Pleistocene and younger sediments (Figure 14). These transgressive sediments are patchy and discontinuous lens that have filled Pleistocene incisions cut into the bedding planes (Baldwin et. al. 2004).

Previous studies as well as onshore coastal borings in the vicinity of Myrtle Beach and Surfside Beach identified this region to be an intersection of Cretaceous and Tertiary units. Although the approximate area of the unconformity is known to be near Surfside Beach it is difficult to differentiate Cretaceous from the Tertiary in the offshore sub-bottom records (Balwin et. al. 2004).

In the northern part of the study area (Little River) exposed outcrops or hardgrounds appear to be Cretaceous in age. In the central study area (Garden City) hardgrounds were Tertiary in age. In the southern project (Winyah Bay) no exposed hardground was identified within the ancestral Pee Dee River System. Rather the bottom was covered by a continuous modern sediment veneer associated with the fluvial deposit (Schwab 1999).

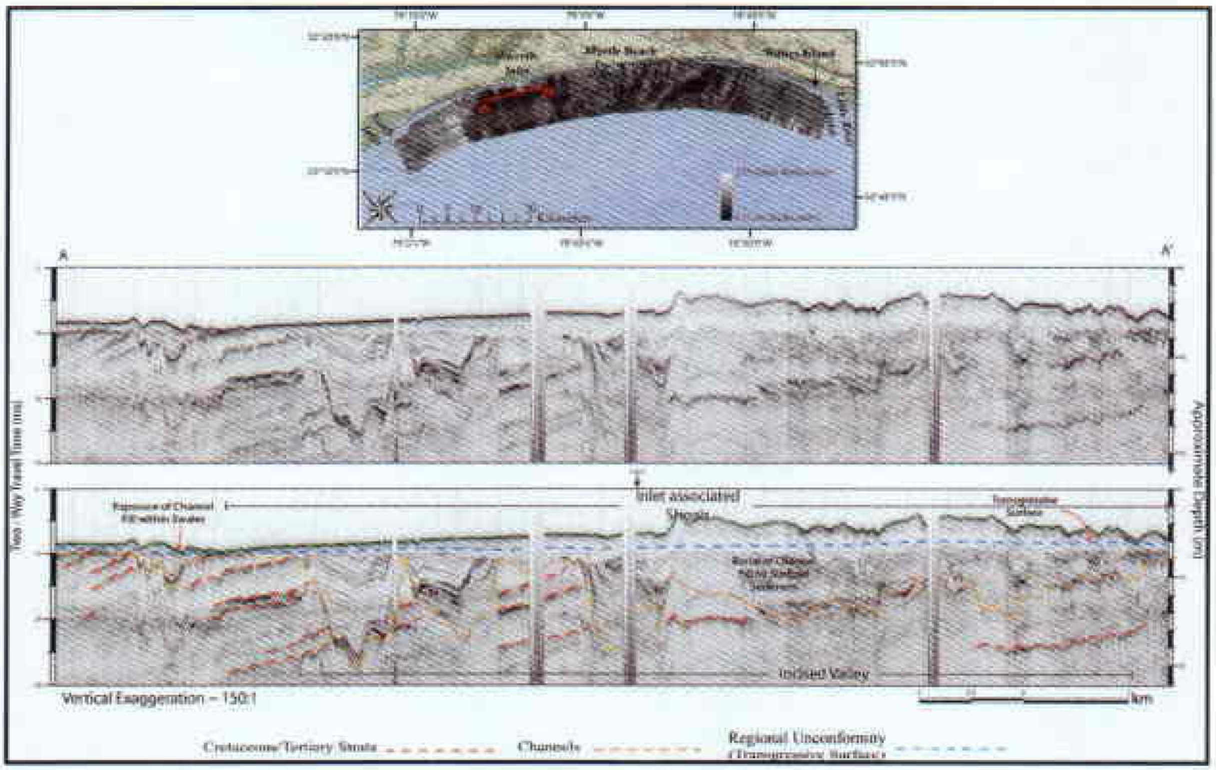

Figure 14. Seimic stratigraphy interpretation of Long Bay from SCCES. (Balwin et. al. 2004)

Sub-bottom Analysis

Analysis of sub-bottom data was based on comparisons of 1991 coring data with sub-bottom data collected by M-AT/ER using the ODEC 10 Hz Stratabox system. Identification of hard reflectors (bedding planes) was based on the findings of the SCCES seismic investigations.

Discussion and Findings of Sub-Bottom Investigations

Late Pleistocene and Holocene strata or structure within the three borrow areas overlies a highly variable Tertiary or late Cretaceous framework. The top of these earlier formations are well eroded or incised by Pleistocene streams or inlets forming readily discernable channels and ridges in seismic profiles. Overlying Pleistocene sediments are discontinuous and their distribution and are depended on the topography of the Tertiary or Cretaceous foundation on which they are seated. Late Pleistocene sediments appear to be thinly arranged in overlapping bedded sequences and distinguished (in core samples) from apparent Holocene deposits by shell lag deposits.

Surfside Borrow Area

In the Surfside Borrow Area sub-bottom records provide clear evidence of regressive and transgressive deposition pattern (Figures 16). A paleochannel or paleoestuary is evident through the central portion of the borrow area. Along northern portion of this channel is a well defined sequence boundary. The channel is filled with layered

Pleistocene deposits to depths exceeding 17 feet. On either side of the paleochannel the surficial and transgressive sediments form a thin (less than 60 inches) to non-existent layer over a gradually sloping Tertiary or Createaceous platform (Figures 17, 18, 19 and 20). These upper sediments appear to be well sorted and reworked by hydrodynamic and or other coastal processes.

