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UNDERWATER CULTURAL RESOURCES SURVEY OF THE HOUMA NAVIGATION CANAL, CAT ISLAND PASS CHANNEL REALIGNMENT, TERREBONNE PARISH, LOUISIANA

April 1998

FINAL REPORT

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In August 1997, a cultural resources remote-sensing survey was conducted in the Cat Island Pass Channel of the Houma Navigation Canal, in the nearshore Gulf of Mexico in Terrebonne Parish, Louisiana. The survey was conducted to locate and assess significant historic shipwrecks or other underwater cultural resources that may exist in the approximately 100 acre project area. The remote-sensing survey located a number of targets, four of which displayed characteristics similar to those of known shipwrecks. Diving to investigate these targets was conducted in November 1997. This examination revealed that none of the targets represented significant cultural remains.

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REPLY TO
ATTENTION OF:

April 22, 1998

Planning Division
Environmental Analysis Branch

To the Reader:

This report of investigations was designed, funded, and guided by the U.S. Army Corps of Engineers, New Orleans District, as part of our cultural resources management program. The report was completed as part of the Houma Navigation Canal, Cat Island Pass Channel Realignment Project, Terrebonne Parish, Louisiana.

We concur with the recommendations and commend the efforts of the authors. Louisiana's State Historic Preservation Officer has reviewed and concurred with the recommendations by letter dated March 6, 1998.

James M. Wojtala
Project Archeologist

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Final Report

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CHAPTER 1

INTRODUCTION

This report presents the results of a remote-sensing survey and diver investigations undertaken to locate and assess underwater cultural resources along a 2.7-mile-length of the Houma Navigation Canal (HNC), Cat Island Pass Channel Realignment, located in the nearshore Gulf of Mexico in Terrebonne Parish, Louisiana (Figure 1). The study was undertaken in response to the New Orleans District Corps of Engineers plans to realign this segment of the existing navigation channel. The realignment has become necessary to reduce the frequency of maintenance dredging caused by increased shoaling in the present channel. This shoaling is resulting from lateral movement and deposit of sediments from Timbalier Island, a barrier island located immediately east of the existing channel. Dredging will be required to remove the sediments, which will be placed in an existing ocean dredged material site west of the channel. A hydraulic cutterhead dredge will be used to establish the 18-ft-deep and 300-ft-wide navigation channel. The present survey was to investigate only the limits of the channel realignment which will be impacted by dredging activities.

Cat Island Pass has served as a navigation route connecting the Gulf of Mexico with the interior of the central coast of Louisiana through much of the historic period. In particular, the pass provided access to Terrebonne Bay and to Bayous Terrebonne, Grand Caillou and Petit (or Little) Caillou which were, and still are, regionally important water routes leading inland. Several shipwrecks are known to have occurred in the general area of the pass, and unreported wrecks likely exist. Primarily because of the possibility of shipwrecks occurring in the Cat Island Pass area, the New Orleans District undertook the survey and investigations reported here in compliance with their responsibilities in various Federal laws and regulations; particularly 36 CFR 800, the regualtions governing Section 106 of the National Historic Preservation Act of 1966.

This study involved background historical research, a remote-sensing survey and diver investigation of several targets discovered during the survey. The primary instruments used in the remote-sensing survey were the proton precession magnetometer, side-scan sonar and fathometer. In the last two decades these instruments have become standard components in the array of equipment used in searching for shipwrecks. Later sections of this report provide details on this equipment and the conduct and results of the study. It is important to recognize that these instruments, in general, can most easily detect larger historic craft such as steamboats, seagoing ships, large fishing boats, etc., particularly those containing large quantities of ferrous metal. Smaller boats or other cultural materials without iron elements, may exist as wrecks or resources in the study area; however, they are much more difficult to locate and identify.

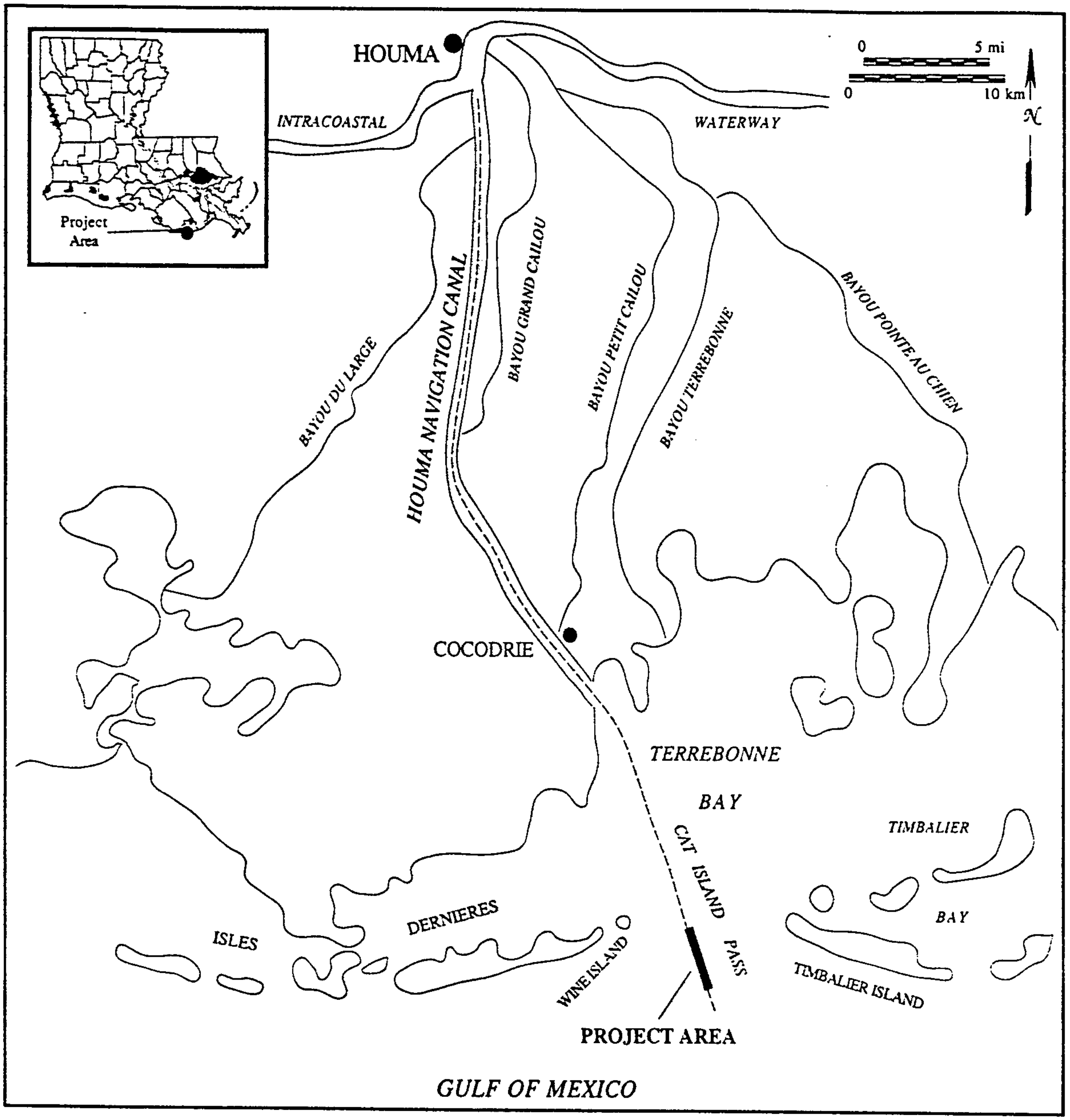


Figure 1. The location of the Cat Island Pass project area.

In conjunction with the remote-sensing survey, data on the geological history and shipwreck potential of the project area were collected. This information provided a background against which the results of the remote-sensing data could be interpreted. Interpretation relied on the information available on vessel losses in the project area and on past impacts that natural and man-induced activities may have had on wrecks in the HNC. Identification and evaluation of these impacts were derived, in part, from assumptions about various effects that these forces would have on a sunken vessel. Interpretation of remote-sensing data also drew upon the available literature on similar shipwreck surveys. Each of these factors are discussed in the following chapters.

The data developed in this study provide the New Orleans District with knowledge of the cultural resources potential of the project area. In addition, it is hoped that the information provided here will serve as a contribution to the broader area of the District's overall management of cultural resources. This study also provides a contribution to the expanding body of literature dealing with the application of remote sensing survey in the search for shipwrecks.

The Project Area

The project area consists of the proposed channel realignment of the HNC, Cat Island Pass from Mile -0.9 to Mile -3.6, COE C/L Station 2000+00 to C/L Station 2145+00 (see Figure 1). The Cat Island Pass Channel is situated between Timbalier Island to the east and Wine Island to the west, historically part of the Isles Dernieries (Last Islands). These land masses form the barrier island system between Terrebonne Bay and the Gulf of Mexico. The navigation channel in this area is maintained by dredging to a depth of 18 ft and a width of 300 ft. In the following discussions the terms survey corridor, survey area and project area are interchangeable and refer specifically to the 300-ft-wide segment of the navigation channel examined, an area measuring approximately 100 acres.

The remote-sensing survey recorded over 20 targets in the project area, but only four of the magnetic and side-scan sonar targets are of particular interest. Most of the 20 targets can be identified as discrete pieces of modern debris and trash, dumped or lost overboard from the many commercial and recreational boats and barges that have traveled the HNC. Four targets, designated as 1, 5, 2 and 6, because of their magnetic and/or side-scan sonar characteristics, were deemed worthy of further study. Diving operations were undertaken to examine these four targets, none of which proved to be significant cultural resources. Detailed discussions on all of the conduct and findings of the survey and diving are provided in later sections of the report.

Previous Archaeological Research

Several cultural resources studies have been undertaken in the general vicinity of the project area. Most of these involved examination of nearby land and marsh areas; relatively few studies designed specifically to locate underwater cultural materials have been conducted in the region. Weinstein (1987) conducted a survey along Bayou Mauvais Bois in the Terrebonne Parish marshes west of the project area. This study involved investigations along two proposed pipelines and located several prehistoric shell middens. Heartfield, Price and Greene, Inc. (1989) conducted a survey for Tenneco Gas for a proposed pipeline near the juncture of Bush Canal and Bayou Terrebonne that revealed no cultural resources. Two cultural resources surveys (Castille 1983; Castille and Holmes 1983) were undertaken in the city of Houma to assess historic sites and standing structures along Bayou Terrebonne for a proposed bridge corridor. These studies identified 283 historic structures, several dating to the middle and late 19th century. Many of the structures are associated with the oyster and shrimp canning/packing industry of Houma. Many structures were located along Bayou Terrebonne on East Main Street and East Park Avenue, an area of much watercraft activity in the late nineteenth century and early twentieth centuries. A cultural resources investigation of a portion of Bayou Grand Caillou by Flayharty and Muller (1983) located 69 derelict vessels along the bayou. A magnetometer was used in the survey, but no significant anomalies were recorded. Flayharty and Muller noted that local informants knew of submerged watercraft; and that the negative remote sensing results were probably due to the fact that most, if not all of these craft, were of mostly wooden construction. Two recent investigations have dealt with watercraft documentation in the region (Robinson and Seidel 1995; Stout 1992). While these studies were not in the project area, the variety of vessels documented represent the same types that traveled along the coast and through the project area.

A large number of remote-sensing surveys have been undertaken offshore in the coastal waters of Louisiana in relation to activities associated with oil and gas exploration and production. Gagliano (1978) reported on a survey in the West Cameron Area, which is outside the project area, but used essentially the same types of investigative methods to locate submerged cultural resources. In addition to the magnetometer, side-scan sonar and bathymetric instruments, a sub-bottom profiler was utilized to evaluate relict landforms to identify possible drowned terrestrial sites. One potential site, a suspected buried archaeological deposit, was located, but no shipwrecks were identified during the survey. Several magnetic anomalies were recorded, but they were associated with pipelines and offshore platforms. Another remote-sensing survey to the east of East Timbalier Island involved the evaluation of cultural resources for an offshore oil port marine facility (Gagliano et. al. 1978). This survey used the same array of instruments as the previously mentioned study, with the addition of divers, who examined several magnetic anomalies and took core samples along the pipeline right-of-way. None of the recorded magnetic anomalies were considered historically significant due to the fact that the "seafloor in the survey area is criss-crossed by pipelines and littered with debris related to the offshore mineral extraction industry" (Gagliano et al. 1978). It was further noted in the report that operations associated with the mineral extraction industry tended to leave materials scattered around activity areas. It was determined that, typically, a field of discarded and lost trash and debris extended for about 2000 ft around drilling vessels or platforms. Along pipelines and communication cables debris was found in an area typically 1000 to 1500 ft wide.

In 1984, Floyd and Stuckey reported on a remote-sensing survey conducted to determine the location of seafloor or subbottom hazards to construction of a 10-inch pipeline for Texas Gas Transmission Corporation. The instruments used in this survey were a magnetometer, side-scan sonar and a subbottom profiler. The pipeline route was in Blocks 2 and 9, south of Isles Dernieries and west of Cat Island Pass. Eleven magnetic anomalies were located; but all ranged from 15 to 24 gammas with very brief signature widths, suggested the anomalies "represented debris discarded during prior construction activities in this rather congested production field" (Floyd and Stuckey 1984).

The project area is included in a broad discussion of the prehistoric and archaeological potentials of the Gulf of Mexico by Coastal Environments, Inc. (1977), although no specific information on the Cat Island Pass area is given. Also, the region is considered by Pearson et al. (1989) in a general study of the history of waterborne commerce and shipwreck potentials within the New Orleans District. The project area was not considered specifically in this study and the navigation history of the immediate area was only minimally discussed. That study did, however, note the existence of several reported historic shipwrecks in the general vicinity of Cat Island Pass.

CHAPTER 2

ENVIRONMENTAL SETTING

The project area is located in the Mississippi River delta plain of Louisiana. The delta plain includes the lower portion of the present river, its present delta and areas occupied by former deltaic systems of the river. This is an area characterized by both fluvial and deltaic features, such as natural levees; abandoned and relict distributaries; interdistributary basins, vast areas of saline, brackish and fresh marshes; large saline and brackish bays; and coastal lakes, beach ridges and barrier islands. The project area, specifically, is situated in the modern barrier island zone of the deltaic plain. Cat Island Pass is a shallow water pass extending between two barrier islands, Timbalier and Wine Island, historically part of the Isles Dernieries (Last Islands). Today, Wine Island is almost completely gone, exposed primarily during periods of low water. The pass connects the Gulf with the western end of Terrebonne Bay. The two primary streams that empty into this portion of Terrebonne Bay are Bayou Petit Caillou and Bayou Terrebonne. Historically, these bayous connected the inland port community of Houma and other smaller communities, plantations and farms with the Gulf through Cat Island Pass. While these bayous continue to be used by recreational and some commercial traffic (primarily shrimp and fishing boats), much of the commercial traffic now travels along several navigation canals constructed in this century.

Geology

The Mississippi River delta plain is a massive wedge of alluvial and deltaic sediments extending for almost 320 km miles along the coast of Louisiana and over 100 km inland. Its geologic history is related to a sequence of episodes of delta building and deterioration resulting from the progradation and subsequent abandonment of the present and former Mississippi River courses and deltas over the past 9,000 years or so. Thus, the Mississippi delta plain is a composite geomorphic feature consisting of numerous coalesced delta complexes which themselves are composed of numerous smaller units, commonly referred to as delta lobes. The surface morphology of each delta plain and lobe is similar, consisting of a network of distributaries that radiate out from an abandoned or active trunk channel and are separated by interdistributary troughs consisting of vast areas of marsh, swamp, ponds and lakes.

Between about 9,000 years ago and the present, the Mississippi River built several delta complexes, each consisting of several delta lobes. The delta complexes represent major shifts in the course of the Mississippi River. Drawing from Frazier's (1967) earlier work, and relying on recent archaeological data, Weinstein and Gagliano (1985:Fig. 1) have identified the following major delta complexes from oldest to youngest: Maringouin, Teche, Metairie, LaLoutre (St. Bernard), Lafourche-Terrebonne, Plaquemines and Belize, the modern delta complex (Figure 2).

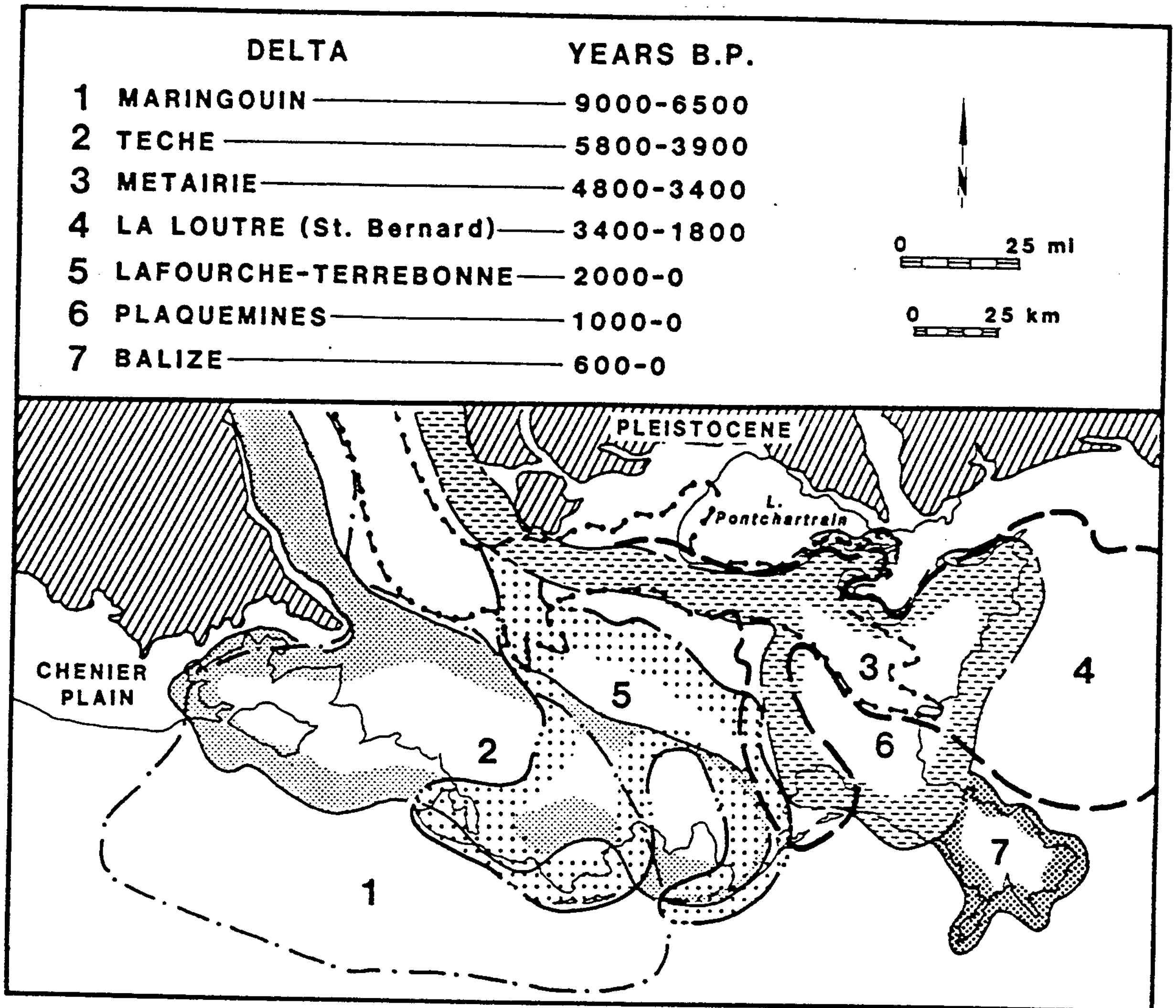


Figure 2. Mississippi River deltaic complexes (source: Weinstein and Gagliano 1985:Fig. 1).

