INTEGRATED

FEASIBILITY REPORT

AND

ENVIRONMENTAL IMPACT STATEMENT

COASTAL STORM DAMAGE REDUCTION PROJECT

SURF CITY AND NORTH TOPSAIL BEACH

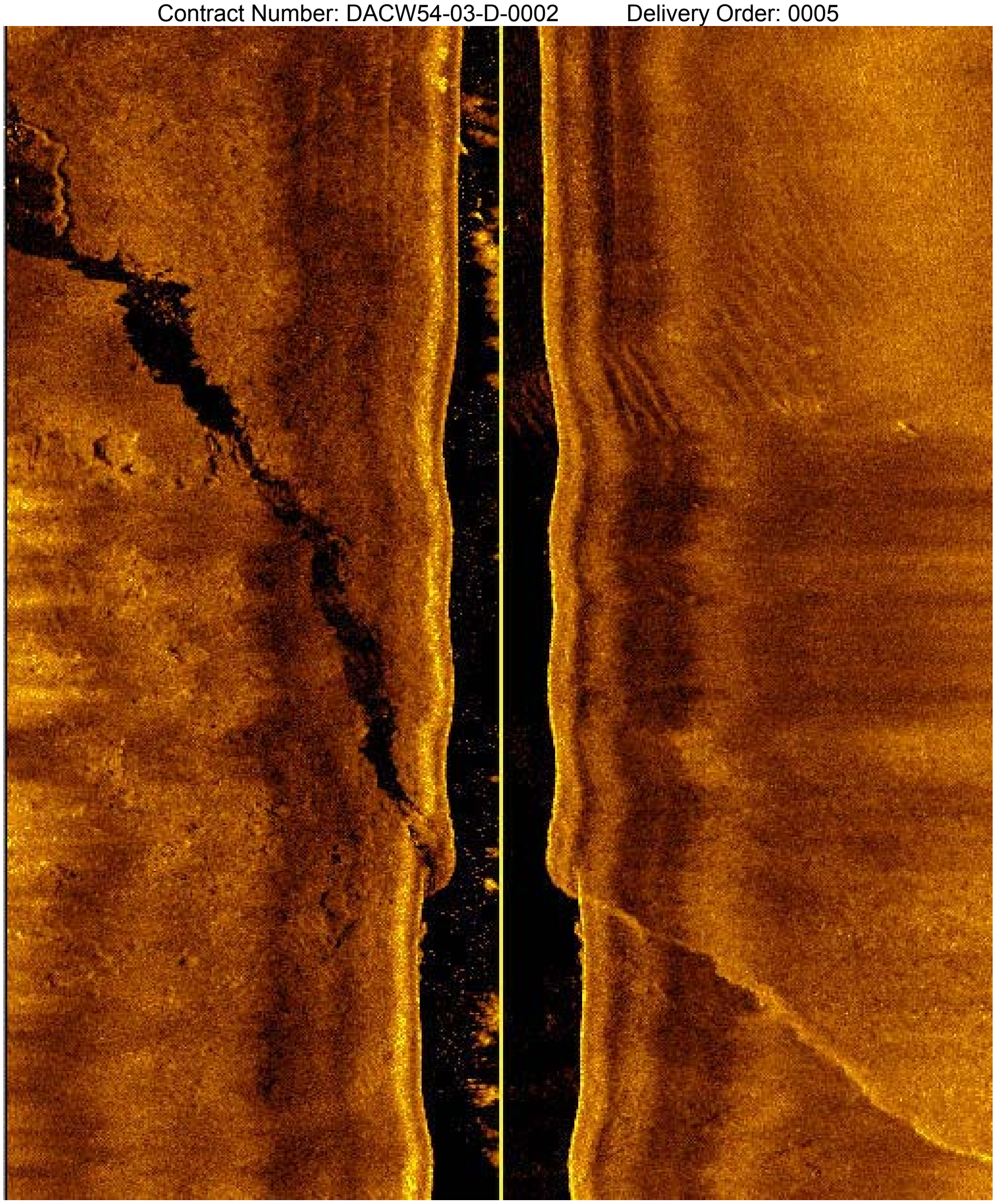
NORTH CAROLINA

Appendix U

Archaeological Appendix

An Archaeological Remote Sensing Survey of Surf City-North Topsail Beaches Offshore Borrow Areas

Contract Number: DACW54-03-D-0002 Delivery Order: 0005



Exposed rock ledge in Borrow Area LN1

Submitted To:

U.S. Army Corps of Engineers
Wilmington District

Submitted By:

Mid-Atlantic Technology and Environmental Research, Inc.
Principal Investigator:

Wes Hall

23 September 2005

An Archaeological Remote Sensing Survey of Surf City-North Topsail Beaches Offshore Borrow Areas

Contract Number: DACW54-03-D-0002 Delivery Order Number: 0005

Submitted To:

U.S. Army Corps of Engineers
Wilmington District
69 Darlington Avenue
Wilmington, North Carolina 28403

Submitted By:

Mid-Atlantic Technology and Environmental Research, Inc.
441 Blossom Ferry Road
Castle Hayne, North Carolina 28429

Principal Investigator:

Wes Hall

23 September 2005

ABSTRACT

The U.S. Army Corps of Engineers Wilmington District (USACE) is conducting preliminary investigations of seven proposed sand borrow areas totaling +/- 12,000 acres, for a beach re-nourishment project at Surf City-North Topsail Beaches, in Pender and Onslow Counties, North Carolina. As a part of these investigations, Mid-Atlantic Technology and Environmental Research, Inc. (M-AT/ER) of Castle Hayne, North Carolina, conduct marine magnetometer and side-scan sonar 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.

In addition to archaeological resources, M-AT/ER conducted a search to 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 14 October 2004 and May 10 2005.

The remote sensing survey identified no magnetic anomalies or the acoustic targets related to cultural resources within any of the seven proposed sand borrow areas. No additional archaeological investigations or actions are recommended.

Hard bottom ranging from low to high relief was found in each proposed borrow area. Appropriate action to avoid or mitigate sand mining impacts to these areas should be exercised.

TABLE OF CONTENTS

LIST OF FIGURES

INTRODUCTION

The U.S. Army Corps of Engineers Wilmington District (USACE) is conducting preliminary investigations of seven proposed sand borrow areas totaling +/- 12,000 acres, for a beach re-nourishment project at Surf City-North Topsail Beaches, in Pender and Onslow Counties, North 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] and side-scan sonar[2] 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)[3].

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 14 October 2004 and May 10 2005.

PROJECT LOCATION

The seven survey areas are located between 2 and 4 nautical miles offshore of Surf City and North Topsail Beach. The survey areas were located 7 to 19 nautical miles northeast of New Topsail Inlet. Figures 1 and 2 show the project location and the relative position of each borrow area, followed by Figures 3 through 10 that provide detail of each survey area. North Carolina State Plane coordinates (NAD 83) are included for reference. The combined acreage for the seven borrow areas is +/- 12,000 acres.

---

[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 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.

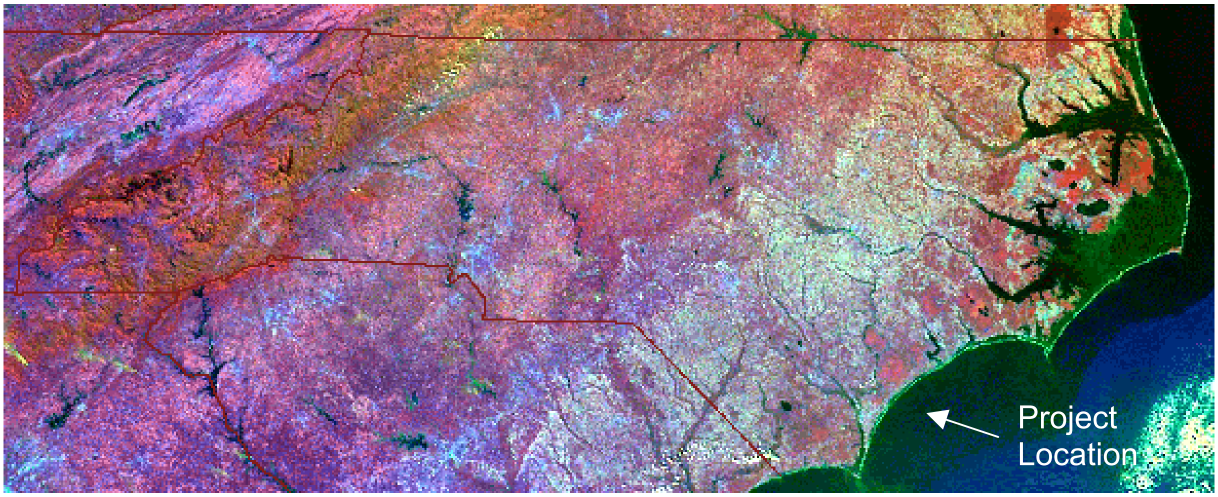


Figure 1. Project Location Map.

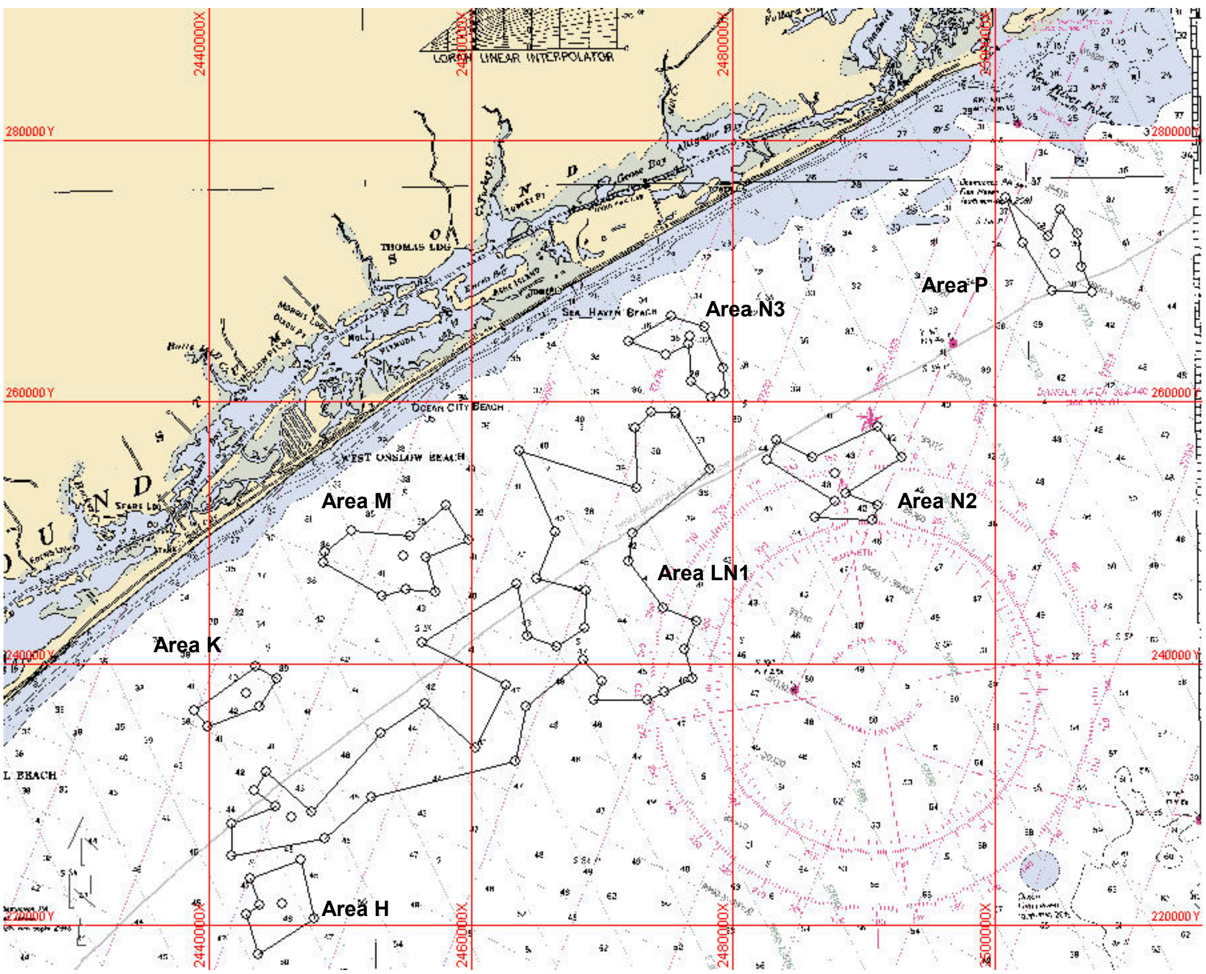


Figure 2. Relative Position of Project Areas

North Carolina State Plane Coordinates (NAD 83) for the proposed sand borrow areas:

Area H

x	y
2446987	225033
2443172	223555
2443846	221546
2442825	220884
2443731	217786
2448013	220552

Area K

x	y
2438842	236368
2439815	235165
2443837	236712
2445157	238873
2443553	239793

Area M

x	y
2450899	250165
2448779	248565
2448738	247715
2453215	245142
2455020	245723
2457285	245475
2456551	248114
2459851	249423
2458040	252130
2455385	249735

Area N2

x	y
2482642	255512
2487788	252443
2486319	251215
2490652	250949
2491103	252084
2488659	253055
2492875	255758
2491058	258142
2486120	255781
2483302	257062

Area N3

X	y
2474907	263606
2476566	264404
2476786	261508
2478342	260354
2479315	260660
2479301	262586
2477793	265729
2475308	266532
2472011	264594

Area P

X	y
2507494	268362
2506613	270356
2506334	272832
2505053	274732
2504144	272680
2500861	275609
2502188	272115
2504376	268450

Area LN1

x	y
2443402	230301
2445092	229129
2441682	227807
2441717	225316
2448825	226655
2452400	229839
2463352	232513
2464183	236746
2468532	240243
2469994	238637
2469420	237181
2473432	237267
2474819	237834
2476898	238870
2476328	241108
2477191	243211
2474670	244234
2472049	247782
2472292	249978
2478220	254870
2475639	259219
2473736	259234
2472581	258025
2472660	253466
2463732	256238
2466388	250055
2465042	246504
2468781	245543
2468626	242696
2466522	241309
2464316	242167
2463481	246095
2456232	241586
2462665	238303
2460354	233551
2456478	236939
2453090	234734
2447804	228664
2444323	231783

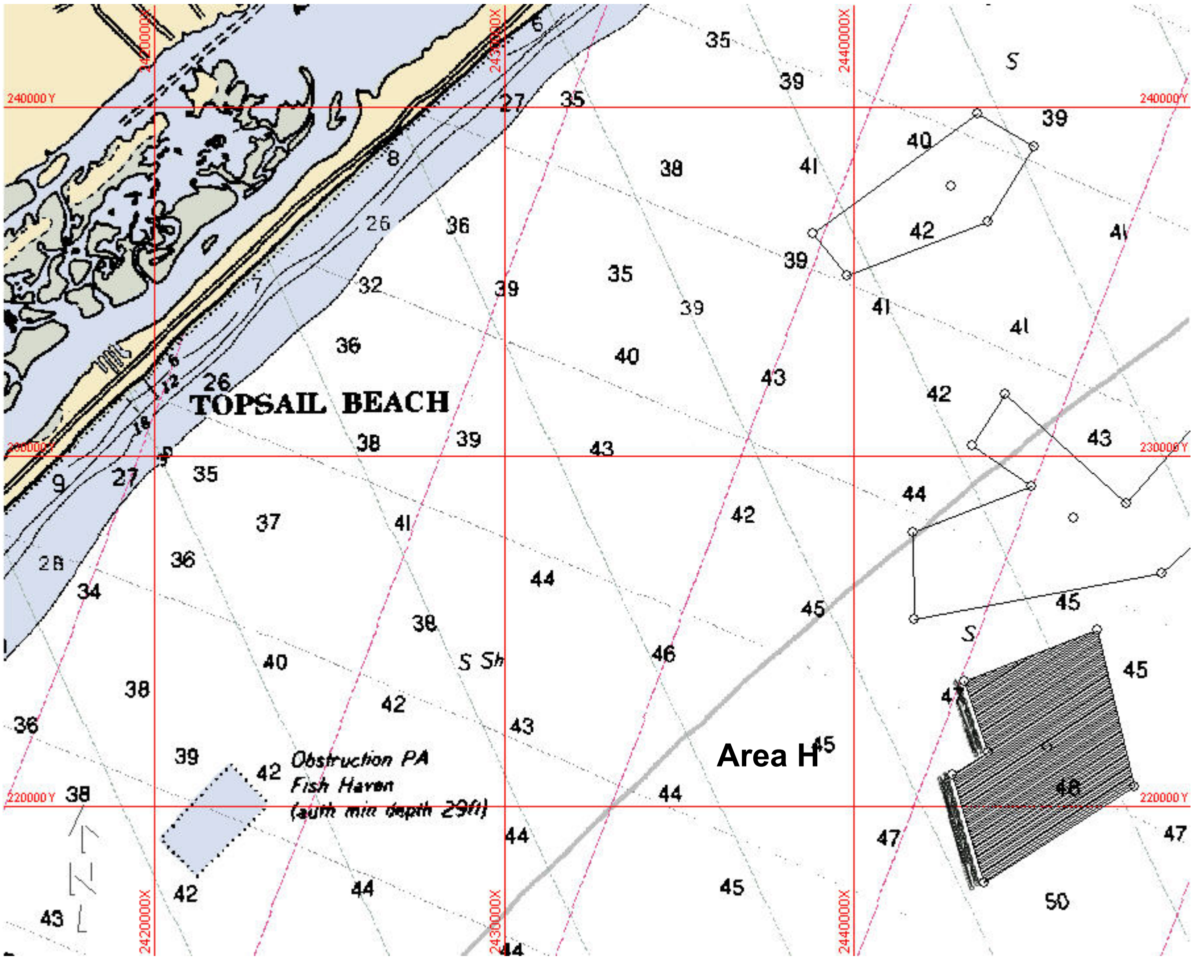


Figure 3. Area H.

The Area H survey consisted of 80 lines @ 65ft/20m spacing, totaling more than 354,771 linear ft/59 nautical miles with water depths of 45 to 47 ft.

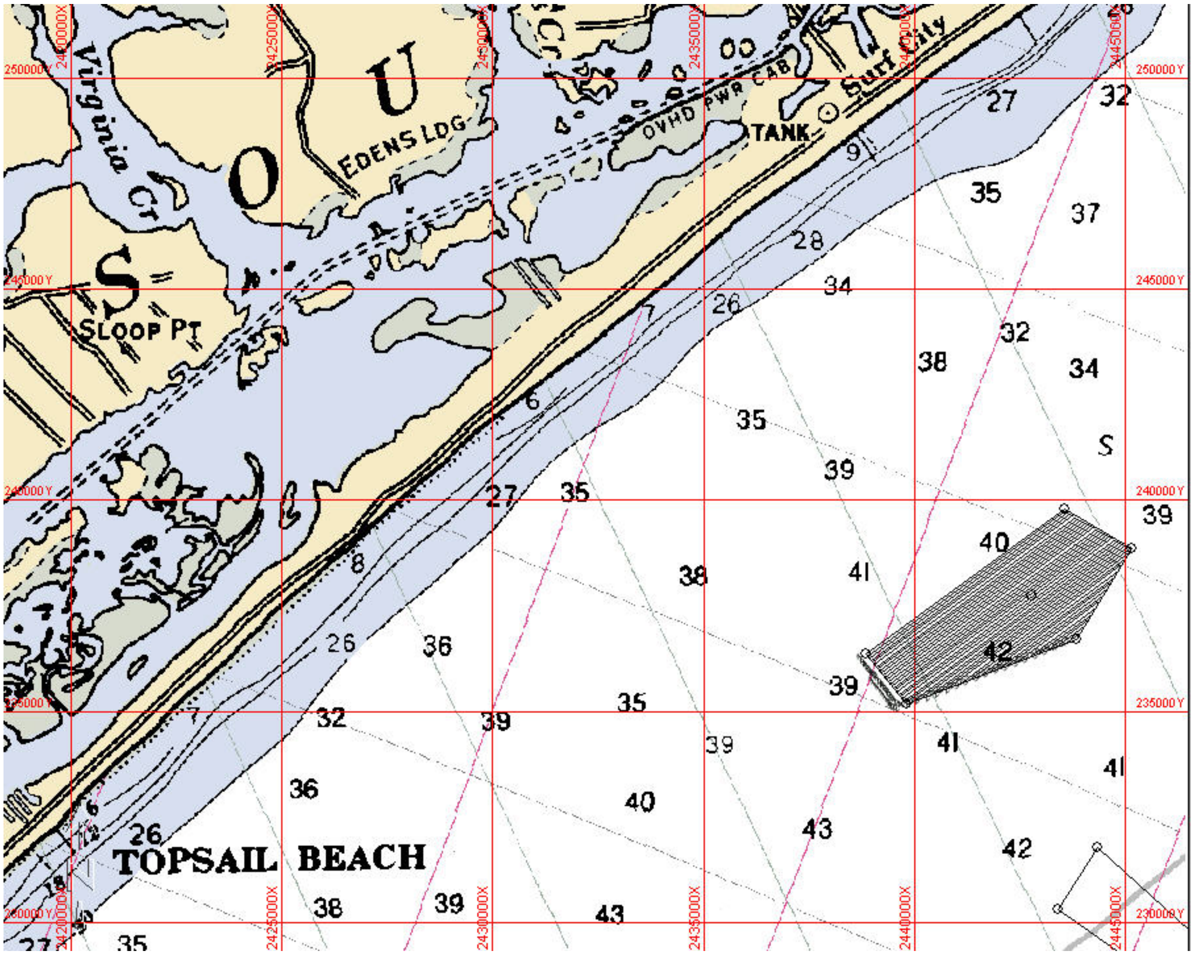


Figure 4. Area K.