Within the sub-bottom records, there is no indication of stratification or protected deposition of surficial (Late Pleistocene or Holocene) sediments that would contain or support any remnant evidence of human occupation or usage. No additional underwater archaeological investigations are recommended within the Surfside Borrow Area.

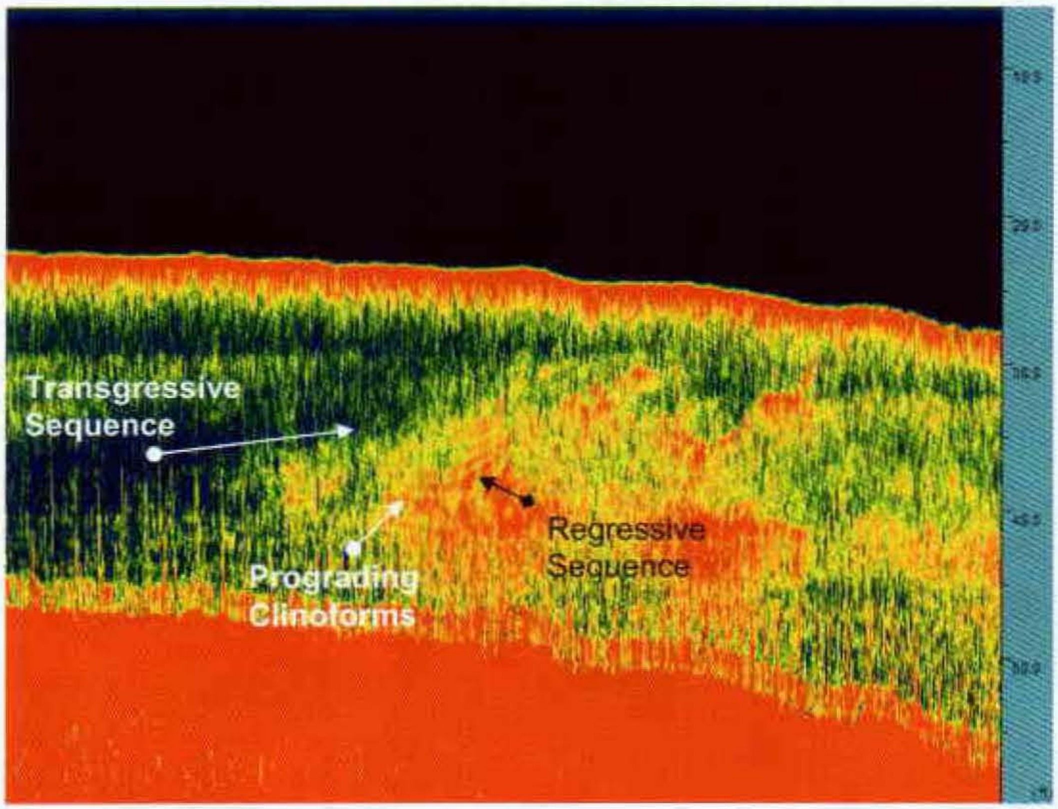