This process of deltaic development over time and space establishes the framework for barrier island development. The advance or retreat of shorelines is caused by the change in balance between rates of sediment deposition and effects of subsidence and erosion by the sea. Deltas and shorelines advance at the mouths of active streams which transport sediments seaward. Erosion occurs near the mouths of inactive streams which cannot transport sufficient sediment to sustain their position (Gagliano et al. 1975:9-15). Barrier islands are formed along delta margins as a delta lobe goes through deterioration after abandonment. As a delta lobe is abandoned and the deltaic surface begins to submerge through subsidence, the sand deposits that had been distributed along the delta margin often remain as a series of barrier beaches or barrier islands, separated from the retreating delta shoreline by a shallow bay or estuary (Williams et al. 1992). With continued subsidence, the barrier sediments become subject to redistribution, characterized by an inland migration of the island coupled with loss of sediment and a decrease in the size of individual islands.

The Cat Island Pass project area is associated with the abandoned Lafourche-Terrebonne delta complex (Figure 2) and the barrier systems of the Timbalier Islands and the Isles Dernieries represent the islands formed as the delta complex has retreated. The most recent geological evidence indicates that Lafourche-Terrebonne delta complex began as a distributary (present day Bayou Lafourche) off the main trunk of the Mississippi River approximately 1500 years ago (Tornquist et al. 1996). This date is later than that proposed by earlier geological studies, but is in line with currently available archaeological data from the Lafourche-Terrebonne region (Pearson and Davis 1995; Weinstein and Kelley 1992). Possibly after only 500 years or so of progradation, flow into the Lafourche-Terrebonne system from the main trunk of the Mississippi River began to decrease and, soon, the system began to deteriorate. Bayous Petit Caillou and Terrebonne, which empty into Terrebonne Bay northwest of the project area, constitute two now-relict channels that were components the Lafourche-Terrebonne system. As the margins of the delta began to erode back, barrier islands were formed. The Timbalier Islands were created over only the last 300 years as erosion from the Caminada-Moreau Headland at the mouth of Bayou Lafourche supplied sand for barrier development. Landforms developed into continuous duned terraces and spits on the downdrift ends of the islands. The Timbalier Islands are, therefore, "laterally-migrating, flanking barrier islands built by recurved spit processes" (Williams et al. 1992:4). The Isles Dernieries are older and were formed by the erosion of the Bayou Petit Caillou headland and beach ridges over the last 600 to 800 years (Williams et al. 1992:4).

In a survey report examining Bayou Terrebonne in 1880, it was noted that the mouth of Bayou Petit Caillou had previously been at Caillou Island, well seaward of the mouth at that time. It was noted that in 1850 the bayou ran between narrow strips of sea marsh between Timbalier Bay and Terrebonne Bay. By the time of the survey in 1880, this area of marsh had broken up into isolated grass islands by the action of waves (Annual Report of the Chief of Engineers [hereafter cited ARCE] 1880:1180). Trips from Montegut to Caillou Island by land were common at one time and there was a lighthouse and even a hotel on the island (Guidry 1985:37). However, the processes of subsidence and erosion are continuing and more and more fast lands are being eroded and the form and content of the barrier islands are constantly changing as well as being removed. This trend of beach erosion along the barrier islands in Terrebonne and Lafourche parishes has been recorded in a comparative study by Williams et al. (1992). In 1887, for example, a large part of Wine Island existed and, in fact, extended into what is today the project area. The entrance pass was situated slightly east of where Cat Island Pass is today, plus, as noted earlier, Wine Island is almost completely gone.

Modern Setting

Louisiana leads the nation in the loss of its wetlands and in coastal erosion. Erosion of its barrier islands, in places, exceeds 20 meters per year. Louisiana's barrier islands have decreased by more than 40 per cent on the average and some islands have lost 75 per cent of their areas within the past 100 years. The trend of land loss is expected to continue for years to come. The physical processes that cause this erosion are complex and there is much debate and controversy within the technical and academic community over which cause is the most significant and on which measures would alleviate coastal land loss (Williams et al. 1992:1). The Isles Dernieries, on the western edge of the study area, have the highest rate of coastal erosion in the state. Between 1890 and 1988 most of the central arc of Whiskey Island had eroded, as well as a large portion of Wine Island (Williams et al. 1992:2). Further discussion of barrier island erosion is beyond the scope of this study, but it is sufficient to note that the processes are both natural and human induced, and affect the movement of sediments that both bury and expose cultural resources. The present conditions affecting the study area are an ongoing part of the history of the Lafourche-Terrebonne delta system and illustrates the geomorphic processes of erosion of the headlands and the concurrent development and lateral migration of the flanking barrier islands (Williams et al. 1992:4).

CHAPTER 3

NAVIGATION HISTORY

Historical Background

This chapter presents an overview of the history of the region around the project area with an emphasis on its navigation history. No attempt is made to elaborate on the archaeology of the area nor on the more recent settlement history of the Terrebonne region as these topics are beyond the scope and needs of this study. The earliest Europeans to visit the present-day Terrebonne Parish area were probably French trappers and, prior to 1765, few Europeans had settled there (Watkins 1937). Beginning in 1764, Acadian settlers began to move into the region, most of them coming down Bayou Lafourche and across to Bayou Terrebonne. This migration of Acadians continued until about 1795, under the encouragement of the Spanish who had acquired Louisiana from the French in 1763. These Acadian emigrants settled along the fertile natural levee lands along the many bayous in the area and, initially, established small farms. Soon, they spread to most of the habitable natural levee lands in the region and, in addition to farming, added stock raising, hunting, fishing and trapping. These early French settlers named the region Terrebonne, which means "the good earth," in recognition of the richness of the area.

Not long after the acquisition of Louisiana by the United States in 1803, Anglo-American settlers began to move into the area. Many of these individuals acquired large tracts of land and established cotton and, later, sugarcane plantations. As a result, many of the original Acadian settlers removed to more isolated and, often, marginal areas and were forced to engage in other economies, such as fishing and trapping.

In 1822 Terrebonne Parish was created from Lafourche Parish. Although the upper reaches of the parish was settled, most of the lower Terrebonne was still a wilderness. Michel Theriot established the first plantation on Bayou du Large in 1839. As late as 1841, when the Robichauxs settled near Montegut on Bayou Terrebonne, the region was described as "a complete wilderness . . . and nearly all kinds of wild animals abound, deer, bear, etc., Houma consisted at that time of three or four little houses" (Becnel 1989:12-13). The first actual buildings in town were erected in 1834 and until 1847 were confined to the south bank of Bayou Terrebonne. The corporate limits were expanded to include the north bank of the bayou in 1899 (Castille 1983:2). Although it was not the first town established in Terrebonne, Houma soon became the largest and has remained the principal urban center in the parish to this day.

It was during the 1830s and 1840s that sugar cane cultivation began to dominate the region and it remained the major industry until early in the present century. By 1851, there were over 100 large sugar plantations with 80 sugarhouses in production in Terrebonne. There were twelve sugar plantations on the lower Terrebonne and in 1891 the great Terrebonne Sugar Mill opened at Montegut (Wurzlow 1985:VII:58). By 1905, with the introduction of oyster and shrimp canning/packing in the late 1800s, Houma became one of the largest oyster shipping ports in the world (Castille 1983:2). The oysters were processed; they would be unloaded from luggers by air suction and sent to the steamer by conveyer to be brined and cooked in the shell. They were then, mechanically shucked (Wurzlow 1985:VIII:97). Houma's population grew steadily; but in the 1920s and 1930s, the city experienced rapid growth due to the discovery of oil and gas in Terrebonne Parish (Castille 1983:3).

Maritime Travel and Commerce in the Project Area

Travel by boat was a way of life for many years for those who lived along the bayous in Terrebonne Parish. Natural waterways were numerous and roads were few and those that existed were muddy and impassable most of the time. It was normally only by boat that one could travel reasonably within the region and reach outlying communities and fishing spots, oyster beds and shrimping grounds. Boats were the backbone for commercial transportation in the region, but they also played a vital role in the areas' religion, sports, education and recreation (Wurzlow 1985:V:32).

The importance of water transportation led to early attempts to improve navigation in the region. By 1823, Terrebonne landowners were required by law to keep clear a 10-foot-wide channel along bayous bordering their lands (Watkins 1937:114). In upper Lafourche Parish a man-made connection had been cut from Bayou Lafourche to Bayou Terrebonne in 1825. This canal greatly improved regional shipments of goods, although it was limited to shallow-draft vessels. This canal was later filled, but in its day it contributed to the movement of produce, such as, molasses, moss and sugar through the wharfs at Thibodaux (Rogers 1976). Between 1840 and 1945, numerous water courses intended primarily for transportation were built and improved. In the Lafourche area was the Barataria Canal, which later became the Company Canal. This canal provided a convenient route from Morgan City to New Orleans through a system of natural and man-made water courses. Settlements along the middle reaches of Bayou Lafourche had an easy and safe route into the markets to the east and west. The canal provided a continuous east-west navigable waterway from Bayou Terrebonne to New Orleans. By 1908, traffic along the route had declined. Small fish and vegetable luggers were the principal users. Lumber, sugar, moss and molasses were also part of the canal's commerce (Davis 1973).

A variety of small vessels were involved in travel and commerce along these bayous and canals. These included the local craft such as pirogues, chalands, esquifs and bateau (Knipmeyer 1956), as well as flatboats, luggers, steamboats and, perhaps, keelboats. These vessels were used to move people and to carry the commodities of the region to market, which normally meant travel to New Orleans or to an intermediate location such as Houma, Thibodaux or Donaldsonville where goods were transshipped. Goods moving out of the region included cotton, corn, indigo, molasses, rice, sugar, tafia and lumber (Gould 1951). Sugar, for example, was brought to New Orleans in "pirogues, skiffs, or boats made from solid logs. Each planter has his boat and, . . . could send his crop to market in it—a few hogshead or bales at a time" (Gould 1951:211). Poor records related to this trade provide little insight into the receipts of Louisiana sugar, molasses and rice delivered in this manner. Sailing sloops, schooners and luggers were also involved in this type of trade. While much of the trade was along inland waterways, some vessels traveled along the coast in the Gulf of Mexico. These vessels would have had to utilize the numerous passes leading to gulf waters, including Cat Island Pass.

Prior to the introduction of the steamboat in the area, flatboats or flats were the major type of commercial craft in use on the inland waterways. One particular type of flatboat was the "cordelle" boat which was simply a flatboat pulled with a rope by men, horses or mules using towpaths worn into the natural levee (Butler 1985). Sailboats were cordelled up the bayou, as well, and were also pushed with a pole (Wurzlow 1985:I:154). Even after the introduction of steamboats, flatboats continued in use and, in fact, increased in number after the Civil War. The flatboat was well suited to the narrow and shallow waters of the bayous. In addition, they were cheap and offered an inexpensive means of carrying bulky freight to market. As can be seen, life and transportation revolved around the water and along the bayous. Even in death, the funeral corteges often traveled via the pirogue. One such event was recorded, in a cortege from L'Isle de Jean Charles to a church at Point aux Chenes when the deceased traveled in the first pirogue followed by mourners in their pirogues. In fact, the only way to reach L'Isle de Jean Charles was by boat until after World War II (Wurzlow 1985:V:32).

During the Civil War, the coastal area was used by blockade runners, although the effectiveness of the Union blockade limited the numbers of these vessels. Most of these blockade runners were small sailing vessels and little is known about them, but a few larger steamers also attempted to sneak in or out of the area's myriad of waterways. For example, in February 1862 the sidewheel steamer *Victoria* was driven ashore near Fort Livingston by Union ships as she attempted to enter Barataria Bay (Pearson 1993:474). In September 1861, the small Louisiana state "War Schooner" *Antonia* was ordered to the "Timbalier Islands" to assist two schooners "loaded with arms for the State or for the Confederacy" (Pearson 1993:472). It is not known where, or if, the *Antonia* found these vessels. Later, in November 1861, the *Antonia* was sent to Brush Island to remove or destroy any cattle that might be there to prevent Union forces from obtaining them. Brush Island, now almost gone, was located in Terrebonne Bay not far from Cat Island Pass. The *Antonia* spent some amount of time patrolling the coast attempting to aid blockade runners and searching for local citizens who might be communicating with the enemy blockade ships. In 1864, Union officer Captain Moore was sent to Bayou Grand Caillou to detect Confederate smugglers. Raids were planned and carried out capturing considerable amounts of food and equipment and a few small boats were destroyed. One boat was mentioned that was not captured, a small schooner used as a blockade runner (Official Records of the War of Rebellion [hereafter cited ORE] 1893:927-929).

The great importance of watercraft in the region inevitably meant that boat building would become important. There were some commercial builders in the area, but many built boats primarily for personal use, family or friends. One of the commercial builders along Bayou Terrebonne was John A. Boyne and his sons John Madison, Andrew and Bill. They had two boatways and one boat they built, the *Helen Snow*, was named for the boat owners daughter who was born in 1895 during the "deep freeze" when the bayou froze and Houma was covered with 18 inches of snow.. The Boynes, as did others, built their boats out of cypress, which grew in abundance in the Terrebonne swamp (Wurzlow 1985:V:33).

A description of the old Boyne Boat Ways is given in the following reminiscence by Ovide Bazet:

> This is my conception of the old Boyne boat Works on lower Bayou Terrebonne at Madison's Canal in about the year 1910, at which time I was 10 years old. The boat tied to the wharf is the type they specialized in at that time. It was a wide semi-round bottomed boat with graceful curves... It resembled a large wide scoop with a box on top. There was barely enough space in the cabin for the gasoline engine. The boat was steered on the outside from the rear. There was a large, compartment in the front under the foredeck where the catch of shrimp, fish or oysters was stored in ice until it arrived in Houma. This compartment which was opened by a trap door on the deck was called the "hole". This boat was called a "lugger". In spite of the excellence of workmanship and its gracefulness in the water, the boat was built for hard work. It was designed to navigate the shallow lakes, bayous and bays of which the coast of Terrebonne Parish is noted. Using only hand tools, carpenters at that time took much pride in their work and regardless of the time involved to build a boat, excellence of workmanship took priority. Every boat could be called a work of art [Wurzlow 1985:V:35].

The Rhodes were another boat-building family in the area. Ernest Rhodes was the founder of one of the first and largest boatways along Bayou Terrebonne at the turn of the century. It was located about a mile below Bush Canal. Ernest was the oldest of four brothers, the others were Frank, Gustave and George. They were the sons of Thomas Rhodes, who was a sea captain. Ernest had seven sons and two of them, Elie and Lawrence, became boat builders. Elie worked for the Houma Boat Company, a branch of the Higgins Boat Company of New Orleans, during World War II building P-T boats, landing boats and Navy boats. Elie Rhodes built many boats after World War II himself, all out of cypress. He considered cypress to be the best boat wood noting that "Nothing beats cypress for boats. No other wood will take the water like cypress. Another thing, good cypress does not have as many knots in it as other woods. Wherever a limb grows out, you will find a knot in the wood. When cypress trees grow close together in the swamp, they grow up tall before the limbs come out" (Wurzlow 1985:V:37). By the 1950s, when Elie could not find good cypress anymore, he went into the fishing industry catching fish, shrimp and oysters

Beginning in the third decade of the nineteenth century, steamboats began to travel the waters of the Terrebonne region. Bazet (1934:37) reports that the *S.F. Archer* was one of the first steamers to operate exclusively in Terrebonne Parish. Built along the Ohio River at New Albany, Indiana, in 1854, the sidewheeler *Archer* was owned by J.J. Schaffer & Company and traveled along Bayou black, making connections with the railroad at Tigerville (Way 1994:407). Other steamers operating in the region were the *Harry, Laura, Sadie Downman* and the *N. H. Breaux* to name just a few. The *Harry, Laura* and the *Sadie Downman* belonged to the Daigle Barge Line, whose founder was Emile A. Daigle. The *Harry* and the *Laura* were the first big steamers on the Terrebonne in 1881. They carried only freight in the early days. They would haul barges loaded with lumber and sugar and produce to Houma to be shipped to

New Orleans. They would carry groceries, dry goods and other supplies on the return trip. In the early steamboat days Daigle would dredge the bayou in Houma at his own expense to keep his boats running. He also had a wharf in town where he built barges and had a crew of painters and carpenters to maintain his boats. Emile Daigle had a large interest in the drayage business and owned several landings and wharfs along the bayou. He was a charter member of the Houma Fish and Oyster Company and had an interest in an oyster shop at Sea Breeze. The *Harry* and the *Laura* also towed long strings of barges loaded with "Beaumont" oil. "Sometimes you could see as many as eight or 10 barges trailing behind one of the big boats. The last barge had a long chain dragging an anchor to keep the tow from swinging. You could always tell where the anchor was by the stream of bubbles." The *N. H. Breaux* succeeded the *Laura* and was the last steamer on the bayou in 1930 (*Houma Daily Courier*, Sept. 26, 1971).

Some information on commercial traffic on the waterways of the lower Terrebonne region can be obtained from records published by the Corps of Engineers in the Annual Reports of the Chief of Engineers. However, these records are generally available only for the time period after about 1880. One of the area's waterways for which commercial traffic and navigation information are available is Bayou Petit (or Little) Caillou, one of the waterways leading into western Terrebonne Bay. Measuring about 28 miles long, Little Caillou is considered part of the Lafourche system. The upper channel was reportedly filled and was no longer considered navigable by 1882. At that time, the water depth at the channel mouth was from 2 to 11 feet. During the late nineteenth century, several man-made canals, generally about 4 feet deep, connected Bayou Little Caillou with other waterways (ARCE 1882:1413-1414). No information is provided on commerce for Little Bayou Caillou until the 1930s, apparently suggestive of the minimal amount of commercial traffic traveling along the bayou. Data for the year 1935 are shown in Tables 1 and 2. As can be seen, the vessels used were "motor" vessels and barges and much of the commerce reflected the oystering and shipping activities of the area.

