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U.S. Army Corps
of Engineers
New Orleans District

REMOTE-SENSING SURVEY OF THE BAYOU
LABRANCHE WETLANDS RESTORATION
BORROW AREA, ST. CHARLES PARISH,
LOUISIANA

FINAL REPORT

March 1993

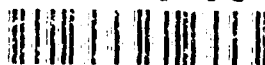
COASTAL ENVIRONMENTS, INC.

1260 MAIN STREET
BATON ROUGE, LA 70802

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New Orleans District
P.O. Box 60267
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**REMOTE-SENSING SURVEY OF THE BAYOU
LABRANCHE WETLANDS RESTORATION
BORROW AREA, ST. CHARLES PARISH,
LOUISIANA**

**By
Charles E. Pearson
William D. Reeves
and
Allen R. Saltus, Jr.**

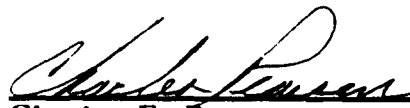
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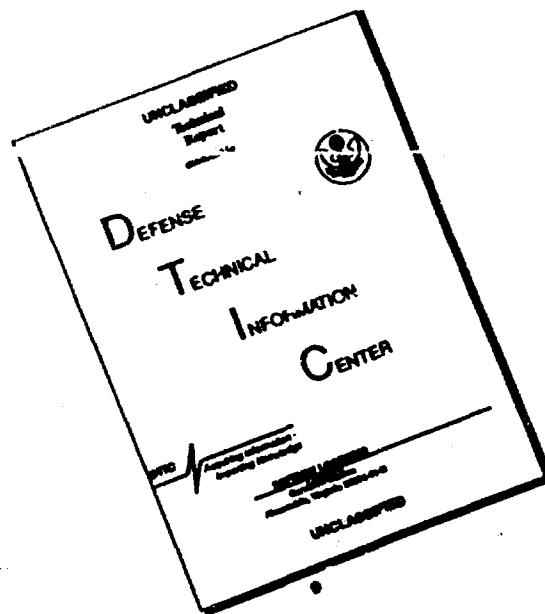
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March 1993

**Coastal Environments, Inc.
1260 Main Street
Baton Rouge, LA 70806**


**Charles E. Pearson
Principal Investigator**

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A remote-sensing survey was conducted at a proposed 500-acre borrow area in western Lake Pontchartrain just off the mouth of Bayou Labranche, St. Charles Parish, Louisiana. Diver examination was conducted at three targets selected as potential cultural properties. No significant cultural remains were found at any of the target locations. A synthesis of documentary information provides a history of the use and settlement of Bayou Labranche and vicinity.				
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REPLY TO
ATTENTION OF:

Planning Division
Environmental Analysis Branch

To The Reader:

This cultural resources effort 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 work documented in this report was performed to provide information needed to assess cultural resource impacts which could result from a Borrow Area in the Lake Pontchartrain.

This report has been reviewed and accepted by the New Orleans District. We commend the contractor's efforts and careful scholarship.

Howard R. Bush

Howard R. Bush
Authorized Representative
of the Contracting Officer

R. H. Schroeder, Jr.

R. H. Schroeder, Jr.
Chief, Planning Division

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CHAPTER 1:

INTRODUCTION

This report presents the results of a cultural resources survey and evaluation of a proposed borrow area located in western Lake Pontchartrain, St. Charles Parish, Louisiana, just off the mouth of a small stream known as Bayou Labranche (Figure 1). The study was conducted by Coastal Environments, Inc., (CEI), of Baton Rouge, Louisiana, for the New Orleans District, U.S. Army Corps of Engineers under Delivery Order No. 0001, Contract DACW29-92-D-0013. The project involved a systematic remote-sensing survey of the 500-ac borrow area (the project area), diving on several targets located during the survey, and the collection of background information on the history, geology, and archeology of the project area. The investigations were designed to locate, identify, and evaluate the significance of any cultural properties in the offshore borrow area, particularly the remains of lost boats and ships.

This borrow area is to serve as the source for sediments that will be dredged and pumped into an adjacent marsh area in order to create new vegetated wetlands. Known as the Bayou Labranche Wetlands Restoration Project, the overall objective is to restore and nourish a portion of the seriously deteriorated marshes located just east of the mouth of Bayou Labranche. The 500-acre borrow area begins about 2000 ft from the lakeshore, extends for 3000 ft into the lake, and measures 7700 ft long (Figure 1). The marsh area where dredged material is to be placed (Figure 1) was not examined in this study because the Corps of Engineers had determined that it had a low probability for containing significant cultural properties.

Although no cultural resources, specifically shipwrecks, are known to exist within the borrow area, Lake Pontchartrain has been used as an important route of travel and commerce since prehistoric times and the potential for boat and shipwrecks in the lake was considered moderately high. Pearson et al. (1989) report 175 recorded wrecks in Lake Pontchartrain, and many other unreported wrecks certainly exist. Additionally, the historical record reveals that Bayou Labranche served as a route of travel between Lake Pontchartrain and the Mississippi River during the early years of French colonization and settlement, and probably also during the prehistoric period, as evidenced by several archeological sites along the bayou and its tributaries. In the late-nineteenth and early-twentieth centuries the area at the mouth of Bayou Labranche was utilized for farming, probably resulting in some amount of small boat activity in and out of the bayou. All of these factors increase the possibility that sunken boats, as well as other cultural remains, may exist in the project area.

The primary instruments used in the remote-sensing survey were the proton precession magnetometer and fathometer. In the last decade, these instruments have become standard elements in the array of equipment used to search for shipwrecks. Details on the equipment and results of the remote-sensing survey are provided in later sections of

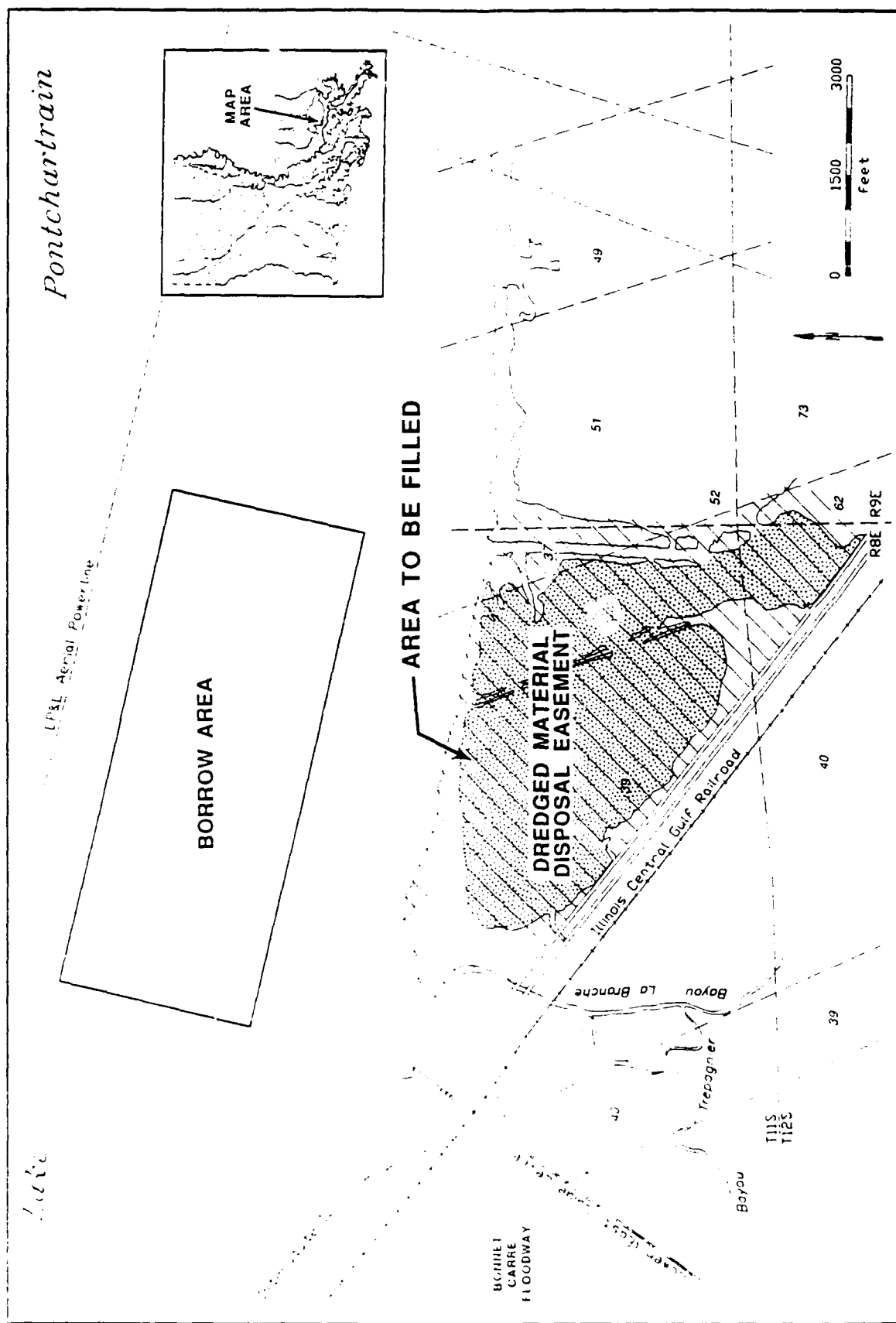


Figure 1. The location of the offshore borrow area (the project area) in relation to the proposed dredged material disposal easement and major natural and cultural features.

this report. As noted, in conjunction with the remote-sensing survey, assessments of the geological background and cultural and settlement history of the project area were made. This information provided a background against which the results of the remote-sensing data could be interpreted.

The data developed in this study are meant primarily to provide the New Orleans District with information on the cultural resources potential of the project area. In addition, it is hoped that the information presented here will serve as a contribution to the broader realm of the District's overall management of cultural resources. Further, it is hoped that this study will serve as a contribution to our understanding of the history of the Lake Pontchartrain region.