Figure 15. Regressive / Transgressive Sequence Boundary Surfside Borrow Area

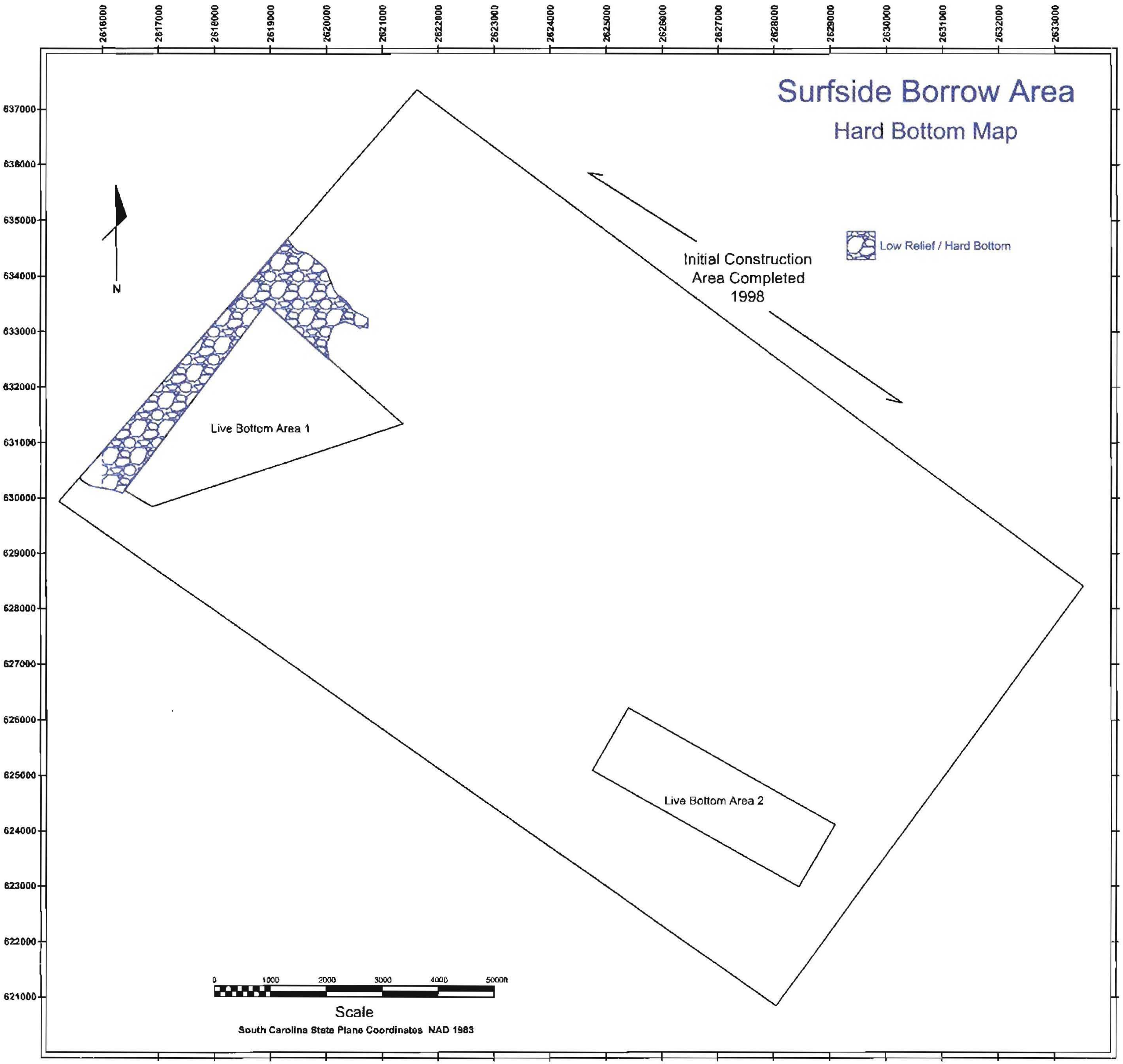

Figure 28. Surfside Borrow Area Hard Bottom Map.

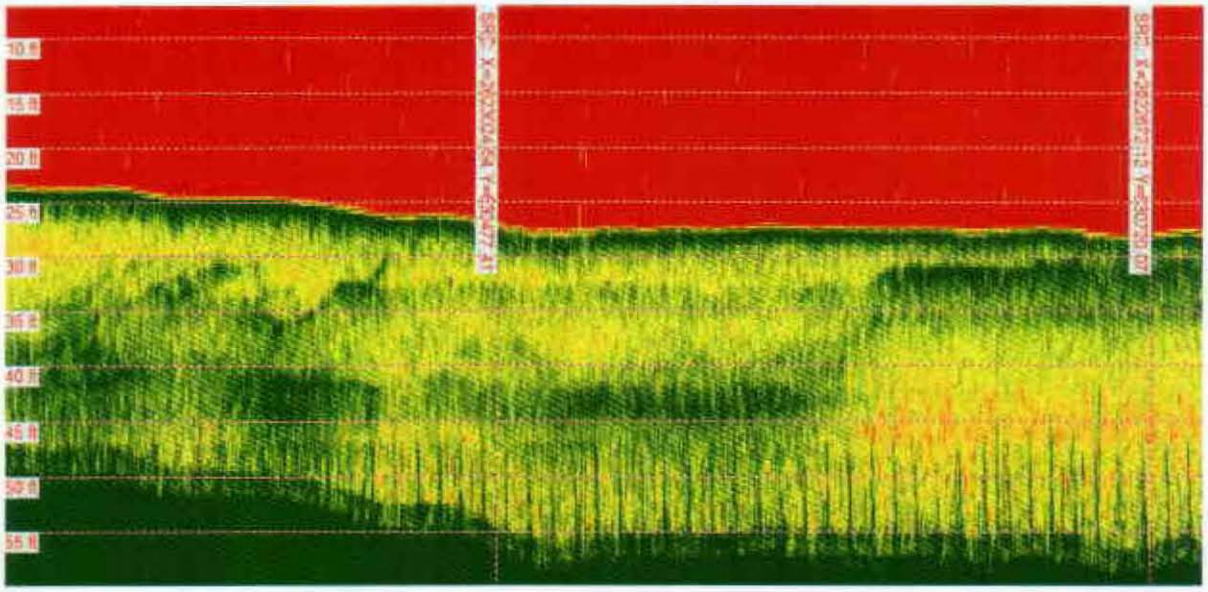

Figure 17. Surfside Borrow Area Regressive / Transgressive Squence Boundary

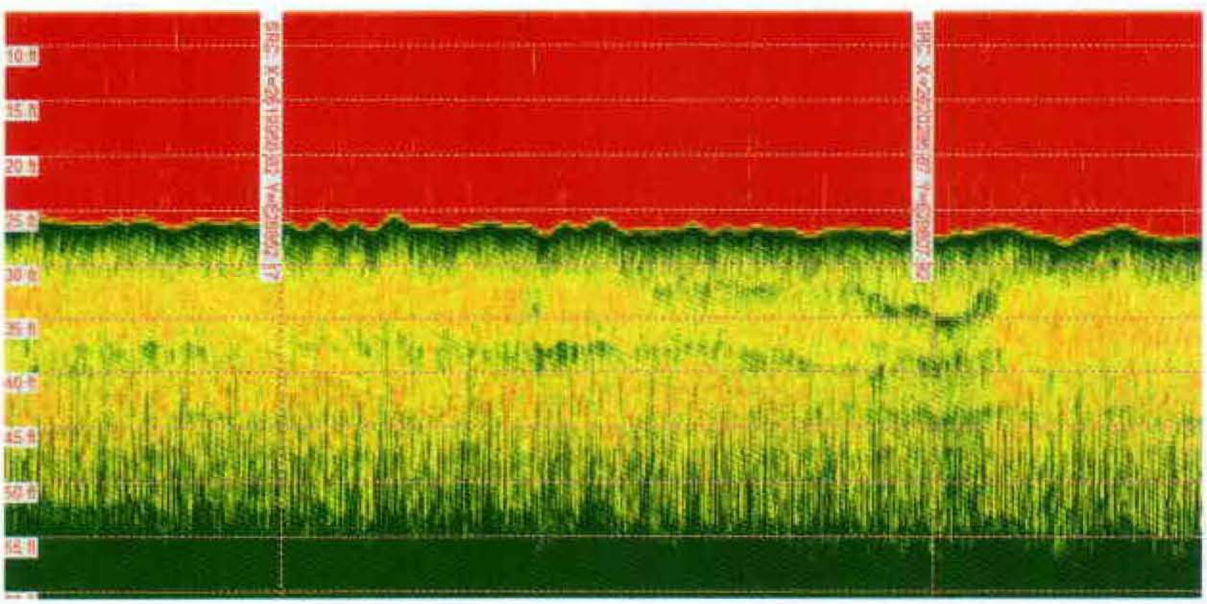

Figure 18. Pleistocene Deposits within PaleoChannel Surfside Borrow Area.