Bayou Grand Caillou is about 28 miles long and empties into Caillou Bay. In 1882, this channel was entirely filled at the upper end and was open with 5 to 8 feet of water throughout most of its lower segment. Vessels traveling on Grand Caillou did not draw more than 7 feet of water (ARCE 1882:1411-1412). No commercial statistics were obtained for this water body for the period prior to 1936.

Bayou Terrebonne represents a major navigable segment of the Bayou Lafourche system. During the early nineteenth century, Houma served as the head of navigation on Bayou Terrebonne. By 1880 the channel above Houma was nothing more than a drainage ditch and was useless for navigation. Below Houma the channel was a shallow tidal bayou. Ultimately, Houma, because of its advantageous location became the major port town in the region. Numerous businesses and facilities for handling boat-borne merchandise developed in the town. As noted earlier, sugar and lumber were major commodities handled at Houma, but many other goods also passed through the town's docks. Castille and Holmes (1983:26) note the importance of the oyster packing industry in the town by the 1920s and report that commodities such as animal furs, cattle and alligator hides and frog legs were packed in barrels with layers of salt and shipped, primarily to New Orleans. In 1880, two steamers traveled the lower end of Bayou Terrebonne "bringing freights from plantations on Terrebonne and other

Table 1. Trips and Drafts of Vessels on Little Bayou Caillou for 1935.

	Up-bound				Down-bound			
Draft (feet)	Steamers	Motor Vessels	Barges	Total	Steamers	Motor Vessels	Barges	Total
6		14	1,203	1,217		14	1,193	1,207
5	200	714	123	1,037	200	714	113	1,027
4	52	353	352	757	52	364	342	758
3		1,429	242	1,671		1,429	232	1,661
2		166	264	430		133	313	446
Total	252	2,676	2,184	5,112	252	2,654	2,193	5,099
Total net registered tonnage	3,012	19,577	219,785	242,374	3,012	19,253	223,840	246,105

Section included: 36 miles. Controlling depth: 6 1/2 feet. Project depth: Navigation season: Entire year.

(after ARCE 1936:631).

Table 2. Commerce on Little Bayou Caillou for 1935 (after ARCE 1936:627)

Domestic

In-Bound	**Tons**	**Out-Bound**	**Tons**
Animals and animal products:		Animals and animal products:	
Oysters, unshucked	355	Oysters, canned	80
Shells	2,950	Shrimp, canned	200
Shrimp, dried	26	Shrimp, dried	50
Shrimp, fresh	295	Shrimp, bran	100
Shrimp, bran	70	Wood and paper:	
Nonmetallic minerals:		Cordwood	25
Gasoline	225	Logs, barged	457
Oil, fuel, and gas	1,200	Nonmetallic minerals: Gasoline	50
Oil, lubricating	15	Unclassified: Ice	1,100
Total	**5,136**	**Total**	**2,062**
Value, $54,0095		Value, $80,377	
		Total, all traffic	**7,198**
		Value, $134,472	

(after ARCE 1936:627)

connecting bayous to Houma for shipment by rail" (ARCE 1880:1179-1180). The greatest part of the freight up the Terrebonne was from the sugar plantations, which included sugar and molasses. Navigation of the upper end of Terrebonne near Houma was done at high tide, which, depending on the winds in the bays, often gave an additional 2 feet of water. Prior to 1880, commerce on the upper Terrebonne was handled "by flatboats which were cordelled and poled from plantations up to Houma" (ARCE 1880:1179-1180). There was a connection by rail at Houma with Morgan's Louisiana and Texas Railroad where freight was then shipped to market. Schooners and sloops also carried a considerable amount of freight through the bays and connecting bayous to New Orleans (ARCE 1880:1179-1180). Some of these vessels, at times, would have sailed out into the Gulf of Mexico, using one of the several available passes, among which was Cat Island Pass.

Information on the commercial statistics for Bayou Terrebonne for the year 1915 for registered vessels shows a total of 7 steamers and 12 gas boats operating on the bayou at that time. The steamers carried a total of 1,500 passengers. For unregistered vessels there were 375 gas boats and 150 unrigged barges. The freight that was carried during the year consisted of a variety of articles. The item that had the greatest value was sugar, valued at $1,132,000. A large quantity of logs were shipped in that year; 15,604,300 feet or an equivalent of 62,417 short tons, reflecting the importance of the timbering industry in the early years of this century. Other commodities shipped in large amounts were ground and grain feed, fertilizer, molasses, fuel oil, oysters, potatoes and miscellaneous merchandise. Smaller quantities of brick, cement, coal, cooperage, lime, lumber, machinery, naval stores, pilings and cypress ties were shipped, as well as, agricultural products such as, corn, eggs, furs, fish, hides, moss, oats, rice, salt, and shrimp (ARCE 1916:2449-2450). Between 1888 and 1935 freight tonnage on the Terrebonne increased from 5,416 to 115,666 tons (Table 3). During roughly the same period steamship traffic increased from 15 to 252 trips and barges made from 9 to 2184 trips (Table 4). As on other waterways, barges represent the deepest draft vessels by 1935.

These published commercial statistics provide information on the types of vessels and cargoes traveling along the area's waterways, but they do not convey information on the innumerable small craft that were in use. Large numbers of small vessels, many if not most locally made, were in use in the area from the very earliest periods until today. These included such local vessels as pirogues, bateaus, flats, sailing luggers and the like.

Navigation Improvements

Dredging was considered a standard means to improve navigation in the bayous and streams in the area, but other measures were also explored. An interesting observation noted in Bayou Teche was that steamer traffic had a direct effect on the movement of sediments in the channel, especially on the smaller or narrow streams. It was observed that:

> Side-wheel steamboats, such as are below New Iberia, and not above, are so constructed that there is a strong current from their wheels washing the bottom from some distance away from the mid-channel out to the banks, but no current at all in the middle, consequently the heavier portion of the material washed up is deposited in mid-channel behind the boat, and the swell of the boat, which is

Table 3. Commerce on Bayou Terrebonne for 1935 (after ARCE 1936:630-631).

Domestic

In-Bound

	Tons
Animals and amimal products:	
Fish	1
Lard	125
Milk, canned	188
Oysters, unshucked	2,553
Seafoods, canned	300
Shells	2,600
Shrimp, dried	117
Shrimp, fresh	2,397
Shrimp, bran	147
Vegetable food products:	
Beans and peas, dried	1,100
Beverages	115
Coffee	200
Flour and meal	32
Fruits and vegetables, canned	43
Hay and feed	126
Oats	25
Potatoes	75
Rice, cleaned	125
Sugar refined	120
Sugarcane	15,677
Textiles	17
Wood and paper:	
Logs, barged	457
Paper and manufactures	19
Nonmetallic minerals:	
Bunker oil	7,060
Oil, fuel and gas	2,056
Oil, lubricating	160
Sand and gravel	6

Out-Bound

	Tons
Animals and animal products:	
Dairy products	15
Lard	5
Meat	33
Vegetable food products:	
Flour and meal	10
Fruits and vegetables, canned	56
Fruits and vegetables, fresh	50
Rice, cleaned	7
Sirup and molasses	4
Sugar, raw	8,352
Sugar, refined	16
Sugarcane	5,322
All other	25
Textiles: Rope	4
Wood and paper:	
Cordwood	30
Lumber	2,000
Piling and poles	300
Nonmetallic minerals:	
Baroid	1,600
Bunker oil	720
Cement	800
Coal, anthracite	100
Drilling mud	20,000
Gasoline	459
Grease, lubricating	10
Oil, crude	5
Oil, fuel and gas	1,230
Oil, lubricating	159
Salt	15

(continued)

Table 3. Concluded.

Domestic

In-Bound

	Tons
Ores, Metals and manufactures of:	
Iron and steel, manufactured	120
Iron and steel, rolled	800
Machinery and vehicles: Machinery and parts	1,201
Chemicals:	
Ammunition	32
Soap	150
Unclassified:	
Matches	22
Roofing	185
All other	393
Total	38,744

Value, $1,244,216

Out-Bound

	Tons
Ores, metals and manufactures of:	
Iron and steel, manufactured	450
Iron and steel, rolled	3,200
Machinery and vehicles: Machinery and parts	4,250
Chemicals:	
Explosives	20
Soap	3
Unclassified:	
Ice	2,671
Water, boiler	25,000
All other	1
Total	76,922

Value, $407,748

Up-Bound

Vegetable food products:	
Sugar, raw	6,000
Sugarcane	3,944
Total	9,944

Down-Bound

Vegetable food products: Sugarcane	3,661
Value, $16,474	
Total, all traffic	129,271
Value, $4,004,271	

(after ARCE 1936:630-631)

greater than that from a stern-wheel boat, washes the banks, and causes the widening of the surface. The stern-wheel boat spends the force of its engines on the one wheel at its stern, and the current from it washes up the bottom in the center of the bayou only, and the tendency of the heaviest part of the material washed would be to the more quiet water of the sides. So it would have a tendency gradually to improve the navigation, while the side-wheel boat far more rapidly destroyed it [ARCE 1880:1169].

Table 4. Trips and Drafts of Vessels on Bayou Terrebonne for 1935 (after ARCE 1936:631).

	Up-bound				Down-bound			
Draft (feet)	Motor Vessels	Barges	All Other	Total	Motor Vessels	Barges	All Other	Total
6	3	157		160	3	157		160
5	172	138		310	172	138		310
4	224	121	3	348	224	121	3	348
3	656	48	1	695	656	38	1	695
2	129	11		140	129	11		140
Total	1,184	465	4	1,653	1,184	465	4	1,653
Total net registered tonnage	5,706	33,077	265	39,048	5,706	33,077	265	39,048

Section included: Terrebonne Bay to Terrebonne Bayou, 32.8 miles. Controlling depth: 5 feet. Project depth: 5 feet. Navigation season: Entire year.

(after ARCE 1936:627-628)

Bayou Terrebonne was once an outlet of the Mississippi River via Bayou Lafourche, but due to a closure at Bayou Lafourche in the years prior to 1880, the upper bayou silted in and navigation above Houma became impossible. Below Houma, Bayou Terrebonne was tidally influenced and became a very important navigable waterway for the large plantations and smaller farms downstream. In a Corps of Engineers survey report in 1880, Bayou Terrebonne was examined in some detail in preparation of dredging the following years. The report notes that the roads along the bayou were useless for moving freight. The best avenue depended on the navigation of Bayou Terrebonne, which also connected with other bayous to get produce to market.

Dredging of the Bayou Terrebonne channel was initiated in 1881. Before completion of the first dredging, the bayou at Houma was reportedly 40 feet wide and 4 feet deep, and at low water it was only 10 feet wide and 6 inches deep (ARCE 1889:1508). All navigation at the upper end of Bayou Terrebonne was done at high tide. Above the entrance of Bayou Cane the channel was practically dry. The towboat *Harry*, stationed at Houma, sometimes ascended to the mouth of Bayou Cane during high water (ARCE 1887:1397). This towboat was about 18 feet wide and had a draft of only 18 inches (ARCE 1891:1844). The 1881 dredging project created a 6-foot-deep channel below Houma. Local drainage ditch discharges created shoals that again reduced water depths. In 1885 only one or two small steamboats traveled the lower channel (ARCE 1885:1407). Dredging of a 4-foot channel from the mouth to the railroad depot at Houma was begun in 1880 and completed in 1887 (ARCE 1888:1250). By 1886, channel improvements were sufficient to allow one or two small steamboats to periodically run to Houma (ARCE 1886:1265).

During the later part of 1915, the dredge *Delatour*, dug a channel from the St. Louis Cypress Company bridge in Houma to Bush Canal, the end of channel improvement. The channel was dug to a depth of 6 feet and a bottom width of 50 feet (ARCE 1916:2449).

The Houma Navigation Canal was built by local interests in 1962 to provide a ship canal from the Intracoastal Waterway to the Gulf of Mexico. The HNC has served the oil and seafood industries and recreational needs of fishermen. When constructed in 1962, the channel dimensions were 15 feet deep and 150 feet wide. The total length of the canal was 40.5 miles long with 10 miles in Terrebonne Bay and 3.9 miles in the Gulf of Mexico. The River and Harbor Act of 1962 authorized maintenance of the canal. Maintenance of the canal by the Corps was initiated in November of 1964. In 1973, the project dimensions of the HNC were increased to 18 feet deep and 300 feet wide.

Shipwreck Studies in the Terrebonne Bay Area

Only a few cultural resources studies specifically related to shipwrecks have been conducted in the vicinity of the Cat Island Pass project area. No surveys within the project area itself are recorded at the Louisiana Division of Archaeology and no sites are listed in the bounds of the project area. The studies that have been undertaken in the vicinity were very broad in nature and cover the entire Gulf of Mexico. Garrison et al. (1989) studied the outer continental shelf and Louisiana's coastal waters in *Historic Shipwrecks and Magnetic Anomalies of the Northern Gulf of Mexico*. Berman (1973) has compiled an extensive list of shipwrecks for the coastal waters of the United States. The Work Projects Administration provided two studies that compiled data on vessels sailing in the region: *Ship Registers and Enrollments of New Orleans, Louisiana,* from 1804 to 1870 (Work Projects Administration [hereafter cited WPA] 1942) and the *Record of Casualties to Persons and Vessels On the Mississippi River, Its Tributaries, on Lakes and other Waterways* (WPA 1938) A few oil and gas lease areas have been surveyed, as previously mentioned. Pearson et al. (1989) briefly discuss the navigation history of the area and its shipwreck potential and provide a list of vessels reported lost in the area. One study specifically related to shipwrecks in the region is the investigation of the remains of the eighteenth century Spanish merchantman *El Nuevo Constante* located west of the project area in offshore Cameron Parish (Pearson and Hoffman 1995). The primary importance of this work is its demonstration that significant archaeological remains can be preserved in shallow offshore conditions similar to those found in the project area.

Recorded Shipwrecks in the Vicinity of the Project Area

The earliest recorded shipwrecks near the project area appear in documents beginning in 1830s. However, vessels were traveling the area at an earlier date and earlier, unreported losses must be considered to have occurred. The latest recorded shipwrecks appear during World War II and the activities related to German U-boats. Most of these, while near the project vicinity, are located in the offshore Gulf of Mexico in deeper waters. Table 5 lists wrecks reported in the offshore area in the vicinity of the project area, derived from information presented in Coastal Environments, Inc. (1977). These wrecks are not considered of great concern to the present study because of their presumed distance from Cat Island Pass. Also, modern navigation charts depict several wrecks in vicinity of Cat Island Pass, although none are identified and none fall within the project area itself. Most of these vessels are probably sunken shrimping or fishing boats.

Pearson et al. (1989) mention three vessels reported to have been lost in the near vicinity of the Cat Island Pass project area which are of most concern to this study. These are the sidewheel steamer *Merchant,* built in Baltimore in 1835 and stranded on West Timbalier Island in 1842 (Lytle 1975:281); the schooner *Thistle,* built in 1864 and stranded on the west end of Timbalier Island in 1877 (WPA 1938:318) and the *Lizzie Haas,* also a schooner, which foundered in a heavy gale on Wine Island in 1902 (WPA 1938:210). Because these vessels may have been lost within the project area, they are discussed in more detail below. Also, these three boats can be considered somewhat representative of the types of watercraft using Cat Island Pass during the historic period.

The Sidewheel Steamer **Merchant**

The initial enrollment document for the sidewheel steamer *Merchant* was issued at the Port of Baltimore on May 18, 1835, apparently the date of her completion. The owners are listed as William G. Harrison and Gorham Brooks of Baltimore. She is listed as measuring 305 13/95 tons and having one deck, two masts and a square stern, no galleries, no head with a length of 151 feet 8 inches, a breadth of 25 feet 6 inches and a depth of 8 feet 4 inches (Bureau of Marine Inspection and Navigation [hereafter cited BMIN] 1835). The *Merchant* left

Table 5. Shipwrecks Recorded in the Offshore Vicinity of the Project Area.