The Area K survey consisted of 41 lines @ 65ft/20m spacing, totaling 201,806 linear ft/33 nautical miles with water depths of 39 to 42 ft.

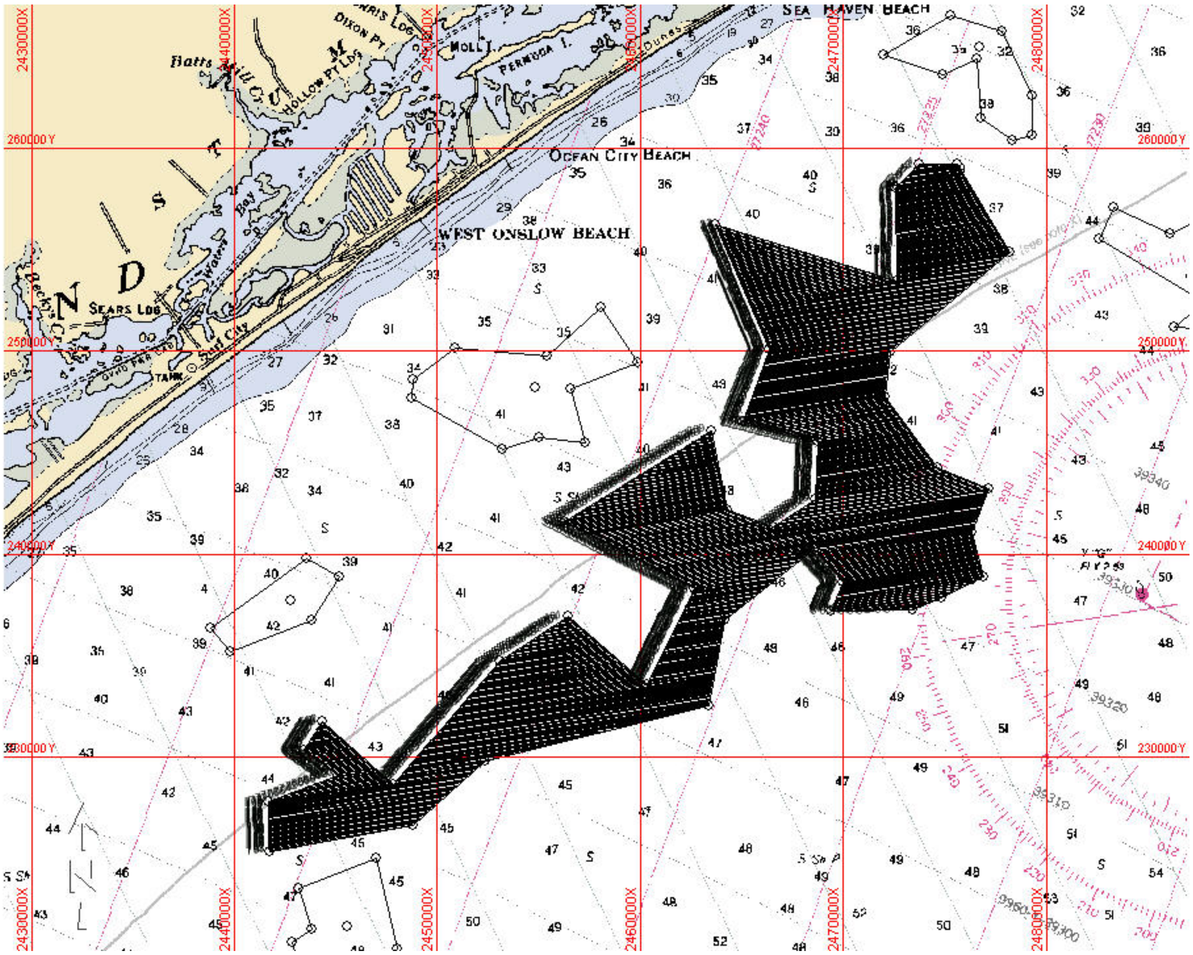


Figure 5. Area LN1.

The Area LN1 survey consisted of 753 lines @ 65ft/20m spacing, totaling 4,496,068 linear ft/740 nautical miles with water depths of 38 to 47 ft.

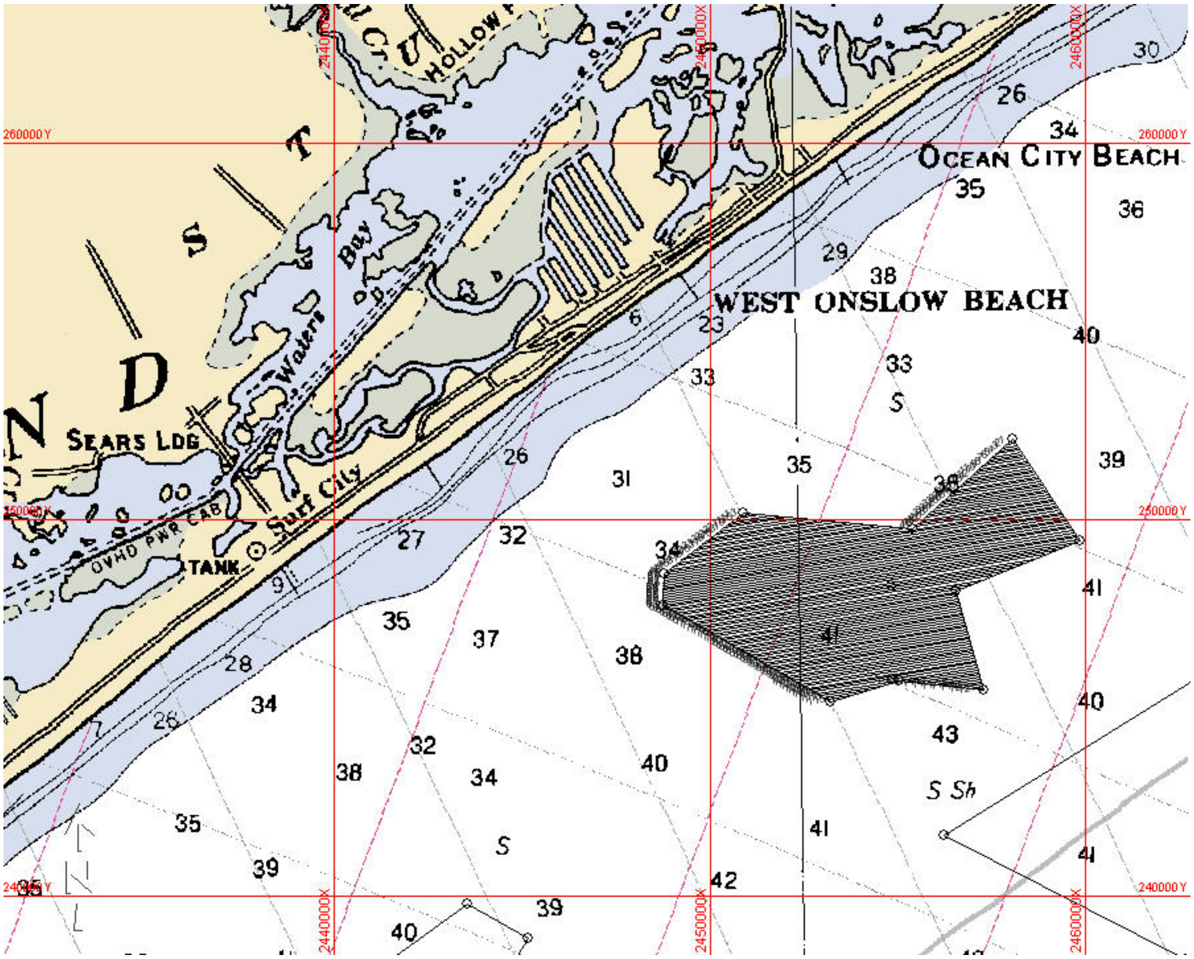


Figure 6. Area M.

The Area M survey consisted of 121 lines @ 65ft/20m spacing, totaling 587,018 linear ft/97 nautical miles with water depths of 32 to 47 ft.

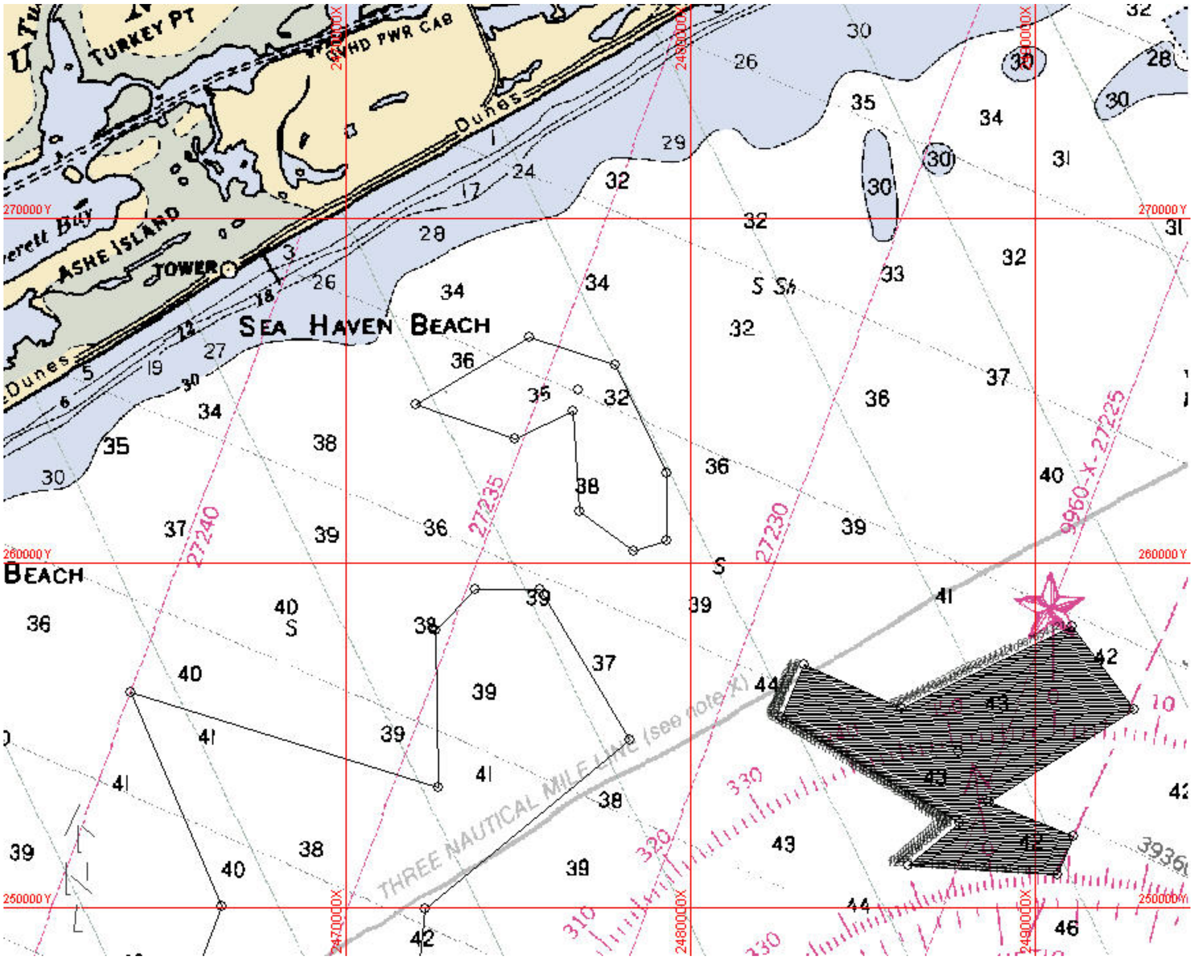


Figure 7. Area N2.

The Area N2 survey consisted of 131 lines @ 65ft/20m spacing, totaling 519,939 linear ft/86 nautical miles with water depths of 41 to 43 ft.

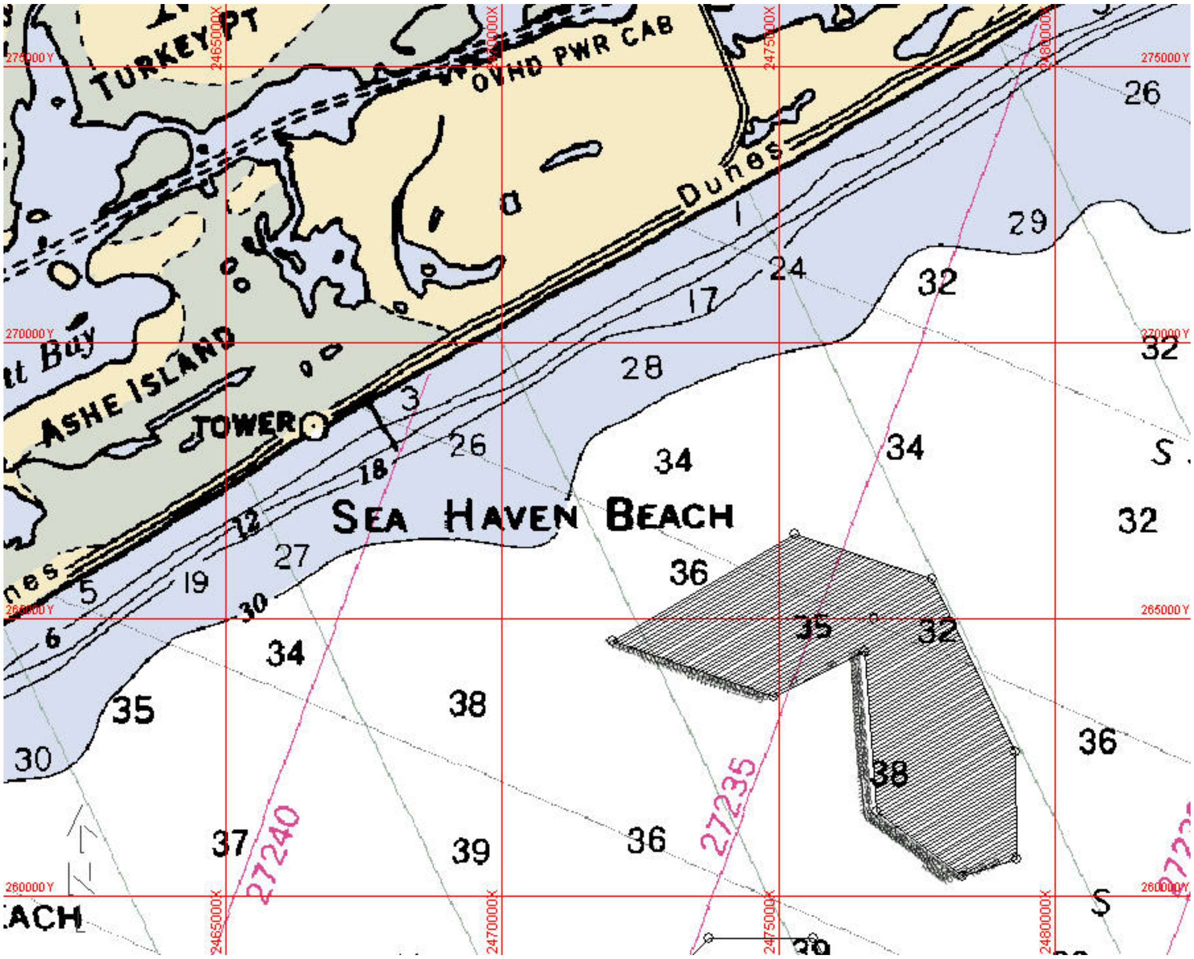


Figure 8. Area N3.

The Area N3 survey consisted of 109 lines @ 65ft/20m spacing, totaling 288,492 linear ft/47 nautical miles with water depths of 32 to 38 ft.

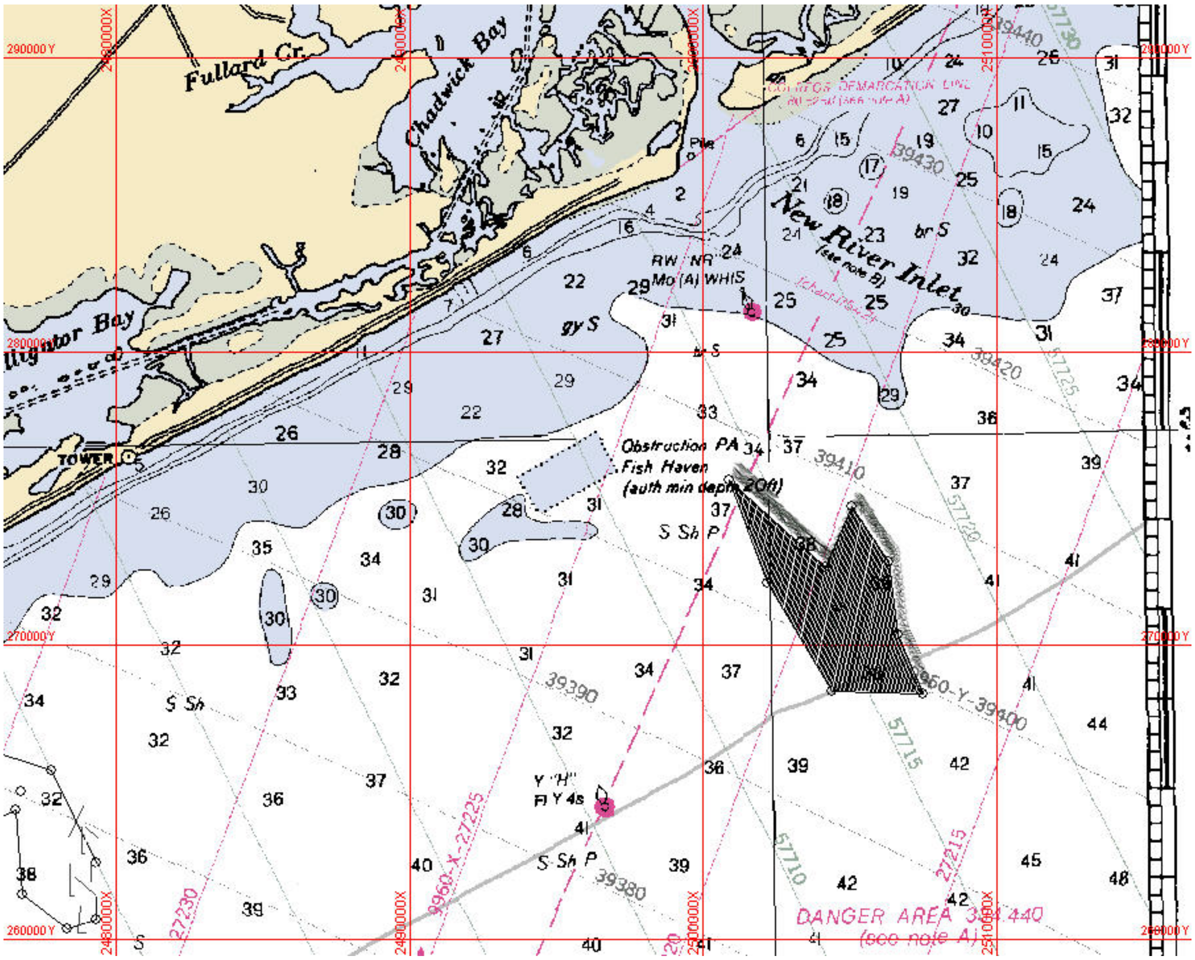


Figure 9. Area P.

The Area P survey consisted of 123 lines @ 65ft/20m spacing, totaling 321,952 linear ft/53 nautical miles with water depths of 37 to 41 ft.

HISTORICAL BACKGROUND

North Carolina's barrier islands formed nearly 18,000 years ago when coastal areas submerged during the Holocene epoch. High sand ridges built up along the mainland beaches by wind and water action, during the last period of glaciations. As the sea level rose, the ridge system failed, causing low-lying areas behind to flood. As a result, lagoons and shallow sounds were formed, leaving the existing dune ridges as barrier islands.

Inlets are formed by the wave action and shifting sands. Most of the inlets are temporary, either migrating along the coast or closing altogether as near shore currents transport sand parallel to the coastline. Permanent inlets occur along the southern coast where the mouths of significant rivers provide enough force to maintain stable inlets (Tubby 2000:59).