CHAPTER 2:

NATURAL SETTING

Regional Geology and Geomorphology

The project area is located in the shallow water of the western end of Lake Pontchartrain, at the southwestern edge of what is known as the Pontchartrain Basin. To the west lie backswamps and natural levees of the Mississippi River, whose channel is 5 mi west of the project area (Figure 2).¹ The geology of this area is dominated by the Mississippi River, its past deltaic processes and present fluvial processes. Over the past 30 years, a considerable amount of geological research that provides the framework for understanding the geologic history and setting of the project area has been conducted (e.g., Fisk 1944; Frazier 1967; Kolb and van Lopik 1958; Kolb, Smith, and Silva 1975; and Russell 1936). Of particular relevance here is the work of Roger Saucier (1963) on the geomorphic history of the Pontchartrain Basin.

The Pontchartrain Basin is a large lowland included in the Mississippi River deltaic plain bounded on the north and west by Pleistocene-age Prairie Terrace formations, and on the south and east by deposits associated with former and present courses and deltaic features of the Mississippi River (Saucier 1963:xii). Most of the area of the basin is today occupied by two shallow-water lakes, Lake Pontchartrain, and the smaller, Lake Maurepas (Figure 2). The Pontchartrain Basin is underlain by a southward continuation of the Prairie formation which is exposed at the ground surface north of the basin. With the onset of falling sea levels in the early part of the Late Wisconsin glacial stage, the Mississippi River and smaller water courses draining the Prairie surface eroded deeply as they adjusted to the changing base level. This system of entrenched valleys has been partially mapped and indicates that several streams converged to form a single, large southward-running channel located just west of the Jefferson Parish-Orleans Parish boundary (Saucier 1963:41). This trench is about 1.3 mi wide and 75 ft deep. The top of the Pleistocene surface at this location is about 75 ft below the present ground surface (Saucier 1963:Fig. 14). One of the tributaries of this major stream runs directly beneath the project area.

Beginning about 18,500 years ago, rising sea levels began to flood the lower ends of these entrenched valleys, and between 4000 and 7000 years BP, when sea level reached near its current level, the shoreline of the Gulf of Mexico was at the Prairie Terrace formations that today constitute the northern boundary of the Pontchartrain Basin. At this time, a large east-west trending barrier spit developed extending from near the mouth of the Pearl River to just west of New Orleans. Known as the Pine Island Beach trend, this sandy spit created a

¹. In the present study, English rather than metric measurements generally are used to conform with the measurements used by the Corps of Engineers for project design and construction.

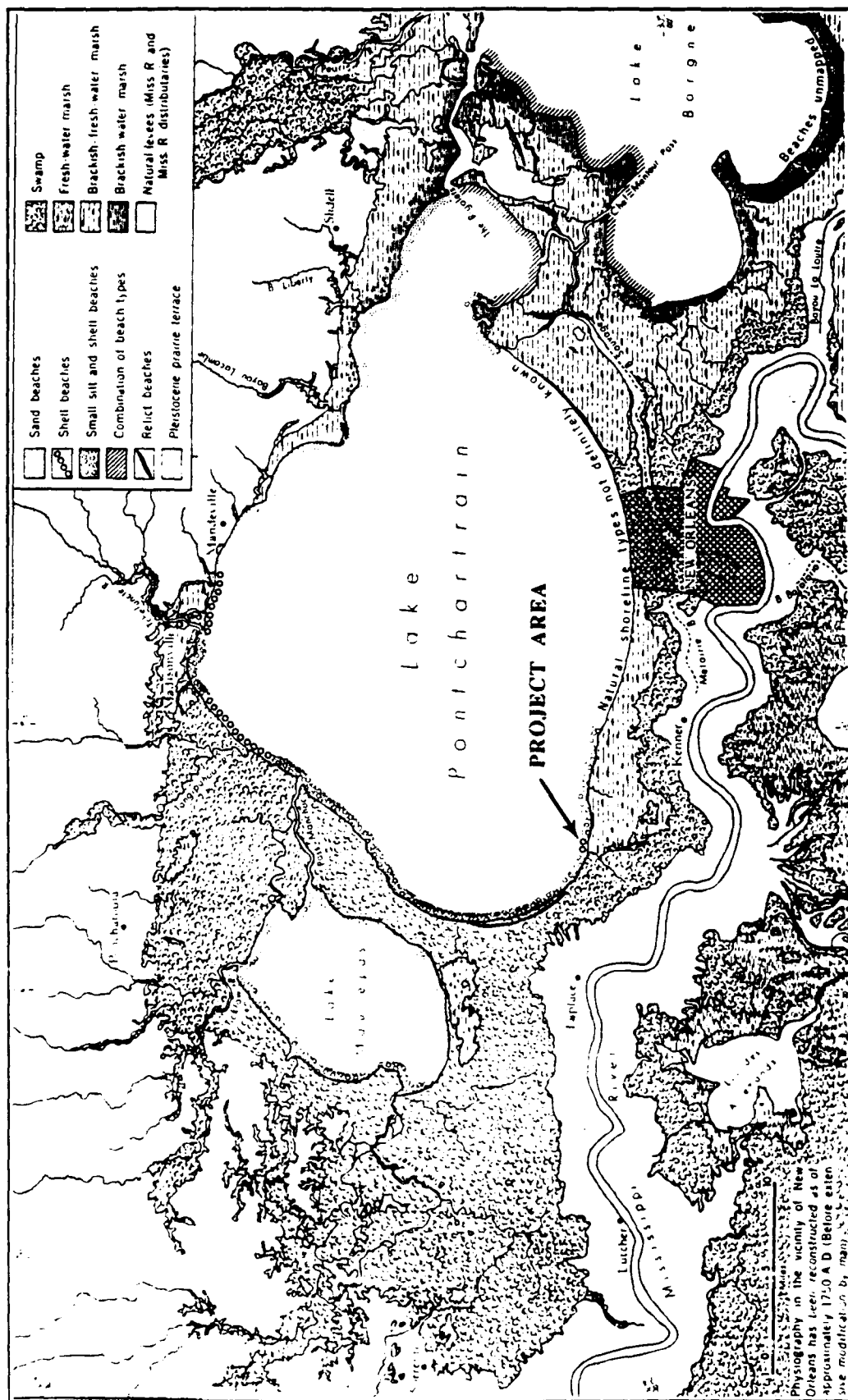


Figure 2. The Pontchartrain Basin showing the project area and major physiographic features (source: Saucier 1963:Fig. 7).

brackish water impoundment known as the Pontchartrain Embayment, which partially encompassed what was to become Lake Pontchartrain.

When the Pontchartrain Embayment was being formed, the entrenched Mississippi River was located farther west; but with rising sea levels the river shifted eastward and began the progradation of an early deltaic system into the region. Over the next several thousand years, the river produced various distinct deltaic systems as it shifted either east or west, dumping untold millions of tons of silt and sand into the Gulf of Mexico (Figure 3). This early deltaic system near the Pontchartrain Embayment has been variously identified as either the Cocodrie (Saucier 1963) or Metairie Delta (Weinstein and Gagliano 1985:123), or an early stage of the St. Bernard Delta complex by Frazier (1967). Saucier, using a series of radiocarbon determinations and prehistoric site occurrences, suggested that the major development of this entire system occurred between about 3,800 and 4,000 years ago (Saucier 1963:61-62), although Frazier (1967:Figure 2) contends that the growth and expansion of the system continued after this date. Between about 1,800 and 3,400 years ago, the initial Metairie system prograded into two major lobes: one, termed the St. Bernard system, expanded to form much

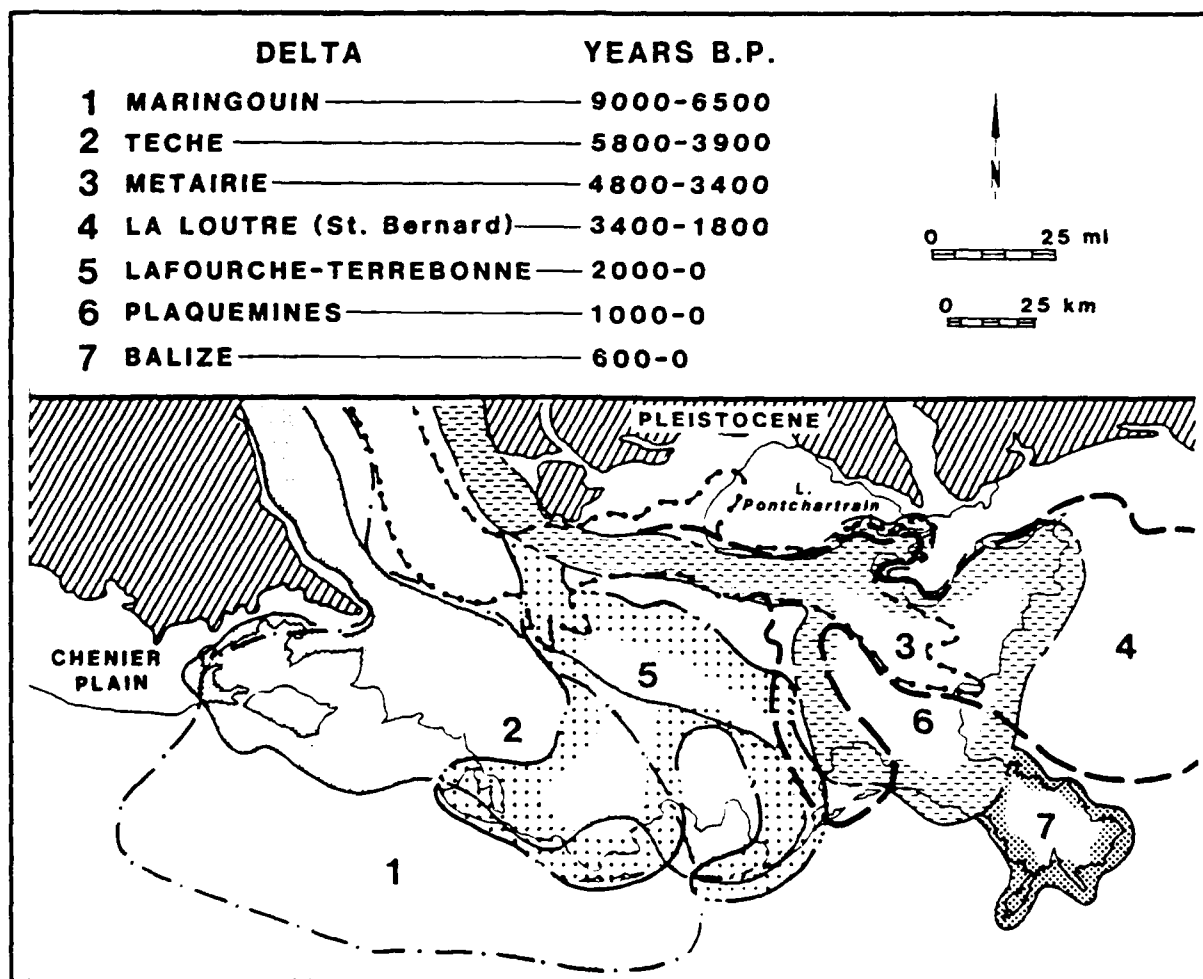


Figure 3. Mississippi River Delta sequence over the past 9,000 years (source: Weinstein and Gagliano 1985:Figure 1).