Name	Latidude	Longitude	Location	Type	Date of Loss	Remarks
America La Reseda			Isles Dernieres		8/18/1779	sank in hurricane
Jerry			14 miles off Timbalier Island		5/10/09	
R.M. Parker	28° 47' 00" N	90° 45' 00" W		steel tanker	8/13/42	war casualty
R.W. Gallagher	32° 32' 30"N	90° 58' 00" W		steel tanker	8/13/42	war casualty
Sheherezade	28° 42' 15"N	91° 23' 00"W		steel tanker	6/11/45	war casualty, in 70 feet
Sun	28° 41' 00"N	90° 19' 00"W		tanker	5/16/42	war casualty
U-166	28° 47' 00"N	90° 45' 00"W		German submarine	8/1/42	war casualty, in 60 feet
Wm. C. McTarnahan	28° 52' 00"N	90° 20' 00"W		steel tanker	5/16/52	war casualty
R.M. Parker	28° 42' 15"N	91° 23' 00"W		steel tanker	8/13/42	war casualty

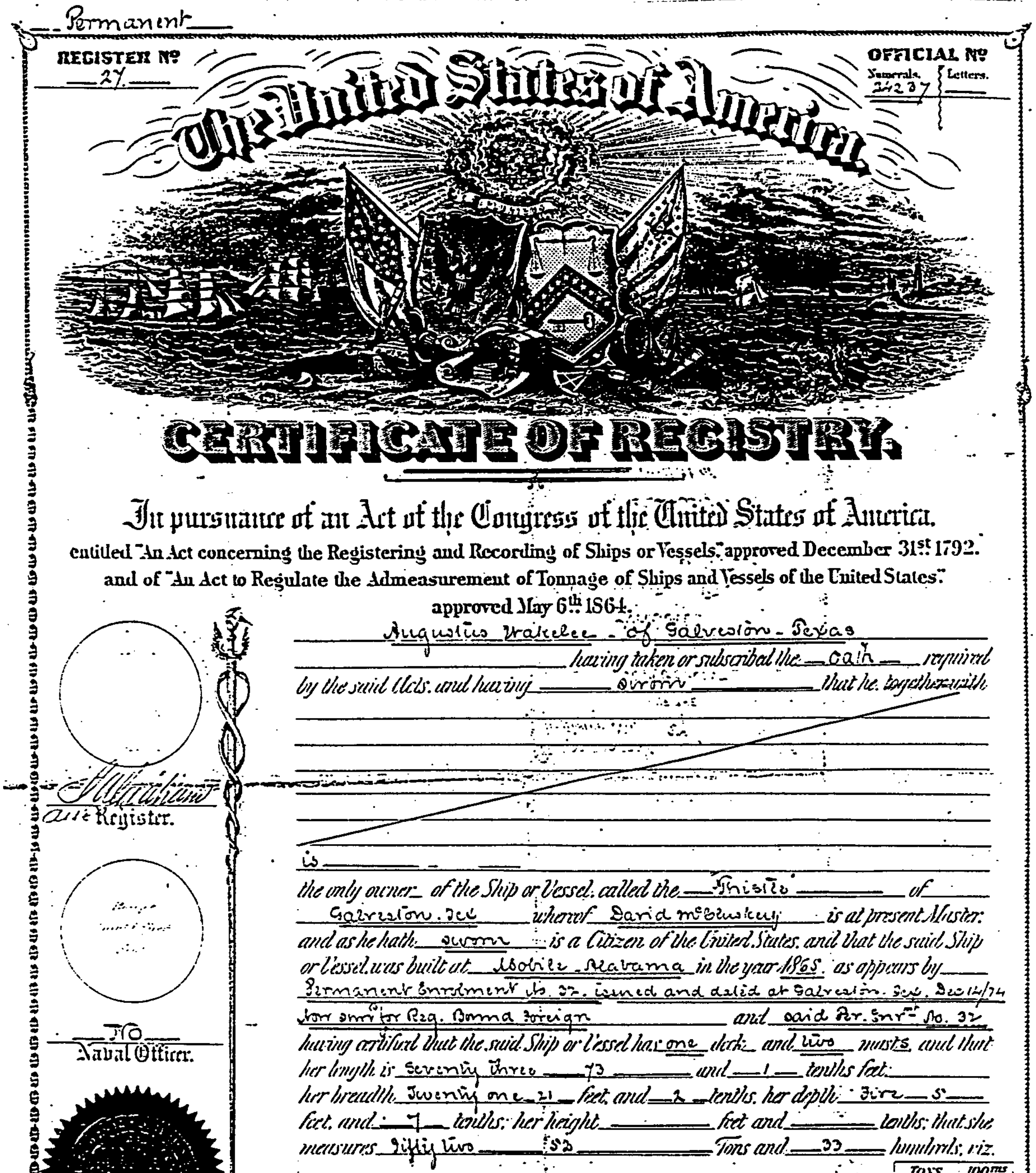
Baltimore for New Orleans not long after her construction, because by mid-1836 she was enrolled in the later city and continued there under different owners for the remainder of her career. The fact that the *Merchant* was fitted with masts would suggest that she was built specifically for operation on the ocean, presumably as a coastal steamer. She is likely to have been built specifically to serve along the coast of the Gulf of Mexico, an area where maritime trade was increasing, particularly, with Texas after her independence from Mexico. On July 1, 1836, the steamer was purchased by the Merchant Steamboat Company of New Orleans, John Kilshaw, Jr., President (BMIN 1836). Other owners, all residents of New Orleans, were Gregory Byrne in November 1837, Maunsel White and Gregory Byrne in November 1838, Robert Shaw in March 1839, and James Walter Breedlove in July 1839 (WPA 1942:III:144). The *Merchant* was reported stranded on West Timbalier Island on October 3 or 4, 1842, with a loss of 8 lives (Lytle 1975:281). Although reported stranded, no information has been found as to the final disposition of the vessel. The *Merchant* may have been recovered and refloated or she may have broken up. Efforts certainly would have been made to salvage the vessel if conditions permitted, but reports of these types of endeavors rarely find there way into the published record.

The Schooner **Thistle**

The *Thistle* was a schooner built in 1864 at Mobile, Alabama. Her first known enrollment document was issued at the Port of Mobile on October 1865, with Thomas D. Bell and James Taih listed as equal owners. The *Thistle* had one deck and two masts, a square stern, a cabin on deck and plain bow head. She measured 52 33/100 tons in burden and her length was 73 1/10 feet, her breath 21 2/10 feet and her depth 5 7/10 feet.(BMIN 1865). The *Thistle* seems to have been rather typical of the schooners built and used along the gulf coast during the nineteenth century. These shallow draft vessels were the most important carriers of cargo to and from many coastal communities prior to the coming of the steamboat. Even after the steamboat, coastal schooners remained active in certain trades down to the early years of the present century (Pearson et al. 1991). The *Thistle's* enrollment changed in 1866 when James Taih became sole owner (BMIN 1866). She was sold back to T.D. Bell with a new enrollment, dated December 27, 1871 (BMIN 1871). Another ownership change occurred on September 3, 1872, when Mrs. Jane F. Bell of Mobile became sole owner, possibly when T.D. Bell passed away (BMIN 1872). In August 1874, Augustus Wakelee of Galveston, Texas, acquired the schooner and she was registered in that city (BMIN 1874:No. 32). In May 1875, Wakelee obtained a "registration" rather than an enrollment document for the *Thistle* (Figure 3) (BMIN 1875:No. 27). Registrations were issued primarily for vessels involved in trade with foreign ports. It is most likely that the *Thistle* was sailing to Mexico or to the Caribbean. In 1875, Wakelee enrolled the *Thistle* in Galveston, placing her back into "Domestic Commerce". The description of the *Thistle* also changed to indicate that she now had a "round" stern, suggesting possible repairs or rebuild (BMIN 1875:No. 21). In 1876, C.J. Ranlett of Galveston acquired the schooner (BMIN 1876) and, on May 24, 1877, Edward L. Ranlett of New Orleans enrolled her in that city as the new owner. The master is listed as R. Whiting (BMIN 1877). Her master was an F.E. Castanzi of New Orleans on her passage from Pascagoula to Tabasco, Mexico, when she was stranded on the west end of Timbalier Island at 3 AM on October 25, 1877. The vessel had been run ashore in high winds and very heavy seas. She was listed as a total lost and valued at $25,000 (WPA 1938:318).

The Schooner Lizzie Haas

The *Lizzie Haas* was another locally-built schooner, named after the owner, Mrs. Lizzie Haas of Madisonville, Louisiana. The *Lizzie Haas* was built in Madisonville, Louisiana, in 1882 and enrolled at the port of New Orleans on July 6, 1882, with John R. Haas as master. She was a fairly small vessel, with a burden of 26 62/100 tons, a length of 59 2/10 feet, a breath of 21 5/10 feet, and a depth of 4 3/10 feet. She had one deck and two masts with a plain head and a square stern (BMIN 1882) (Figure 4). A new enrollment was issued on March 14, 1883, when ownership of the vessel changed to Juan Gener of New Orleans. There are a couple of interesting notes on the new enrollment. The tonnage capacity was reduced to 25 29/100 tons for deductions allowed under an Act of August 5, 1882. There was also a notation of $14.43 paid for the 5 officers and crew for "Hospital money" for the period since July 6, 1882 (BMIN 1883). Another enrollment was issued April 28, 1892, listing a new owner and master, James C. Weaver of New Orleans (BMIN 1892). James Weaver made some changes to the *Lizzie Haas* that required a new enrollment on May 13, 1895. She now had a modeled bow head and her tonnage increased to 34 9/100 tons, plus 2 2/100 tons for "head room" for enclosures on the upper deck. The gross tonnage of 36 11/100 was decreased to a net tonnage of 20 76/100 tons allowed for "Deductions under Section 4153, Revised Statues, as amended by Act of March 2, 1895." Her deductions included 6 10/100 for crew space, 6 73/100 for master's cabin, 1 63/100 for boatswain's stores and 89/100 for storage of sails (BMIN 1895). A new enrollment was issued for the schooner on March 16, 1899, for her owner and master, John Milloit of Madisonville (BMIN 1899). On a voyage on December 11, 1902, from Bayou Grand Caillou to New Orleans, she foundered in a heavy gale on Wine Island. She dragged her anchors, but was unable to save herself from sinking. She was a total lost, valued at $2,500 (WPA 1938:210).



Permanent

REGISTER No 27.

OFFICIAL No Numerals. 24237 Letters.

The United States of America.

CERTIFICATE OF REGISTRY.

In pursuance of an Act of the Congress of the United States of America, entitled "An Act concerning the Registering and Recording of Ships or Vessels," approved December 31st 1792. and of "An Act to Regulate the Admeasurement of Tonnage of Ships and Vessels of the United States," approved May 6th 1864. Augustus Wakelee of Galveston - Texas having taken or subscribed the oath required by the said Acts, and having sworn that he together with

is the only owner of the Ship or Vessel called the Thistle of Galveston . Tex whereof David McCluskey is at present Master, and as he hath sworn is a Citizen of the United States, and that the said Ship or Vessel was built at Mobile - Alabama in the year 1865. as appears by Permanent Enrolment No. 37. issued and dated at Galveston. Tex. Dec 14/74 now surr for Reg. Bound foreign and said Pr. Enr No. 37 having certified that the said Ship or Vessel has one deck and two masts, and that her length is Seventy three 73 and 1 tenths feet, her breadth Twenty one 21 feet and 2 tenths, her depth Five 5 feet and 7 tenths, her height feet and tenths, that she measures Fifty two 52 Tons and 33 hundredths, viz.

	Tons.	100ths
Capacity under the Tonnage-Deck	52	33
Capacity between decks, above the Tonnage-Deck		
Capacity of inclosures on upper deck, viz.		
Total Tonnage	52	33

And that she is a schooner has a plain head and a square stern. And the said Aug. Wakelee having agreed to the description and admeasurement above specified, and given sufficient security according to the said Acts, the said Schooner has been duly registered at the Port of Galveston . Texas

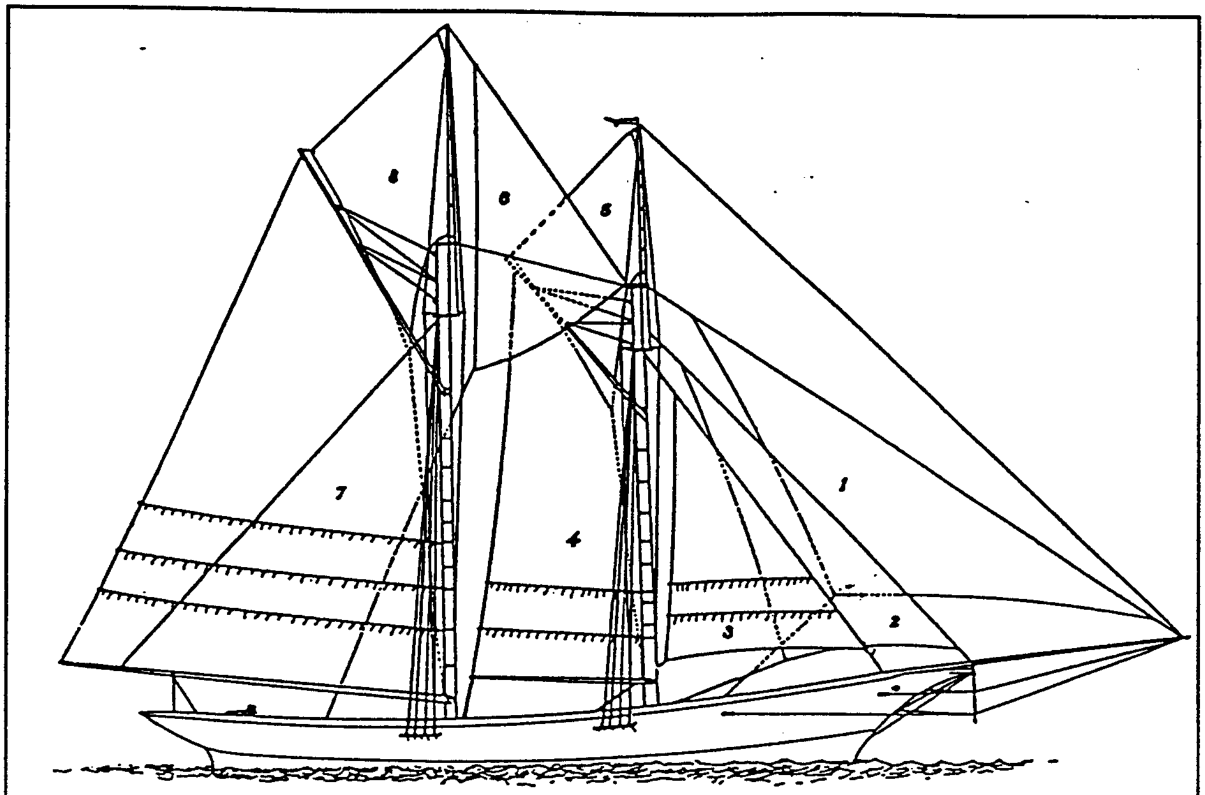
Given under my hand and Seal at the Port of Galveston . Texas this 27th day of May in the Year One thousand, Eight hundred and seventy five

Dy Collector.

Dy Register.

No Naval Officer.

Figure 3. 1875 registration document for the schooner *Thistle* (source: BMIN 1875:No. 27).



SCHOONER'S SAILS
(an inner and an outer jib are sometimes fitted instead of one jib)
1 flying jib, 2 jib, 3 forestaysail, 4 foresail, 5 fore gaff-topsail, 6 main-topmast staysail, 7 mainsail, 8 main gaff-topsail

Figure 4. Two-masted schooner with a sail plan similar to that of the *Lizzie Haas* (Taggart 1983:145).

CHAPTER 4

FIELD INVESTIGATIONS

Remote-Sensing Survey

Methodology

The field investigations for this study involved two phases; a remote-sensing survey and a subsequent phase of diving to identify several targets discovered during the survey. The conduct and findings of each of these phases of work are discussed in this chapter.

The survey area for this study included that portion of the Houma Navigation Canal (HNC), Cat Island Pass Channel from Mile -0.9 to Mile -3.6, C/L Station 2000+00 to C/L Station 2145+00 for an authorized width of 300 feet. The project area is located at the mouth of the Pass and in the immediate offshore area of the Gulf of Mexico. Water depths in the project area ranged from about 14 feet to 21 feet. It should be noted that the project area falls within a zone where strong winds and currents and weather-induced high seas are common. Additionally, commercial boat traffic in the form of crew boats, shrimp boats, work barges, etc., make extensive use of Cat Island Pass. As a consequence, close attention was paid to the weather and to boat traffic during both phases of field investigations and, as discussed below, weather delays did occur.

Fieldwork for the remote-sensing survey phase of this project was initiated on August 11, 1997, and was ended on August 14,1997. Two days were spent in the field; the other 2 days were involved in travel and mobilization and demobilization of the survey vessel. The survey vessel used was the *Coli*, a 20-foot-long, half cabin aluminum boat with a 200 horsepower outboard motor. A field crew of three individuals were involved in the project. The weather during the survey was clear and partly cloudy with light winds out of the north and seas were about 1 foot, which provided good survey conditions.

Remote-Sensing Survey Equipment

The remote-sensing survey equipment used during the survey were a fathometer, magnetometer, side-scan sonar and a GPS navigation system. The magnetometer used was an EG&G Geometrics Model G-866 proton precession magnetometer linked to an EG&G Model 801 marine sensor towfish. The stripchart printout of the G-866 records data both digitally and graphically, providing a record of both the ambient background field and the character and amplitude of any anomalies encountered. The magnetometer sensor was towed 70 feet aft of the vessel, placing it 75 feet aft of the navigation system's antenna. The sensor was towed at a depth of approximately 5 feet, placing it only 15 feet or so above the bottom of the 14 to 20 foot deep channel. Vessel speed during the survey averaged about 4 knots.

The EG&G Geometrics Model 866 was run on the 10-100 gamma scale on the dual graphic printout with readings taken at 2 seconds intervals. Background noise levels on the magnetometer were kept below +/- 3 gammas. The magnetometer was run on all transect lines over the approximately 11 linear miles surveyed. For this project the magnetometer was interfaced with a Winbook XP laptop computer, utilizing Navtrak® software applications for data storage and management. During the collection of magnetic data the unit was grounded to limit electromagnetic interference that could introduce background noise into the collected data. To ensure that this did not produce false readings during development of the magnetic contour map, and to ensure that all recorded magnetic anomalies were present on the contour map, stripchart records were examined in conjunction with the contour maps produced from the collected data.

The fathometer used was a Lowrance Model X-15 Graph Recorder operating at a frequency of 192 kHz cycles per second. The transducer for the Model X-15 has a 20 degree cone angle, that produces a wide cone angle of a 6-foot bottom area in 5 feet of water. A chart scale range of 30 feet was used to record bottom depths. Although primarily used to obtain depth information, the fathometer also give some information on the characteristics of the sea bottom. Generally, the fathometer signal displayed a "hard return" with little subbottom penetration, normally an indication of a hard sand bottom.

The side-scan sonar used was a Marine Sonic Technology Sea Scan Sidescan Sonar with a 600 kHz towfish connected to a Sea Scan Personal Computer (PC) system. The software included with the system controls the collection of sonar imagery as well as navigational input and displays the information to the operator in the form of a digital display (utilizing a 13-inch color monitor). The Sea Scan PC allows the operator to view wide tracts of the sea bottom by isonifying along a predetermined swath width and recording the strength of the echoes from the sea bottom. This is performed by a towfish which is towed just above the sea bottom by a tow cable. The towfish emits a continuous narrowly focused beam of sound perpendicular to the path of forward motion. The sound pulses pass through the water and are reflected by the sea/river bottom and from various objects such as shipwrecks, debris, and geographic features (sand ripples, rocks, etc.). The strength of the signal returned to the towfish is recorded and then the entire sonar record line is drawn onto the screen for viewing by the operator. An image of the sea/river bottom in constructed line by line as the sonar record line from each pulse of the sonar is returned to the PC and then displayed onto the color monitor. For every acoustic return from the sea bottom, an intensity is recorded as a value from 0 to 255. Zero indicates that no return was detected in that particular sample and a intensity level of 255 indicates that the maximum intensity was detected. It is these 256 levels of acoustic intensity which are drawn onto the color monitor utilizing a 64 element color scale. Therefore, the intensity values between 0 and 255 are converted to an intensity value of 0 to 63. The intensity values from 0 to 63 are then drawn to the screen by the color scale elements of 0 to 63 respectively.