New Topsail Inlet is located at the lower end of Topsail Beach and connects the waters of the Atlantic Ocean with those of Topsail Sound, in Pender County. New River Inlet is to the north and Old Topsail Inlet to the south. The city of Wilmington is approximately 20 miles to the southwest.

Settlement

Permanent settlement of the Topsail Sound shoreline began in the early eighteenth century. One of the earliest land grants was issued in 1726 to John Baptista Ashe and was comprised of 800 acres "being the banks between Stumpy Sound and New Topsail Inlet" (Angley 1984:1).

Around this same time, the Nixon family began to settle along Topsail Sound, evidenced by the label "Nixon" opposite the inlet on the Moseley Map of 1733. The Wimble Map of 1738 notes several plantations near the inlet as well as an anchorage point just inside the inlet, indicating its use as an artery of coastal trade. By the time of the American Revolution, several other families had settled along the nearby shoreline of Topsail Sound, including the families of Bishop, Price, Morris, and Harrison (Angley 1984:1).

As early as 1755, New Topsail Sound was designated as an official inspection point for export commodities in New Hanover County, along with counties Brunswick, Wilmington, and New Exeter. In the following years of 1758, 1764, and 1770, the legislature again issued the designation. The New Topsail Inlet itself was made the point of inspection for the Topsail Sound area, in 1784. Inspections were conducted for export commodities of fish, flour, butter, flax seed, beef, pork, rice, tar, pitch and turpentine, staves and headings, sawed lumber and shingles (Angley 1984:1).

Settlement continued in the area. By the mid-nineteenth century, new families had established residency. In 1845, in addition to existing sound property, Charles H. Alexander acquired some 75 acres of beach property on both sides of the inlet.

Owen Holmes was granted 76 acres on the upper side of the inlet and 361 acres between New Topsail and Old Topsail inlets, in 1859. Holmes Landing was established directly opposite New Topsail Inlet as a local shipping point, by the time of the Civil War (Angley 1984:2).

Environment

With a depth of 10 feet (presumably at high tide), the inlet was suitable for passage by schooners and small sloops. It appears that the position of the inlet remained relatively stable throughout the Colonial Period. However, the volume of trade was limited by the shallowness of adjoining sounds and a lack of direct communication with the mouth of a large navigable stream (Angley 1984:2).

During the latter part of the eighteenth century and throughout most of the nineteenth century, New Topsail Inlet migrated significantly to the north. According to the Mouzon Map of 1775 and the Price-Strother Map of 1808, the inlet migrated northward some two miles. While the Mac Rae-Brazier Map of 1833 indicates no significant change, the U.S. Coast Survey Map of 1865 shows that an additional migration of two miles occurred during that period. The migration appears to have abated during the end of that century, as is suggested by review of the Kerr-Cain Map of 1882 and the Post Route Map of 1896 (Angley 1984:7).

A detailed U.S Coast Survey Map of 1885 indicates that the New Topsail Inlet was approximately 3,000 feet wide at that time.

Shipwrecks

Eleven vessels were reported or believed to have been lost in the area of Topsail Inlet (see also Shipwreck List).

In 1750, a hurricane struck the mid-Atlantic region, causing the loss of four vessels of the 1750 Spanish Plate Fleet. One of those ships, packet boat *El Salvador* was lost in the vicinity of Topsail Inlet on 18 August 1750 (Stick 1952:244). Due to the shifting sands, the surviving remains were buried in a matter of days, making salvaging operations difficult. The exact position of the vessel has been uncertain, although two locations have been suggested: modern New Topsail Inlet or Beaufort Inlet, which also was known as Old Topsail Inlet during that period (Tubby 2000:51).

Before the Civil War, the following vessels were lost in the vicinity: schooner *Superior*, driven ashore 24 November 1841 (Angley 1984:6); an unknown brig in September 1769, run ashore below Topsail Inlet (Tubby 2000:173); English merchantman *Betsy* in 1771 at Old Topsail Inlet (Tubby 2000:173); schooner *Mary Bear* on 9 September 1881 at New Topsail Inlet (Stick 1952:249); and schooner *William H. Sumner* on 7 September 1919, grounded at Topsail Inlet.

The Civil War activity in the area resulted in a number of wrecks. On 22 October 1862, sailing aboard the USS *Ellis*, Lieutenant William B. Cushing reported the seizure and scuttling of schooner *Adelaide* of Halifax. Abandoned about a mile from the mouth of New Topsail Inlet, the ship was loaded with about 600 barrels of turpentine, 36 bales of cotton, and tobacco. Unable to be floated to sea, the vessel was burned (Angley 1984:4).

Eight days later, en route from Hampton Roads to its Wilmington station, the USS *Daylight* seized the blockade-runner *Racer* near New Topsail Inlet. The vessel, loaded primarily with salt, had been abandoned by her crew along Topsail Beach in order to avoid capture. The USS *Daylight* crew was able to refloat the vessel, which was later taken to New York (Angley 1984:4). (*Graveyard of the Atlantic* lists this vessel as having wrecked at Diamond Shoals (Stick 1952:246)).

The USS *Daylight* again was successful in thwarting Confederate shipping, when they chased ashore and destroyed an unidentified schooner, westward of Stump Inlet (Angley 1984:4).

On 23 September 1863, iron-hulled steamer *Phantom* ran aground and was burned near Rich Inlet. She carried a cargo of government stores including arms, medicine, lead ingots, and sundry items (Tubby 2000:173). It was later confirmed the Phantom actually ran aground in Topsail Inlet (Personal communication, Richard Lawrence, NC Division of Archives and History, Underwater Archaeology Unit, Fort Fisher).

About 5 miles to the northward of New Topsail Inlet, on 2 February 1863, the USS *Mount Vernon* destroyed an abandoned blockade runner loaded with salt (Angley 1984:4), believed to be schooner *Industry* (Tubby 2000:173).

On 25 August 1863, Lieutenant Cushing, aboard USS *Shokokon*, captured the *Alexander Cooper*, which is believed to be the last vessel sunk or captured in the New Topsail Inlet vicinity during the Civil War (Angley 1984:4).

Other vessels lost in the Topsail Inlet vicinity during the Civil War include an unknown schooner that ran ashore westward of Stump Inlet on 22 January 1863; and *Wild Dayrell* (or *Wild Darryl*), a side-wheel steamer that was grounded and burned near Rich Inlet (mistakenly placed in New Topsail Inlet Tubby's thesis). She carried a cargo of shoes, blankets, and valuable merchandise (Tubby 2000:173).

New River Inlet, Surf City and North Topsail Beach

No shipwrecks have been record in New River inlet or offshore of Surf City or North Topsail Beach.

Maritime Commerce

As was indicative of vessels seized, the inlet was active with salt production. A 1864 military map shows at least 2 Confederate salt works situated on either side of Holmes Landing. The presence of the salt works is further substantiated in a letter of 1 November 1862 written by USS Lieutenant William Cushing to his superior.

The following year, on 22 August, Lieutenant Cushing and his men destroyed the second salt works on Topsail Sound, which apparently had been rebuilt later to the east of Holmes Landing (Angley 1984:3).

Twentieth Century Activity

As reported on a detailed map by surveyor Eric Norden in the mid-1920s, New Topsail Inlet had narrowed to a width of 2,550 feet.

In 1932, a 12-feet deep and ninety-feet wide segment of the Intracoastal Waterway between Beaufort and the Cape Fear south of Wilmington was completed. The channel allowed for an increase in vessel traffic from 33,710 tons in 1932 to 243,000 tons in 1939. As reported the previous year, the character of the vessel traffic – of around 9,000 vessel trips – consisted of approximately 8,500 motor vessels, 300 tugs, 200 barges, and a smattering of pleasure craft. Cargo vessels transported agricultural commodities, lumber, petroleum products, seafood, fertilizer, and general merchandise (Angley 1984:8).

No subsequent improvements of any kind were made to the New Topsail Inlet vicinity, or along Topsail Beach, according to a Pender County highway map of 1938. Although a few structures existed near the mouth of the Old Topsail Creek, other structures were located in the Sloop Point area, well to the northeast.

However, by 1947, development of Topsail Beach began. A bridge had been built across the sound (at the upper end of beach), and a road had been constructed along the beach to the mouth of the New Topsail Inlet. Between 1947 and 1970, considerable growth occurred on Topsail Beach, resulting in hundreds of cottages, other structures, a network of streets, and docking facilities at the lower end of the beach adjoining the mouth of New Topsail Inlet. Additionally, a new marked channel provided direct communication between the inlet and the Intracoastal Waterway, besides the associated old Banks and Howard channels.

By the mid-1970s, the New Topsail Inlet had narrowed considerably more – to a width of 1,250 feet from a mid-1920s width of 2,550 feet. During 1938 and 1972, the inlet moved southward some 2,680 feet, reversing the migration of the late eighteenth and early nineteenth centuries. Most of the migration occurred between 1948 and 1956 (Angley 1984:8).

Whereas the earlier maritime activity within the New Topsail Inlet vicinity was related to settlement and expansion, modern-day vessel traffic primarily consists of pleasure craft, sporting fishing boats, and some commercial vessels. Today, the inlet is maintained by the U.S. Army Corps of Engineers.

PREVIOUS INVESTIGATIONS

During 1963 and 1964, the United States Navy, at the request of the North Carolina Division of Archives and History, conducted salvage and exploration activities in the area. Location and preliminary examination was made of a Civil War period steam vessel in the immediate vicinity of either Rich or Topsail Inlet. Limited surviving records of this investigation do not confirm the site's location or describe the extent or nature of the work undertaken (Watts et al. 1975:57).

In 1975, the North Carolina Underwater Archaeology Unit (Fort Fisher) conducted a summer field school that included a general magnetometer survey of portions of the areas north of Carolina Beach to Topsail Island. The magnetometer survey identified four magnetic anomalies in the vicinity of New Topsail and Old Topsail Inlets. Data collected indicates that the two targets were low intensity, multi-component anomalies. These targets were not examined further because of poor weather conditions. The report recommended further magnetic remote sensing.

The third target ("The Phantom Site") was found at a location originally called the Colorado Site, which is located approximately 200 yards south of the southern end of New Topsail Inlet and in 16 to 18 feet of water. Only the boilers, steam machinery, and small portion of the hull were exposed. However, given the intense magnetic signature of 7,000 gammas, it is believed that more of the vessel lies below the bottom. The target was identified as the remains of a mid-nineteenth century iron hull, double screw steamer – possibly the remains of blockade-runner *Phantom*. Additional investigations were recommended in order to positively identify the specific vessel found (Watts et al. 1975:115).

The forth anomaly indicated a target with "a considerable amount of material below the bottom", which was located 1.2 miles east of New Topsail Inlet. This target was deemed most worthy of additional investigation. Dive investigations failed to reveal any materials above the bottom (Kimmel 1998:2).

Prior to this survey, no previous attempts to locate submerged cultural resources were undertaken in this area.

Later, in 1988, the USACOE performed a magnetic survey inside New Topsail Inlet for a proposed borrow area. The survey reported no anomalies within the survey area. However, there is mention of a large object (250 feet in length), located offshore of the borrow area and visible from an aerial photo taken in 1963. The object is not visible on more recent photos.

In 2000, in an effort to locate the 1750 Spanish Plate Fleet *El Salvador,* a magnetometer and side-scan sonar survey was conducted around New Topsail Inlet in a 6-square-mile area centered on the inlet. Two sites were found, and dive investigations of these sites revealed the remains of a late nineteenth to early twentieth century sailing vessel. The other site did not represent the remains of a broken up wreck. The *El Salvador* was not located.

PRE-SURVEY CONSULTATION AND DOCUMENTATION

As part of the investigative effort, M-AT/ER first conducted a literature search to help document man's activities in the vicinity and to provide a historical context for the assessment of potential cultural resources discovered offshore. The search helped to determine the extent and type of commercial and naval activity offshore, which further assisted in the assessment of targets identified during field investigations. This research focused on primary and secondary materials, as compiled by environmental and archeological agencies responsible for managing the State's cultural resources and depositories, such as libraries and museums. In addition, research included consultation with local historians and the State Underwater Archaeologist at Fort Fisher.

The following offices and/or institutions were contacted:

- Underwater Archaeology Unit, Division of Archives and History, Fort Fisher, NC
- North Carolina Maritime Museum, Beaufort, NC
- NC State Archives
- Office of the Historian, U.S. Coast Guard, Washington, D.C.
- Marine Casualty Branch, U.S. Coast Guard
- Maritime Historian, Sanctuaries and Reserves Division, National Oceanic and Atmospheric Administration

Preliminary secondary sources examined:

- 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
- Web Site Review of http://anchor.ncd.noaa.gov/awois/search.cfm
- Historical Maps and Charts

Researchers reviewed source materials at each institution and conducted interviews with librarians/technical staff to determine the best potential sources for background information. A list of known or potential shipwrecks has been developed for the vicinity.

DESCRIPTION OF INVESTIGATIONS

Using a 25-foot survey vessel, M-AT/ER's underwater archaeology team conducted a remote sensing survey of the seven proposed borrow areas. Two remote sensing devices were used: a Geometrics 881 cesium marine magnetometer, and a Marine Sonic 600-kHz side-scan sonar. Each instrument was interfaced with a Starlink

Differential Global Positioning System. HYPACK MAX™ navigation software also was interfaced with the DGPS system, being used to develop the survey lines and maintain vessel track during data collection.

Data was collected along parallel lines spaced at 65-foot (20-meter) intervals. Magnetic data, along with corresponding positioning data, was recorded at one-second sample intervals (or approximately every 8 feet along a track line at 5 knots) using MAGSEA and HYPACK data acquisition software. Since depths in each of the proposed borrow areas ranged from 38 to 45 feet, a 65-pound tri-fin stabilizer/depressor was used to keep the magnetometer sensor at an average depth of 18 to 22 feet above the bottom surface. Acoustic data was recorded with Sea Scan PC acoustic data acquisition software using an onboard PC computer system. At the end of each day, acoustic data was stored on 700 mb CDs. The side-scan sonar fish was maintained at an altitude (generally 20 to 30 feet) above the bottom, which provided the most detailed records.

To assist in data analysis, hydrographic data also was recorded entirely in HYPACK.

Data Analysis

During field investigations, data being produced by the magnetometer and side-scan sonar was 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 to include individual target coordinates, signature characteristics, intensity, and duration. Once all survey line data for an area was edited, that data was converted to an XYZ file (Easting and Northing State Plane Coordinates, and magnetometer data measured in nanoteslas), 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 five-nanoTesla 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 effecting 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 was the subtraction of general background from each successive data sample to develop the actual field gradient. The gradient is the vertical difference (z) among samples. By subtracting successive data samples one from the other, the effects of diurnal changes are 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 are evaluated using the National Register of Historic Places criteria as a basis for the assessment. Determining the significance of an historic vessel depends on whether the wreck site or vessel is:

1) the sole, best, or a good representative of a specific vessel type; or
2) is associated with a significant designer or builder; or
3) was involved in important maritime trade, naval, recreational, government, or commercial activities.

In order for a target to be eligible for nomination to the national register, it must meet one or more of the following criteria:

A. be 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; or

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)

Target assessment for this project 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. Often, modern debris near docks, bridges, or an anchorage is easily identified based solely on the characteristics of its acoustic signature. Most geometrical features identified on the bottom (in open water) are man-made objects — modern debris such as wire rope, chain, or other ferrous material.

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 and has a magnetic signature of any sort, it can be categorized as a potentially significant target.

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. Soft migrating sand or mud can bury large wrecks, leaving little or no indication of their presence on the bottom surface. A shipwreck that occurs in a region with a hard bottom, with little migrating sand, tends to remain exposed and is often visible on sonogram records. However, a magnetic anomaly that is identified in a hard bottom area but has no associated acoustic signature often is discounted as an historic shipwreck. Physical examination is necessary to make a more definitive determination.

The type of magnetic signature that a boat or ship might produce is infinite because of the large number of variables including location, position, chemical environment, other metals, vessel type, cargo, sea state, etc. This dynamic environment is 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.

A small, single-source magnetic signature has the least potential to be a significant cultural resource. Although it might represent a single cannon ball or historic anchor, this type of signature has little potential to meet the above referenced National Register criteria. Conversely, a more complex magnetic anomaly, represented by a broad or intense, multi-component signature, which is particularly if found in soft sand and low-velocity currents, has the greatest potential of representing a shipwreck. A high-intensity, multi-component magnetic signature without an accompanying acoustic signature in an area of relatively high-velocity currents often can frequently be discounted as an historic resource. Eddies created by high-velocity currents most often 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. Frequently, these objects produce a record that clearly indicates a man-made object; however, based solely on the magnetic signature, the object is impossible to identify or date. The only definitive method of determining the nature of the object creating these anomalies is by physical examination.

In making an archaeological assessment, the historical and modern use of the waterway must be taken into consideration. Obviously, historically active areas tend to have greater potential for submerged cultural resources. This information — along with environmental variables, magnetic and acoustic signatures, shape the assessment process. The assessment process is meant to prioritize targets for further underwater archaeological investigations.

DESCRIPTION OF FINDINGS

Investigations to identify documented shipwrecks near the project area revealed that 11 ships have wrecked in the Topsail Inlet and Topsail Beach vicinities. No shipwrecks have been recorded offshore of Surf City, North Topsail Beach or New River Inlet. Most of the shipwrecks occurred during the nineteenth century.

Shipwreck List

Reported Shipwrecks are as follows:

Wreck Name	Date Lost	Type Vessel	Location
El Salvador	18 Aug 1750	Nao	Topsail Inlet (suspected)
Unknown Brig	Sep 1769	Brigantine	Below Topsail Inlet
Betsy	1771	Merchantman	Old Topsail Inlet
Adelaide	22 Oct 1862	Schooner	Mouth of New Topsail Inlet
Alexander Cooper	22 Aug 1863	Schooner	New Topsail Inlet
Industry	2 Feb 1863	Schooner	5 miles north of Topsail Inlet
Phantom	23 Sep 1863	Steamer	200 yards offshore in 30 feet of water, Topsail Inlet
Unknown Schooner	22 Jan 1863	Schooner	Westward of Stump Inlet
Wild Dayrell	3 Feb 1864	Side-wheel Steamer	Rich Inlet
Mary Bear	9 Sep 1881	Schooner	New Topsail Inlet
William H. Sumner	7 Sep 1919	Schooner	Topsail Inlet

Remote Sensing Survey Findings

No single isolated magnetic or acoustic targets or anomalies were identified during the survey of all seven borrow areas. A general geologically generated change in the magnetic background was noted in some areas. There were no indications that these gradual changes in gradient were associated with bottom features or sand.

Many small “false anomalies” created by the contouring of pole data seems to be a product of a combination of factors including change in gradient, line spacing, diurnal change, and the TIN analysis modeling program used to contour data. Most of the false anomalies were monopolar with less than 10 nanotesla in amplitude.

BORROW AREA H

No magnetic or acoustic targets were identified in Borrow Area H (Figure 10).

BORROW AREA K

No magnetic or acoustic targets were identified in Borrow Area K (Figure 11).

BORROW AREA LN1

No magnetic or acoustic targets were identified in Borrow Area LN1 (Figure 12).

BORROW AREA M

No magnetic or acoustic targets were identified in Borrow Area M (Figure 13).

BORROW AREA N2

No magnetic or acoustic targets were identified in Borrow Area N2 (Figure 14).

BORROW AREA N3

No magnetic or acoustic targets were identified in Borrow Area N3 (Figure 15).

BORROW AREA P

No magnetic or acoustic targets were identified in Borrow Area P (Figure 16).