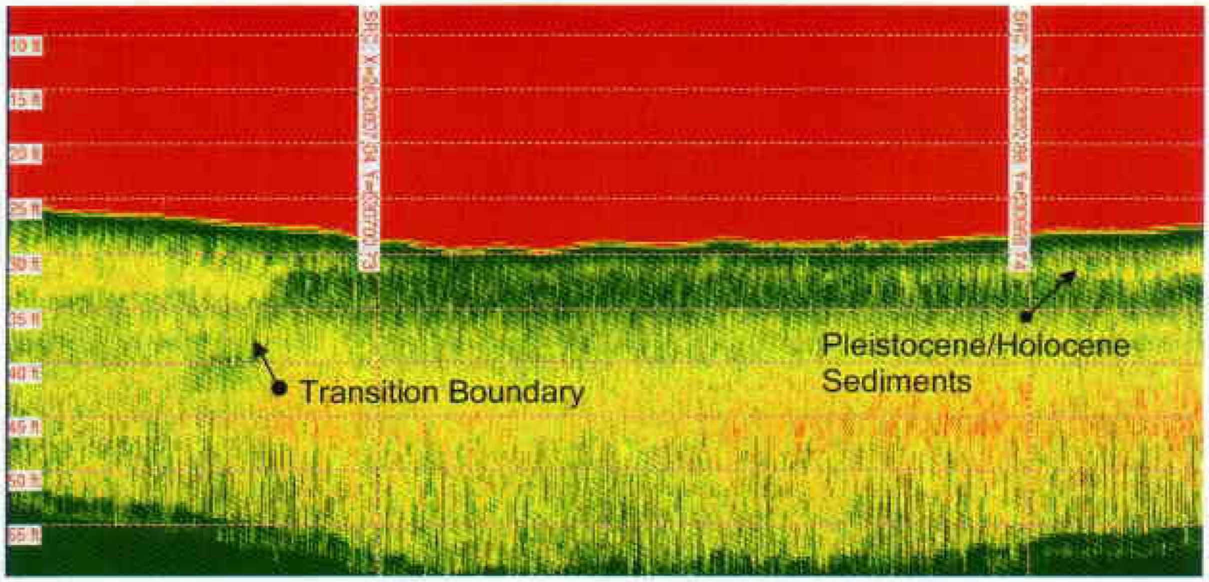

Figure 19. Transition from Paleochannel to Thinly Covered Tertiary/Cretaceous Shelf

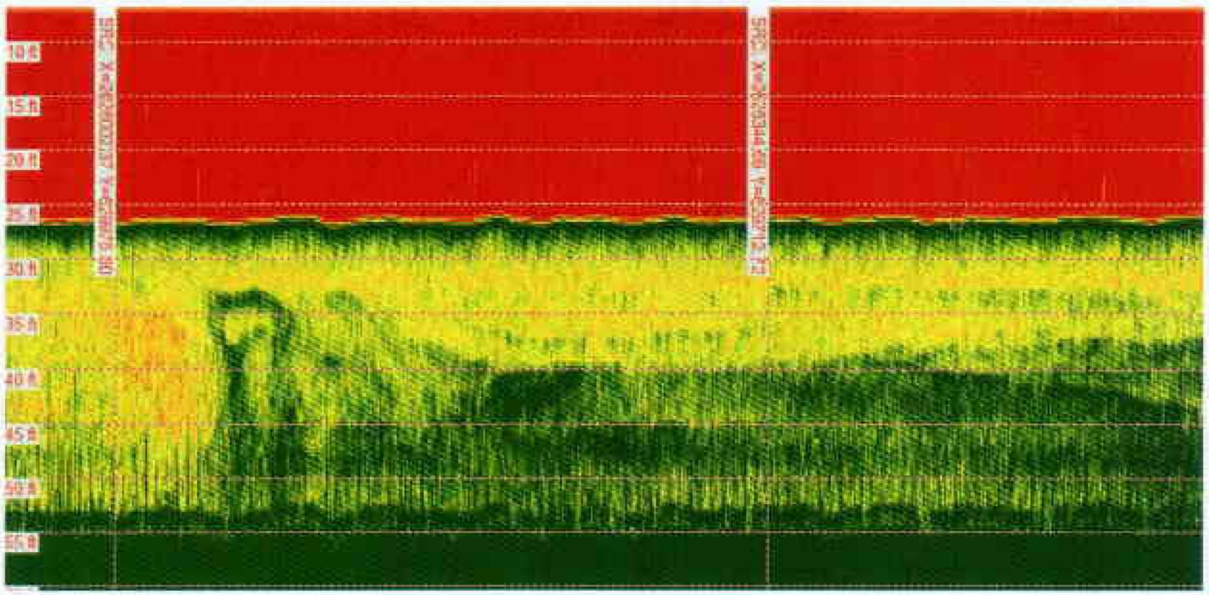

Figure 20. Offshore Paleochannel Boundary Possible Transition to Strandplain

Cane South Borrow Area

In the Cane South Borrow Area sub-bottom records were difficult to interpret but do provide evidence of a regressive and transgressive deposition (Figures 21, 22, and 23). Continental Shelf substrate appears to be incised by at least two diverging paleochannels within the borrow area. The channels are filled with layered Pleistocene deposits to depths exceeding 17 feet. On either side of the paleochannels the surficial and transgressive sediments form a thin (less than 60 inches) to non-existent layer over a gradually sloping Tertiary or Createaceous platform. These upper sediments appear to be well sorted and reworked by hydrodynamic and or other coastal processes.