The Sea Scan PC utilizes an Intel-based computer with the Windows v3.1 operating system for system control and data display. The Sea Scan program allows the operator to control the sonar data collection process, zoom in on various sonar images for increased axial resolution and to save sonar images with the related navigational information. The function of the Sea Scan PC software is to display the relevant sonar image on the screen. Every time the sonar towfish emits an acoustic pulse the reflection data is recorded and displayed along a horizontal line on the display screen. As the towfish passes over the sea bottom it continually emits an acoustic pulse. The image of the sea bottom is drawn by the reflection data line by line. The sensor (towfish) was towed off the port bow approximately 6 feet underwater. The Sea Scan PC also features an integrated plotter complete with a current and survey mode plot display function. The plotter allows the operator to set search patterns and monitor swath coverage while collecting sonar records. Once a feature (such as a shipwreck) is located it may be marked on the Sea Scan plotter for future reference

Positioning

A primary consideration in the search for targets is positioning. Accurate positioning is essential during the running of survey lines and for returning to recorded locations for supplemental remote-sensing operations or subsequent underwater investigation of targets. Those positioning functions were accomplished with a Motorola LGT-1000 GPS-based positioning system. This navigation system has the capability to access numerous coordinate and datum sets. For this particular project the coordinate system was based on the United States, 1927 North American Datum (NAD 27) and on Louisiana State Plane coordinates.

The Motorola LGT-1000, was linked to a Starlink MRB-2A, MSK Radio beacon receiver to attain differential (DGPS) capabilities. Precise positioning was provided through virtually continuous real-time tracking of the moving survey vessel by using corrected position data provided by the on-board GPS system processing both satellite data and differential data transmitted from a shore-based GPS station using RTCM 104 corrections. The shore-based differential station monitored the difference between the position that the shore-based receiver derived from satellite transmissions and that station's known position. The differential signal was obtained from onshore U.S. Coast Guard transmitters, the closest beacon being at New Orleans, Louisiana. Transmitting the differential that corrected the difference between received and known positions, the DGPS system aboard the survey vessel constantly monitored the navigation beacon radio transmissions in order to provide a real-time correction to any variation between the satellite-derived and actual position of the survey vessel.

All positioning coordinates were based on the position of the antenna of the DGPS system. Each of the remote-sensing devices used in this study was oriented to the antenna, and their orientation relative to the antenna (known as a lay back) was noted. This information is critical in the accurate positioning of targets during the data-analysis phase of the project. The system antenna was mounted on the port side stern of the boat at a height of 7 feet above the water surface. The lay back of the magnetometer sensor (sparred off the starboard side of the stern of the survey vessel) was 75 feet aft of the antenna. The lay back of the side-scan sonar was 2 feet port side and 2 feet forward of the antenna. The fathometer transducer was mounted in the bilge on the centerline of the boat parallel with the antenna.

Complete survey coverage of the project area was achieved by running a series of four parallel survey transects along the long axis of the survey area. These transects were spaced 100 feet apart and were designated, from west to east, Transect Lines 0, 100, 200, and 300

(Figures 5a-d). The total linear length included in the basic survey was approximately 11 miles. Also, as is discussed below, a series of additional survey lines were run across several targets discovered during the initial survey. The purpose of these additional transects was to further refine the magnetometer and side-scan characteristics of the selected targets.

Data Interpretation

The data collected during the survey was of high quality. The side-scan sonar records provided a good picture of the bottom in the project area, indicating a generally flat bottom in the navigation channel and its gently sloping sides. Also, the side-scan records indicated the presence of current-produced sand waves on the bottom in portions of the project area. In terms of cultural resources, interpretation of side-scan sonar records is fairly straight forward, in the sense that, generally, dense objects (such as metal or wood) are good reflectors and produce a darker image on the record. Garrison et al. (1989:223) note that side-scan sonar images of shipwrecks tend to be geometrically complex, exhibit scouring, and are associated with magnetic anomalies, while isolated pieces of modern debris tend to produce geometrically simple images. Several objects were identified on the side-scan sonar records. Most appeared as fairly thin, linear objects of various lengths, almost certainly pieces of metal (iron?) pipe.

Magnetic signatures (anomalies) can be characterized by two nonexclusive factors: strength (intensity) and shape, both of which are dependent upon a variety of factors related to anomaly source characteristics. These characteristics include the composition, size, shape and mass of the source object; its magnetic susceptibility; and its distance from the point of measurement. Magnetic anomalies caused by a single-source, ferrous object typically produce a positive-negative anomaly pair known as a dipole. The dipole is usually oriented with the axis of magnetization, with the negative anomaly falling nearest the north pole of the source object. The positive anomaly reading is commonly of greater intensity and area than is the negative.

Although a considerable body of magnetic signature data for shipwrecks is now available, it is impossible to positively associate any specific signature with a shipwreck or any other feature. The variations in the iron content, condition, and distribution of a shipwreck all influence the intensity and configuration of the magnetic signature produced. Also, the manner in which the magnetic data are collected influence the characteristics of the signature. Despite these problems, shipwreck remains do tend to exhibit characteristic magnetic signatures that aid in differentiating them from other types of anomalies. Shipwrecks, because they generally contain numerous ferrous objects, commonly will produce a magnetic signature composed of a cluster of multiple anomalies (both dipoles [i.e., pairs of magnetic highs and lows] and monopoles [i.e., a single magnetic high or low]) which cover a fairly large area. What constitutes a "fairly large area" can be difficult to define, but Garrison et al. (1989:222-223) suggest that a typical shipwreck signature will cover an area between 10,000 and 50,000 square meters. Their estimates are related primarily to larger vessels lost in the Gulf of Mexico, and small types of vessels, such as ones similar to those that sailed the waters of the project area, would produce signatures of a smaller size. Even these smaller vessels, however, should produce the characteristic multiple (sometimes termed "complex") anomaly signature which often can be distinguished from the isolated, individual anomaly signature that is

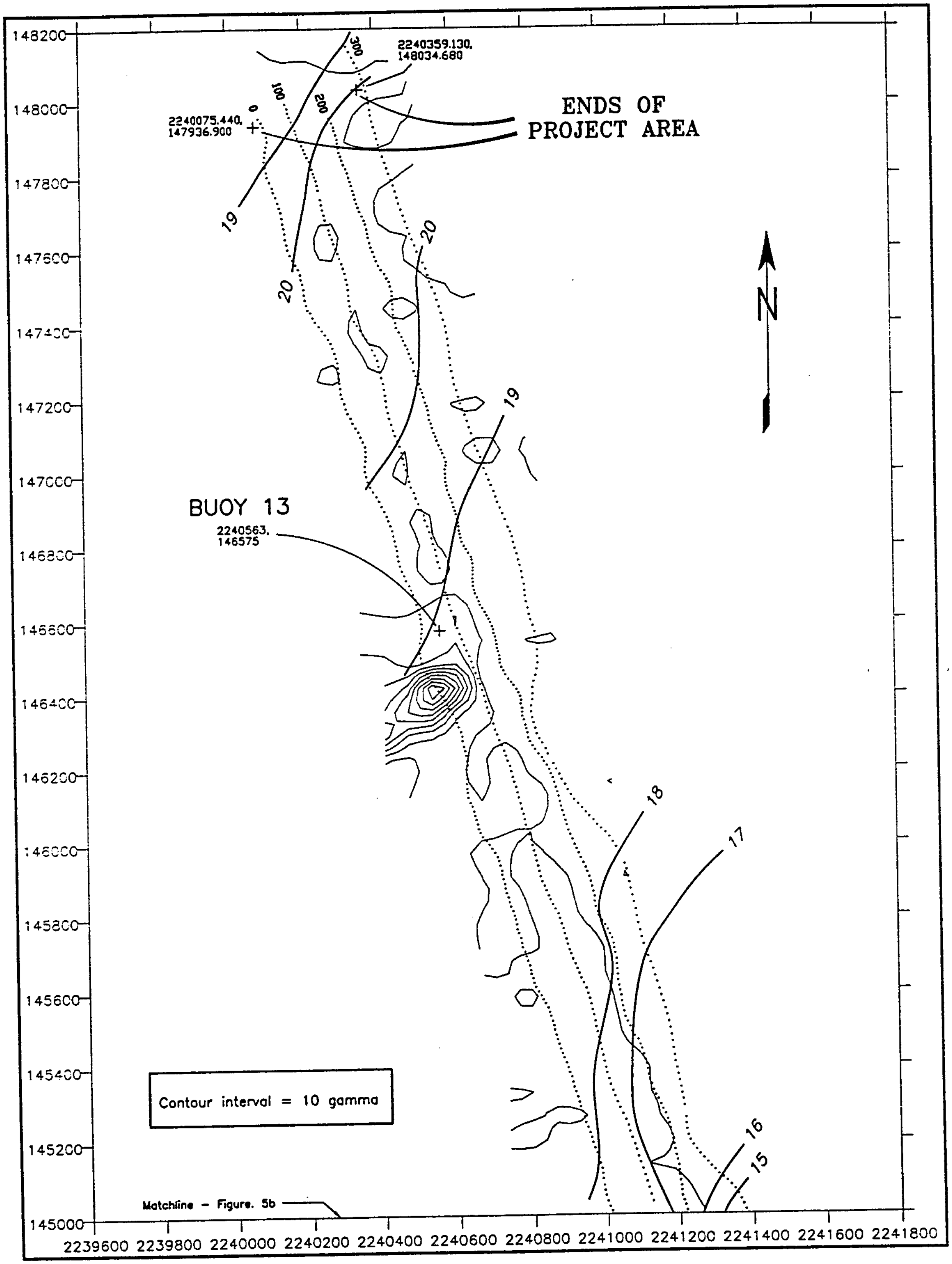


Figure 5a. Upper portion of project area showing survey lines and magnetic bathymetric data.

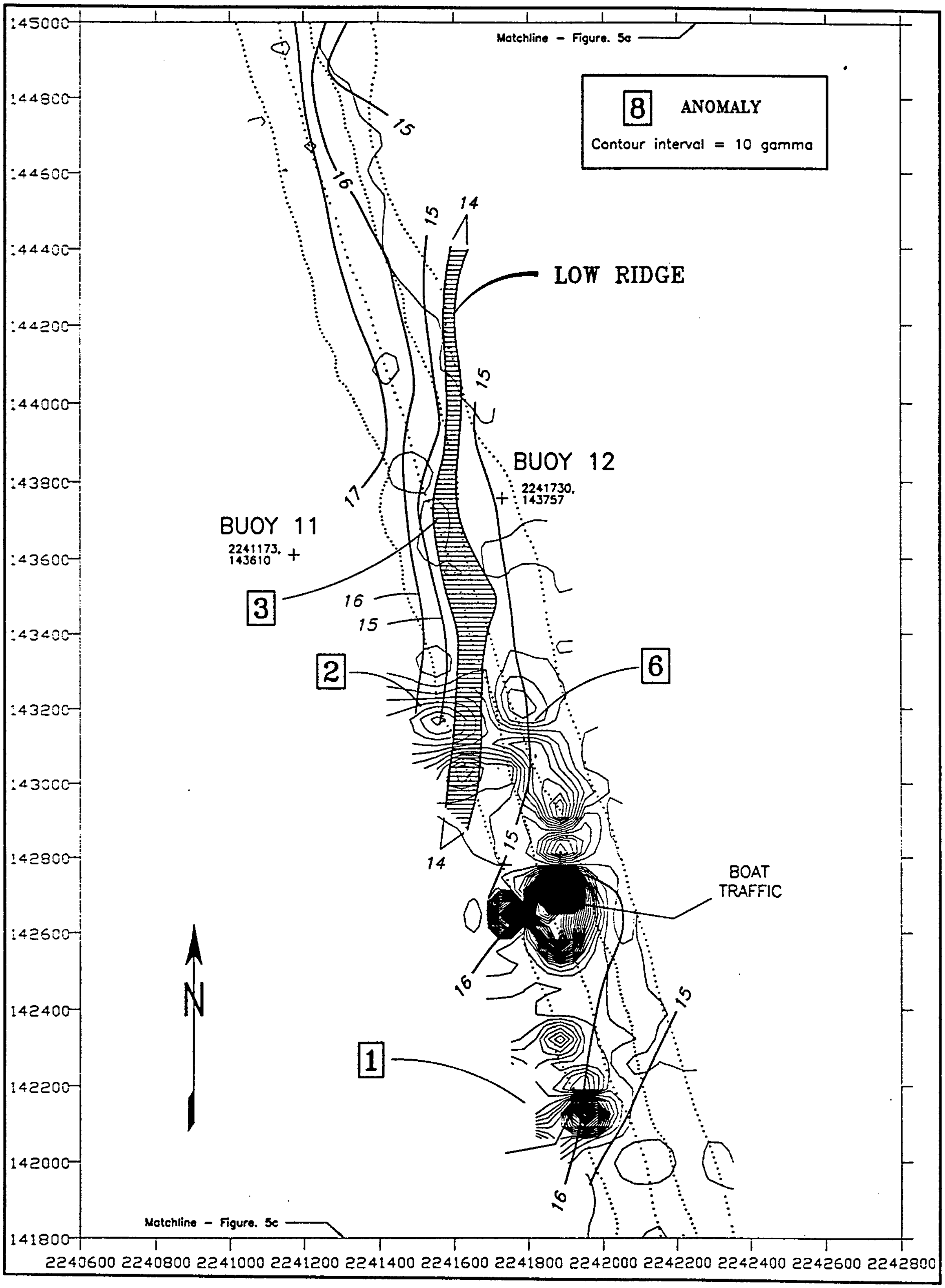


Figure 5b. Upper central portion of project area showing survey lines and magnetic bathymetric data.

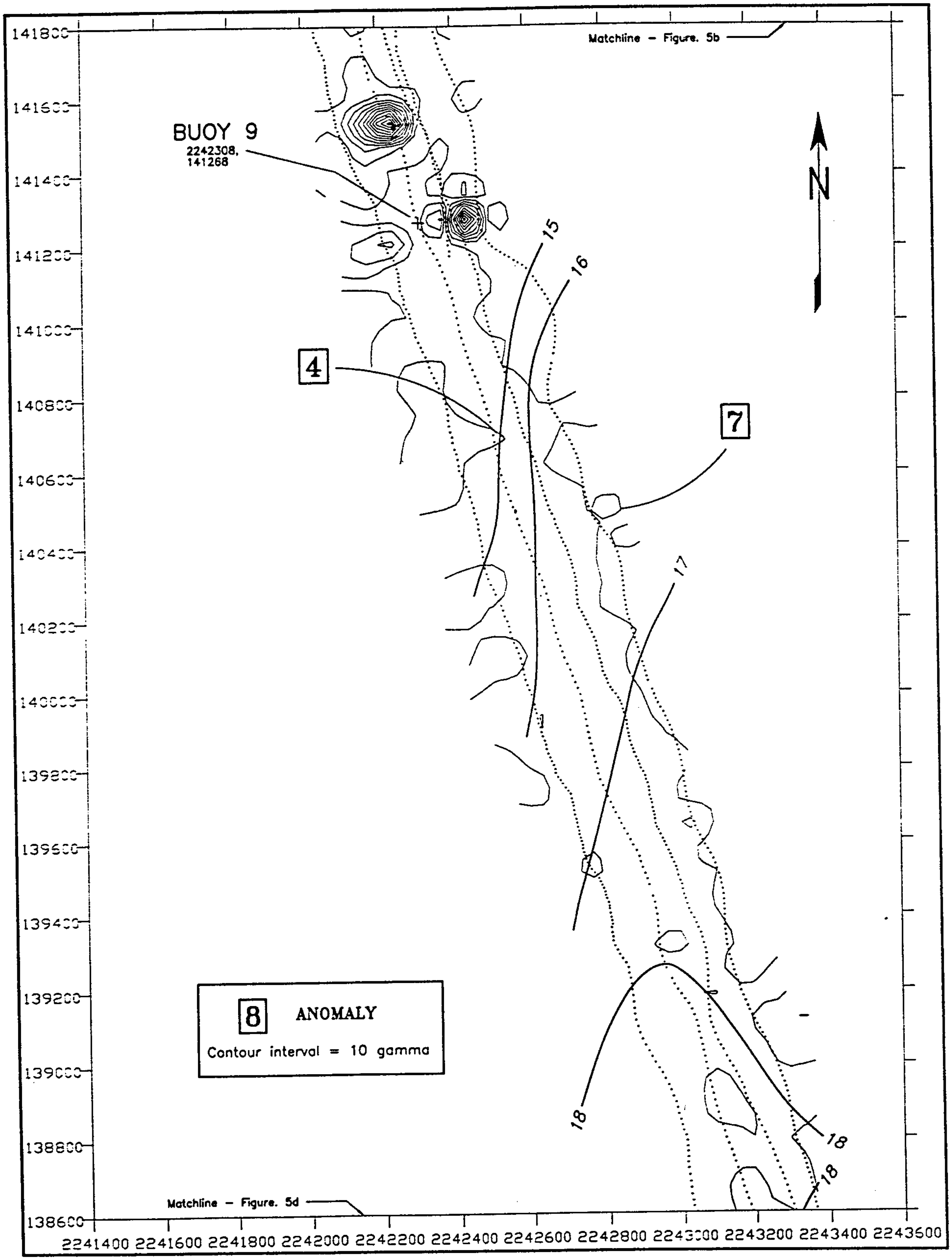


Figure 5c. Lower central portion of project area showing survey lines and magnetic bathymetric data.