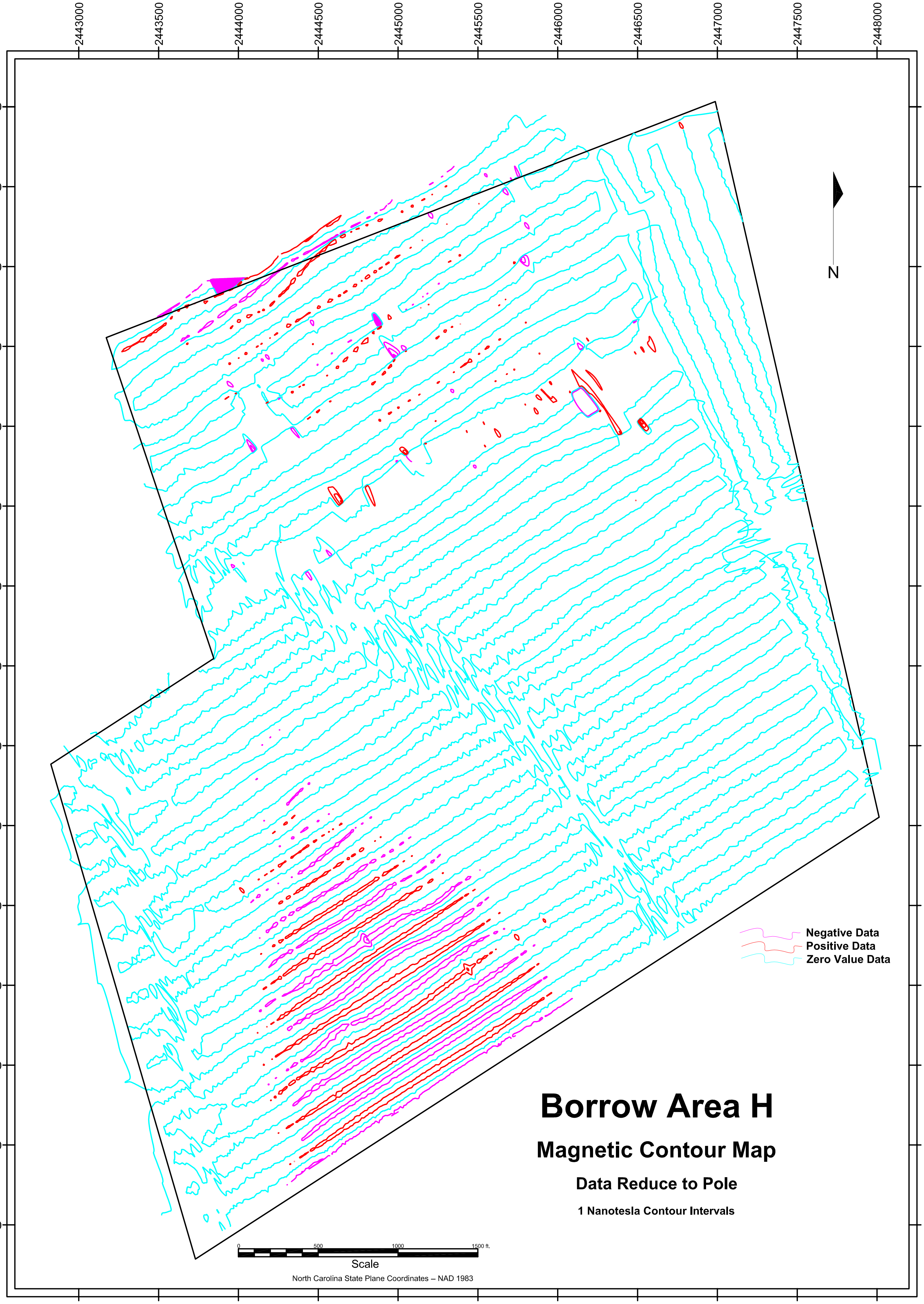


Figure 10. Area H Magnetic Contour Map.

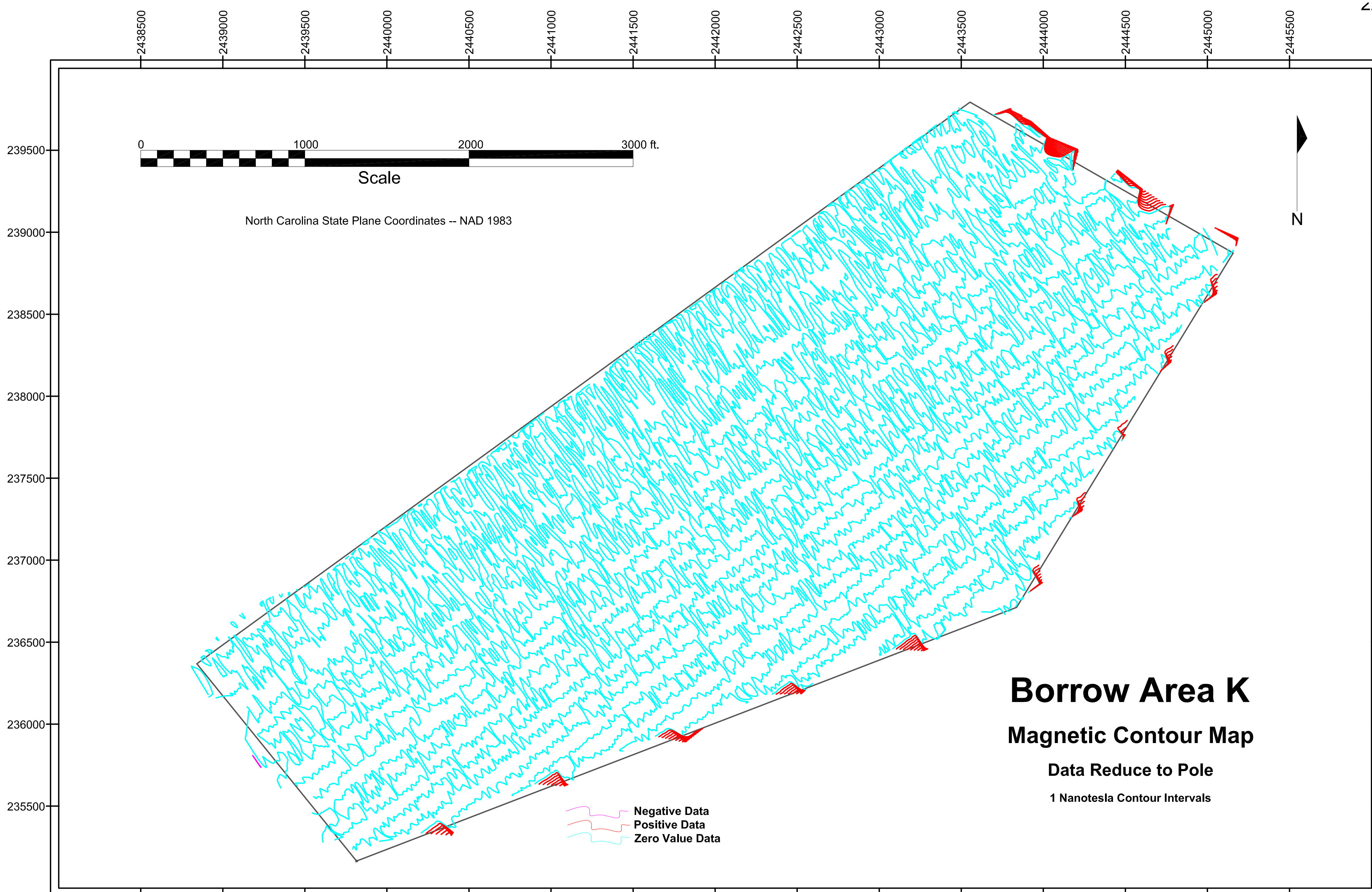


Figure 11. Area K Magnetic Contour Map.

Figure 12. Area LN1 Magnetic Contour Map.

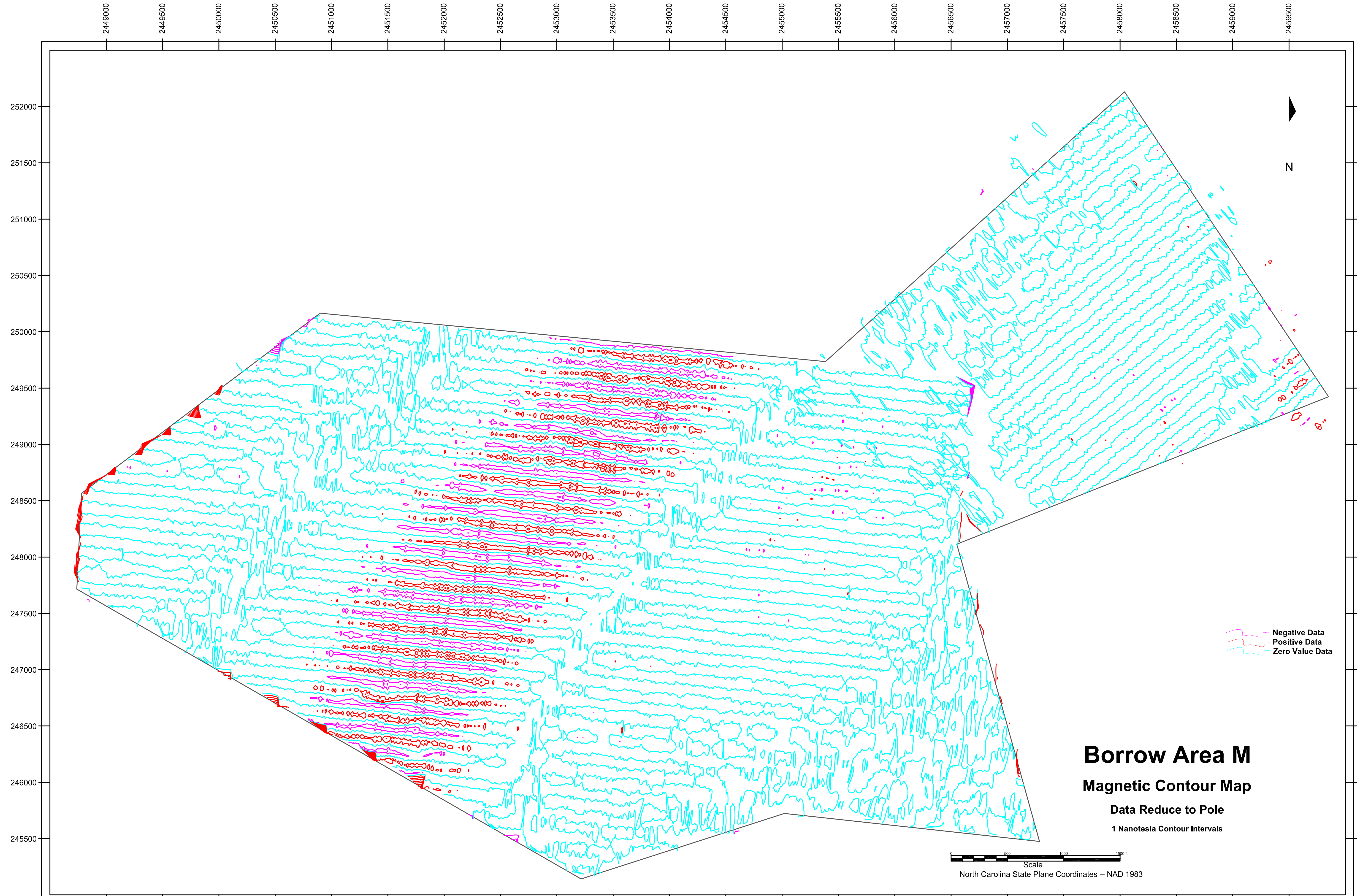


Figure 13. Area M Magnetic Contour Map.

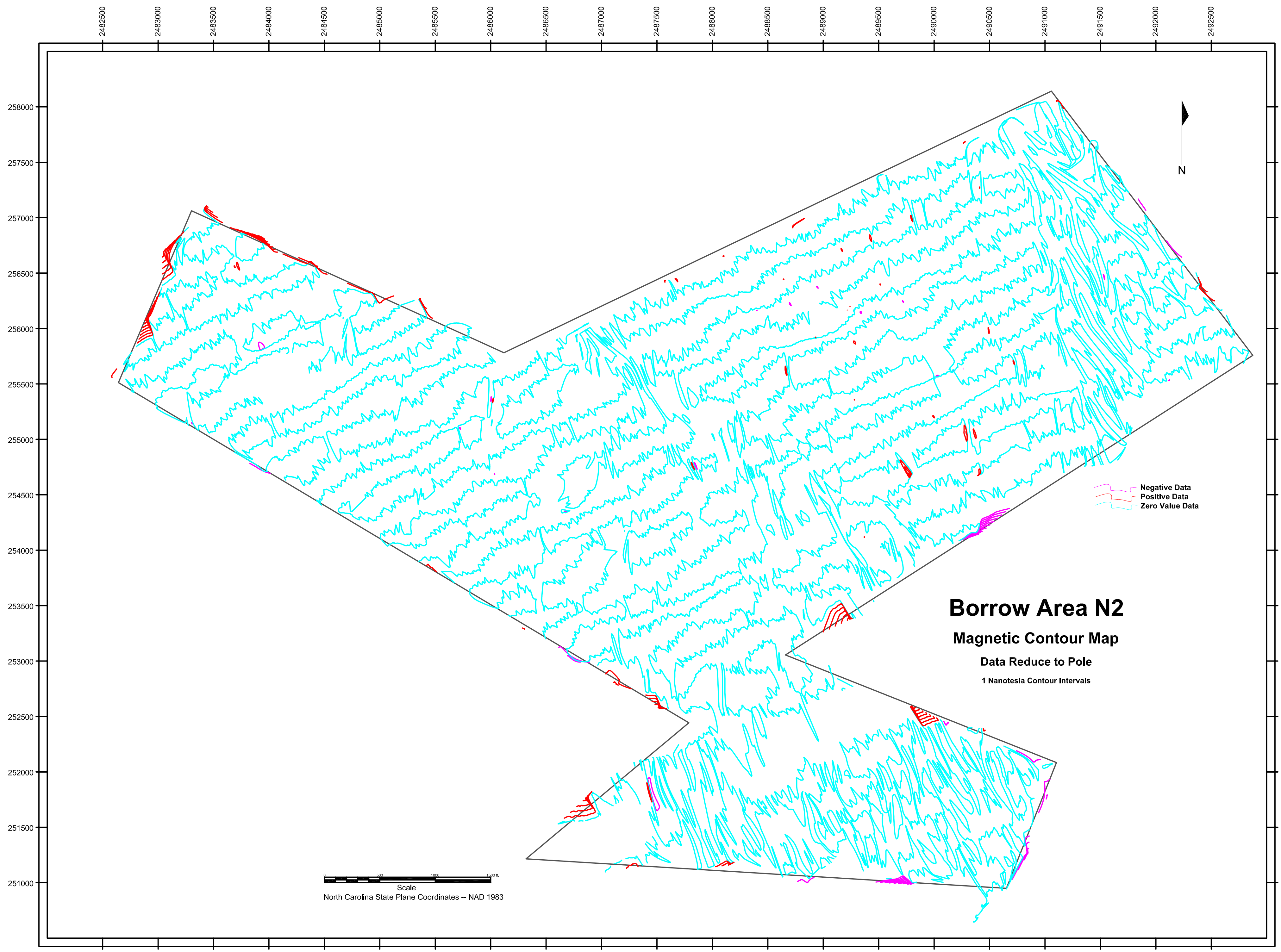


Figure 14. Area N2 Magnetic Contour Map.

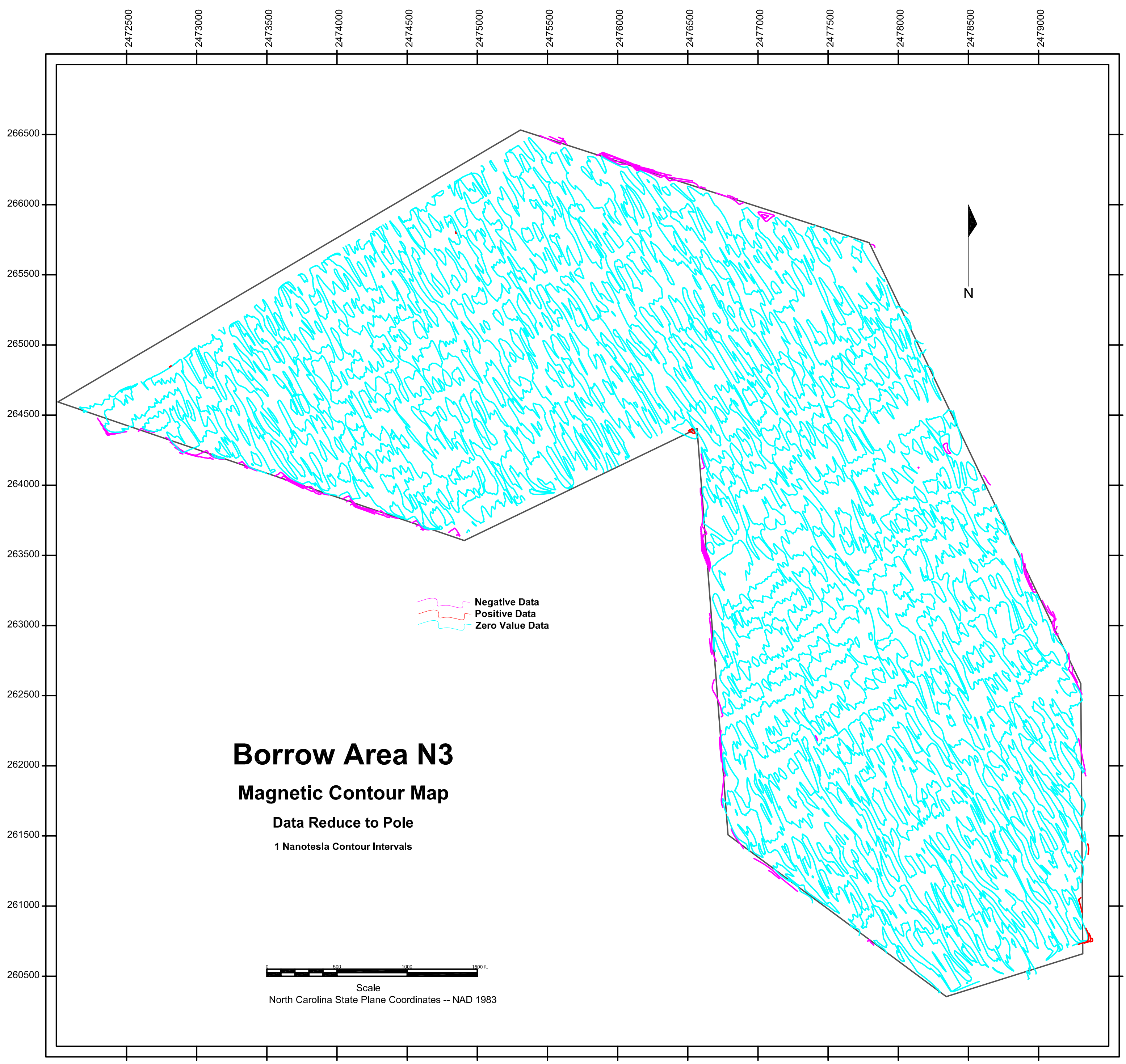


Figure 15. Area N3 Magnetic Contour Map.

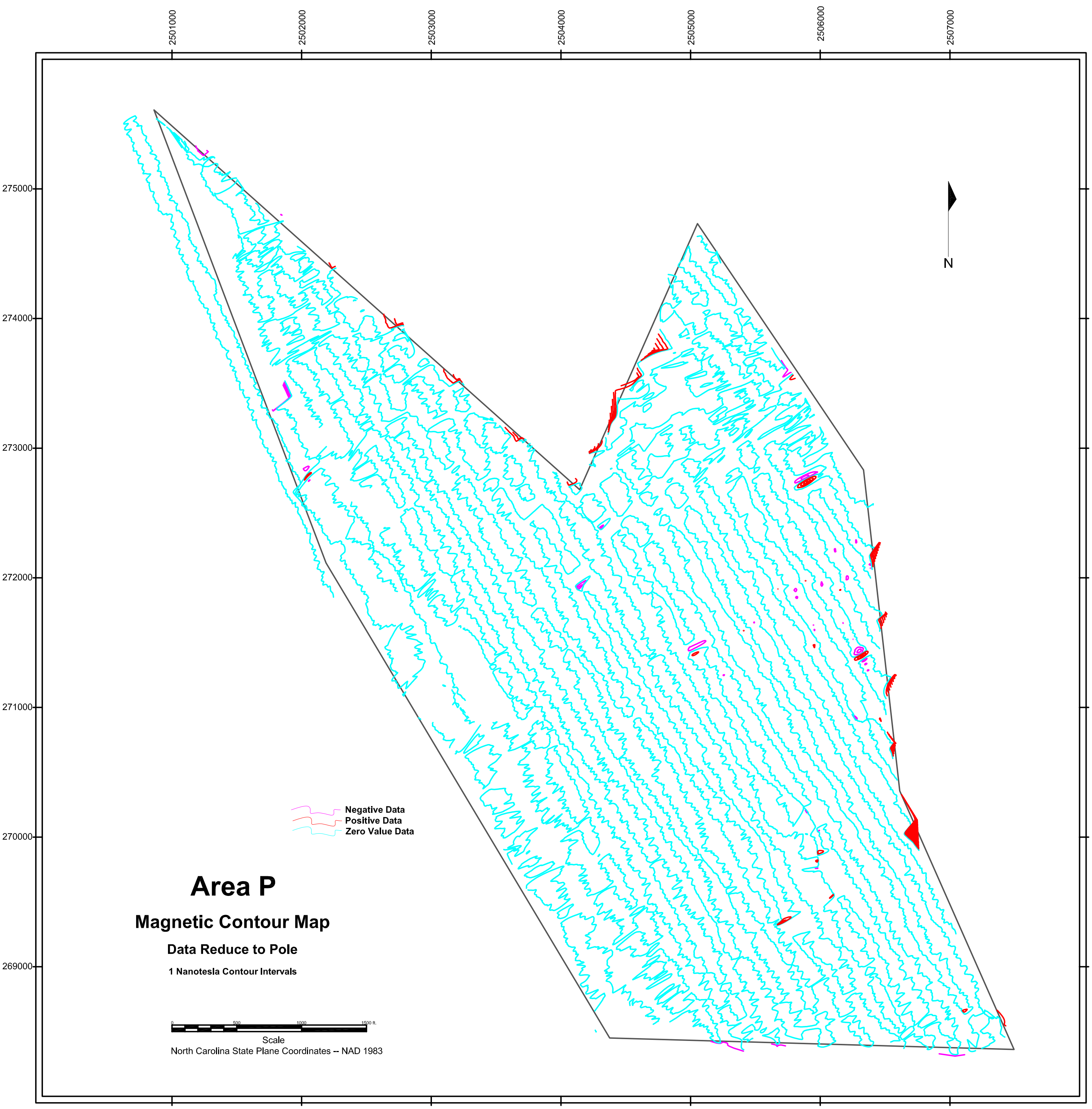


Figure 16. Area P Magnetic Contour Map.