of the land in present-day St. Bernard Parish; and the other, the La Loutre system, prograded south from the area of New Orleans along a course now occupied by Bayou des Familles, Barataria Bayou and Bayou Cutler (Weinstein and Gagliano 1985:123). Hahn and Pearson (1988:23) recently reported on radiocarbon dates from buried natural levee features presumed to be associated with Metairie Delta system in St. Charles Parish, just a few miles east of the project area. These dates indicate the Metairie deltaic features here could date as late as 1700 years B. P. (Before Present), suggesting the features could be associated with the later La Loutre lobe, supporting the contention of Weinstein and Gagliano (1985:123) that the system was developing as late as about 1800 B. P. These early natural levee deposits lie at a depth of about 15 to 20 ft beneath the present ground surface (and below the study area). Whatever the date, with the expansion of deltaic formations into this area the Pontchartrain Embayment was closed off and Lake Pontchartrain was formed.

Sometime before 2,000 years ago the Mississippi River began shifting some of its flow to the west, following present-day Bayou Lafourche and creating the Lafourche-Terrebonne Delta (see Figure 3) (Weinstein and Gagliano 1985:125). The old deltaic and fluvial features of the Metairie system lost much of their flow and underwent subsidence and deterioration, allowing Gulf waters into Lake Pontchartrain, resulting in a brackish-water environment. About 1,200 years ago the main flow of the Mississippi River again shifted east, either near or actually reoccupying the older Metairie-La Loutre channel. This shift to the east led to additional land development in present-day St. Bernard and Plaquemine parishes, overlying the earlier deposits of the St. Bernard and La Loutre lobes (Weinstein and Gagliano 1985:125). These deltaic deposits again isolated Lake Pontchartrain from the Gulf of Mexico, except for an outlet at the eastern end, corresponding closely to the present-day location of the Rigolets (Saucier 1963:75). These deltaic developments marked the last period of extensive sedimentation in the Pontchartrain Basin; since that time the shoreline of Lake Pontchartrain has generally expanded through erosion. Consequently, as Saucier notes (1963:75) former shoreline locations are now located well out in the lake. By about 600 years ago, the flow of the Mississippi River in the area just south of New Orleans coalesced into a major channel following the present course and began the formation of the present bird-foot delta, known as the Balize Delta (see Figure 3) (Weinstein and Gagliano 1985:125).

Natural Setting of the Project Area

The project area lies in the shallow waters of the western end of Lake Pontchartrain, about 2,000 ft from the shoreline. Just west of the project area is the Lower Guide Levee of the Bonnet Carré Floodway, a man-made spillway designed to carry water from the Mississippi River to Lake Pontchartrain during periods of flood. Just east of the guide levee, Bayou Labranche empties into the lake (Figure 4). Bayou Labranche, and its major tributary, Bayou Trepagnier, drain the backswamp and marsh areas lying between Lake Pontchartrain and the Mississippi River. Interstate 10 and the tracks of the Illinois Central Railroad run along the lakeshore just southwest of the project area.

Water depths in the borrow area range from about 2 ft to about 11 ft. Bottom sediments, as observed during diving, consist primarily of silts and sandy silts and the entire lake bottom in the project area contains a large population of live *Rangia cuneata*. Probing during the diving operations indicated that these relatively soft, silty deposits extended to depths of 6 to 9 ft below the lake bottom, at which point a lens or layer of harder material was encountered, apparently shell. The 6-to-9-ft-thick silty sediments are presumed to be

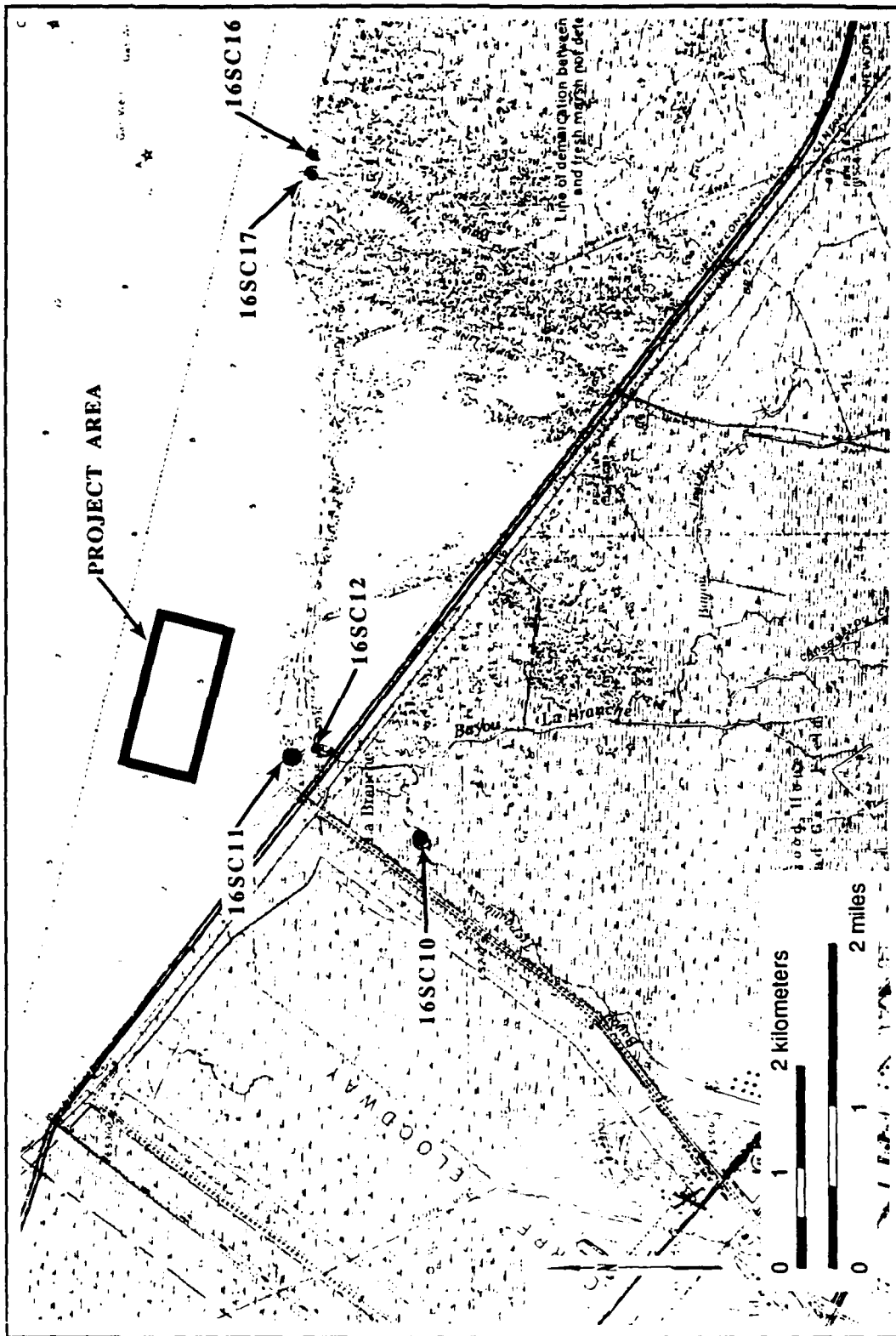


Figure 4. Cultural and natural features in the vicinity of the project area (Map Source: USGS Bonnet Carré Quadrangle, 15 min series, 1969).

Mississippi River deposits derived from the overflow of the several crevasses which have occurred at Bonnet Carré over the past century. Bonnet Carré, located on a cutbank of the Mississippi just east of Laplace, has been the site of numerous crevasses since the mid-nineteenth century. Crevasses have been reported here since 1750 (Gunter 1953), and major ones occurred in 1849, 1857, 1867, 1871, and a series of almost continuous crevasses occurred between 1874 and 1882 (Saucier 1963:89). Through time, the crevasses at Bonnet Carré, as well as those elsewhere, increased in intensity because of the artificially high water levels maintained in the Mississippi River by the construction of an expanding system of artificial levees (Elliott 1932; Saucier 1963:86-88). In most instances, waters from the Bonnet Carré crevasses flowed across the Mississippi River's natural levees, through the backswamps and into Lake Pontchartrain, carrying tremendous quantities of sediment which were deposited in the lake. The crevasse of 1874 was described by Hardee (1876:112):

The present crevasse, which was caused in the spring of 1874 by breach in the levee at Bonnet Carré bend, about 35 miles above the city [New Orleans], is now 1,370 feet in width in a direct line across the gap, and as the discharge of water courses towards lake Pontchartrain, 5 miles distant, it widens in a fan-like shape so that by the time it reaches the shore of the lake the flow of water has attained a breadth of more than 22 miles.

Hardee (1876) estimated that the sediments carried into Lake Pontchartrain by the crevasses of 1874-1876 covered an area measuring 22 mi long and 4 mi wide and were about 6.5 ft thick.