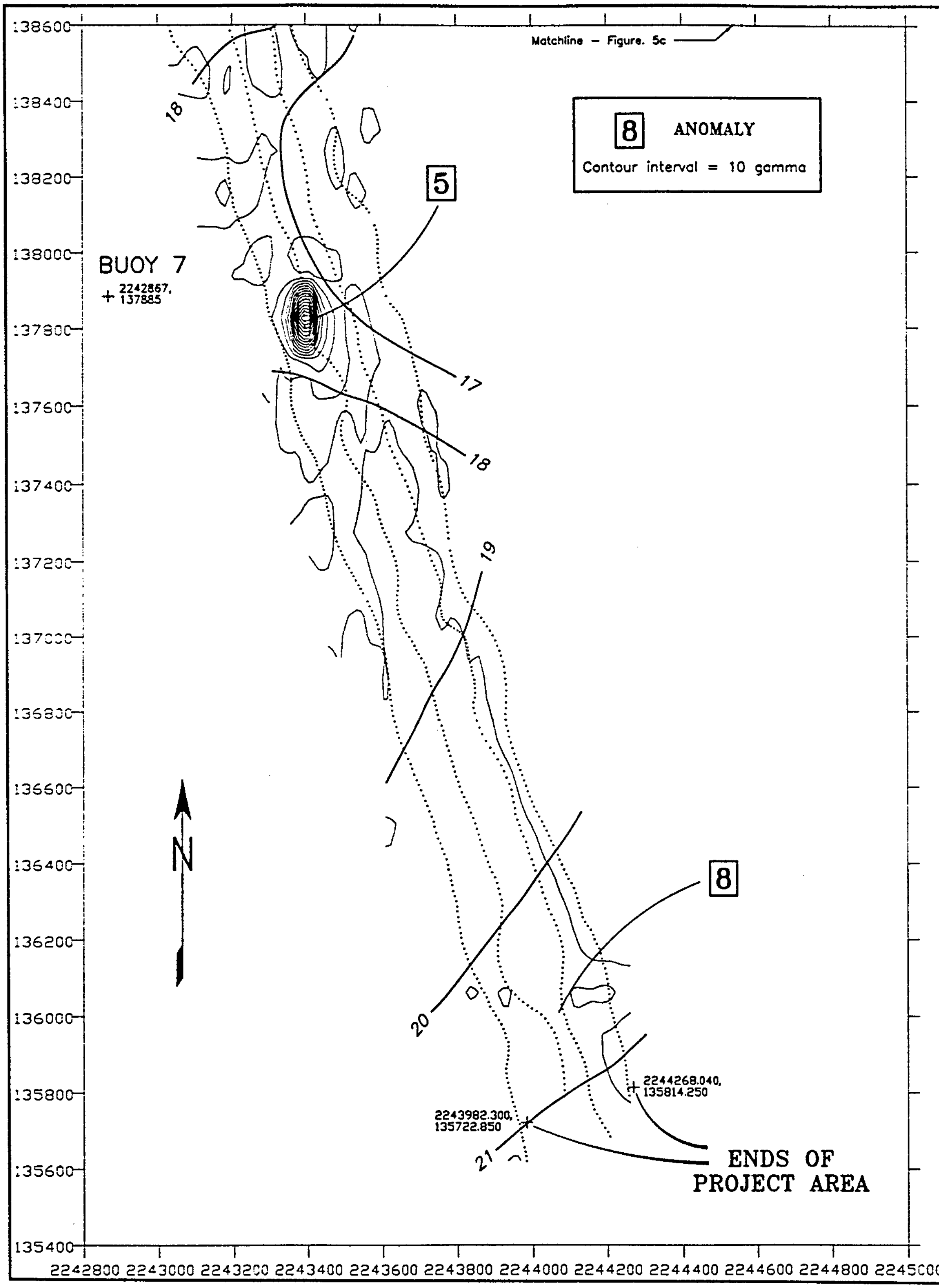


Figure 5d. Lower portion of project area showing survey lines and magnetic bathymetric data.

characteristic of modern pieces of debris (barrels, pipes, pieces of cable, etc.). It should be recognized, however, that complexity is partially dependent upon distance from the source. A magnetic anomaly recorded when the sensor is close to a shipwreck may exhibit a complex configuration, because individual ferrous objects are detected; however at a greater distance the signature may resemble a single dipole because the entire wreck is being recorded as a single-source object.

The multiple magnetic anomalies of shipwrecks tend to exhibit differential amplitude, reflecting the variability in size, composition, and mass of the elements of the shipwreck. Some non-shipwreck objects, such as a long length of cable, may produce a multiple anomaly signature covering a fairly large area, but the anomalies will customarily show a uniformity of amplitude, distinct from the variability seen in shipwreck signatures (Garrison et al. 1989:122).

In general, the magnetic signatures of watercraft of modest to large size will range from moderate to high intensity (greater than 50 gammas) when the sensor is at a distance of 20 feet or so. Additionally, shipwrecks tend to produce signatures that are greater than 80 or 90 feet across the smallest dimension. While recognizing that a considerable amount of variability does occur, this information establishes a beginning point for the identification of the sources of the magnetic anomalies in the study area.

Evaluation of the remote-sensing data relative to their potential for representing a possible shipwreck, relied on a variety of factors including target characteristics (i.e., side-scan image type, magnetic anomaly gamma strength and duration), association with other side-scan or magnetic targets on the same or adjacent lines, and relationship to observable target sources (i.e., channel buoys) which were noted on the magnetometer and side-scan records.

Magnetic anomalies were evaluated on the basis of amplitude or gamma strength in concert with duration or spatial extent. Apart from the obvious channel buoys and boat traffic which produced anomalies with strong magnetic signatures of appreciable duration, the majority of anomalies were characterized by low gamma signatures (less than 20 or 30 gammas) of very short duration. A typical magnetic anomaly is shown as Figure 6. Indicative of small, single source objects, these anomalies are presumed to represent isolated pieces of debris and were not afforded further evaluation unless associated with a "cluster" or group of similar anomalies on the same or adjacent survey lines.

Water depths along the survey corridor ranged from about 14 to 20 feet, but most commonly on the order of 18 feet. With survey lines spaced 100 feet apart and with the magnetometer sensor about 6 feet below the water surface, objects lying on or near the bottom would have been from as near as 8 feet to as far as about 48 feet away from the sensor in most of the project area. The remains of an average vessel would create a fairly large and obvious magnetic anomaly at these relatively short distances (see Garrison et al. 1989). In light of this, anomalies that were less than 30 gammas in strength were eliminated from consideration as possible wrecks unless other factors suggested otherwise. These other factors included occurrence of an anomaly on adjacent survey lines and occurrence of a cluster of individual anomalies.

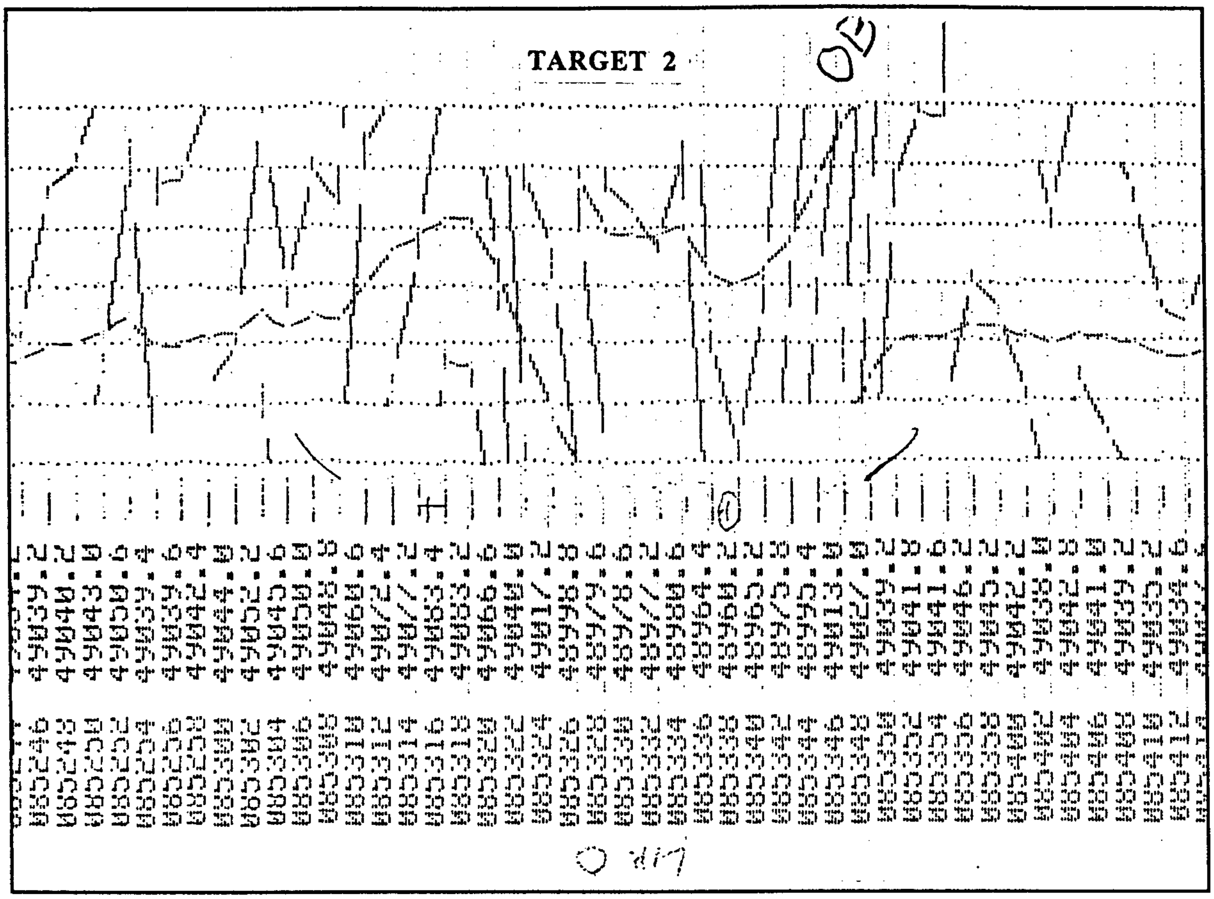


Figure 6. Typical magnetic anomaly recorded during the survey.

Evaluation of the magnetic targets also included correlations with side-scan sonar targets. Because the sonar record gives a visible indication of the target, identification or evaluation of potential significance are based upon target shape, size and configuration, as well as association with magnetic targets. Targets such as isolated sections of cable or chain can normally be immediately discarded as nonsignificant, while large areas of above-sediment wreckage are commonly easily identifiable.

Examination of Oil and Gas Pipelines

Large numbers of oil and gas pipelines exist along coastal Louisiana and accurate interpretation of remote-sensing data requires that their locations be identified. Several maps were examined to assess the presence of oil and gas pipelines in the project area. The earliest map available was a 1947 map from the Louisiana Department of Conservation showing the oil and gas lines within the state. The map indicated very little oil and gas activity in the Terrebonne Bay area and showed one pipeline nearby over land, but none in the project area itself. The 1980 Offshore Louisiana Oil and Gas Map published by the Department of Natural Resources indicated a new 12-inch pipe line running north/south to the east of the Cat Island Pass channel. This pipeline was owned by the Tennessee Gas Pipeline Company (TGP). In 1981, Texaco had a 20-inch pipeline running north/south and east of Cat Island Pass extending out into the Gulf of Mexico. In 1983, along the same corridor, the Transcontinental Gas Pipe Line Corporation had a 20-inch crude oil pipeline. Further examination of pipelines routes near the project area through 1990, did not indicate any crossing the channel in Cat Island Pass. All indications are that pipelines avoided the "Fairway" boundaries of the navigation channel of Cat Island Pass.

Remote-Sensing Survey Results

The collected magnetic data were input into the program SURFER to produce magnetic contour maps. The contoured data are shown in Figures 5a-d. A large number of fairly high intensity, single-point magnetic anomalies were recorded; but these have been eliminated from the map because they are believed to represent individual ferrous materials related to modern ship traffic, such as chain, cable, barrels, pipe, etc. Relying on the criteria discussed above concerning the remote-sensing characteristics of shipwrecks, 8 magnetic targets were initially selected for more careful review. Information on these targets is presented in Table 6. This table includes data on the magnetic intensity and character of targets, side-scan characteristics, if any, and the location of the target as recorded on each of the four survey lines. Location is given by position fix numbers which were recorded every 2 seconds or approximately every 20 feet. Five of these targets, Numbers 1, 2, 4, 5 and 6, were identified in the field and additional survey transects were run over them to collect more definitive magnetic data. Two of the targets, Numbers 2 and 6, originally identified as separate entities on magnetometer records, constitute adjacent magnetic signatures located in the center of the proposed dredging activities. These signatures could be related and associated with the same source. Four of the magnetic targets, numbers 3, 4, 7 and 8, could be correlated with objects seen on side-scan sonar records. All of these objects were identified as pieces of pipe. Because these objects are unlikely to represent significant cultural remains, these targets were subsequently eliminated from additional consideration.

The fathometer records revealed a relatively uniform seabottom over most of the area, except for a long, linear ridge that extended northeastward across the upper center of the survey area, as shown in Figure 5b. Figure 7 presents a segment of the fathometer record taken along Transect Line 100 which shows this approximately 3-foot rise. On this line, the ridge has a shallow gully in its top. This feature was not observed on the other lines nor did the ridge rise quite as high on the other lines. As shown in Figure 10, Targets 2 and 3 are located along this ridge. A small piece of pipe was seen on side-scan records at Target 3 and it had been eliminated from further consideration. However, no surface features except for the ridge was observed in the area of Target 2.

Information on the targets selected for examination was submitted to Jim Wojtala, archaeologist with the New Orleans District, subsequent to the evaluation of the collected data. At that time, it was recommended that five of the targets be examined. These were Targets 1, 2, 4, 5 and 6. However, more careful examination of the side-scan sonar records revealed that Target Number 4 was almost certainly associated with an object identified as a piece of pipe. Because the other 4 targets could not be reasonable eliminated as potential cultural remains, it

Table 6. Targets of Interest Recorded in the Cat Island Pass Survey Area.

Target Number	Magnetic Character*	Magnetic Intensity**	Anomaly Length (ft)	Side Scan Record	Water Depth (ft)	Location State Plane Coor.
1	C	478	432	none	18	N142180; E2241940
2	D	123	280	none	16	N143100; E2241600
3	D	52	75	pipe	14.5	N143768; E2241253
4	D	50	180	pipe	18	N140700; E2242400
5	D	450	162	none	18	N137820; E2243460
6	D	448	162	none	16	N143140; E2241800
7	D	57	60	pipe	16	N140460; E2242990
8	M	65	32	pipe	17	N136020; E2244160

* C=complex or multiple; D=dipole; M=monopole; ** in gammas

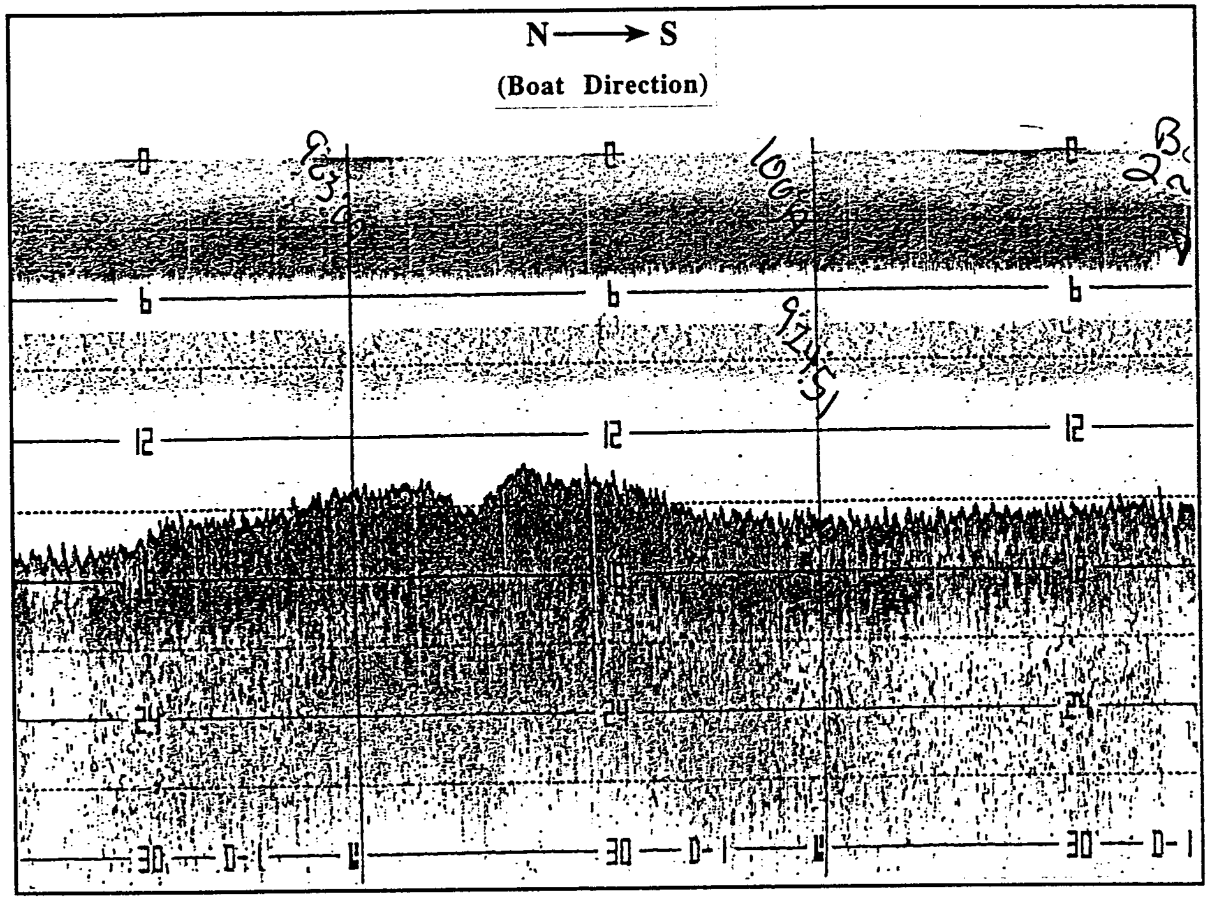


Figure 7. Segment of fathometer record along Transect Line 100 showing the low ridge that extended across the survey area. Scale: 1 in. = approx. 380 ft

was recommended that diving be conducted to identify and evaluate them. The Corps of Engineers concurred with these recommendations. The findings of the diving are presented below.

Diver Investigations

Diver investigations for this study involved the relocation, examination and identification of the objects designated as Targets No. 1, 2, 5 and 6 during the remote-sensing survey. Bad weather delayed the start of fieldwork for some period of time; fieldwork was ultimately initiated on November 10, 1997, and was completed on November 15, 1997. A total of 4 days were spent in the field and 2 days in travel and mobilization and demobilization of the survey/dive vessel. The survey and dive vessel used was the 53-feet motor vessel *Manana,* provided by Captain Mike Howell of New Orleans. A dive crew of five individuals were involved in the project. The team consisted of Charles Pearson (Principal Investigator), Carey Coxe, Michael Krivor, Mike Ham, and Stephen James (Dive Supervisor). Additionally, Joan Exnicios, archaeologist with the New Orleans District, accompanied the crew during the entire project serving as an observer and conducting safety inspections.

Weather conditions during the fieldwork were extremely variable. For example, on November 12 an attempt was made to dive on targets, however, high seas (2 to 3 feet) made anchoring difficult, plus rain and fog reduced visibility. Visibility was of particular concern because all of the targets were within or immediately adjacent to the navigation channel and commercial boat traffic in the channel (shrimp boats, crew boats, jack-up barges, sea-going barges, etc.) was fairly heavy. Thus on November 12 it was determined to be too dangerous to anchor or dive. On other days, similar conditions prohibited diving for short periods of time.

The examination of each target involved two phases of work, target relocation with remote-sensing equipment and target evaluation by divers. Target relocation involved using a magnetometer to relocate each of the targets, all of which had been identified as magnetic anomalies during the remote-sensing survey. The magnetometer used was a Geometrics Model G-166. Positioning during the study was provided by a Motorola LGT-1000 GPS system linked to a Starlink MRB-2A, MSK Raidobeacon receiver to obtain differential correction. This was the same system used during the remote-sensing survey which helped insure replication of results.