IDENTIFICATION OF HARD BOTTOM AREAS

M-AT/ER reviewed acoustic records (side-scan sonar and depth) 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.

Hard bottom was identified to some degree in each proposed borrow area. Using AutoCAD's area calculation program M-AT/ER calculated the approximate percentage of hard bottom or exposed bottom in each proposed borrow area:

Borrow Area H = 2% hard bottom all low relief.

Borrow Area K = 73% hard bottom with mix of low, moderate and high relief.

Borrow Area LN1 = 13% hard bottom with mix of low, moderate and high relief.

Borrow Area M = 48% hard bottom with mix of low, moderate and high relief.

Borrow Area N2 = 19% hard bottom all low relief.

Borrow Area N3 = 20% hard bottom with mix of low and moderate relief.

Borrow Area P = 46% hard bottom with mix of low to moderate relief.

The following are example imagines and maps of each borrow area defining hard bottom in three levels low, moderate and high as described above.

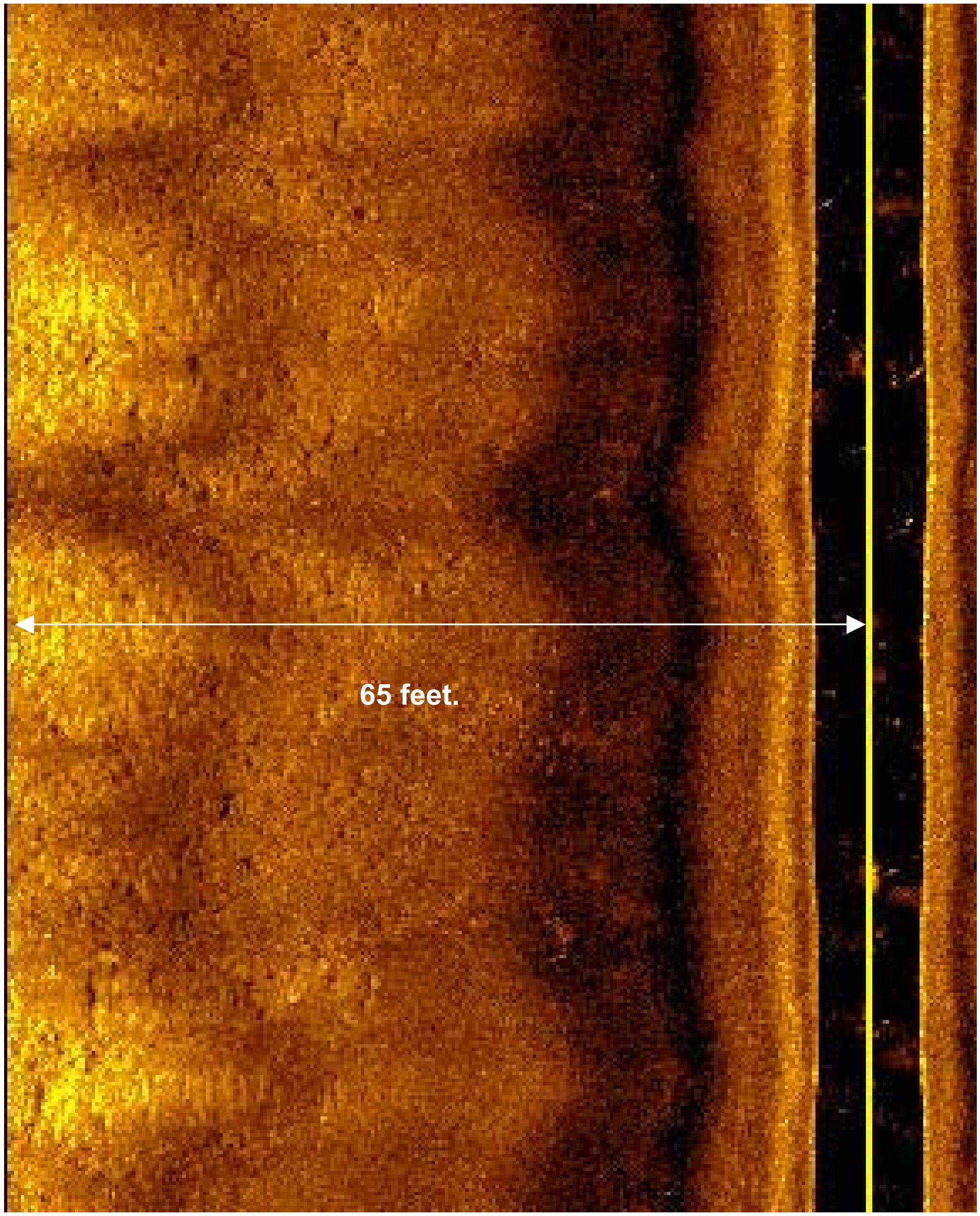


Figure 17. Sonar image of typical hard bottom in Area H.

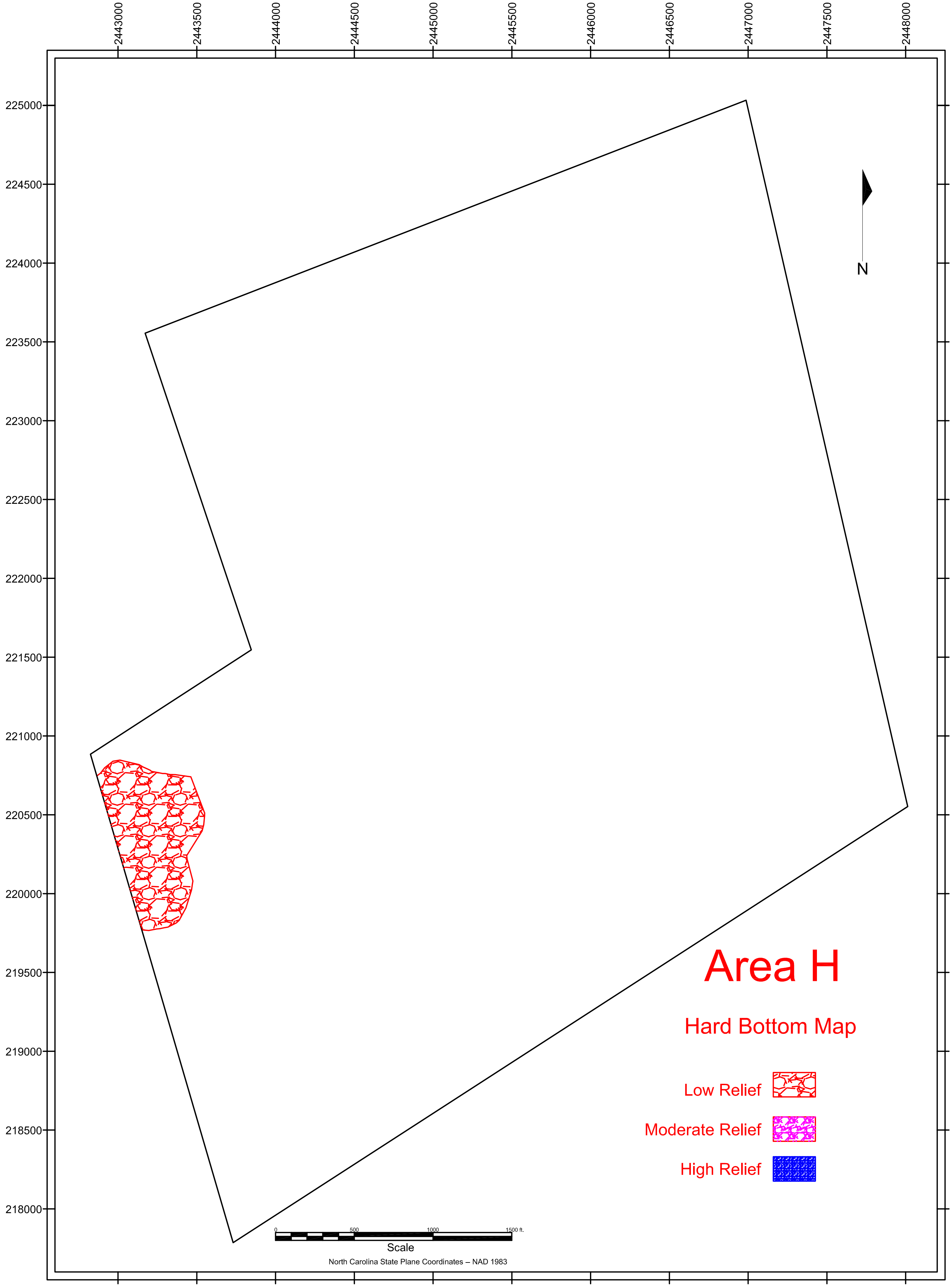


Figure 18. Area H Hard Bottom Map.

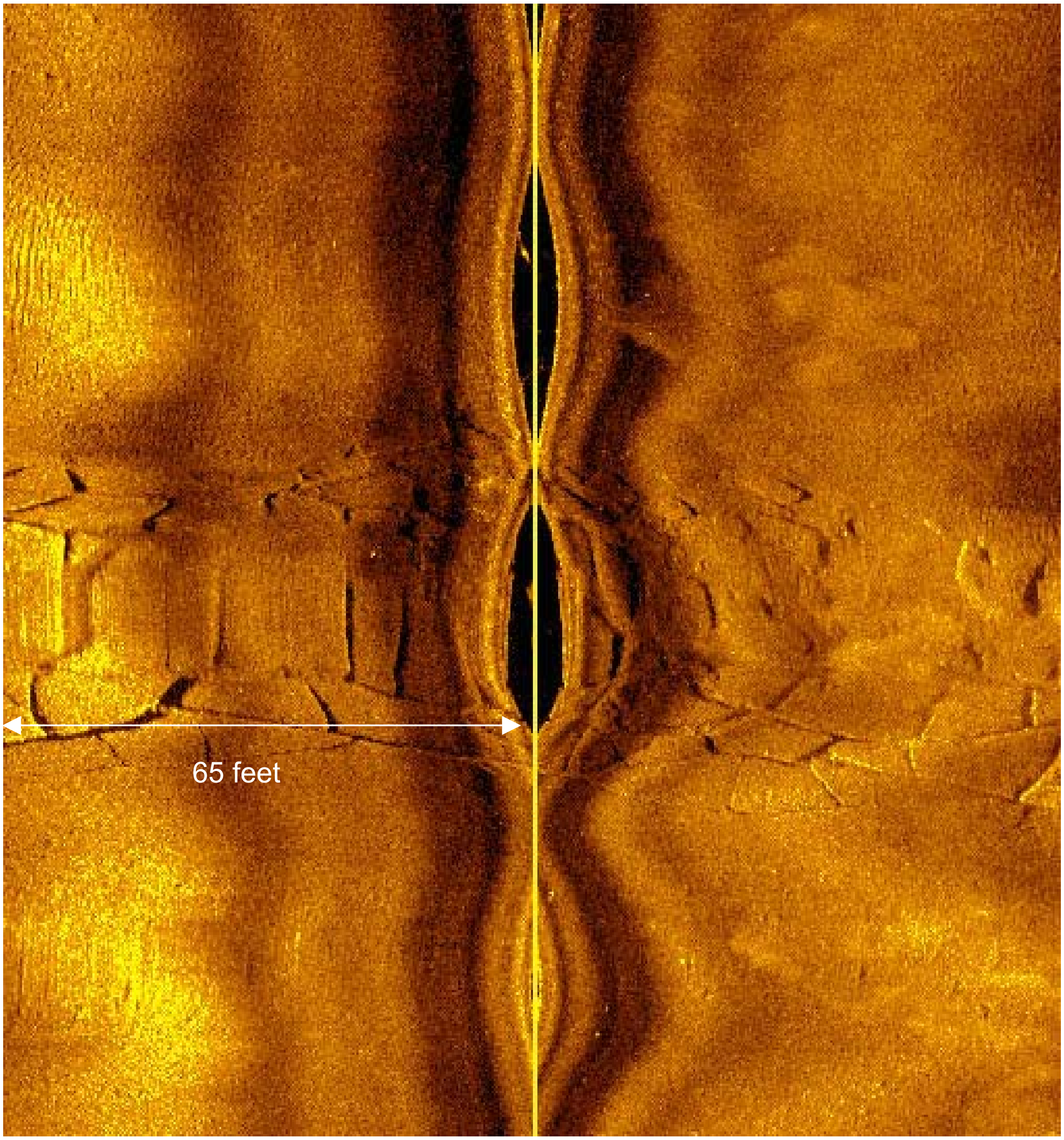


Figure 19. Sonar Imagine of Moderate Relief Hard Bottom in Area K.

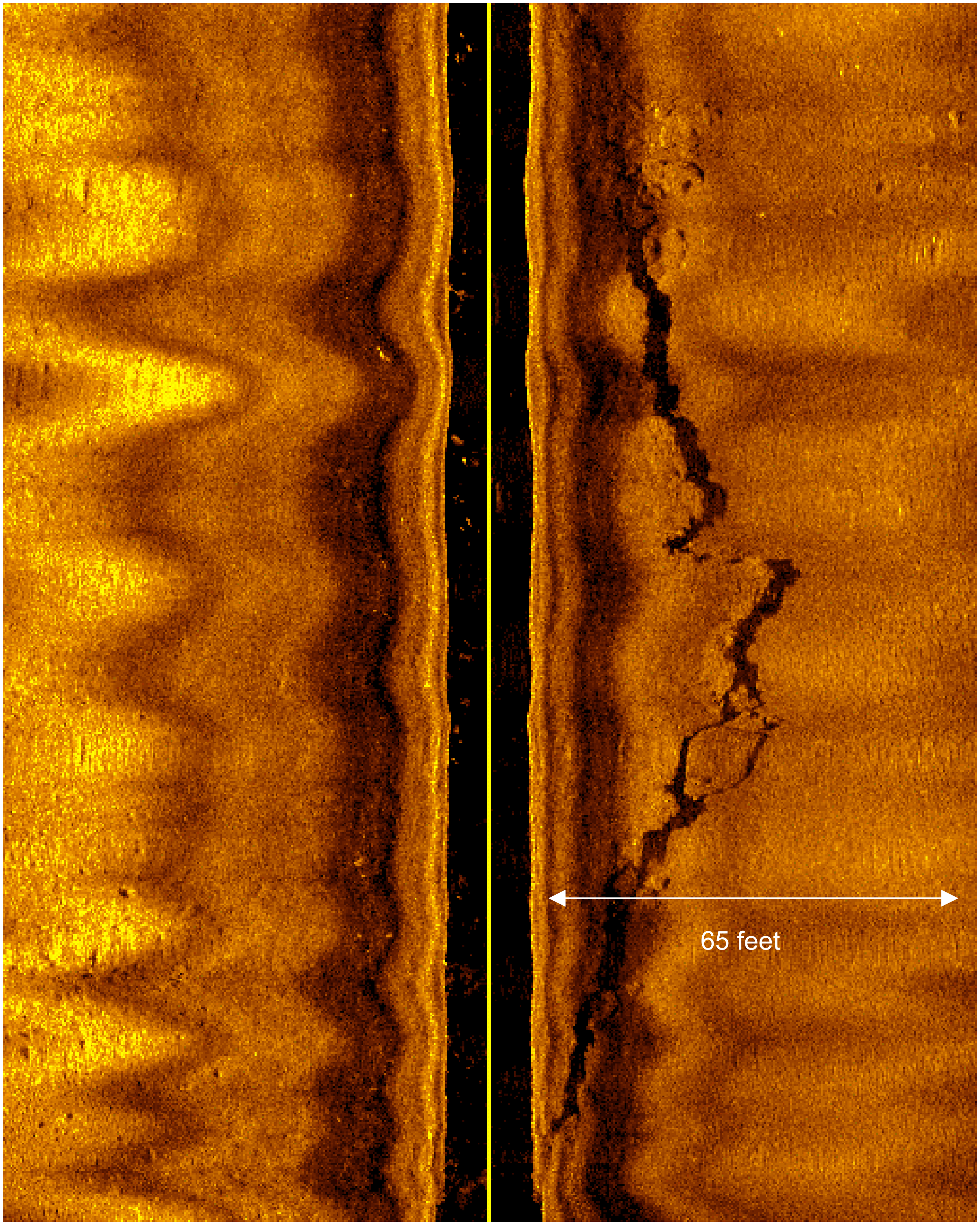


Figure 20. Example Sonar Image of Moderate to High Relief in Area K.

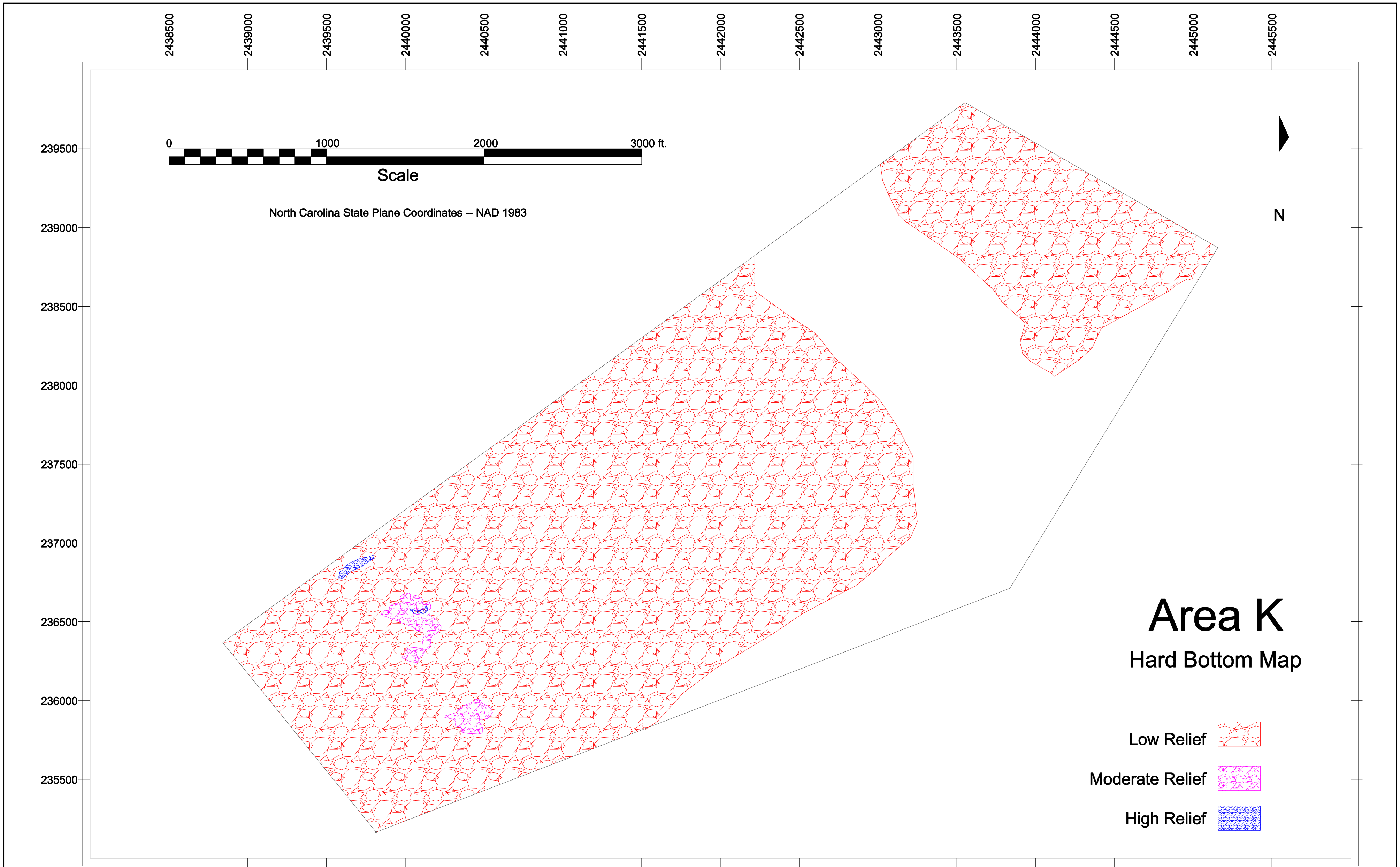


Figure 21. Hard Bottom Map of Area K.