Within the sub-bottom records, there is no indication of stratification or protected deposition of surficial (Late Pleistocene or Holocene) sediments that would contain or support any remnant evidence of human occupation or usage. No additional underwater archaeological investigations are recommended within the Surfside Borrow Area.

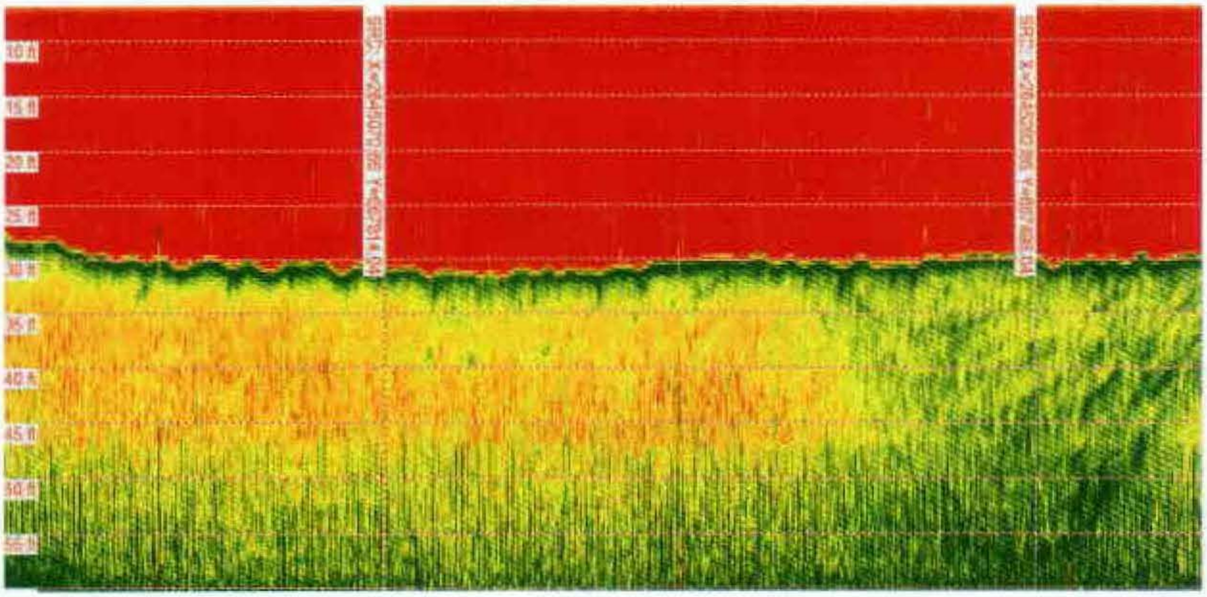

Figure 21. Narrow Incised PaleoChannel Cane Borrow Area.

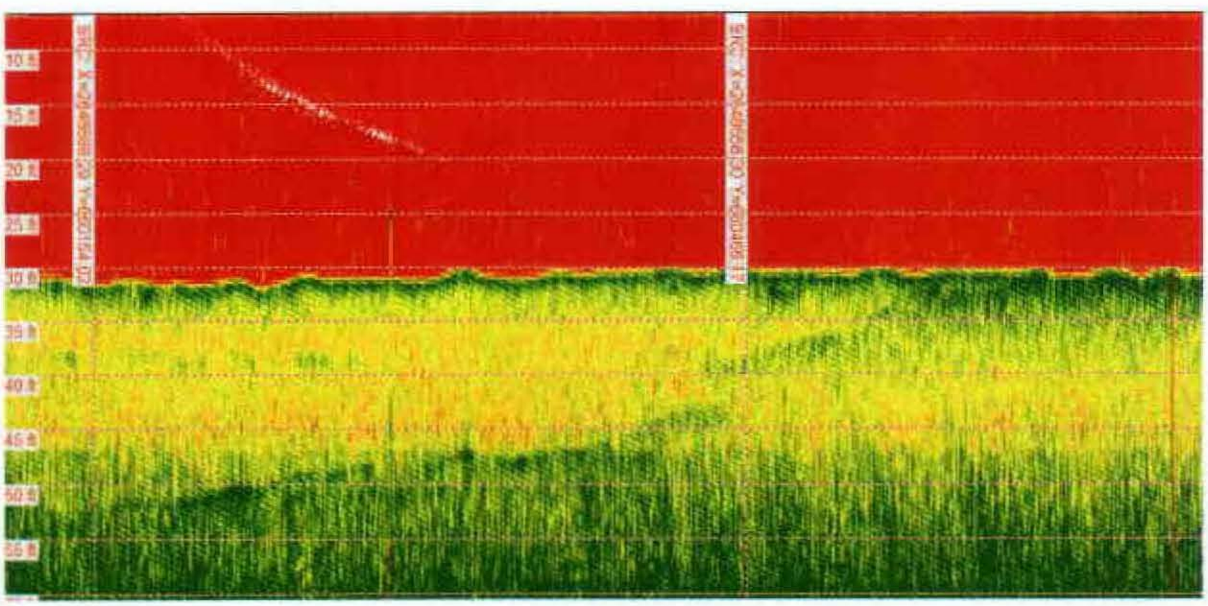

Figure 22. Transition from Paleochannel to Thinly Covered Tertiary/Cretaceous Shelf.