During target relocation, the magnetometer was towed behind the vessel at a distance of 75 feet, as during the remote-sensing survey. The relocation involved making several passes with the magnetometer over the position of the targets, as obtained during the initial survey. sufficient passes were made to gain an idea of the center of the magnetic signature, which was then buoyed. Once a buoy was dropped, additional passes were made using the buoy as a reference point to try to refine the location of the center of the magnetic signature. In some instances, this required dropping additional buoys.

Once the target was accurately located, diver examination was initiated. The dive vessel was securely anchored, positioning its stern adjacent to the buoy marking the target location. A diver was then put overboard with the magnetometer sensor. The diver lowered the sensor to the bottom (circa 20 feet deep) and dragged the sensor across the identified target location. This technique allowed the precise identification of the center of the magnetic signature, normally the location of the source object. Once the magnetic center was found, a new buoy was positioned there or the original buoy was repositioned as necessary. A diver was then sent down to examine the target.

All diving activities followed the New Orleans District, Corps of Engineers procedures and safety requirements. A Surface Supplied Air system (SSA) was used. Air was provided from a cascade system of two, 200 cubic feet 2100 PSI commercial 'K'-bottles of certified breathing air. The system consisted of two complete diving sets, each with a dive helmet and 200 feet of air hose. One diving set was used by the diver in the water, and the second was employed by the stand-by-diver. The systems included hard wire radio communication between divers and the dive vessel. A written log recording time and air in, time and air out, depth of dive, environmental characteristics (i.e., visibility, current) etc., was maintained for each dive. Additionally, the boat captain maintained a lookout for boat traffic and kept in constant radio communication with boats in the immediate vicinity. Prior to conducting diving, the United States Coast Guard office in New Orleans was notified and they issued a Notice to

Mariners which identified the location and duration of the diving operations. A safety briefing was held each day prior to diving and the safety requirements and concerns were reviewed. Prior to each dive, safety procedures and concerns and the archaeological objectives of the dive were discussed and reviewed. Dive logs and field notes were kept for each dive. The results of examination of each of the selected targets are presented below.

Target Number 1

Target Number 1 is located along the western edge of the survey area at Louisiana State Plane Coordinate N 142180, E 2241940. This target produced a large, complex magnetic signature containing dipole highs and lows as shown in Figure 5b. This magnetic signature covered an area 430 feet along Transect Line 0 and displayed a maximum magnetic deflection of 478 gammas (see Table 6). This target was recorded on magnetic records only along Transect Line 0, but its size and complexity is characteristics of scattered pieces of ferrous debris, not unlike what would be expected at a shipwreck site. It was thought possible that the source for this magnetic signature lay along the edge of the survey area and, possibly, extended outside of it to the west.

The initial phase of examination involved running several magnetometer transects over the coordinates of the target and dropping a buoy at the location of the magnetic high/low intersect. Fairly high seas (circa 2 feet) and a strong east to west current made placement of the buoy and subsequent anchoring of the boat somewhat difficult, but it was accomplished after several attempts. The buoyed location was within a few feet of the target position recorded during the initial survey. A diver was then placed into the water with the magnetometer sensor and dragged it across the bottom in the area of the buoy. It was quickly determined that the center of the magnetic signature lay about 50 feet northeast of the buoy so the diver set another buoy at this point. The diver then descended to examine the seabottom in the area around the buoy. This was accomplished by holding tightly onto the dive hose and swinging the diver across the target location in a series of arcs directed by radio from above. After swinging across the target location in one direction the dive hose was let out 10 feet and the diver would then swing back in the other direction across the target location. On the dive vessel, the Dive Supervisor directed the movement of the diver by following his bubbles relative to the buoy location to insure complete coverage of the target area. Appropriate notes and a sketch map of the movement of the diver was made. It should be noted that there was a moderate amount of boat traffic in the Cat Island Pass Channel and the GIWW during the examination of Target No. 1. Most of the vessels were shrimp boats, but several larger vessels also passed down the Cat Island Pass Channel. Fortunately, the target location was toward the edge of the ship channel such that passing vessels created no serious problems or delays.

The water depth at the buoy location was 18 feet, visibility at the bottom was zero and bottom sediments consisted of moderately soft silts and muds with a few shells. A moderate east-west current was noted by the diver at the bottom. A thorough examination of the bottom around the buoy was made and nothing was found. A 7-foot-long iron probe was then sent down to the diver and he systematically probed into the bottom across the target location. Probes were placed at approximately 6-foot-intervals along a series of arcs directed from the surface. A sketch map of probe locations is shown as Figure 8. Probing revealed a 6- to 6.5-

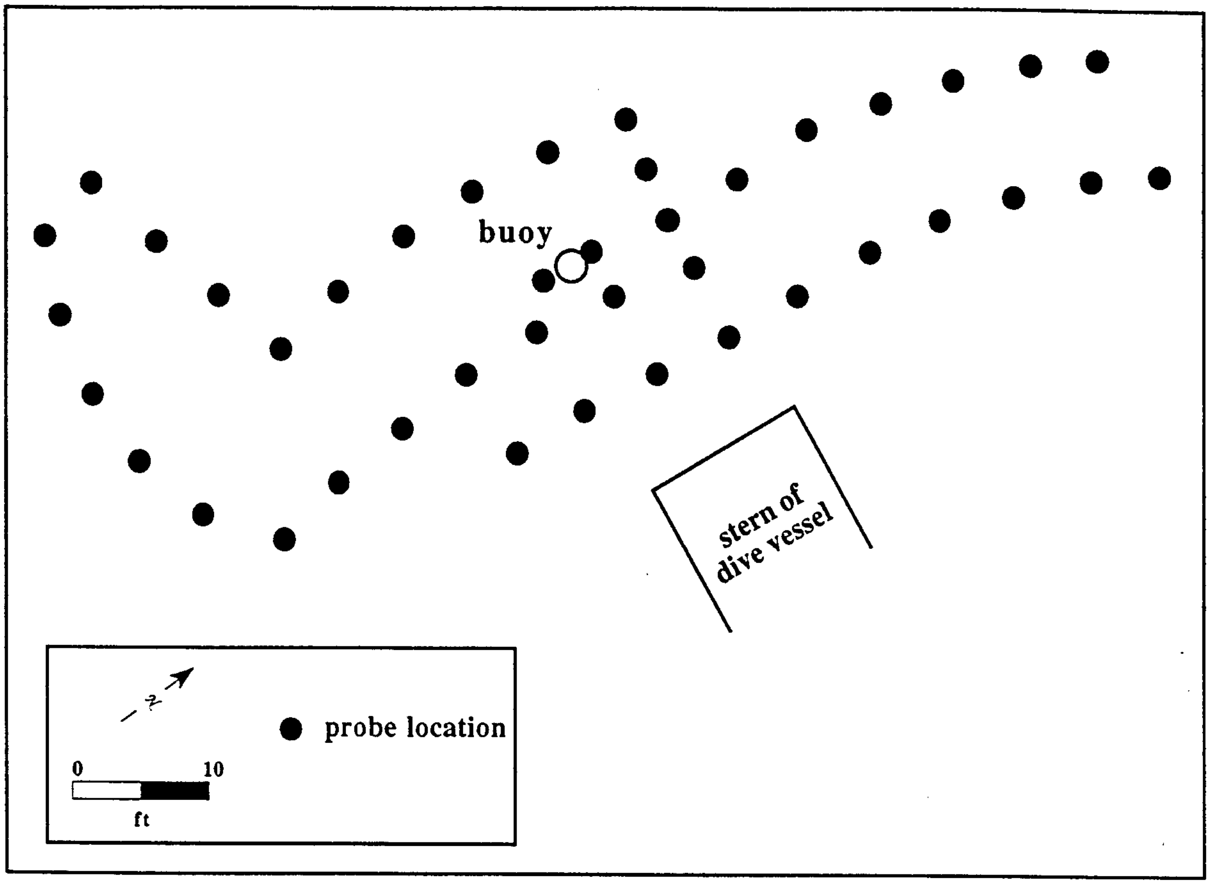


Figure 8. Sketch map of probe locations placed at Target 1.

foot-thick stratum of moderately soft to moderately hard sediments, thought to be a silty to silty clay material, underlain by a harder stratum that extended to 7 feet below the bottom, the length of the probe. Based on feel, the diver identified the lowest stratum as sand.

No objects were encountered during the probing, despite the rather intense magnetics recorded at the location. It is believed that the source for Target Number 1 consists of a scatter of small objects or, possibly, pieces of iron or steel cable. Past examinations of similar targets have shown that it is often very difficult to locate these types of small objects under the diving conditions encountered at Cat Island Pass. Probably the only to find them would be to conduct very extensive underwater excavations. The lack of any sort of material that could be related to boat structure at Target 1 mitigates against the time and effort required to undertake extensive excavations. While the source for Target Number 1 was not found, all of the available evidence suggests that it consists of modern trash and debris; materials that are not considered historically significant.

Target Number 2

Target Number 2, also, is located along the western edge of the survey area at Louisiana State Plane Coordinate N 143100, E 2241600 (see Figure 5b). This target produced a large magnetic dipole covering an area 280 feet along Transect Line 0 and displayed a maximum magnetic deflection of 123 gammas (Table 6). As discussed earlier, Target 6 was located immediately east of Target 2 and it was thought that the two may be related to the same source object(s). Additionally, the position of Target 2 corresponded to the linear ridge noted on fathometer records. The relocation and diving procedures at Target 2 were essentially the same as those at Target 1.

Three dives were made on Target 2, although the initial dive was conducted at the very end of a day and represented only a cursory examination. The other dives involved dragging the magnetometer sensor across the target area to refine its position, examination of the bottom, probing with an iron probe, plus probing with a hydraulic probe. Target 2 lay in about 16 feet of water, visibility at the bottom was zero and a very light east to west current was noted. When the magnetometer sensor was dragged across the target location, magnetic intensities of over 2000 gammas were recorded. The divers determined that the center of the magnetic signature corresponded with the low ridge. Examination of the ridge indicated that it was comprised of oyster shell rising about 2 feet off of the bottom. The surrounding sediments were similar to those recorded at Target 1. Diver examination found nothing exposed at or above the bottom other than the ridge of shell. After examination of the bottom, the 7-foot iron probe was sent down to the diver and systematic probing of the target area was started. It was found that the shell was so dense that the diver could not insert the probe so a hydraulic probe was set up. This probe consisted of a 10-foot-long piece of 1-inch diameter PVC pipe attached by a fire hose to a 7.5 horsepower water pump. The hydraulic probe worked reasonable well, although it took some effort to penetrate through the shell ridge.

Four lines of hydraulic probes, spaced at 3-foot intervals, were placed in the cardinal directions around the buoy marking the target location. In most instances the probe could be inserted to its full 10-foot-length. It was found that the shell ridge consisted of a 3- to 4-foot-thick layer of oyster shell underlain by a moderately hard stratum presumed to consist of silts and sandy silts. Twelve feet east of the buoy weight (toward the navigation channel) the probe encountered a solid object at a depth of 3 feet. This object appeared to be near the center of the shell ridge. Subsequent probing to delineate the object revealed that it was linear in shape, at least 12 feet long and about 2 to 2.5 feet wide. The buried object extended from the buoy in a northeastward direction toward the center of the navigation channel and seemed to correlate exactly with the low ridge that extends across the navigation channel. Probing was unable to follow the object for more than about 12 feet because after that point it could not be located. It is possible that the object becomes more deeply buried and more difficult to locate. Also, when efforts were made to find the object beyond this 12-foot distance the bottom currents became stronger, making it difficult for the divers to work under water. An attempt was made to excavate down to the object using the force of water from the hydraulic probe, but this proved impossible because the loose shell and surrounding sediments quickly refilled the hole. The 7-foot iron probe was sent back down to the bottom so that the diver could use it to "tap" on the buried object in hopes of determining if it was metal. This probing indicated that the object is very hard, certainly not wood. But the object produced a dull feeling "thud" when tapped, not the typical "pinging" feel produced by metal when it is struck.

All of the collected data suggests that the source for Target 2 is a piece of buried iron or steel pipe. The lack of a "pinging" when probed would seem to indicate that the pipe is encased in cement or concrete, a common practice. The small piece of pipe delineated may be a part of, or the remnants of, a pipeline that extended across the survey area. Pipelines are commonly covered by a protective layer of shell, and the low ridge seen extending across the survey area very likely represents a pipeline route. The lack of magnetics along the rest of the low ridge would seem to indicate that the pipe has been removed within the bounds of the navigation channel and the piece discovered is a remnant left at the edge of the navigation channel. If this ridge does represent a pipeline location, no record of it has been found in the published literature on pipeline locations. This object is not considered historically significant, however, the piece of pipe found, plus any undiscovered portions of the pipeline, could represent impediments or hazards to dredging and their presence should be of concern to the Corps of Engineers.

Target Number 5

Target Number 5 consisted of a 450-gamma anomaly located in the lower (southern) portion of the survey area at State Plane Coordinate N 137820, E 2243460 (see Figure 5d). The magnetic signature had been recorded only along Transect Line 100, but its intensity and size (162 feet long) indicated that it should be examined. The relocation and diving procedures at Target 5 were the same as those employed at the other targets. Target 5 was located near the center of the navigation channel such that a careful watch on boat traffic had to be maintained.

Target 5 lay in about 18 feet of water; visibility o the bottom was zero and a slight east to west current was noted at the bottom. As at the other target locations, diver examination and systematic probing with the 7-foot iron probe were conducted at Target 5. Probing indicated moderately hard silty to sandy sediments extending to the length of the probe, 7 feet. Several thin, but slightly stiffer, lenses could be felt when probing. These are believed to represent lenses of sand. No objects were discovered during the examination of the bottom nor during the probing, even though dragging the magnetometer sensor across the target location recorded a several hundred gamma anomaly. As at Target 1, it is felt that the source(s) for Target 5 consists of a dense, but small object or objects, buried at a fairly shallow depth. The source most likely consists of metallic debris, such as cable, pipe or the like, derived from the extensive boat traffic using the channel.

Target Number 6

Target Number 6 consisted of large magnetic dipole originally recorded along Transect Line 200 at State Plane Coordinate N 143140, E 2241800 (see Figure 5b). The magnetic signature consisted of a dipole with a magnetic intensity of 448 gammas extending 280 feet along the survey transect line. As noted earlier, it was originally believed that Target 6 and Target 1, because of their proximity, could be associated with the same source object(s). When the Target 6 location was resurveyed with the magnetometer no magnetics were recorded. Ultimately, over a dozen passes were run across the originally identified target location with the magnetometer and nothing was found. It is believed that the source object for Target 6 had been moved or removed between the time of the original remote-sensing survey and the diving operations. It could have been moved by currents, or even by propellor wash from large vessels. But it is much more likely that it was dragged away by a shrimper, as dragging in this area is common. This phenomena of "missing" targets has been noted elsewhere, generally in locations where boat traffic and shrimping activity is fairly high. Pearson and Hudson (1990) recorded a similar happenstance in the Matagorda Ship Channel in Texas where discussions with shrimpers revealed that they commonly catch cable and other trash in their nets, often dragging it for long distances. The fact that source object for Target 6 has been moved would suggest that it was fairly small and on or near the surface, lending some support to the fact that it consisted of modern trash or debris.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

The remote-sensing survey of the HNC, Cat Island Pass Channel Realignment recorded a large number of magnetic anomalies and side-scan sonar targets. Most of the targets were interpreted as modern debris. Four targets, Numbers 1, 5, 2 and 6, were of significant magnitude and appearance to suggest there being possible shipwrecks or significant cultural resources. In light of the past history of navigation and use of the Cat Island Pass area and because several shipwrecks are known to have sunk in the vicinity, it was determined that diver identification and evaluation of these targets was required. None of the targets examined represented significant cultural remains and no further consideration of them is deemed necessary. The findings of this study do, however, add to the growing body of information on submerged resources within the New Orleans District and to the application and interpretation of remote-sensing survey.

The findings of the remote-sensing survey of the Cat Island Pass Channel are not unlike those reported from other similar settings where modern usage of a waterway or water body is high. For example, Pearson (1987) recorded numerous, small magnetic anomalies in the Laguna Madre near Port Isabel, located on the extreme southern Texas coast. The anomalies were concentrated in an area heavily used by small boat traffic and it was argued that the magnetics were largely the result of modern debris lost or thrown from boats. More direct equivalents to the present study are results from recent surveys in Aransas Pass and the Corpus Christi and La Quinta Ship Channels in Texas (James and Pearson 1991; Pearson and Simmons 1995) and from Mobile, Pascagoula, Galveston and Matagorda bays, where modern commercial vessel traffic is fairly high (Irion 1986; Mistovich and Knight 1983; Mistovich et al. 1983; Pearson and Hudson 1990). In remote-sensing studies conducted in these settings, modern debris was abundant and constituted the bulk of the magnetic signatures recorded. In one study in Mobile Bay, Irion (1986) reported that all of the magnetic anomalies that were investigated by divers were modern debris, much of it consisting of discarded steel cable. James and Pearson (1991) and Pearson and Hudson (1990) had similar findings in the dredged Corpus Christi and La Quinta Ship Channels and the dredged navigation channel through Matagorda Bay, Texas.

The problems of differentiating between modern debris and shipwrecks on the basis of remote-sensing data have been discussed by a number of authors. This difficulty is particularly true in the case of magnetic data. There is no doubt that the only positive way to verify a magnetic source object is through physical examination. However, the size and complexity of a magnetic signature does provide a useable key for distinguishing between modern debris and shipwreck remains (see Garrison et al. 1989; Pearson and Hudson 1990). Specifically, the magnetic signatures of shipwrecks tend to be large in area and tend to display multiple magnetic peaks of differential amplitude. Modern debris (at least individual pieces of debris), on the other hand, tends to produce magnetic signatures that are small in area and which display single magnetic peaks or multiple peaks of similar amplitude. Most magnetic signatures recorded during the present survey tended to display these latter characteristics. The two exceptions, are Targets 1 and 5, which may be associated with historic shipwrecks or other cultural resources.

Pearson and Hudson (1990:40) have argued that the past and recent use of a waterbody must be an important consideration in the interpretation of remote-sensing data; in many situations the most important criteria. Unless the remote-sensing data or the historical record provide compelling and overriding evidence to the contrary, it is believed that the history of use should be a primary consideration in interpretation. What constitutes "compelling evidence" is, to some extent, left to the discretion of the researcher; however, in a setting such as San Antonio and Aransas bays, where modern commercial traffic and fishing activities have been intensive, the presence of a large quantity on modern debris must be anticipated. This debris will be scattered along the channel right-of-way, although it may be concentrated at areas where traffic would slow or halt, and it will normally appear on remote-sensing records as discrete, small objects. This is exactly the pattern observed in the remote-sensing records obtained along the HNC, Cat Island Pass Channel. With the exceptions noted, none of the targets in these areas exhibited characteristics sufficiently compelling to override the assumption that they represent modern debris. Diver evaluation of numerous similar targets in similar settings, particularly the recent work at Port Ingleside (Pearson and James 1997), in Aransas Pass (Pearson and Simmons 1995) and in the Corpus Christi and La Quinta Ship Channels (James and Pearson 1991) provides sufficient information to argue against the need for diver examination on most of the targets found in this study.