E:\Fig11&21.dwg 11/24/2008 3:51:15 PM

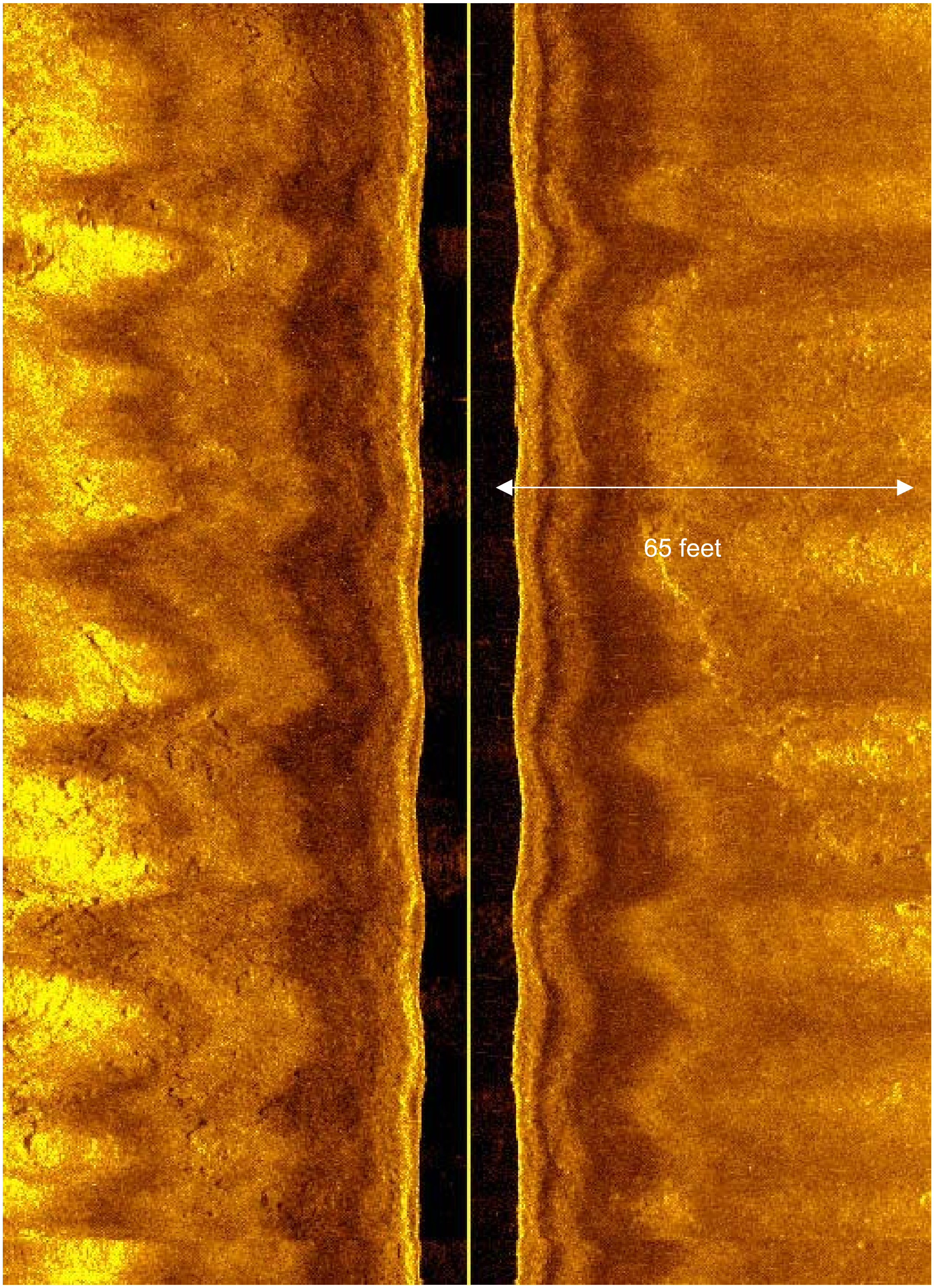


Figure 22. Example Sonar Image of Low Relief in Area LN1.

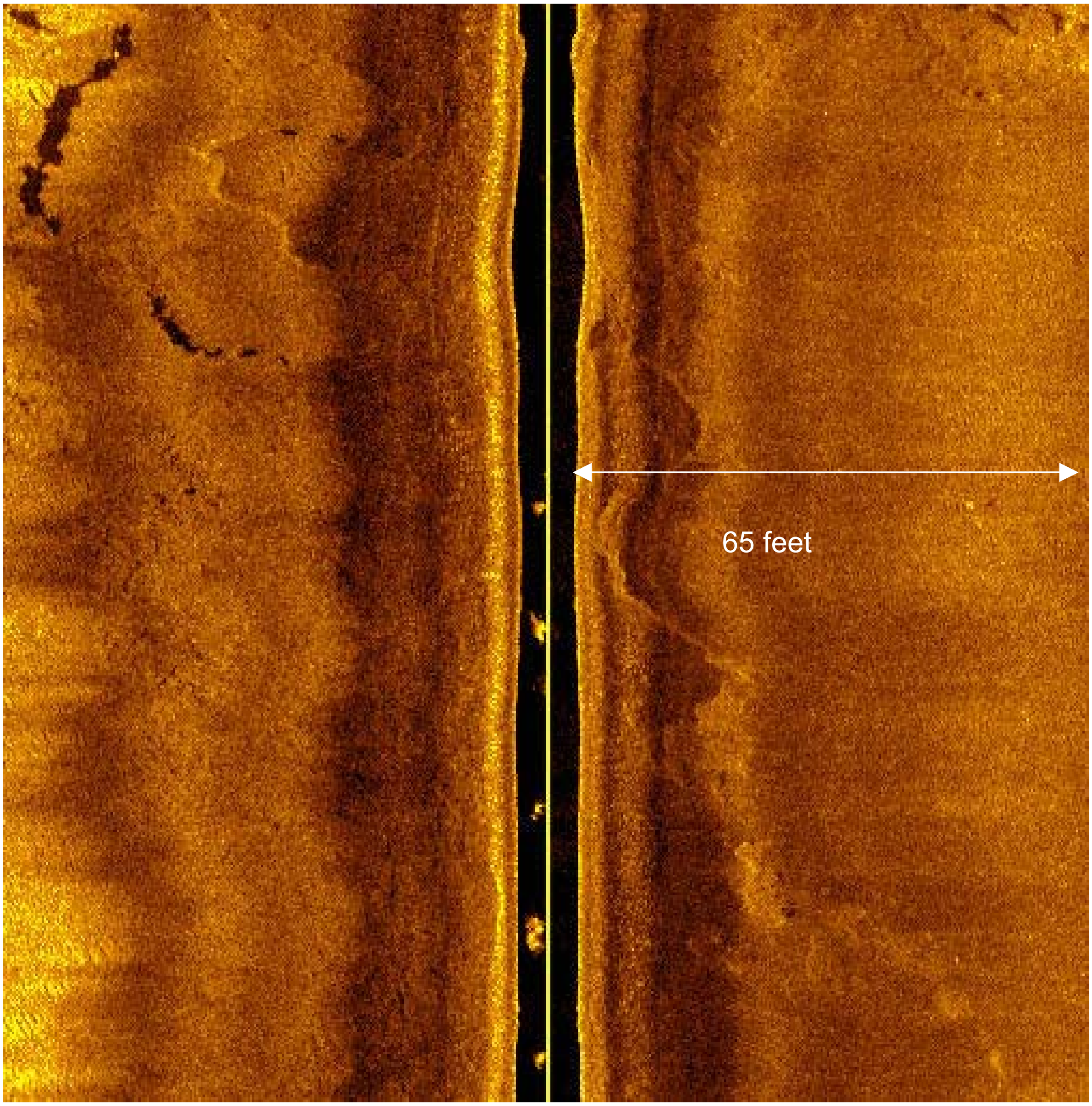


Figure 23. Example Sonar Image of Moderate Relief in Area LN1.

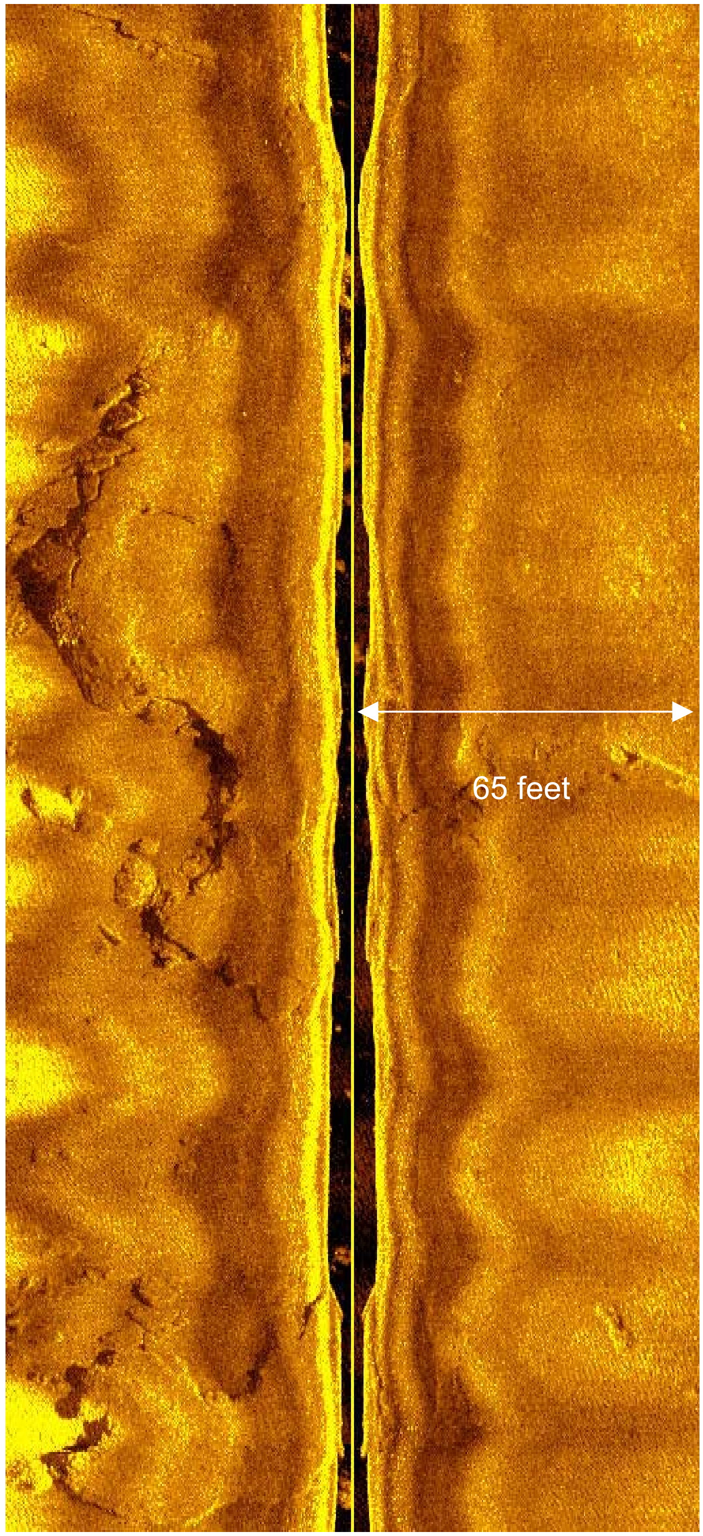


Figure 24. Example Sonar Image of High Relief in Area LN1.

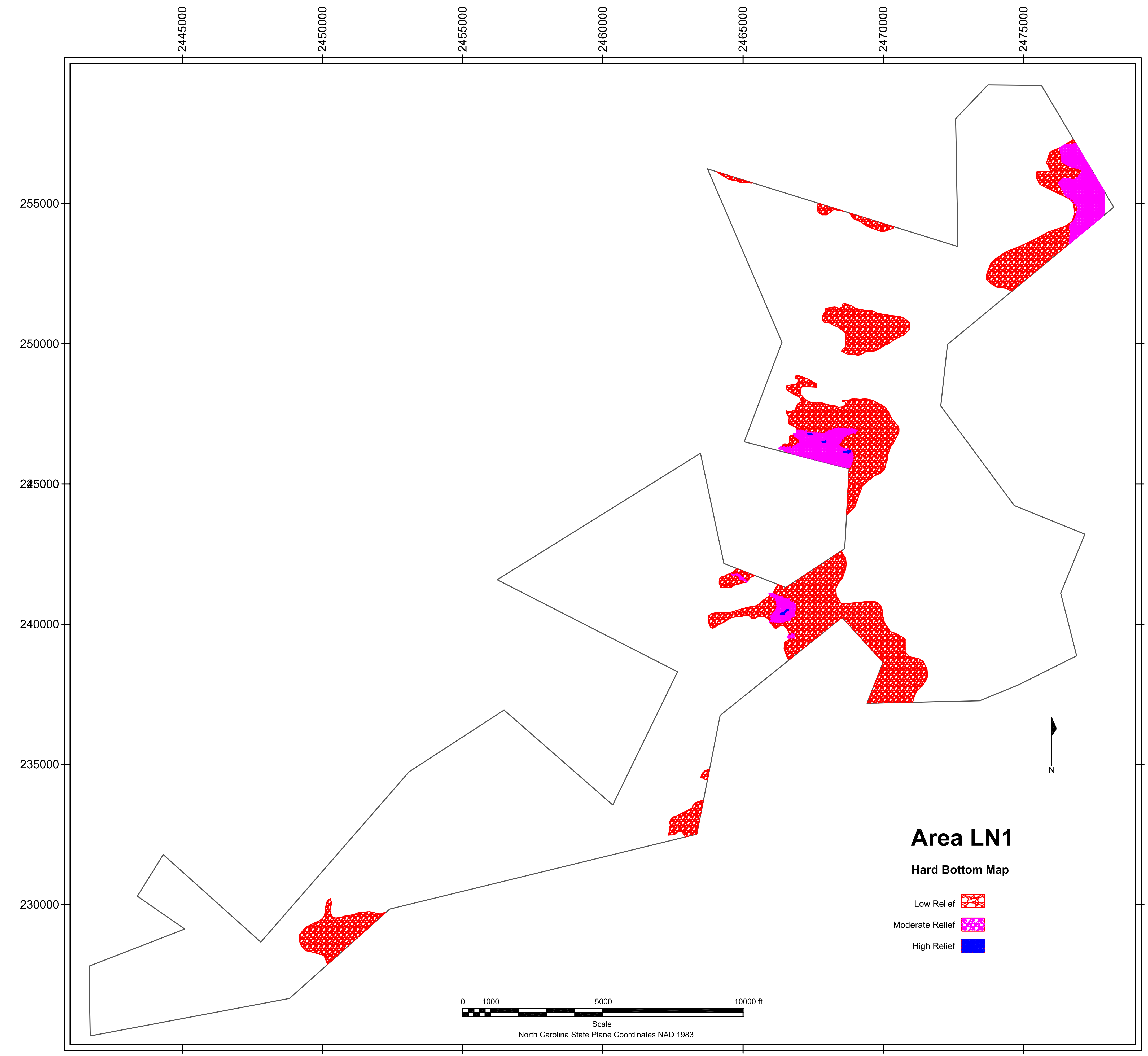


Figure 25. Hard Bottom Map of Area LN1.

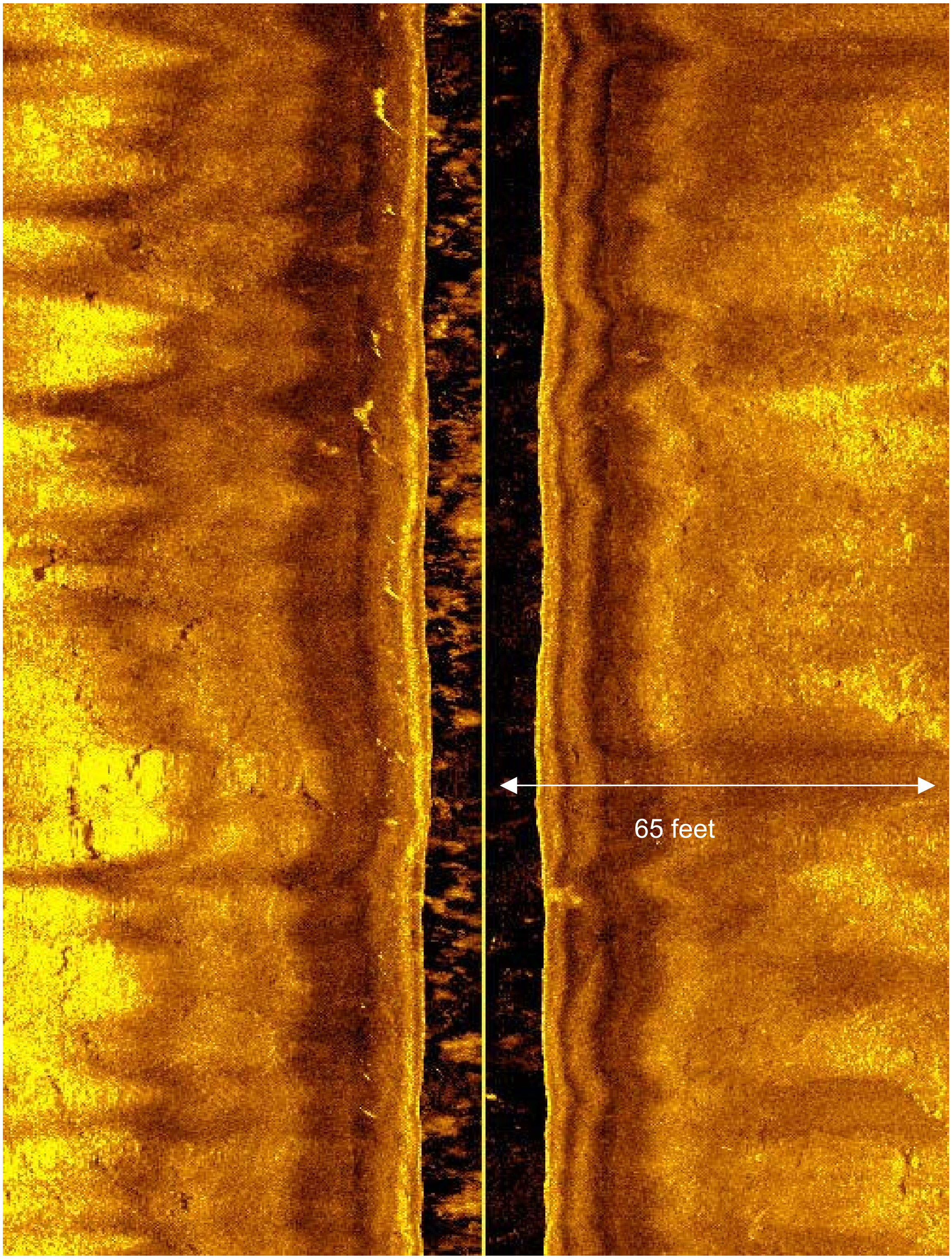


Figure 26. Example Sonar Image of Low Relief Area M.