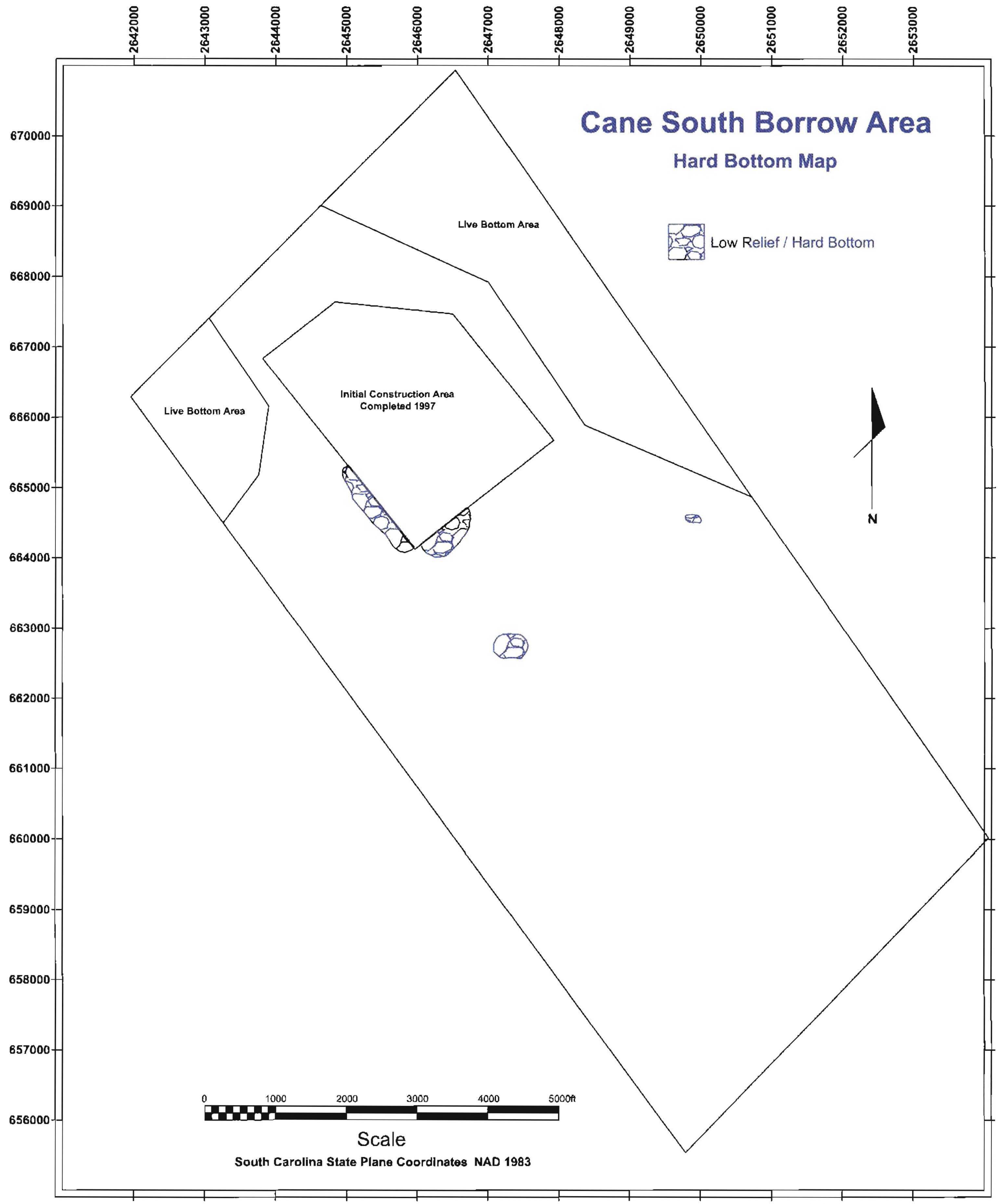

Figure 30. Cane South Borrow Area Hard Bottom Map.

Little River Borrow Area

In the Little River Borrow Area sub-bottom records and coring data identified only a thin (48 inches or less) to nonexistent layer of sediments overlying a relatively flat Cretaceous substrate (Figures 24, 25,and 26). These sediments appear to be well sorted and reworked by hydrodynamic and or other coastal processes.

Within the sub-bottom records, there is no indication of stratification or protected deposition of surficial (Late Pleistocene or Holocene) sediments that would contain or support any remnant evidence of human occupation or usage. No additional underwater archaeological investigations are recommended within the Surfside Borrow Area.