The absence of identified shipwreck remains along the channels examined in this study does not preclude the possibility that wrecks may exist in other, unsurveyed, portions of the channel and bay. Additionally, the fact that channels have been dredged and maintained without the report of shipwreck remains should not be construed as evidence of the absence of shipwrecks within maintained areas. The wreck of the *Mary*, adjacent to the south jetty in Aransas Pass, is a case in point. The remains of the vessel rest beside the dredged channel and extend into the channel itself and have apparently been impacted by channel maintenance activities in the past (Pearson and Simmons 1995). Additionally, the remains of this vessel were easily identified and recognized as a shipwreck on magnetometer and side-scan sonar records (Hoyt 1990; Pearson and Simmons 1995).

Because of this, diver examination was considered necessary to assess Targets 1, 5, 2 and 6. Diver examination of these targets discovered no significant cultural remains. One target (6) could not be relocated and it has apparently been removed from its original location. Two targets, 1 and 5, while producing intensive magnetics could not be found by divers. This suggests that the sources for these magnetics consist of small or scattered pieces of metal. In light of the history of past use of the Cat Island Pass Channel it is believed that these source objects consist of modern trash and debris accidentally or purposefully lost form commercial vessels. The source for Target 2 was located and identified as a piece of buried, cement coated pipe. This object is not considered significant, but it may represent a hazard that could damage a dredge if struck. Also, a linear ridge extending across the navigation channel may represent a continuation of the pipeline of which Target 2 is a part. It appears as if the pipe has been removed along this route, but some segments may exist buried adjacent to the present channel. The depth of the identified piece of pipe is about 4 feet below the bottom of the channel at a depth of about 18 to 19 ft below MGVD. The dredged depth for the channel is planned to be 18 feet, such that the target lies just at or just below the extent of dredging. Because the target could be impacted by dredging, its location should be considered during dredging operations. In summary, none of the remote-sensing targets examined in the Cat Island Pass Navigation Channel represent significant cultural remains and no further examination is considered necessary.

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APPENDIX A:

Scope of Services
Delivery Order No. 4

CEMVN-PD-RN March 28, 1997

SCOPE OF SERVICES
Contract DACW29-97-D-0017
Delivery Order 04

UNDERWATER CULTURAL RESOURCES SURVEY
OF THE HOUMA NAVIGATION CANAL CAT ISLAND PASS
CHANNEL REALIGNMENT, MILE -0.9 TO MILE -3.6,
TERREBONNE PARISH, LOUISIANA.

1. **Introduction**

This delivery order calls for a remote sensing survey for underwater cultural resources in Cat Island Pass, Terrebonne Parish, Louisiana. The U.S. Army Corps of Engineers, New Orleans District (NOD) plans to realign a portion of the Houma Navigation Canal (HNC) from Mile -0.9 to Mile -3.6, C/L Station 2000+00 to C/L Station 2145+00 using a hydraulic cutterhead dredge. Between Mile 0 and the minus 18-foot contour in the Gulf of Mexico, the HNC measures 18-feet-deep and 300-feet-wide. Additional details on the project are provided in Sections 2 and 3, below. The contract period for this delivery order is 32 weeks.

2. **Project Area**

The project area is located in Cat Island Pass, between Terrebonne Bay and the Gulf of Mexico (Attachment 1). A segment of the HNC from Mile -0.9 to Mile -3.0 is to be realigned approximately 700 feet to the west. A segment of the HNC from Mile -3.0 to Mile -3.6 is to be realigned approximately 500 feet east. There will be no change to the navigation channel's maintained width or depth. Approximately 100 acres of new water bottom, 900,000 cubic yards of material, would be dredged as a result of this realignment.

3. **Background Information**

Timbalier Island, a barrier island located immediately east of the existing channel, is moving laterally depositing sediments into the existing channel with impacts to shipping interests. The realignment of the HNC is necessary to reduce the frequency of maintenance dredging caused by increased shoaling. The material removed from channel is to be placed in the existing ocean dredged material disposal site located west of the navigation channel. For the purpose of this study, investigations are to be conducted only within the limits of the channel realignment.

A consideration of cultural resources was included in NOD's 1975 report entitled Composite Environmental Statement for Operation and Maintenance Dredging of Four Projects Located South of the Gulf Intracoastal Waterway in Terrebonne Parish, Louisiana. An inventory of shipwrecks and other waterborne resources surrounding the HNC was completed by Pearson, et al. (1989). The wreck of the ca. 1858 *Afton Jr.* was reported on the west side of the navigation channel near Mile 0. The *Thistle* is reported to have wrecked east of the HNC in 1887. The *Lizzie Haas* is reported to have sank just west of the project area in 1902. There is a potential for encountering remains of shipwrecks or other underwater cultural resources within the project area.

4. General Nature of the Work

The purpose of this study is to locate significant historic shipwrecks or other underwater cultural resources which may exist in the project area. The study will employ a systematic magnetometer and side-scan sonar and bathymetric survey of the study area using precise navigation control. All magnetic and sonar anomalies will be interpreted based on expectations of the character of shipwreck signatures. All potentially significant anomalies located by the survey will be investigated by more intensive survey. No diving will be performed under this delivery order.

5. Study Requirements

The study will be conducted utilizing current professional standards and guidelines including, but not limited to:

- the National Park Service's National Register Bulletin 15 entitled, "How to Apply the National Register Criteria for Evaluation";

- the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation as published in the Federal Register on September 29, 1983;

•Louisiana's Comprehensive Archaeological Plan, dated October 1, 1983;

•The Advisory Council on Historic Preservation's regulation 36 CFR Part 800 entitled, "Protection of Historic Properties";

•the Louisiana Submerged Cultural Resource Management Plan published by the Division of Archaeology in 1990.

The study will be conducted in three phases: Review of Background Sources, Remote Sensing Survey, and Data Analyses and Report Preparation.

a. Phase 1: Review of Background Sources. This phase is limited to research of available literature and pertinent historical, archival, geomorphological and nautical maps and records contained in existing documents. A navigational history and an inventory of known shipwrecks in the study area is provided in the report entitled A History of Waterborne Commerce and Transportation within the U.S. Army Corps of Engineers, New Orleans District and an Inventory of Known Underwater Cultural Resources prepared by Coastal Environments, Inc. (1989). The focus of this work will be to identify available information on shipwrecks recorded in the project vicinity, identify historic and modern navigation hazards or other anomalies or features which might relate to significant underwater resources. The background work will provide a context for interpreting anomalies which may be discovered during the course of the survey.

b. Phase 2: Remote Sensing Survey. Upon completion of Phase 1, the contractor shall proceed with execution of the remote sensing fieldwork. The equipment array required for this survey effort is:

(1) a marine magnetometer
(2) a positioning system
(3) a side-scan sonar system
(4) a fathometer.

The survey will include an approximately 100 acre area inside the boundaries drawn by joining the following (NAD 1927) coordinates:

1) x=2240075.44, y=147936.90
2) x=2243982.30, y=135722.85
3) x=2244268.04, y=135814.25
4) x=2240359.13, y=148034.68

The following requirements apply to the survey:

(1) transect lane spacing will be no more than 100 feet.
(2) positioning control points will be obtained at least every 100 feet along transects,
(4) background noise will not exceed +/- 3 gammas,
(5) magnetic data will be recorded on 100 gamma scale,
(6) the magnetometer sensor will be towed a minimum of 2.5 times the length of the boat or projected in front of the survey vessel to avoid noise from the survey vessel,
(7) the survey will utilize the Louisiana State Plane Coordinate System,
(8) additional, more tightly spaced, transects will be run over all potentially significant anomalies.

Two copies of a brief management summary will be submitted to the COR within two weeks after completion of the fieldwork (eight weeks after award). Additional requirements for the management summary are contained in Section 6 of this Scope of Services.

c. Phase 3: Data Analyses and Report Preparation. All data will be analyzed using currently acceptable scientific methods. The post-survey data analyses and report presentation will include as a minimum:

(1) post-plots of survey transects and data points;
(2) same as above with magnetic data included;
(3) plan views of all potentially significant anomalies showing transects, data points and contours;
(4) correlation of magnetic, sonar, and fathometer data, where appropriate.

The interpretation of identified magnetic anomalies will rely on expectations of the character (i.e. signature) of shipwreck magnetics derived from the available literature. Interpretation of anomalies will also consider probable post-depositional impacts and the potential for natural and modern, i.e. insignificant, sources of anomalies. The Contractor will file state site forms with the Louisiana State Archeologist and cite the resulting state-assigned site numbers in all draft and final reports for any anomaly classified as a site.

The report shall contain an inventory of all magnetic anomalies recorded during the underwater survey, with recommendations for further identification and evaluation procedures when appropriate. These discussions must include justifications for the selection of specific targets for further evaluation. The potential for each target or submerged historic property to contribute to archeological or historical knowledge will be assessed. Thus, the Contractor will classify each anomaly as either potentially eligible for inclusion in the National Register, or not eligible. The Contractor shall fully support his recommendations regarding site significance. The report will include a summary table listing all anomalies. At a minimum, the tables will include the following information: Project Name; Survey Segment/Area; Magnetic Target Number; Gammas Intensity; Target Coordinates (Louisiana State Plane). The report will provide the assessment of potential significance and recommendations for further work. Recommendations for equipment and methodology to be employed in future evaluation studies must be discussed in detail.

If determined necessary by the COR, the final report will not include detailed site location descriptions, state plane or UTM coordinates. The decision on whether to remove such data from the final report will be based upon the results of the survey. If removed from the final report, such data will be provided in a separate appendix. The analyses will be fully documented. Methodologies and assumptions employed will be explained and justified. Inferential statements and conclusions will be supported by statistics where possible. Additional requirements for the draft and final report are contained in Section 6 of this Scope of Services.

A product to be provided under this delivery order and submitted with the draft reports will include CAD design files compatible with the NOD Intergraph system and the NOD provided base map design files. The files will use the same settings and precision as the seed file for the NOD base map .dgn file. In addition to the information specified above, the survey coverage area, the locations of all anomalies and other pertinent features such as: channel beacons and buoys, cables and pipeline crossings, etc. are to be included on the map.

6. Reports

a. Management Summary Two copies of a brief management summary which presents the results of the fieldwork will be submitted to the COR within two weeks of completion of the fieldwork (eight weeks after award). The report will include a summary table listing all anomalies, a brief description of each anomaly located during the survey, and recommendations for further identification and evaluation procedures when appropriate. A preliminary map will be included showing the locations of each anomaly.

b. Draft and Final Reports Five copies of a draft report integrating all phases of this investigation will be submitted to the COR for review and comment within 14 weeks after the date of the award. Completed state site forms will be submitted under separate cover at the same time as the draft report. The final report shall follow the format set forth in MIL-STD-847A with the following exceptions: (1) separate, soft, durable, wrap-around covers will be used instead of self covers; (2) page size shall be 8-1/2 x 11 inches with 1-inch margins; (3) the reference format of American Antiquity will be used. Spelling shall be in accordance with the U.S. Government Printing Office Style Manual dated January 1973.

The COR will provide all review comments to the Contractor within 8 weeks after receipt of the draft reports (22 weeks after date of order). Upon receipt of the review comments on the draft report, the Contractor shall incorporate or resolve all comments and submit one preliminary copy of the final report to the COR within 4 weeks (26 weeks after date of order). Upon approval of the preliminary final report by the COR, the Contractor will submit one reproducible master copy, one copy on floppy diskette, 30 copies of the final report, and all separate appendices to the COR within 32 weeks after date of order. A copy of the Scope of Services shall be bound as an appendix with the Final Report. The Contractor shall also supply a complete listing of all computer files submitted. This listing will include file names, file types, disk number, and file description.

7. Weather Contingencies

The potential for weather-related delays during the survey necessitates provision of one weather contingency day in the delivery order. If the Contractor experiences unusual weather conditions, he will be allowed additional time on the delivery schedule but no cost adjustment.

8. Attachments

Attachment 1. Map showing the study area

APPENDIX B:

Scope of Services
Delivery Order No. 5

CEMVN-PD-RN

September 25, 1997

SCOPE OF SERVICES
Contract DACW29-97-D-0017
Delivery Order 05

AN EVALUATION OF MAGNETIC ANOMALIES FOR
THE HOUMA NAVIGATION, CANAL CAT ISLAND PASS
CHANNEL REALIGNMENT, MILE -0.9 TO MILE -3.6,
TERREBONNE PARISH, LOUISIANA.

1. Introduction

This delivery order requires the identification, recordation and evaluation of three potentially significant underwater anomalies and one anomaly cluster identified as a result of a remote sensing survey of the Houma Navigation (HNC) Canal Cat Island Pass, Channel Realignment Project, Terrebonne Parish, Louisiana. A remote sensing survey was completed by Coastal Environments, Incorporated (CEI) for the U.S. Army Corps of Engineers, New Orleans District (NOD). The NOD plans to realign a portion of the HNC from Mile -0.9 to Mile -3.6, C/L Station 2000+00 to C/L Station 2145+00 using a hydraulic cutterhead dredge. The contract period for this delivery order is 24 weeks.

2. Project Area

The project area consists of the reported locations of Anomaly Numbers 1, 2, 4, 5, and 6. Anomalies 1, 4, and 5 are isolated targets. Anomalies 2 and 6, recorded on adjacent track lines, represent an anomaly cluster.

3. Background Information

Available information on the three anomalies and one anomaly cluster is found in the management summary dated September 12, 1997 and subsequent correspondence faxed to NOD.

4. General Nature of the Work

The study will consist of hands-on diver verification, recordation, and evaluation of anomalies; data analysis and report preparation.

5. <u>Study Requirements</u>

The study will be conducted utilizing current professional standards and guidelines including, but not limited to:

- •the National Park Service's National Register Bulletin 15 entitled, "How to Apply the National Register Criteria for Evaluation";

- •the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation as published in the Federal Register on September 29, 1983;

- •Louisiana's Comprehensive Archaeological Plan, dated October 1, 1983;

- •The Advisory Council on Historic Preservation's regulation 36 CFR Part 800 entitled, "Protection of Historic Properties";

- •the Louisiana Submerged Cultural Resource Management Plan published by the Division of Archaeology in 1990.

- •the U.S. Army Corps of Engineers Safety and Health Requirements Manual EM 385-1-1 Dated September 3, 1996.

The study will be conducted in two phases: Fieldwork, and Data Analyses and Report Preparation.

a. <u>Phase 1: Fieldwork</u>. Fieldwork will be initiated immediately upon award of this delivery order and will be prosecuted as expeditiously as possible. The fieldwork shall commence with the relocation and verification of anomaly locations. This will require diving and possibly some excavation. The methods shall include, and are not limited to, physical search of the water bottom at anomaly locations, use of metal detector, probing to locate buried sources, and hydraulic jet excavation, if necessary, to uncover anomaly sources.

For any anomaly classified as a site, the Contractor will file state site forms with the Louisiana State Archeologist and cite the resulting state-assigned site numbers in all draft and final reports. All sites recorded in the project area will be recorded to scale on the appropriate 7.5 minute quadrangle. Artifacts may be observed and recorded but not collected from the site.

Site recordation will consist of hands-on examination, including measuring and mapping each site. Maps will include site boundaries, control point locations, feature and artifact locations, excavation areas, and prominent natural and cultural features in the site area.

b. Phase 2: Data Analysis and Report Preparation. All data will be analyzed using currently acceptable scientific methods. All anomalies will be evaluated against the National Register criteria contained in Title 36 CFR Part 60.4 and within the framework of the historic setting to assess the potential eligibility for inclusion in the National Register.

The historic setting for shipwrecks within NOD has been described in the report entitled A History of Waterborne Commerce and Transportation Within the U.S. Army Corps of Engineers, New Orleans District and an Inventory of Known Underwater Cultural Resources prepared by CEI. The collection of additional information on the historic setting of the HNC project area is now being undertaken by CEI as part of the original survey efforts for this project.

The Contractor shall classify each site as either eligible for inclusion in the National Register or not eligible. The Contractor shall fully support his recommendations regarding site significance. The Contractor shall also recommend detailed and appropriate mitigation measures for all sites classified as eligible.

The analyses will be fully documented. Methodologies and assumptions employed will be explained and justified. Inferential statements and conclusions will be supported by statistics where possible. Additional requirements for the draft report are contained in Section 6 of this scope of services.

6. Reports

a. Phase 1 Interim Report. Immediately upon completion of the fieldwork, the Contractor shall meet with NOD's technical reviewer(s) to provide a verbal report on the results of the fieldwork.

b. Draft and Final Reports. The written report of investigations shall be incorporated into the initial draft survey report to be completed under Delivery Order Number 2 of this same contract. The schedule of the initial draft survey report will be revised as necessary. Five copies of a draft report integrating all phases of this investigation will be submitted to the COR for review and comment within 6 weeks upon completion of the fieldwork (11 weeks after award of this delivery order). Copies of the completed state site forms will be submitted with the draft report.

In accordance with the requirements of Delivery Order Number 2, under this contract, the final report shall follow the format set forth in MIL-STD-847A with the following exceptions: (1) separate, soft, durable, wrap-around covers will be used instead of self covers; (2) page size shall be 8-1/2 x 11 inches with 1-inch margins; (3) the reference format of American Antiquity will be used. Spelling shall be in accordance with the U.S. Government Printing Office Style Manual dated January 1973.

The COR will provide all review comments to the Contractor within 6 weeks after receipt of the draft reports (17 weeks after date of order). Upon receipt of the review comments on the draft report, the Contractor shall incorporate or resolve all comments and submit one preliminary copy of the final report to the COR within 4 weeks (21 weeks after date of order). Upon approval of the preliminary final report by the COR, the Contractor will submit one reproducible master copy, one copy on floppy diskette, 30 copies of the final report, and all separate appendices to the COR within 24 weeks after date of order. A copy of the Scope of Services shall be bound as an appendix with the Final Report. The Contractor shall also supply a complete listing of all computer files submitted. This listing will include file names, file types, disk number, and file description.

7. Weather Contingencies

The potential for weather-related delays during the investigations necessitates provision of one weather contingency day in the delivery order. The Contractor assumes the risk for any additional costs associated with weather delays in excess of one day. If the Contractor experiences unusual weather conditions, he will be allowed additional time on the delivery schedule but no cost adjustment.