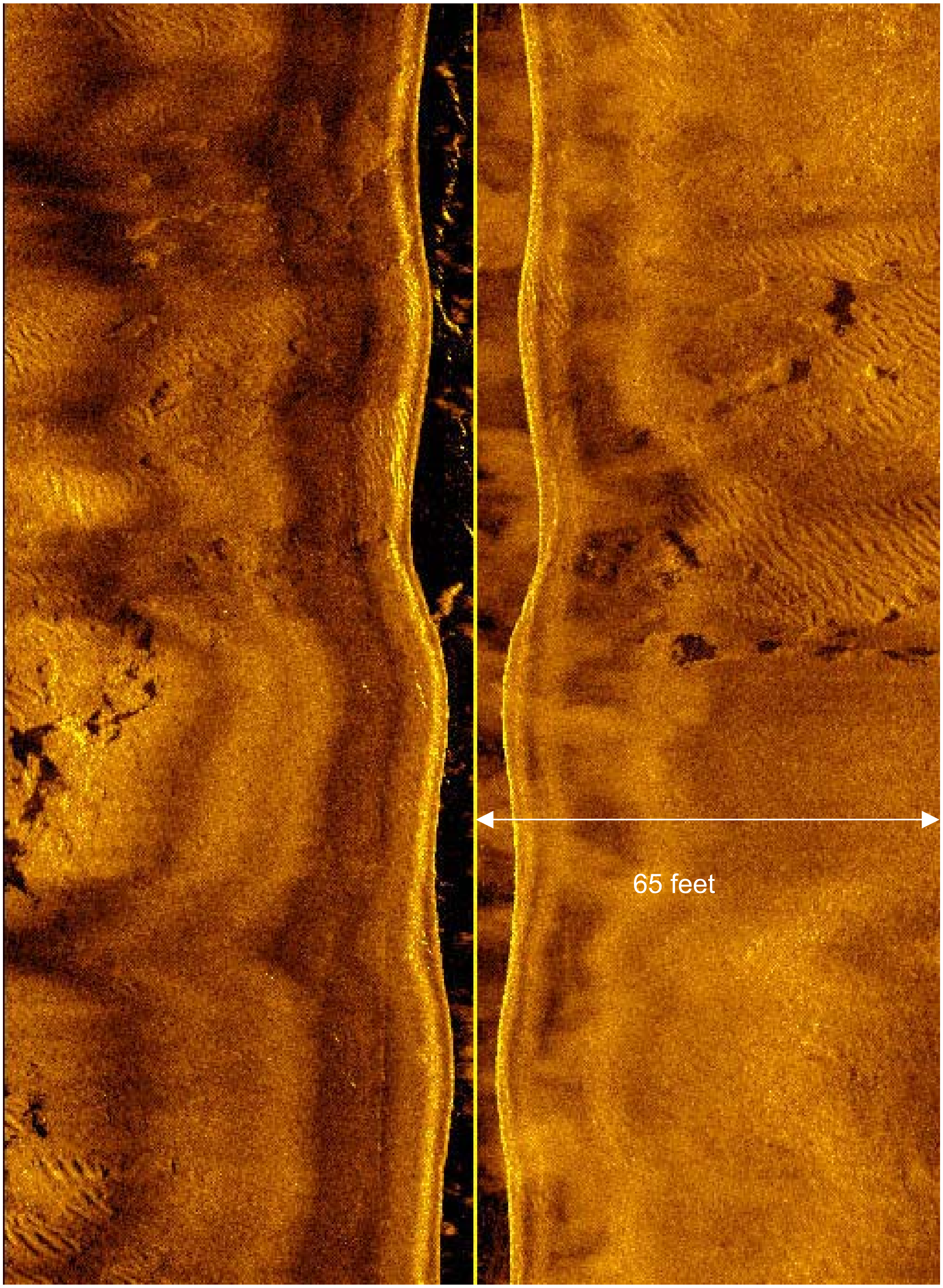


Figure 27. Example Sonar Image of Moderate Relief Area M.

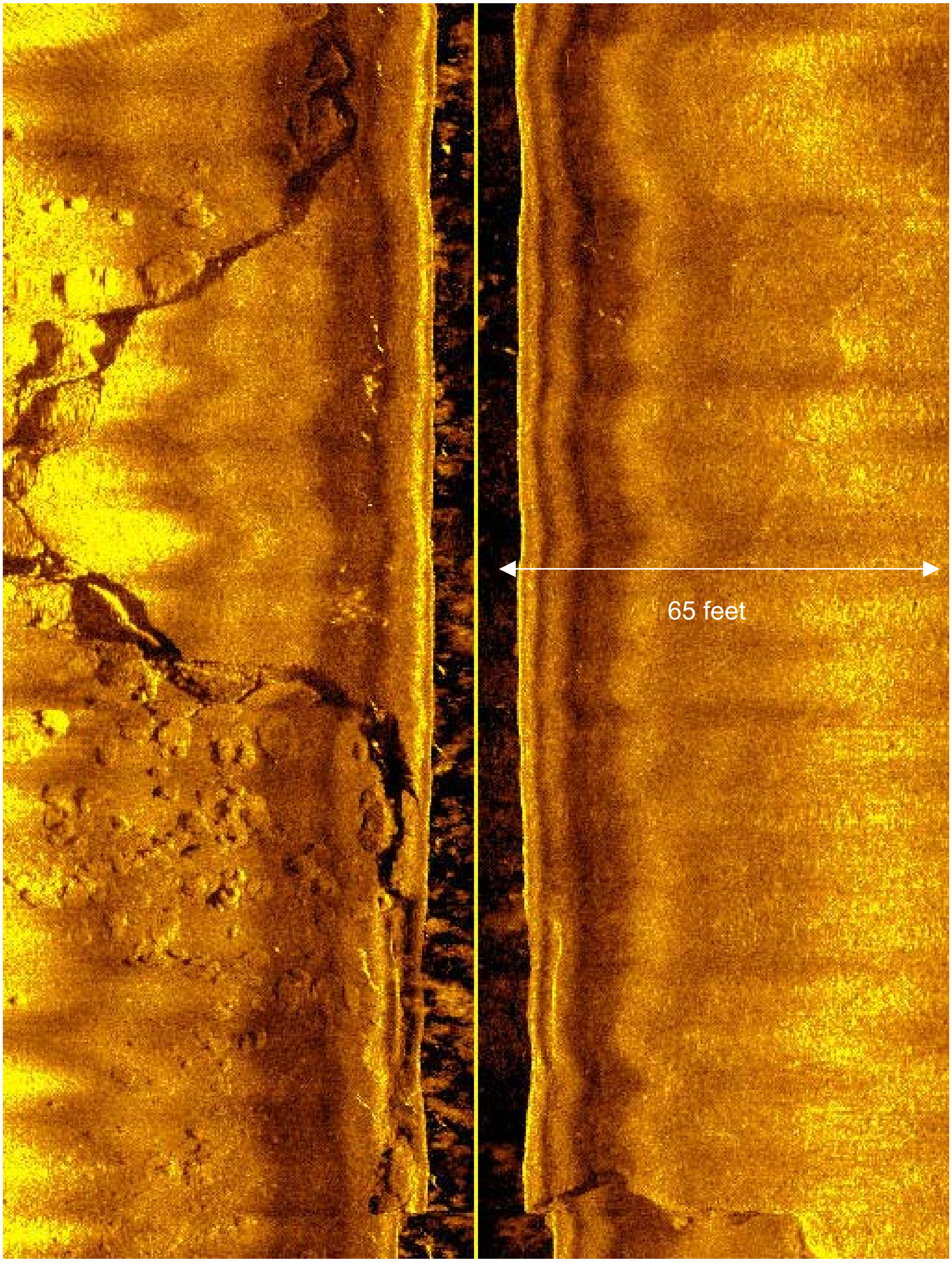


Figure 28. Example Sonar Image of High Relief in Area M.

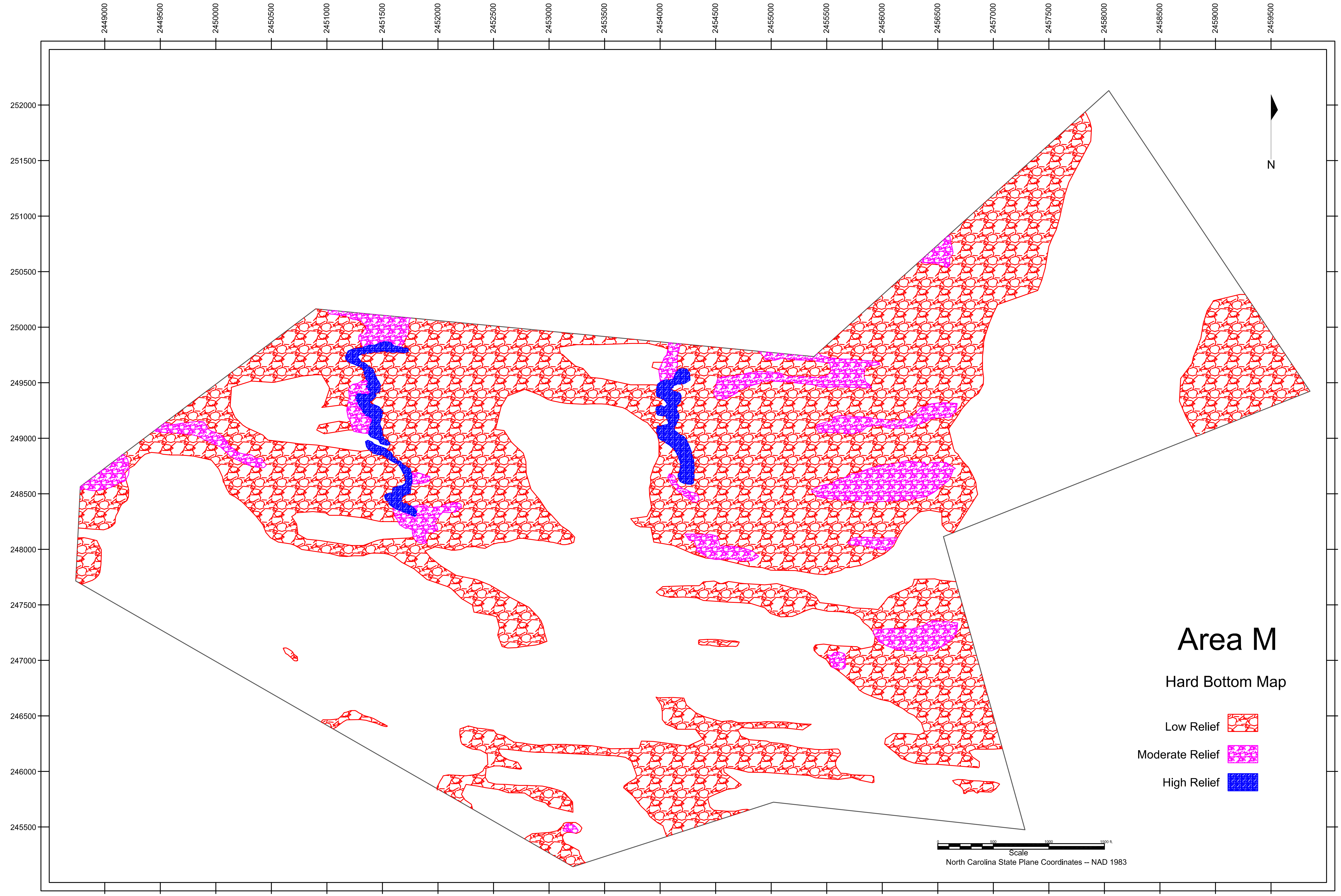


Figure 29. Area M Hard Bottom Map.

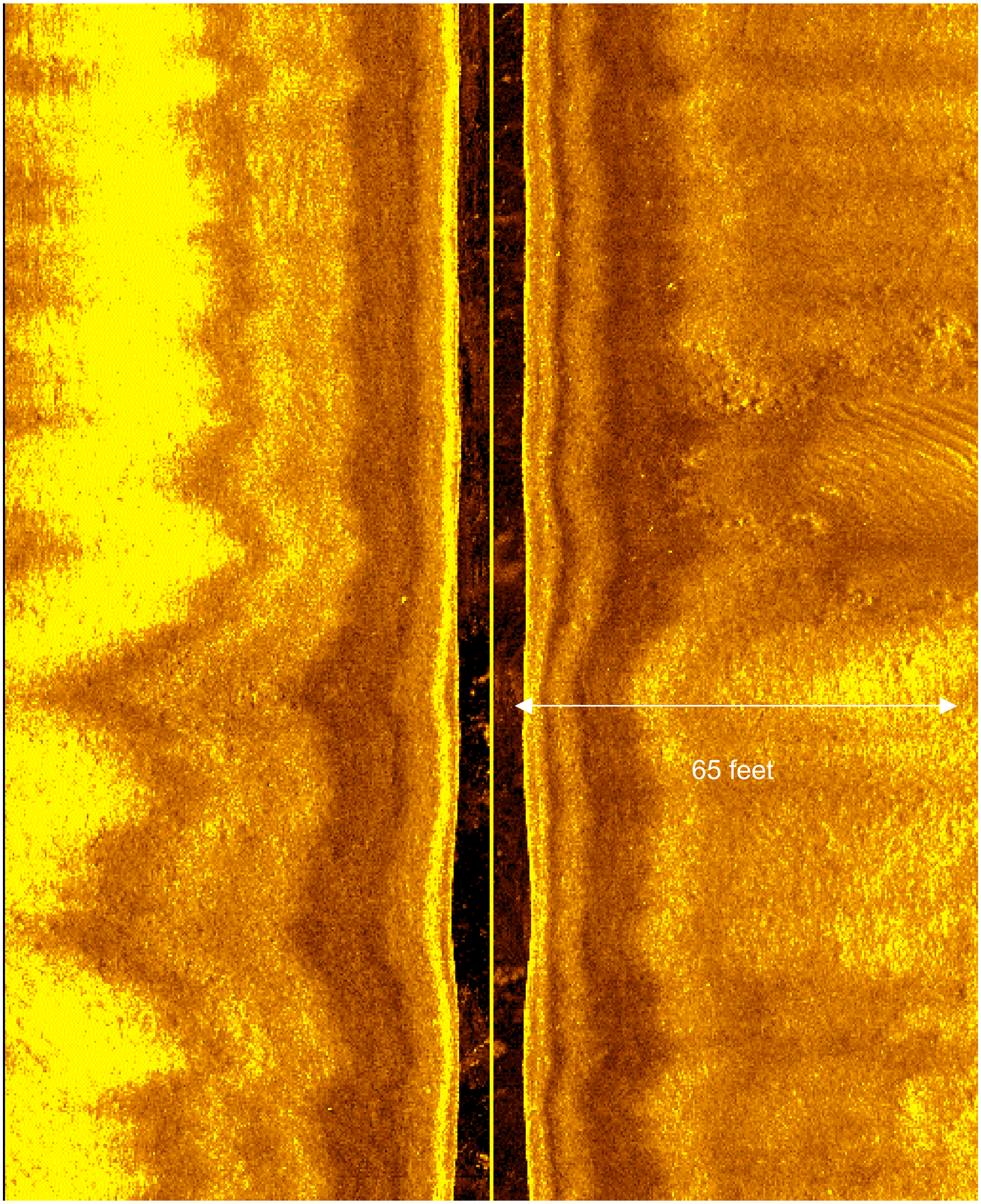


Figure 30. Example Sonar Image Low Relief in Area N2.

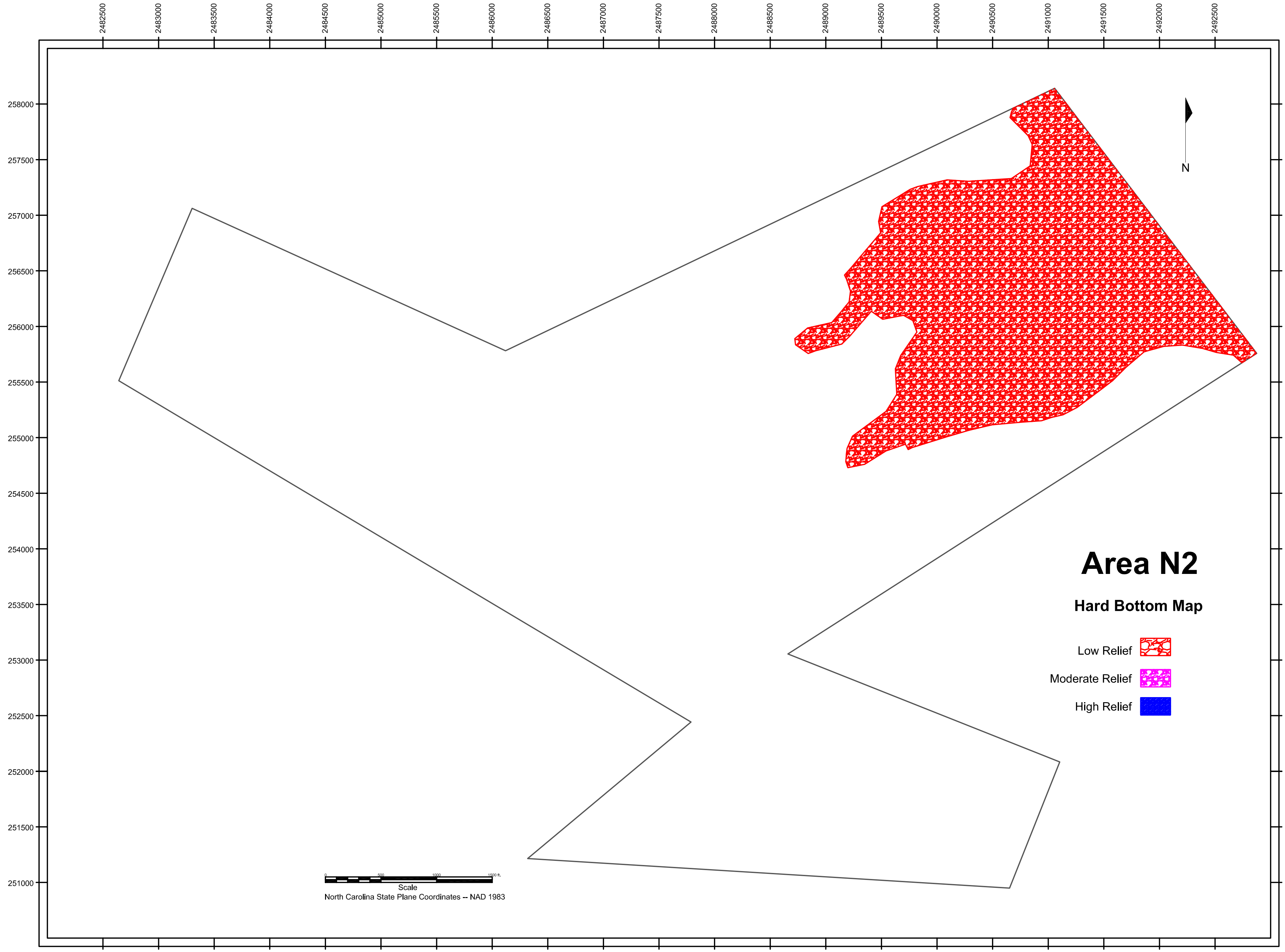


Figure 31. Area N2 Hard Bottom Map.

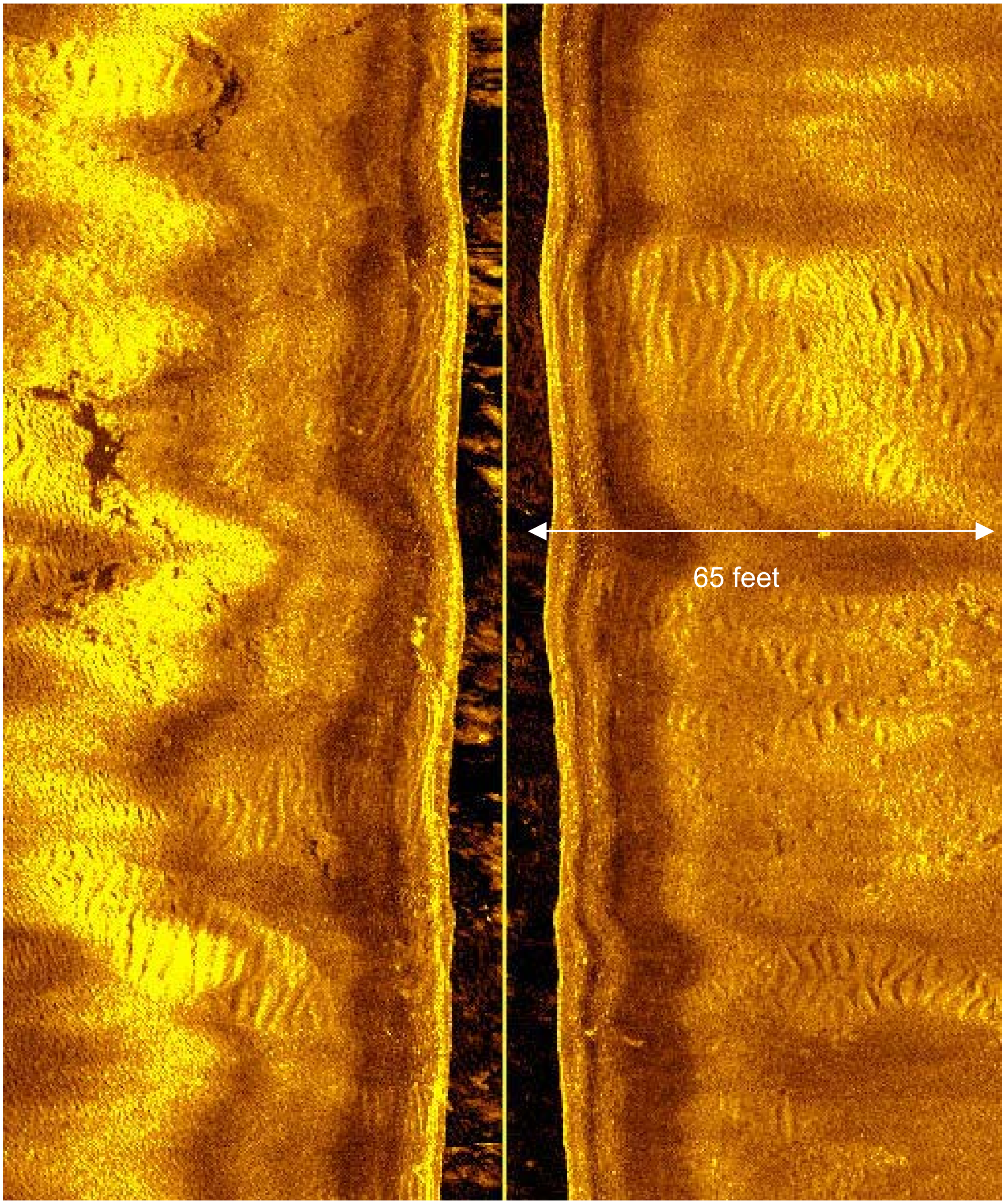


Figure 32. Example Sonar Image of Low to Moderate Relief in Area N3.