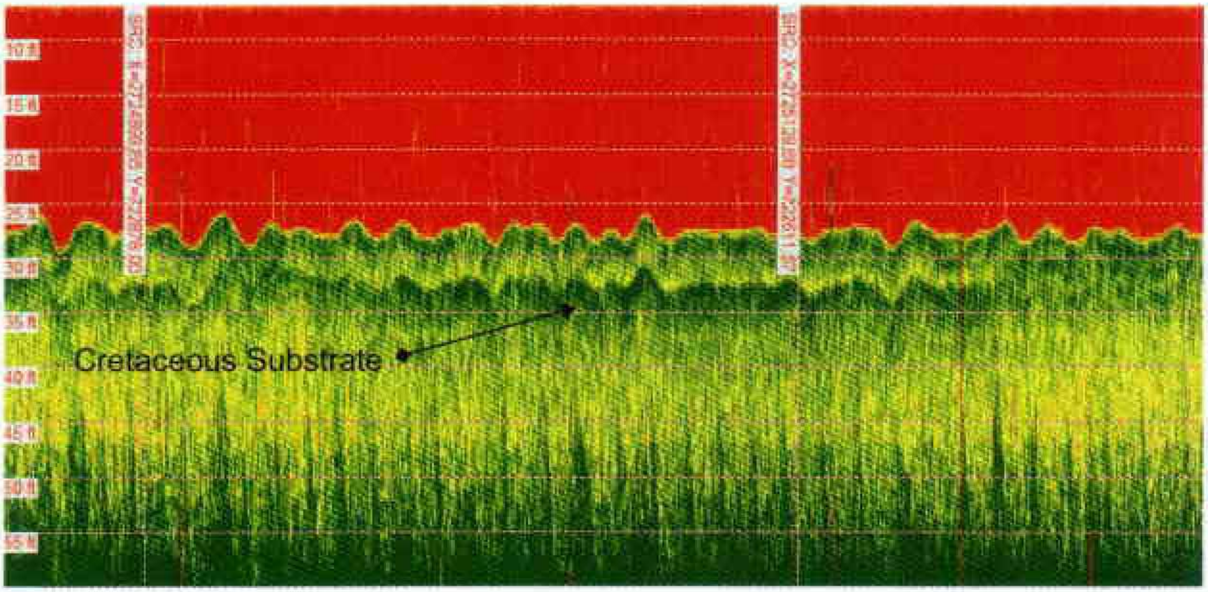

Figure 24. Typical Profile Across Entire Little River Borrow Area.

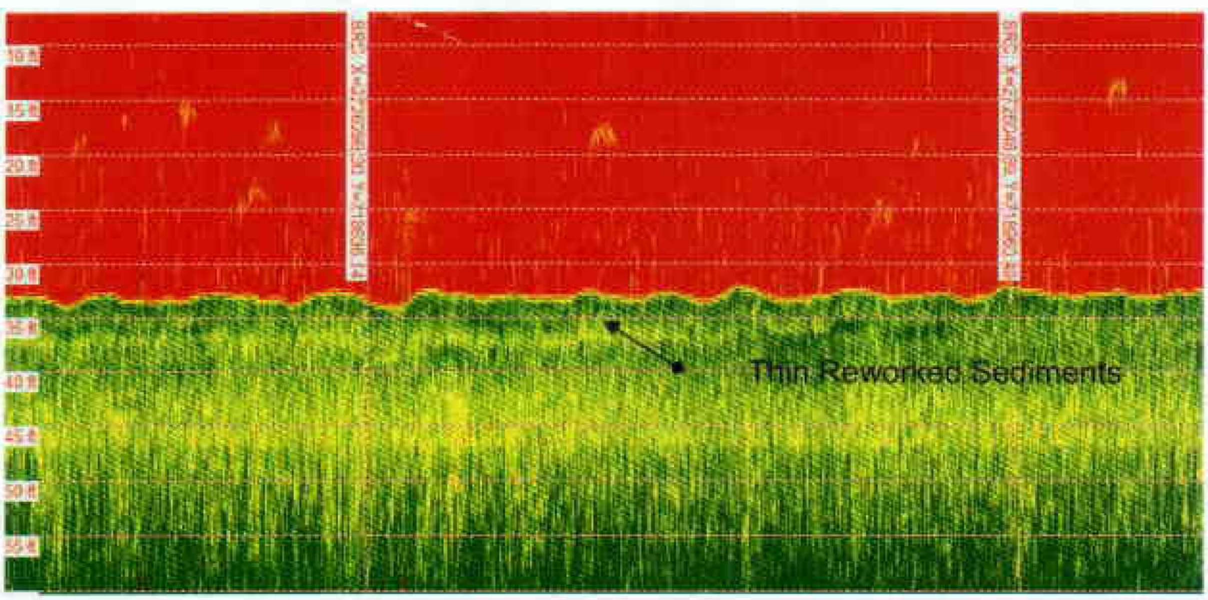

Figure 25. Thin Pleistocene/Holocene Sediments.