In 1931, the Corps of Engineers constructed the Bonnet Carré Floodway, primarily to protect new Orleans from flooding by serving as an overflow during periods of high water on the Mississippi River. The spillway also has served to eliminate natural crevasses at Bonnet Carré Bend. The spillway has been opened several times since its construction, and studies have indicated that these openings have carried considerable quantities of silty sediment into the lake, although the amounts appear to be less than was carried by natural crevasses (Saucier 1963:92). Some of the bottom sediments found in the project area, then, are certainly derived from openings of the spillway over the past 60 years.

Despite these periods of massive sediment influx, the shoreline of Lake Pontchartrain in the vicinity of the study area is retreating through erosion, just as is most of the perimeter of the lake. This shoreline retreat probably has been occurring for several hundred years, but reliable information on its rate and extent is available only for the past 100 years or so. Figure 5 presents information on shoreline positions around the mouth of Bayou Labranche taken from several reliable maps made in the late nineteenth and twentieth centuries. As can be seen, almost 1,000 ft of shoreline have been lost in this relatively short period of time. One must assume that several hundred years ago, the shoreline passed through the project area, as did the course of Bayou Labranche. Figure 5 also shows the positions of several former structures around the mouth of the bayou. Most of these were associated with an early-twentieth-century land reclamation and agricultural project established here. A full discussion of this ill-fated venture is presented in a later section.

Bayou Labranche represents the major drainage into Lake Pontchartrain in this area. The bayou extends from near the backslope of the Mississippi's natural levee below New Sarpy, running north for a distance of about 4 mi before emptying into Lake Pontchartrain. Its major tributaries are Bayou Traverse on the east, and Bayou Trepagnier on the west. Bayou

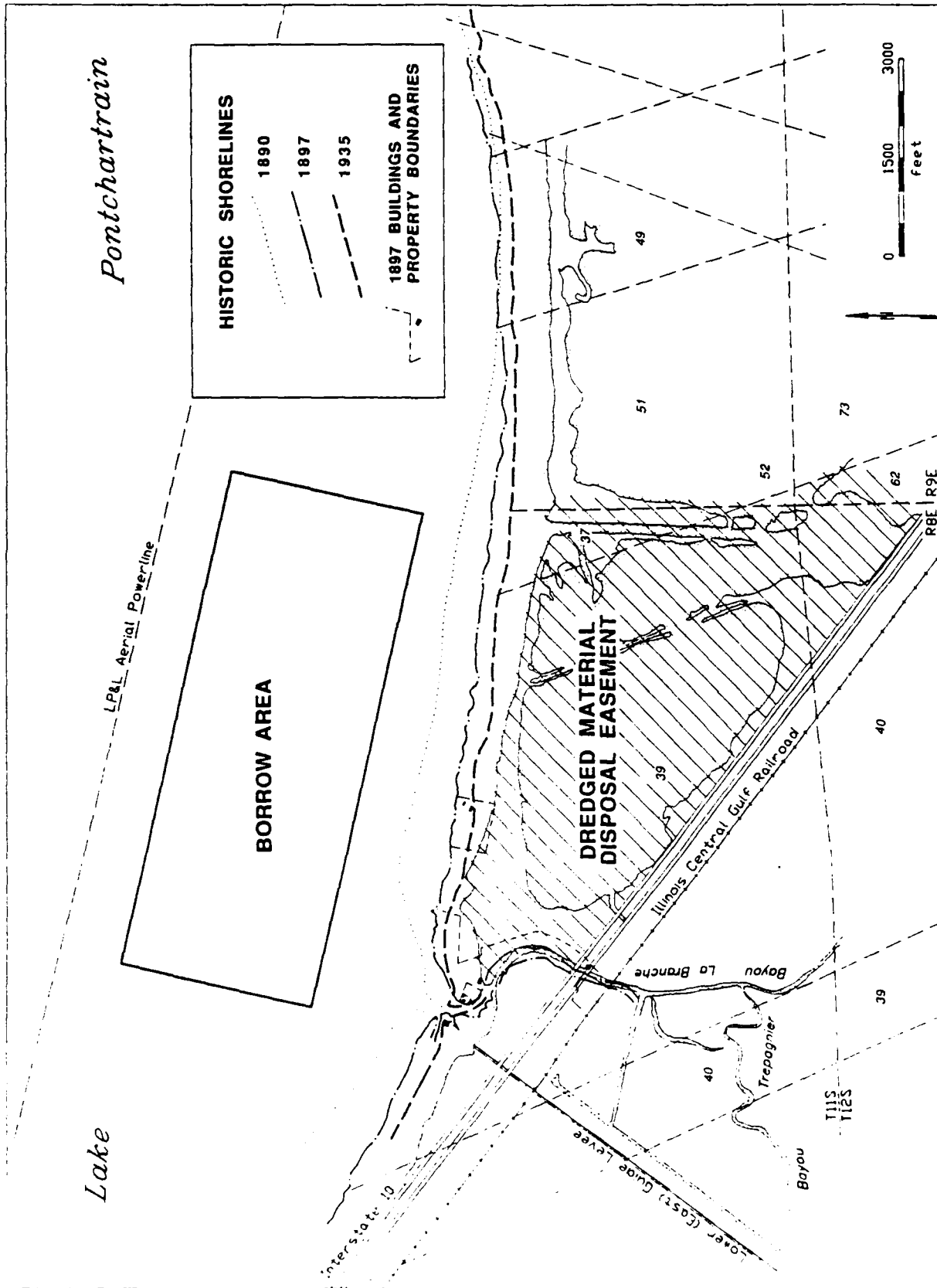


Figure 5. Historic shoreline locations in the vicinity of the project area. Note also the locations of several structures shown on the 1897 U.S. Coast and Geodetic Survey, Part of Lake Pontchartrain, Louisiana, map.

Trepagnier today generally parallels the Lower Bonnet Carré Guide Levee; however, this course may be fairly recent and partially artificial. Prior to the extensive crevassing at Bonnet Carré and the construction of the spillway, the course of Bayou Trepagnier may have extended farther west, across what is now the Bonnet Carré Floodway. Eighteenth-century maps of the area, while not extremely precise, do seem to indicate a more westerly position and course for the bayou. On these early maps, Bayou Labranche, or probably more precisely, the Bayou Labranche-Bayou Trepagnier system, was called "Bayou Tigouyn" (or some variant thereof) or "Ravine du Sueur."

Both Bayou Labranche and Bayou Trepagnier seem to be quite old, as indicated by prehistoric archeological sites located on their banks. The Bayou Trepagnier site (16SC10), apparently located on subsided levees of Bayou Trepagnier near its juncture with Bayou Labranche, has produced Tchefuncte culture ceramics, suggesting an occupation about 2,200 to 2,400 years ago (see Figure 4) (Weinstein et al. 1977:44). The site seems to have been abandoned until about 1,500 years ago, as evidenced by the occurrence of Baytown and Coles Creek ceramics (Weinstein et al. 1977:44). As discussed above, the exposed natural levees in this region should be associated with the modern course of the Mississippi River, which did not reoccupy this area until about 1,700 years ago, and possibly not until about 1,000 years ago (Weinstein and Gagliano 1985:125), long after the establishment of the Tchefuncte occupation at the Bayou Trepagnier site. Hahn and Pearson (1988:24) have put forth a hypothesis that suggests that the Bayou Trepagnier site was originally established about 2,400 years ago when the bayou was a distributary of the earlier Metairie Delta system. When the main flow of the Mississippi shifted to Bayou Lafourche about 2,000 BP, the bayou lost flow and sedimentation, its natural levees began to deteriorate and subside and were soon abandoned by their human occupants. Subsequently, when the main flow of the Mississippi returned to its approximate location about 1,500 years BP, the ancestral Bayou Trepagnier course was reoccupied, levee formation and progradation were reinstituted, and the bayou, and presumably, the surrounding area were reoccupied (Hahn and Pearson 1988:24). Bayous Trepagnier and Labranche apparently remained important for both habitation and travel up into the early historic period. As is discussed more fully below, in the eighteenth century one or both of these bayous were utilized by Indians and Europeans as a portage to pass between Lake Pontchartrain and the Mississippi River. However, European settlement in the region concentrated on the high, well-drained natural levees of the Mississippi; very little occupation occurred along the shore of Lake Pontchartrain.

Bayou Labranche seems to form a boundary between two major physiographic settings. Flanking the lake to the east of the bayou and extending to present-day New Orleans is an area consisting primarily of low-lying, brackish-freshwater marsh, while the region to the west and north of the bayou is characterized by typical riverine backswamps (see Figure 2). The marshes are characterized by very low salinities (derived from the waters of Lake Pontchartrain) and plants such as three-cornered grass, cattail, salt grass, black rush, and oyster grass. The distribution of plants in these marshes is complex and controlled by minor changes in elevation, drainage, and salinity (Saucier 1963:24). Today, a considerable amount of this marsh area has been converted to open water, a recent result of subsidence as well as increasing saltwater intrusion, which is killing off certain classes of marsh vegetation. Southward, away from Lake Pontchartrain and the project area, the brackish-freshwater marshes grade into typical bottomland backswamps which fringe the backslopes of the natural levee of the Mississippi River (see Figure 2).

The backswamp area to the west and north of Bayou Labranche is a poorly-drained, tree-covered setting. The dominant tree species are cypress and water tupelo, although most of the mature cypress have been removed by historic logging operations. Species such as red maple, black willow, cottonwoods, and several types of oaks occupy the slightly higher elevations in backswamps. Much of the swamp area is less than a foot above mean Gulf level, and sediments are characteristically organic to highly organic clays with scattered lenses of silt and peat (Saucier 1963:21). South and west of the backswamps are the natural levees of the Mississippi River (see Figure 2).

CHAPTER 3:

CULTURAL SETTING

Previous Investigations

Research on the geology and archeology of the Pontchartrain Basin area in general has been moderately intensive over the past 30 years. Some of this work has been conducted in the near vicinity of the project area, or has particular relevance to the present study. Roger Saucier's (1963) synthesis of the geomorphological history of the Pontchartrain Basin relied on both geological and archeological data. In particular, he used known archeological site ages and distributions to date landforms and to develop the geomorphological chronology for the basin. His work remains as the most comprehensive synthesis of these data for the region. In his study, Saucier drew on the earlier works of Ford and Quimby (1945); Ford and Webb (1956); Kniffen (1936); and McIntire (1954). Among the prehistoric sites used by Saucier in his study were three located just south of the project area: 16SC10, the Bayou Trepagnier site located along Bayou Trepagnier; 16SC11, the Bayou Labranche mouth site, located at the present mouth of Bayou Labranche; and 16SC12, the Bayou Labranche site, located on the east side of Bayou Labranche just in from its mouth (see Figure 4).