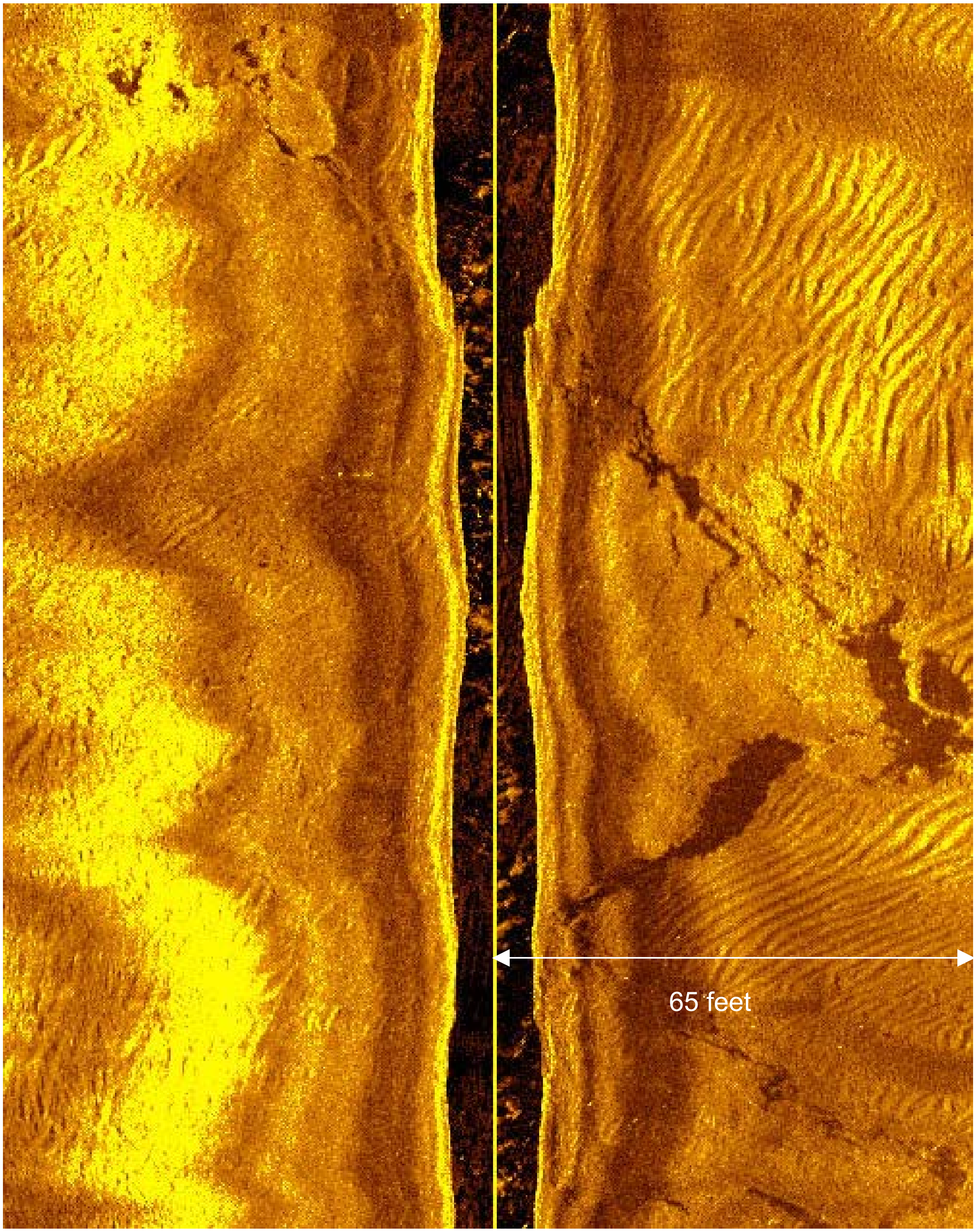


Figure 33. Example Sonar Image of Moderate to High Relief in Area N3.

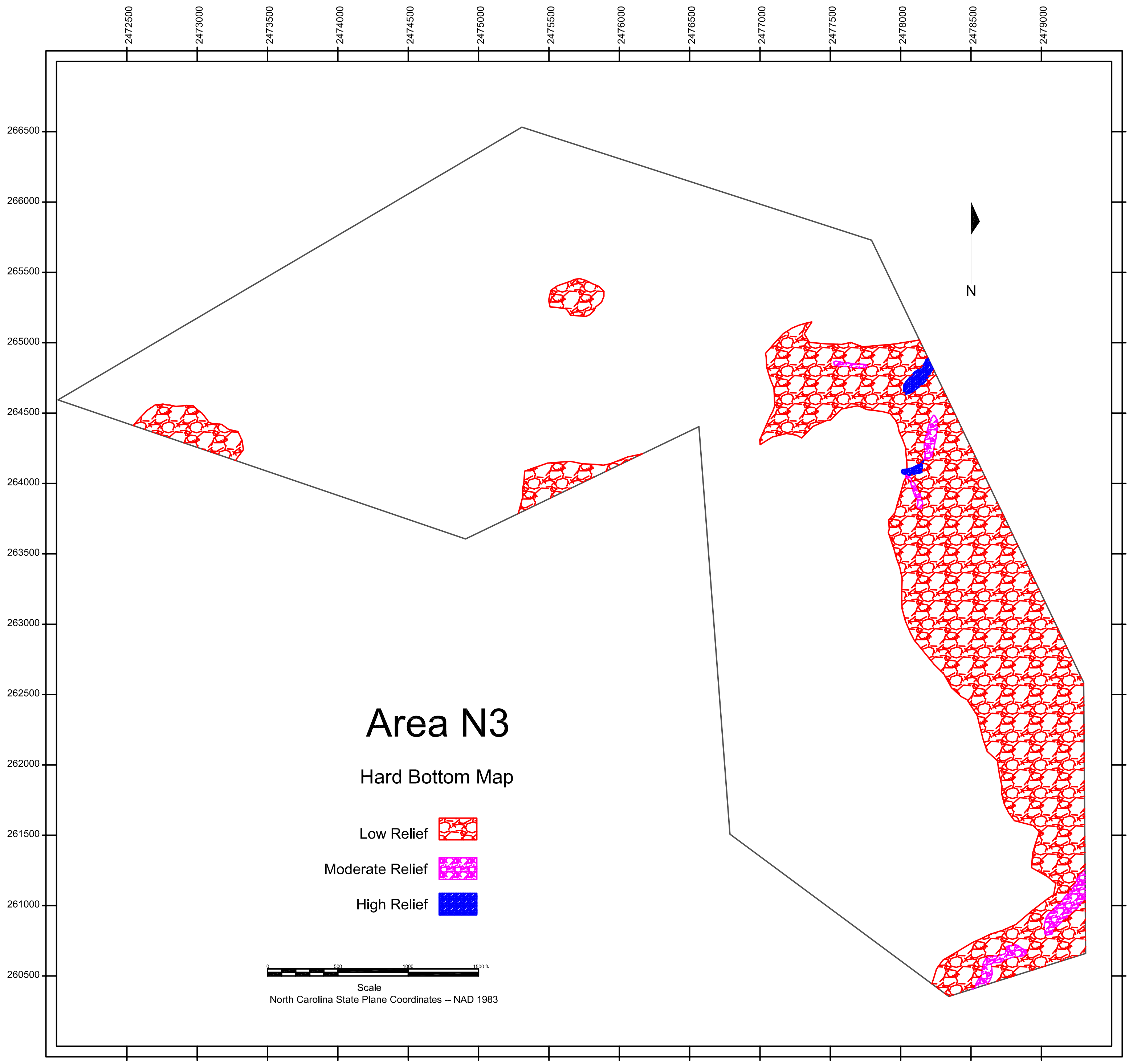


Figure 34. Area N3 Hard Bottom Map.

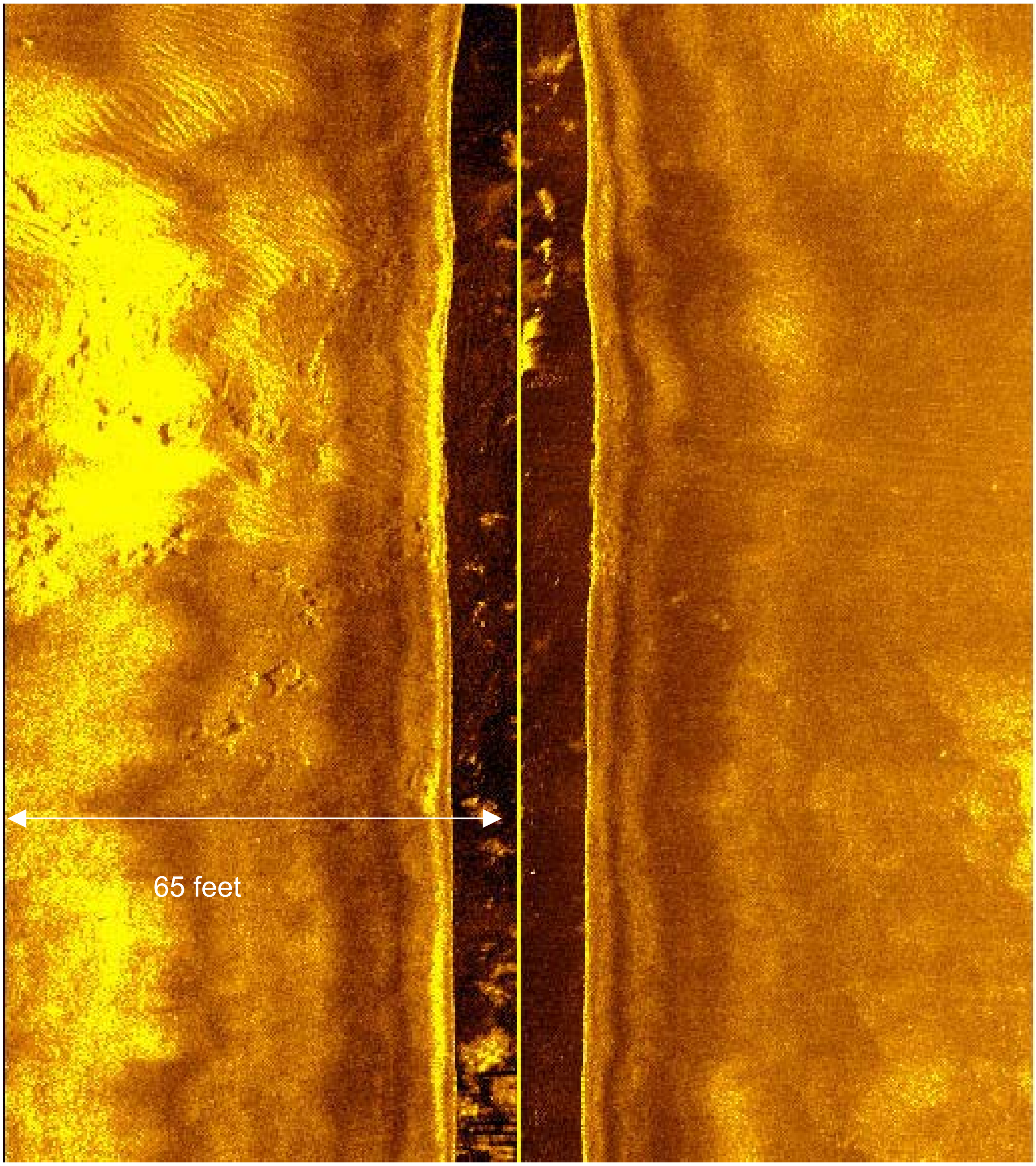
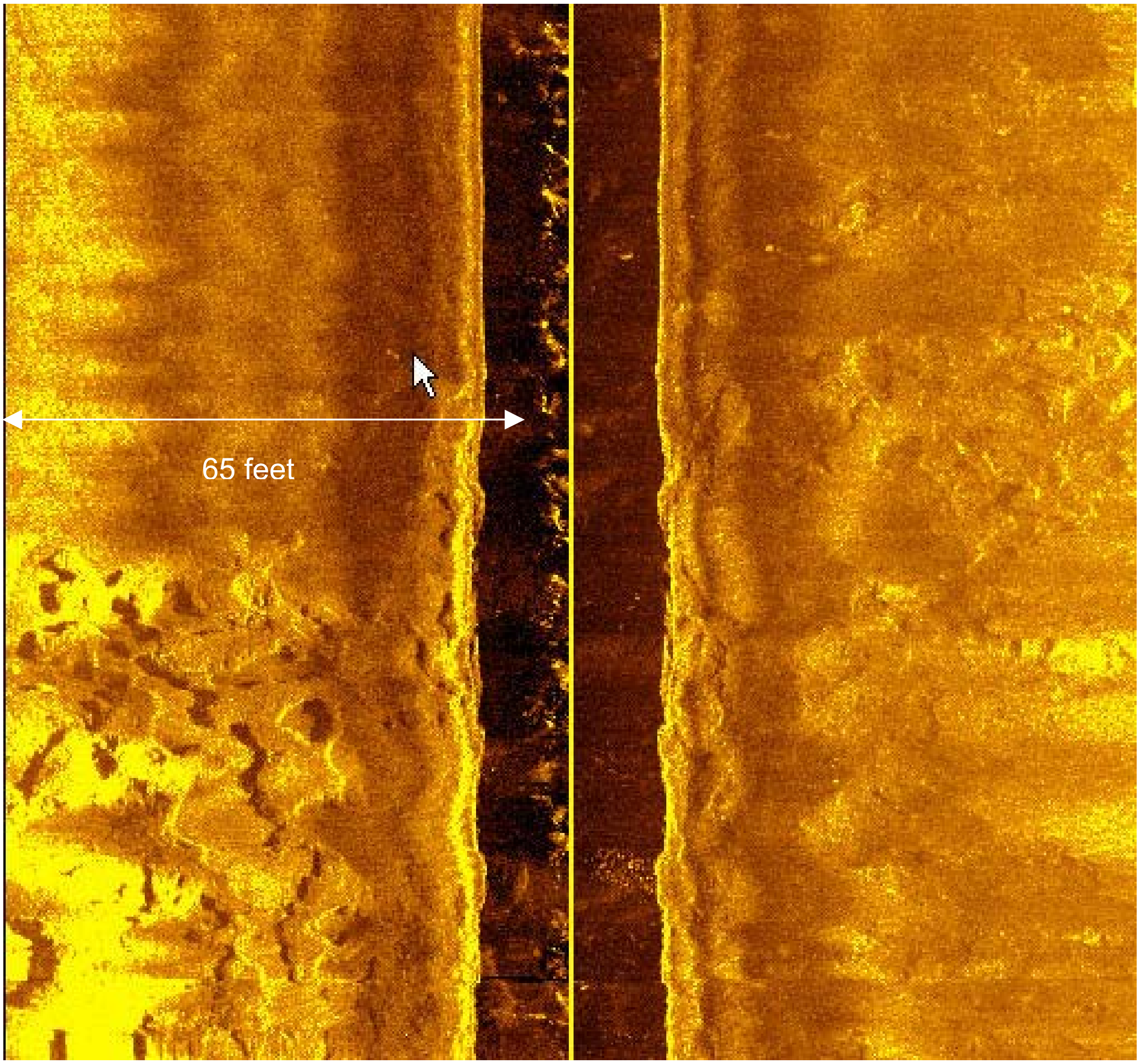


Figure 35. Example of Sonar Image of Low Relief in Area P.



z

Figure 36. Example Sonar Image of Moderate Relief in Area P.

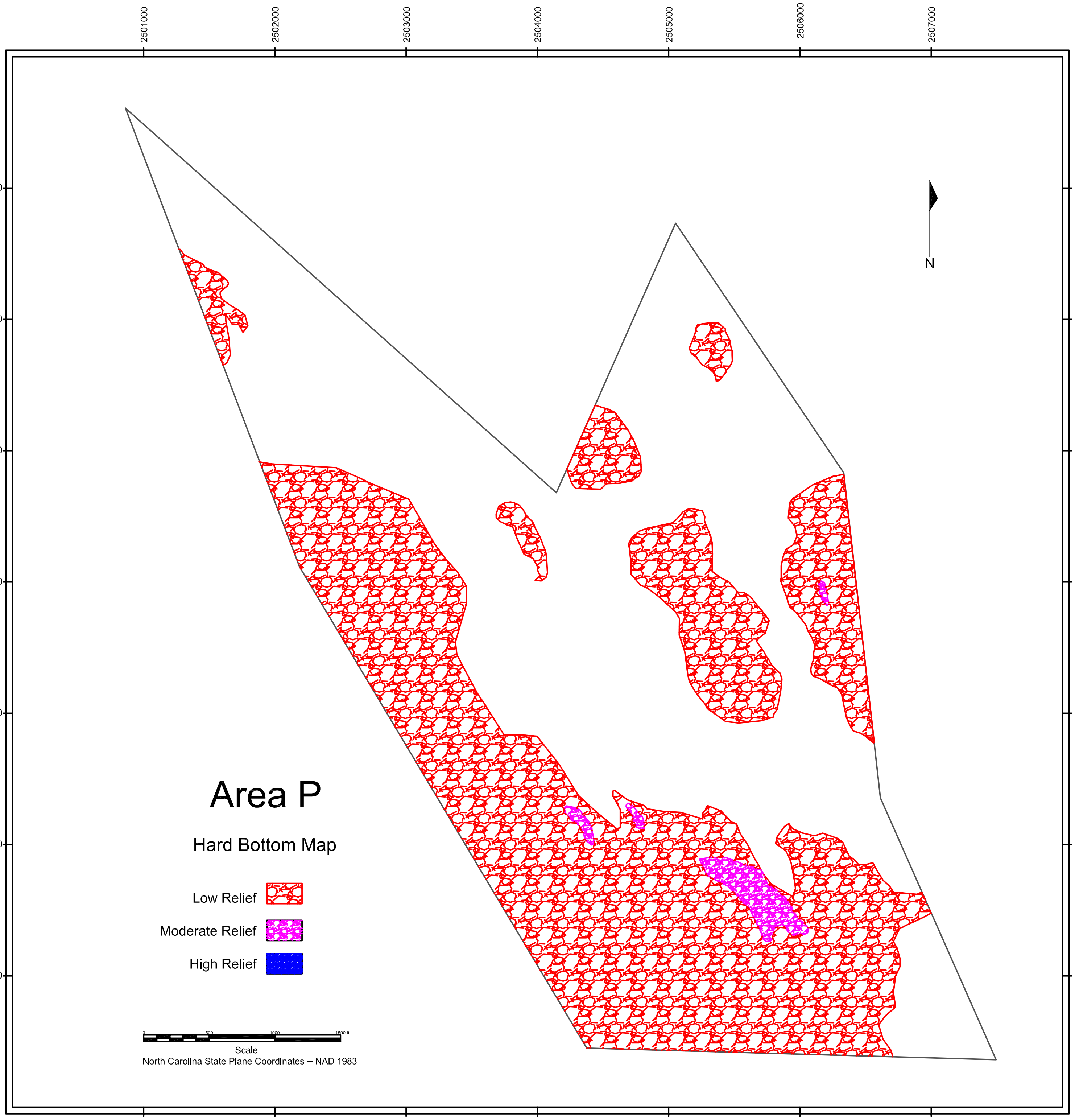


Figure 37. Area P Hard Bottom Map.

CONCLUSIONS AND RECOMMENDATIONS

The remote sensing survey identified no single-source magnetic anomalies or the acoustic targets within any of the seven proposed sand borrow areas. No additional archaeological investigations or actions are recommended.

Hard bottom ranging from low to high relief was found in each proposed borrow area. Appropriate action to avoid or mitigate sand mining impacts to these areas should be exercised.

REFERENCES

Angley, Wilson

1984 *An Historical Overview of New Topsail Inlet*. North Carolina Division of Archives and History, Raleigh, NC.

Stick, David

1952 *Graveyard of the Atlantic: Shipwrecks of the North Carolina Coast*. The University of North Carolina Press, Chapel Hill, NC.

Kimmel, Richard

1988 *Report of Magnetic Survey, New Topsail Inlet Borrow Area (New River Inlet, West Onslow Beach)*.

Tubby, Raymond

2000 *Historical and Archaeological Investigation of the 1750 Spanish Plate Fleet Vessel El Salvador*. Unpublished Masters thesis, East Carolina University.

Watts, Gordon P. Jr. et al.

1975 *Report of the Activities of the 1975 Field School in Underwater Archaeology*. Unpublished report by Underwater Archaeology Unit, prepared for the North Carolina Department of Cultural Resources and the University of North Carolina at Wilmington.