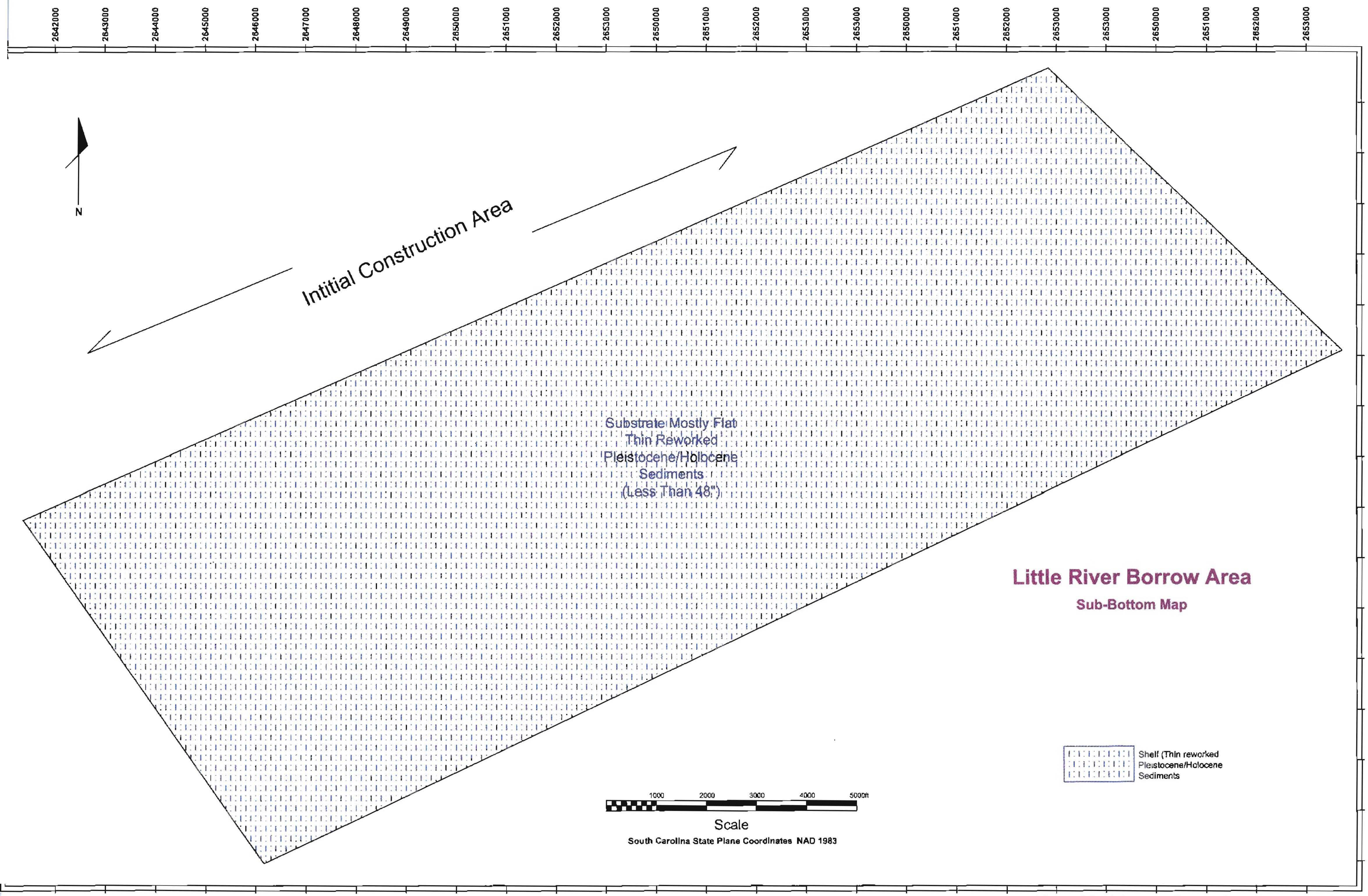

Figure 26. Little River Borrow Area Sub-Bottom Map.

Identification of Hard Bottom Areas

M-AT/ER reviewed acoustic records (side-scan sonar and sub-bottom) to identify and define areas that were "hard bottom" or habitat for marine animals. Hard bottom areas were defined as areas larger than 1,800 square meters. Other characteristics include "low" protrusions – the majority of the area less than .5-meters above the bottom; "moderate" protrusions – the majority of the area 1 to 2 meters above the bottom; and "high" protrusions – more than 2 meters above the bottom.

Surfside Borrow Area

Low relief hard bottom was identified along the northern side of a known "Live bottom" area within the Surfside Borrow Area. Below is a typical example side scan sonar images of low relief hard bottom in that vicinity (Figure 27 and 28).

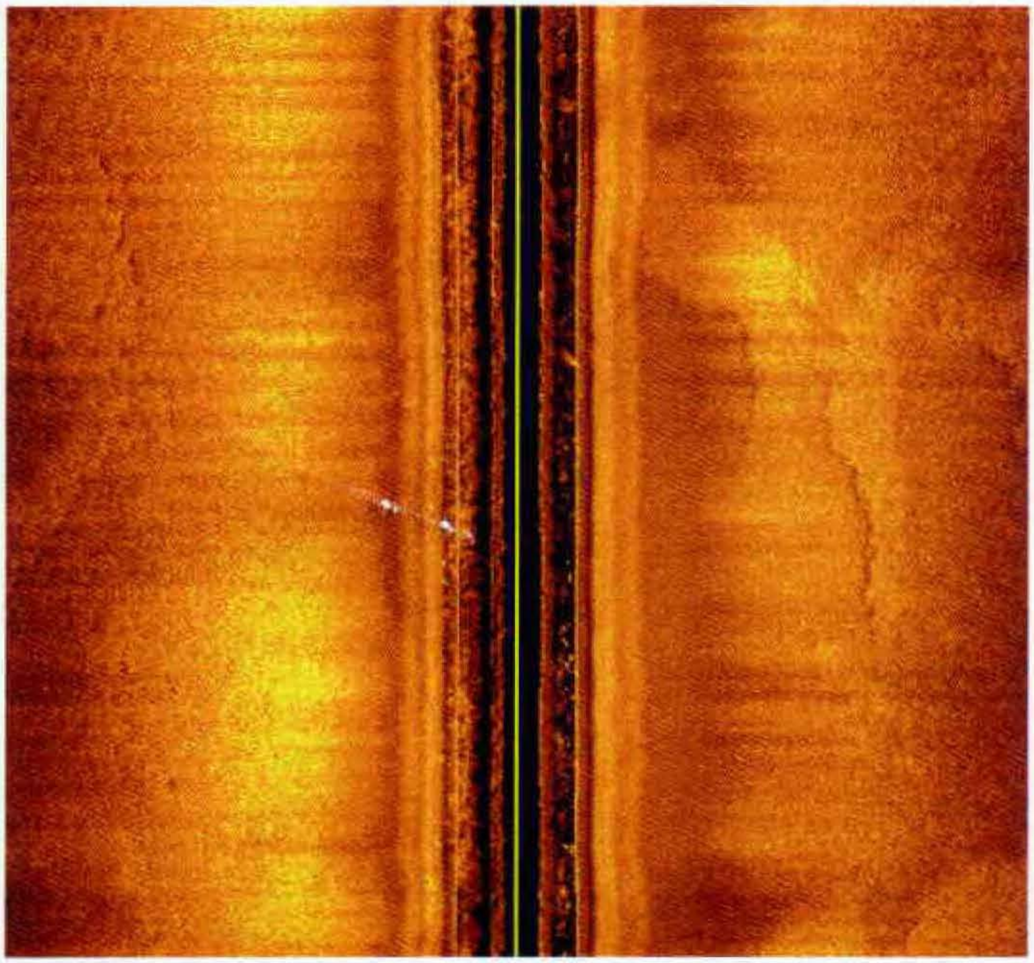

Figure 27. Surfside Borrow Area - Low Relief Hard Bottom.