Subsequent to Saucier, an extensive survey and review of prehistoric sites in the western lake Pontchartrain area conducted relative to the proposed construction of Interstate 410 was undertaken by CEI (Weinstein et al. 1977). In 1980, CEI personnel visited several sites located on the shore of Lake Pontchartrain just east of the project area (Weinstein 1980). New World Research, Inc., conducted a cultural resources study of sections of the Lake Pontchartrain and Vicinity Hurricane Protection project east of the present project area. One element of that study involved magnetometer survey in Lake Pontchartrain which located a number of offshore targets, several of which were recommended for additional study (New World Research, Inc. 1983). In 1986, R. Christopher Goodwin and Associates, Inc., presented the results of a Phase 1 cultural resources survey of the Bonnet Carré Spillway (Yakubik et al. 1986). That study located five sites, primarily concentrated near the present Mississippi River. These sites included foundation remains on Roseland Plantation (16SC52), the Kenner and Kugler cemeteries (16OR50 and 16OR51), and three small surface scatters of artifacts. Subsequently, a Phase 2 study of the spillway resources was conducted (Poplin et al. 1988). It involved pedestrian survey and deep auger testing of selected areas within the spillway, including areas at the eastern end of the spillway adjacent to Lake Pontchartrain and near the present project area. No new archeological sites were found, but the three prehistoric sites on Bayous Labranche and Trepagnier were revisited (Poplin et al. 1988). In 1986, R. Christopher Goodwin and Associates, Inc., undertook a cultural resources inventory of the Montz Freshwater Diversion Project Corridor, at the upper boundary of the Bonnet Carré Floodway near the Mississippi River (Franks et al. 1986). In 1988, CEI, undertook a cultural resources survey relative to the St. Charles Parish Hurricane Protection levee (Hahn and

Pearson 1988). That study located three new sites, all representing historic period drainage facilities located on the backslope of the Mississippi River natural levee. In addition, the study included pedestrian survey and deep auger testing along the southern end of Bayou Trepagnier, a short distance south of the present study area.

Coastal Environments, Inc., recently conducted an overview of the history of navigation and the potential for boat wrecks in the waterways within the New Orleans District (Pearson et al. 1989). That study included a review of the history of boat use on Lake Pontchartrain and indicated that a large number of vessels had been lost in the lake during the historic period. No wrecks are known to exist in the immediate vicinity of the project area, but because of the extensive use of the lake since the prehistoric period, unrecorded losses may have occurred in this portion of the lake.

Previously Recorded Archeological Sites

Several previously recorded archeological sites lie in the near vicinity of the project area (see Figure 4). Three of these, 16SC10, 16SC11, and 16SC12, are prehistoric shell middens located along the banks of Bayous Labranche and Trepagnier. Two other nearby sites are 16 SC 16 and 16 SC 17, located on the shore of Lake Pontchartrain at the mouth of Bayou Piquant, about 3 mi east of the project area.

The **Bayou Trepagnier site (16SC10)** is a buried *Rangia cuneata* shell midden located on the west bank of Bayou Trepagnier about 0.9 mi from Lake Pontchartrain. This site was originally located during the dredging of Bayou Trepagnier and examinations of the site were made in 1951, 1958, 1963, and 1977. The site measures 610 ft long and at least 12 ft deep. Ceramic collections from the site reveal at least three cultural components: Tchefuncte (Pontchartrain phase); Baytown; and possibly Mississippian (Bayou Petre phase) (Weinstein et al. 1977:44).

The **Bayou Labranche Mouth site (16SC11)** is located on the east bank of the mouth of Bayou Labranche and consists of a wave-washed *Rangia* shell deposit stretching 250 ft along the shore of Lake Pontchartrain and about 150 ft along the bank of the bayou. Collections made in 1963 and 1977 indicate the site was occupied during the Marksville period. Additionally, historic ceramics and glass at the site suggest an early-twentieth-century occupation, probably related to the agricultural facility developed here at that time (see below) (Weinstein et al. 1977:49, 51, 53). Recently, archeologists with R. Christopher Goodwin and Associates conducted auger and shovel testing at the site and concluded that the earlier estimates of site size and condition were accurate (Poplin et al. 1988:84). A brief examination of this site was made during this study, but no collections were made. It appears as if lakeshore erosion is continuing to destroy and remove the site.

The **Bayou Labranche site (16SC12)** is a small, buried *Rangia* shell midden located on the east bank of Bayou Labranche about 1,200 ft from the bayou's mouth. This site was discovered during dredging operations in 1951 and has been visited several times; however, no diagnostic artifacts have ever been recovered from the site (Poplin et al. 1988; Weinstein 1980; Weinstein et al. 1977:53;). The site was briefly examined during the present study, but no artifacts were found. It appears to be partially covered by dredged material.

The two sites at the mouth of Bayou Piquant, 16SC16 and 16SC17, consist of wave-washed *Rangia* shell stretching along the lakeshore. One site, 16SC16, has produced ceramics dating from the Troyville-Coles Creek culture (Weinstein et al. 1977:53; Yakubik et al. 1986:44), but in 1980 it could not be relocated and it has possibly been destroyed by erosion (Weinstein 1980). Site 16SC17, also a wave-washed *Rangia* shell deposit, has produced ceramics indicative of a post-Marksville occupation (Yakubik et al. 1986:44; Weinstein et al. 1977:53). When revisited in 1980, this site also had disappeared (Weinstein 1980).

Occupational History of the Project Area

Aboriginal Occupation

The following section presents a brief overview of the sequence of prehistoric occupation in the western Lake Pontchartrain region, specifically as it is applicable to this study. As indicated in the above section on the geology of the region, aboriginal occupation in the vicinity of the study area will date only from the past 3000 years or so, that period when landforms became available for human settlement and exploitation.

Although aboriginal populations have resided in Louisiana since the Paleoindian period (Table 1), the earliest known archeological remains in the western lake Pontchartrain area date to the Poverty Point period (1500 B.C. to 500 B.C.). This period is characterized by distinctive baked clay balls (Poverty Point objects), microlith and lapidary industries, and earthworks. Poverty Point occupation is known from the nearby Bayou Jasmine site (16SJB2), located northwest of the present project area. Collections from the Bayou Jasmine site include a large number and variety of bone tools, as well as Poverty Point objects. Radiocarbon dates from the site yielded a date of circa 1750 B.C., slightly earlier than most Poverty Point components (Gagliano and Saucier 1963). Saucier (1963:60) argues that the Bayou Jasmine site is located on the subsided natural levees of a distributary of the Cocodrie Delta (the Metairie Delta system as used here) which ran northward from the area of Laplace. The occurrence of *Rangia cuneata* at the Bayou Jasmine site suggests a brackish-water environment for the nearby body of water (i.e., ancestral Lake Pontchartrain), presumably after the progradation of the Metairie deltaic system had partially isolated the Pontchartrain Embayment from Gulf waters. Poverty Point sites may exist in the near vicinity of the project area, but they would be on now-buried landforms associated with the Metairie Delta system.

As Hahn and Pearson (1988:16) note, these landforms occur at 15 to 20 ft below the surface in the upper reaches of Bayou Trepagnier, and presumably will be at similar or slightly shallower depths in the project area. Most importantly, sites are likely to be associated with distributary streams and their natural levee systems. If present-day Bayou Trepagnier and Bayou Labranche occupy the same or similar courses as earlier distributaries of the Metairie Delta system, then there may be early sites buried beneath them or encapsulated in their buried natural levees. The mouth of Bayou Labranche is just inland from the project area, and presumably, its course formerly ran across the project area prior to the erosion and retreat of the lake shoreline in this area. It is possible, then, that high probability landforms (in this case natural levees) exist buried beneath the project area. Prehistoric sites may or may not exist on these landforms.

Based on the geological history of the region, the earliest sites expected to be on surficial landforms would date no earlier than the Tchefuncte culture of the Tchula period (ca. 500 B.C.-A.D. 1). The Tchula period is characterized by the introduction of pottery and some cultivated

Table 1. Coastal Louisiana Cultural Sequence and Chronology.

STAGE	PERIOD	CULTURE	TIME INTERVAL	PHASES		
				Eastern Area	Central Area	Western Area
Formative	Historic	Various Cultures	PRESENT	Various Tribes		
			A.D. 1750			Little Pecan
			A.D. 1700			
	Mississippian	Mississippian Plaquemine	A.D. 1600	Delta Natchezan	Petite Anse	
			A.D. 1500	Medora	Burk Hill	Bayou Chene
				Barataria		
			A.D. 1200			
	Coles Creek	Transitional Coles Creek		St. Gabriel	Three Bayou	Holly Beach
			A.D. 1000			
		Coles Creek	A.D. 900	Bayou Ramos	Morgan	Jeff Davis
			A.D. 850	Bayou Cutler	White Lake	Welsh
			A.D. 700			
	Baytown	Truyville-like		Whitehall	?	Roanoke
			A.D. 400			
	Marksville	Marksville		Gunboat Landing	Vezey	Lake Arthur
			A.D. 200	Magnolia & Mandalay		
				Smithfield	Jefferson Island	Lacassine
				LaBranche		
			A.D. 1			
	Tchula	Tchefuncte	250 B.C.	Beau Mire	Lafayette	Grand Lake
			500 B.C.	Pontchartrain		

(continued)

Table 1. Concluded.

STAGE	PERIOD	CULTURE	TIME INTERVAL	PHASES			
				Eastern Area	Central Area	Western Area	
Archaic	Poverty Point	Poverty Point	500 B.C.	Garcia	Beau Rivage	?	
			1000 B.C.		Bayou Jasmine		Rabbit Island
			1500 B.C.	Pearl River	Copell		Bayou Blue
	Middle Archaic	Archaic	3000 B.C.	Monte Sano	Banana Bayou	?	
			5000 B.C.	Amite River			
			Early Archaic	St. Helena	?		?
	Lithic	Late Paleo	Paleo-Indian	6000 B.C.	Jones Creek	Vatican	Strohe
		Early Paleo		8000 B.C.	?	Avery Island	?
Pre-Projectile Point		?	10,000 B.C.	?	?	?	
			?				

plants, such as squash and bottle gourd (Byrd and Neuman 1978:11-13). Despite these introductions, Tchula populations maintained the hunting, fishing, and gathering economy characteristic of earlier periods. A number of Tchefuncte culture sites are known in the Pontchartrain Basin, including shell middens and conical mounds. The Bayou Trepagnier site (16SC10), located near the project area, has produced ceramics of the Pontchartrain phase of the Tchula period. The available evidence from this site, and from many other Tchefuncte sites in the region, suggest an emphasis on the exploitation of lake and brackish marsh resources, such as shellfish (especially oyster and *Rangia cuneata*) and fish.

Following the Tchula period is the Marksville period (A.D. 1-400), characterized by a distinctive suite of ceramics, much of which suggests influences from the midwestern United States. This and other lines of evidence indicate that a well-established, long-range trading network was maintained during the Marksville period. This period is characterized by an increasing reliance on horticulture, the construction of earthen burial mounds, and elaboration in mortuary practices, all of which suggest increasing economic and social complexity. There are some indications that the population in the Pontchartrain Basin decreased during the Marksville period, and it has been suggested that this was related to a decrease in salinity in the lake and corresponding extirpation of *Rangia cuneata* (New World Research Inc. 1983). The salinity change occurred as a result of freshwater inflow derived from the Mississippi River which shifted to its present course about this time. It is noted, however, that the Bayou Labranche Mouth site (16SC11), is a *Rangia* shell midden that has produced what have been identified as early Marksville period ceramics (Phillips 1970), indicating the presence of *Rangia*, as well as Marksville peoples, in this area of the Pontchartrain Basin.

The Baytown period (A.D. 400-700) saw the introduction of the bow and arrow and new pottery styles. Maize horticulture seems to have gained a foothold during this period, but it did not fully replace the basic pattern of hunting and gathering. The population of south Louisiana relied heavily upon lake and brackish marsh resources. Following the Baytown period was the Coles Creek period (A.D. 700-1200), seemingly characterized by a significant population expansion in south Louisiana. Reliance on maize horticulture increased during the Coles Creek period. Both temple and burial mounds were built.

The subsequent cultural interval, the Mississippi period (A.D. 1200-1700) is characterized by the development of two contemporaneous cultures in the southern part of the Lower Mississippi Valley. The Plaquemine culture seems to have developed out of the indigenous Coles Creek background, while the Mississippian culture, characterized in part by distinctive shell-tempered ceramics, derived largely from influences spreading from areas to the east and north of the lower valley region.

During the early years of European contact, a number of American Indian groups occupied the area of the Pontchartrain Basin. Some of these were apparently descendents of the earlier prehistoric populations, while others had recently moved into the region due to pressures and disruptions brought on by the arrival of Europeans in the Southeast and the Mississippi Valley. In 1682, René-Robert Cavelier, Sieur de La Salle, on his voyage down the Mississippi reported that the Quinipissa lived in a village adjacent to the Mississippi River in the vicinity of present-day Destrehan, south of the project area. In 1700, Pierre Le Moyne, Sieur d'Iberville, the leader of the French colonizing effort in Louisiana, recorded that the Quinipissa village had been abandoned (McWilliams 1981:111). Other groups living in the area included the Acolapissa, who were probably related to or associated with the Quinipissa

(Kniffen et al. 1987:51); the Bayougoula, who lived on the Mississippi River north of the project area, but who seemed to have hunted and roamed over the whole region; and the Ouacha and Chaouacha, two groups who occupied the Barataria Basin region between the Mississippi River and Bayou Lafourche.

European Occupation

The following sections present an overview of the historic settlement of the region at the western end of Lake Pontchartrain and adjacent Mississippi River area of St. Charles Parish. Much of what is included here has been drawn from Hahn and Pearson (1988). This is followed by a more detailed discussion on the history of use and settlement of the area at the mouth of Bayou Labranche.

La Salle, and a small group of French explorers, were the first Europeans to lay claim to the area which would become St. Charles Parish, although the survivors of Hernando De Soto's party had passed by on their journey down the Mississippi River in 1542. LaSalle, intent on finding a trade route from Canada to China, travelled to the mouth of the Mississippi, arriving there on April 7, 1682. His attempt to settle the region was unsuccessful; it was not until 1699 that the French were able to occupy the region that later became Louisiana. In that year, Pierre Le Moyne, Sieur d'Iberville, accompanied by his brother, Jean Baptiste Le Moyne, Sieur de Bienville, established a French settlement on Biloxi Bay and began to explore the lower Mississippi River area. Exploration and travel through Lake Pontchartrain and the St. Charles Parish area continued throughout the first two decades of the eighteenth century, but it was not until about 1719 that settlement of the region began.

French Colonial Period

The settlement history of the east bank of St. Charles Parish is complex because it was eventually settled by two distinct groups of people moving into the area from opposite directions. From upriver came the Germans from the area of present-day Edgard in St. John the Baptist Parish. These settlers were primarily small-farm owners who sold their vegetables and other farm goods to New Orleans consumers and merchants (Davis 1971:71). From downriver came the wealthy plantation-owning French and French creoles whose land holdings in the east bank area known as *Cannes Brulées* were often quite vast as compared to the German farms. Although St. Charles Parish came to be known as part of the "German Coast" because of the number of Germans residing there, the French plantation owners held the real wealth and power of the parish and, of the whole colony of New Orleans.

German Coast

The settlement of the German Coast is closely tied to the career of the Scottish financier, John Law. Law organized the General Bank of Finance in 1716 after convincing Philippe, duc d'Orléans, that France would become a very wealthy country by printing paper money. In 1717, Law's paper money was accepted in France and his bank was made the Royal Bank of France the following year. During this same period, Law organized the Company of the West in order to use some of the bank deposits to develop the French colony of Louisiana. In 1717, the Company of the West was given the proprietorship of Louisiana in return for settling the territory at the company's expense (Davis 1971:52, 53).

To attract settlers of good character, the Company of the West and its successor, The Company of the Indies, distributed pamphlets and handbills throughout Germany and the surrounding areas extolling the virtues of Louisiana. The Germans responded positively to the advertisements, and in 1719 many made their way to the colony. Large numbers of these eager immigrants died enroute to French ports and many more died on the transatlantic voyage to the Louisiana colony (Deiler 1969:17, 17). Once in Louisiana, more of the surviving Germans died of disease and hunger after being disembarked at the settlement of New Biloxi (Davis 1971:58; McWilliams 1953:235).

The first of the German settlements on the Mississippi, *Le premier ancien village allemand*, was founded in 1719, just one year after the establishment of New Orleans (Adams in Gianelloni 1965:ix; O'Neil et al. 1984:21). This village, about 30 mi above New Orleans, was located about 1.5 mi inland on the west bank of the Mississippi River. The German immigrants were given this land on the west bank partly because the French believed it to be mostly worthless swamp (Maduell 1972:vii). The remainder of the 1719 German immigrants were settled on John Law's concession in Arkansas.

When news reached Europe that Louisiana was not as idyllic as had been advertised, French businessmen began withdrawing their holdings from the Royal Bank of France. Gold and silver became scarce, paper money flooded the market, and the French government was forced to devalue their paper money. The bank soon collapsed and Law was forced to flee France for his life in December 1720 (Davis 1971:61).

Shortly after the bank's collapse, a second group of Germans arrived in Louisiana under the leadership of Karl Friederich d'Arensbourg. D'Arensbourg and his fellow colonists settled near the earlier settlement of *Le premier ancien village allemand*, but closer to the river (Deiler 1969:52). The two villages later became known collectively as "Karlstein." Both were abandoned in 1721 in favor of higher ground nearer the river after a September hurricane inundated the area (Deiler 1969:51).

The size of the German settlement on the German Coast grew rapidly in 1722 with the arrival of the German colonists from the abandoned Arkansas settlement. By 1722 the Arkansas Germans realized that their fate as a colony was doomed without the financial support of John Law. Early in that year they descended the Mississippi to New Orleans and requested that Governor Bienville give them return passage to Europe. Bienville was able to persuade the Arkansas Germans to join their compatriots on the German coast rather than return to Europe. These German *engagés* settled along the banks of the river amongst the earlier settlers. By May 1722 the population of the German coast was 257 (Deiler 1969:37, 38, 74).

It was not until after 1728 that the east bank of the German Coast began to be settled. Prior to this time a number of large concessions had been made along the Mississippi to individuals who were to improve and settle their property. However, the concessionaires in many places failed to improve their lands. As a result, a royal edict was passed in 1728 that cancelled many of the large concessions along the Mississippi River between Bayou Manchac and the Gulf of Mexico (Deiler 1969:76). This measure was undertaken as a means of forcing landholders to improve their holdings and of breaking up large, unimproved holdings. It was hoped this would increase the number of settlers in the colony, thereby dissuading the Spanish and English from encroaching on French lands. The 1728 edict effectively opened the east

bank up for settlement and by 1731 several German habitations had been established there (Deiler 1969:76, 77).

The growth of German settlements on the east bank of the river was hampered by sporadic Indian attacks that continued until the mid-eighteenth century. In April 1747 a Choctaw raid resulted in the killing of one German settler and the kidnapping of seven others. French troops were sent to the area to protect the colonists but were soon removed. The Germans, fearing for their welfare, fled to the west bank for safety. A similar raid occurred on November 9, 1748, when two Frenchmen and two negroes were killed on the east bank of the river (Deiler 1969:60, 61).

Cannes Brulées

The settlement of Cannes Brulées, present-day Kenner and surrounding area, is also closely tied to John Law and the Company of the West. When the Company of the West received the proprietorship of Louisiana in 1717, it also acquired the right to grant land to settlers. By 1720 two grants were made in Cannes Brulées, one to Count d'Artagnan and the other to the syndic for the Company of the Indies, Jean-Baptiste-Martin Dartaguiette Diron (Giraud 1991:32; McWilliams 1953:242, 243; Swanson 1975:66). Dartaguiette's concession was held with his younger brothers, Bernard Diron Dartaguiette, the inspector general of Louisiana troops, and Pierre Dartaguiette d'Itouralde (Giraud 1991:177; McWilliams 1953:243).

By 1723 several other settlements were made in Cannes Brulées. Ascending the river from the habitation of Dartaguiette Diron were the those of Count d'Artagnan, Chantreau de Beaumont, Sieur de La Coste, and Denis Ferandon. These five tracts of land were located in present-day Kenner and the eastern portions of St. Rose in St. Charles Parish. Farther upriver, in an area called *Ance aux Outardes*, was the residence of Sieur Sanson, near present-day Montz and Norco.

The 1724 census adds several landholders to the above list. Ascending the river from Dartaguiette Diron are the lands of d'Artagnan, Beaumont, Jean Pujeau, Joseph Harasse, Claude Merand, and finally Ferandon (Conrad 1970:19, 20). Above Ferandon are Francois Moyne, Edme Dounon, Sebastien Bouette, Francois Cheval, Rene Chesneau dit Duchesne, Philippe Dauny, Pierre Brout, two unknown families, and Pierre Cezard (Conrad 1970:19, 20).

While the German Coast residents were primarily involved in truck farming, the Cannes Brulées plantations were primarily engaged in cultivation of cash crops such as indigo and tobacco, and, to a lesser degree, silk and the candleberry tree (Davis 1971:73). However, both corn and rice were grown throughout the area. Rice agriculture was developed in Louisiana very early in the colony's history, as corn, a native cultigen, was not particularly favored by the Europeans. Le Page Du Pratz reported that rice was introduced into the colony shortly after 1712 (Davis 1971:72). Rice was competing with corn as a staple crop in the young colony by 1720, and it became more important with the introduction of Black slaves in 1723 (Giraud 1937:118). Soon, rice hulling mills were introduced to process the crop (Giraud 1937:128).

In 1732 Cannes Brulées, along with the rest of Louisiana, reverted to the French crown as the Company of the Indies found that it could no longer support the colony. By the 1750s France realized that Louisiana was a financial burden and that there had been little return for the millions of *livres* spent on the development and supply of the colony. In 1762 France ceded Louisiana and the Isle of Orleans to Spain in the secret Treaty of Fountainebleau. While France saw Louisiana as a financial drain, Spain saw the colony as a defensive mechanism against British expansionism. Although the legal transfer of the colony took place in November 1762, it was not until October 1764 that the colonists actually found out that the transfer had taken place (Davis 1971:61, 62, 69, 70).

Spanish Colonial Period

Although the transfer of Louisiana from France to Spain occurred in 1762 and was made public in 1764, it was not until March 1766 that Don Antonio Ulloa, the first Spanish governor of Louisiana, arrived in the colony to take possession of the territory. The French and francophiled German residents of the colony did not want their government transferred to Spain and hoped that the slow transfer reflected lack of Spanish resolve in taking over the colony. In October 1768 Nicholas Chauvin de Lafreniere, attorney general of the province, presented a list of grievances to Governor Ulloa (Moore 1976:149) which had been signed by many of the German Coast and Cannes Brulées settlers. In October 1768, approximately 500 Germans and Acadians arrived in New Orleans to express their dissatisfaction with Governor Ulloa. The Acadians had been falsely told that Ulloa was withholding specie that was to be used to redeem their worthless Acadian script and the Germans had been informed that Ulloa had no intention of paying them for their goods that had already been shipped to New Orleans (Moore 1976:151). In fact, Ulloa had no specie for exchange and had sent Gilbert de St. Maxent to the German Coast to pay off Spanish debts (Moore 1976:150, 151). St. Maxent, however, had been abducted by cohorts of Lafreniere and was unable to make the payment (Moore 1976:150).

Once in New Orleans the Acadians and Germans were convinced to support the Superior Council in an effort to rid the colony of Governor Ulloa. Realizing that he had little popular support, Ulloa was forced to evacuate Spanish civil authorities from New Orleans on November 1, 1768 (Moore 1976:163). Although this temporarily rid the colony of Spanish authority, a new Spanish Governor, General Alejandro O'Reilly, arrived in August 1769 to take formal possession of Louisiana for Spain. O'Reilly found Lafreniere and five of his cohorts guilty of conspiracy and had five of them executed by firing squad; the sixth had already died of natural causes.

By the 1770s most of the land facing the Mississippi River in the German Coast had been claimed (Conrad 1981:vii). While many grants along the river extended as far back as Lake Pontchartrain, some had a depth of only 40 arpents. While some of these smaller landholders had second depth grants of 40 arpents made by the Spanish government, this was not a common practice until the American period (Conrad 1981:vii). Some of the larger landholdings in the German Coast began to break up in the 1770s, as the original owners divided their holdings among their children (Conrad 1981:vii).

German Coast planters continued to grow vegetables for sale in New Orleans as their primary crops until the end of the eighteenth century (Conrad 1981:viii). Francisco Bouligny's 1776 account of the area notes that most planters cultivated only the 600 to 800 *varas* nearest

the river and reserved the rest for pasture and timber (Din 1977:45). Apparently little use was made of the lakeshore in the vicinity of the project area, as most activities and settlement were confined to the high levee lands near the river. Indigo, the predominant cash crop during the 1760s in Cannes Brulées, became unprofitable to grow in Louisiana during the 1790s because of high production costs, soil exhaustion, pollution, and crop infestation (Holmes 1967:346-348). After a 1793 St. Dominique slave revolt, many residents of the island moved to Louisiana, bringing an interest in sugarcane agriculture with them (Conrad 1981:viii). Etienne de Boré's introduction of a profitable method of growing sugarcane along with Antoine Morin's refinement of the granulation process allowed large landholders to begin large-scale production of sugarcane, which soon became the dominant crop in St. Charles Parish. An 1802 account of the colony by Berguin-Duvallon noted that by that time indigo was only rarely grown, while sugar and cotton were the main cash crops (Davis 1806:131).

American Period

Louisiana remained under Spanish control only until October 10, 1800, when the unprofitable colony was returned to France under the Treaty of San Ildefonso. On May 2, 1803, Louisiana was transferred from France to the United States in the Louisiana Purchase even though France did not take formal possession of the colony until November 30, 1803. The Americans took formal possession of Louisiana on December 20, 1803.

The east bank of St. Charles Parish at the time of the Louisiana Purchase was considered to be part of the Isle of Orleans. In 1805, the Orleans territory was divided into twelve counties. The County of the German Coast consisted of the present-day east banks of St. Charles and St. John the Baptist parishes. It remained in existence from 1805 until 1807. St. Charles Parish was one of 19 parishes formed in May 1807.

The agriculture of the newly formed parish remained similar to what it had been during the earlier colonial period, although sugarcane became increasingly important as time passed. As sugarcane was such a lucrative crop, many planters sought to form sugar plantations. Economically viable sugar plantations, however, require a great deal of land and many smaller farms in St. Charles Parish were gradually consolidated into larger and larger plantations.

Rice continued to be grown well into this period and St. Charles Parish became a major rice producer in the state. An early-nineteenth-century account of rice agriculture on the German Coast notes that the rice fields were flooded during high river stages by trenches cut through the river levee (Robin 1966:112). These trenches, while providing necessary irrigation for the fields, represented weak spots in the river levee system and were the culprit of many crevasses during the eighteenth and nineteenth centuries.

While several small Civil War skirmishes were fought in St. Charles Parish, all occurred on the west bank. Numerous buildings were destroyed on both sides of the river by Union gunships (Yoes 1973:79, 80). Other buildings, including several in the vicinity of the project area, were confiscated for use by the Union government. The closest the east bank of the parish came to fighting was in August 1862 near present-day Hahnville after Federal troops learned of a Confederate attempt to gather cattle on that bank of the river (Yoes 1973:80). Several gun emplacements were constructed along the shores of Lake Pontchartrain, but none seem to have been built in the near vicinity of the project area.

Sugar production declined during the Civil War and Reconstruction as planters lost their financial resources and their labor supply (Ginn 1940:34). In response to these difficulties, area sugar planters turned their attention increasingly towards rice cultivation, as it was less expensive and less labor-intensive. The rice industry expanded so rapidly during the early post-bellum years that it became the most important crop of the state (Ginn 1940:35), and it remained important in St. Charles Parish into this century. There were only four sugar plantations on the east bank of St. Charles Parish in 1890 (Bouchereau 1892) and only three in 1900 (Bouchereau 1902). Prospect Plantation was the last sugar plantation on the east bank of St. Charles to produce cane, ceasing production in 1912 (Bouchereau 1917:47).

The east bank of St. Charles Parish underwent extensive change during the early years of the twentieth century. Plantations and truck farms began to give way to industrial complexes, particularly those related to petroleum, during the second decade of the century. Destrehan Plantation became the home of the Mexican Petroleum Company in 1914, although production did not commence at the plant until 1916 (Grey 1936). The Mexican Petroleum Company was later taken over by the PanAmerican Petroleum Company and continued operations until 1958. In 1920 the Petroleum Import and Export Corporation began construction of a refinery in St. Rose. The St. Rose refinery was opened in 1921 and was later taken over by Cities Services Oil Company (Elfer 1936:8).

What was to become the largest refinery in the parish began with the construction of the Marine Terminal, a refinery of several 55,000-barrel storage tanks, near the town of Sellers in 1916. This facility, built by the Roxana Petroleum Company, began operations in 1918. Following World War I, an asphalt refinery was built by the New Orleans Refining Company near the Marine Terminal. This refinery became so important to the local economy that the town of Sellers was renamed Norco, the acronym of the New Orleans Refining Company. In the spring of 1929, Shell Petroleum Corporation (formerly Roxana Petroleum Company) took over the Norco plant and began modernizing the facility. The plant resumed operations in 1930 with 650 workers (Dawson 1936).

During the middle of the twentieth century, the Good Hope Oil and Gas Field, north of the town of Good Hope, was established as a major oil field. Expansion of the oil industry during this period brought an increased need for oil and chemical refineries, several of which were built along both banks of the Mississippi River in St. Charles Parish.

History of Settlement and Use of Bayou Labranche and the Bayou Labranche Wetlands

Bayou Labranche as a Portage, 1699-1720

Bayou Labranche came to the notice of the French during their initial exploration of Lake Pontchartrain and the Mississippi River, because it extended almost to the Mississippi and, thus, represented a convenient portage between these two bodies of water. Use of this portage eliminated the need to travel via the mouth of the Mississippi, significantly shortening the distance between the river and the French settlements around Biloxi and Mobile. Among the first to mention Bayou Labranche was André Pénicaut (or Pénigault), a carpenter who apparently came with Iberville's second voyage to Louisiana in 1700. More specifically, Pénicaut was one of the *engagés* (hired men) brought by Pierre-Charles Le Sueur to go to the Upper Mississippi to exploit copper mines and other minerals (McWilliams 1981:117). He left

an account of his travels with the groups involved in the early exploration of the region (McWilliams 1953).

Pénicaut writes that he was with a party headed by Bienville that first explored the Lake Pontchartrain area, giving names to the various lakes, headlands, and streams found. Directed by Indian guides, the exploration party traveled from Biloxi into Lake Pontchartrain and along its south shore, intent on finding a short route to the Mississippi. After passing a headland which they named Point-aux-Herbes, a point east of New Orleans still known by that name, the party traveled six leagues farther along the lake to where:

... a small river flows into it which is called, in savage, *Choupitcatcha*; the French call it today Rivière d'Orléans because afterwards (as will be shown at the proper time) there was built near this river, one league away from the lake, the town of new Orleans. Five leagues farther, always turning to the left along the lake shore, one comes to a stagnant body of water that the savages call *bayouque*; it is a drain for waters that flow from high grounds. We made camp near this place because the savages who were guiding us made us understand that we should go by way of it to the Mississippi River [McWilliams 1953:14].²

The bayou known as Choupitcatcha is present-day Bayou St. John, which soon became the main portage between Lake Pontchartrain and the Mississippi River, as well as the place where the city of New Orleans would be founded. Pénicaut's description of the location of the "stagnant" bayouque indicates that it is present-day Bayou Labranche. A review of early-eighteenth century maps reveals that the only large bayou located west of Bayou St. John that extended close to the banks of the Mississippi was the Bayou Labranche-Bayou Trepagnier system. Known variously as "Ravine de Sueur" and "Bayou Tigouyn" in the eighteenth century, Bayou Labranche was obviously known and used by the Indians as a portage, a use that probably extended back into prehistory.

Pénicaut's description of the portage goes on:

On the morning of the next day, having left our longboat in that bay, we set out on foot to make our way to the river bank. For three quarters of a league we crossed through a wood filled with cypress; these are trees that grow in low, marshy regions and that are of a prodigious height, bearing a kind of olive as fruit. Coming out of this wood, we entered some tall reeds, or canes, which bear a grain very much like oats, from which the savages make a quite tasty bread and also a soup which they call *sagamité*. After crossing through these canes for a quarter of a league, we reached the bank of the Mississippi.

This greatly delighted us. We looked with admiration at the beauty of the river, which was at least half a league wide at the spot where we saw it, which is forty leagues above its embouchure at the sea. Its water is light-colored, very good to drink, and quite clear. At this place its banks are covered with canes, about which we have just spoken. Everywhere else the area along

² McWilliams (1953:14) suggests that Pénicaut is actually giving the account of Bienville's expedition which reached the Mississippi through Lake Pontchartrain in August 1699. Pénicaut, if he came on Iberville's second voyage, could not have been in Louisiana this early and would not have been on this exploration. In this event, and in many others, Pénicaut purposefully, or accidentally, mixes up his facts and dates. However, he did travel with Pierre-Charles Le Sueur from the lake to the Mississippi in 1700 and they almost certainly used the Bayou Labranche portage.

the river appeared to us to be covered with all kinds of forest trees, as far as we were able to discover, such as oaks, ash, elms, and others whose names we did not know.

That night we slept on the bank of the river under some trees, upon which wild turkeys (of which there are great quantities) came at dusk to perch for the night. By moonlight we killed as many of them as we wanted without their being frightened away by the discharge of our guns. I can say in all truth that I have never seen such big ones in France, for these weighed as high as thirty pounds when ready for the spit. Next day we returned to our longboats. Those who had remained behind to guard them were very much gladdened when we informed them that we had slept on the banks of the Mississippi River [McWilliams 1953:14-15].

Other early French accounts also mention the portage at Bayou Labranche. Father R. F. du Ru, a Jesuit priest traveling with Iberville on his second voyage up the Mississippi River, has left an account which seems to refer to this portage (Butler 1934). Having spent some time at the site of Fort Mississippi, then under construction in present-day Plaquemines Parish, du Ru notes that they were to meet Pierre du Gué and Pierre-Charles Le Sueur (who Pénicaut was with) at a point farther up the river. Le Sueur and du Gué were bringing their parties of men across Lake Pontchartrain to the river via a portage. On February 22, 1700, du Ru, traveling ahead of Iberville, arrived at the rendezvous and noted:

M. du Gué decided not to wait for us. He has gone on with his party to the Bayougoulas. Thus we have not found anybody at the rendezvous by M. Le Sueur. This place is forty leagues up the river and one can reach it through Lake Pontchartrain which borders the river very closely. We shall arrive there in three days through a small river which is only three leagues from the Mississippi. From the head of that little river we must cross through woods but on a path where there is water up to one's waist and mud to one's knees. At least, it was so when our gentlemen crossed. As for me, who have also had the honor of going through with M. d'Iberville on an earlier voyage, I have had both water and mud up to my knees and there was one occasion when I sank into it up to my waist [Butler 1934:16].

Du Ru goes on to note that Le Sueur "lost two of his men in crossing the forest. At least it has been five days since anything has been heard from them" (Butler 1934:17). At least one of these men, Joseph de Limoges, was found, but the fate of the other is unrecorded.

There are several lines of evidence suggesting it is the Bayou Labranche portage that du Ru is referring to, and not Bayou St. John, as is commonly believed. Perhaps most revealing is the account of Jean-Baptiste Bernard de La Harpe in his *Historical Journal of the Establishment of the French in Louisiana* (La Harpe 1971). La Harpe arrived in Louisiana in 1718 and remained for five years and his manuscript journal of the history of Louisiana down to 1722 contributes significantly to our understanding of events of that early period. For the date October 10, 1699, La Harpe noted:

M. de Bienville left these villages [i.e., the Bayougoula]. Four leagues down-stream, he arrived at the Tigonillou portage, which leads to the lake. The portage has since been named "Ravine du Sueur." On October 11, he traversed the portage, a league long, and crossing the lakes, arrived at the settlement at Biloxi on October 17 [La Harpe 1971:17].

For February 19, 1700, reporting on the same meeting with Le Sueur that Father du Ru had recorded in his journal, La Harpe wrote:

M. d'Iberville and M. de Bienville left [from Fort Mississippi] to go to the Bayagoula village. They had with them ten naval guards who had begged M. d'Iberville to allow them to follow him as far as the Spanish settlements, which were thought to be established on the Red River. The same day they met M. Le Sueur at the Tigouillou portage. He was having his supplies carried over in order to continue his trip to the Sioux country. It was at this time that the portage was named for M. Le Sueur [La Harpe 1971:21].

La Harpe's account definitely equates the portage called Ravine du Sueur with Bayou Tigonillou in all of its various spellings. Du Ru's first hand account and La Harpe's journal reveal that the portage was named after Pierre-Charles Le Sueur, possibly because he was the first, or at least most important personage, to lead a large group of men across the portage. Also connecting Le Sueur with this portage is the Guillaume De L'Isle map of 1702, a map which relied primarily on information collected by Le Sueur, as well as others with Iberville and Bienville (Figure 6). De L'Isle shows this stream as "*Portage des égaréz*," or the "portage of the lost," almost certainly a reference to the men lost during Le Sueur's crossing in February of 1700. This event also contributed to the subsequent attachment of Le Sueur's name to the portage. Most historians have generally accepted that the crossing used by all of these early explorers was Bayou St. John, but the positions of the Portage des égaréz on the De L'Isle map, and the Ravine du Sueur on later maps, are definitely not at the location of Bayou St. John, but at the position of present-day Bayou Labranche.

The use of the name Ravine du Sueur on historic maps seems to have lasted through much of the eighteenth century. For example, the D'Anville map, produced in 1732, portrays the "Ravine du Sueur," accompanied by the word "portage," as being quite distinct from Bayou St. John (Figure 7). Subsequently, the 1774 or 1776 map by Bernard Romans also shows Ravine du Suer, but the Gauld map of 1778 uses "Tigoyon," a name which seems to be used in various forms in the early-nineteenth century. For example, the 1803 map attributed to Carlos Trudeau shows Bayou Labranche as the Tigouyn River (Figure 8), as does the Latour map of 1812. Both show the stream stretching almost all of the way to the river.

The Bayou Tigouyn or Ravine du Sueur seems to have maintained its importance as a portage only for a short period of time. With the establishment of New Orleans at the Bayou St. John portage, that location became the major crossing between the lake and the river, and the Ravine du Sueur slipped into obscurity.

Nineteenth-Century History of the Bayou Labranche Mouth Area

Title History of the Labranche Wetlands

At the time of the arrival of the Americans to Louisiana in 1803, the land lying at the mouth of Bayou Labranche consisted of the rear of two sugar plantations, one of 15 1/3 arpents front on the river owned by Pierre Marie Cabaret d'Etrepy, and the other tract of 18 1/2 arpents owned by Jean Francois Piseros (Maduell 1975:68, 72). In the following discussions, the sequence of ownership of these properties is followed; however, it is noted that the area around the mouth of Bayou Labranche was far to the rear of these properties and, thus, was an area which saw very little use or settlement during the nineteenth century.

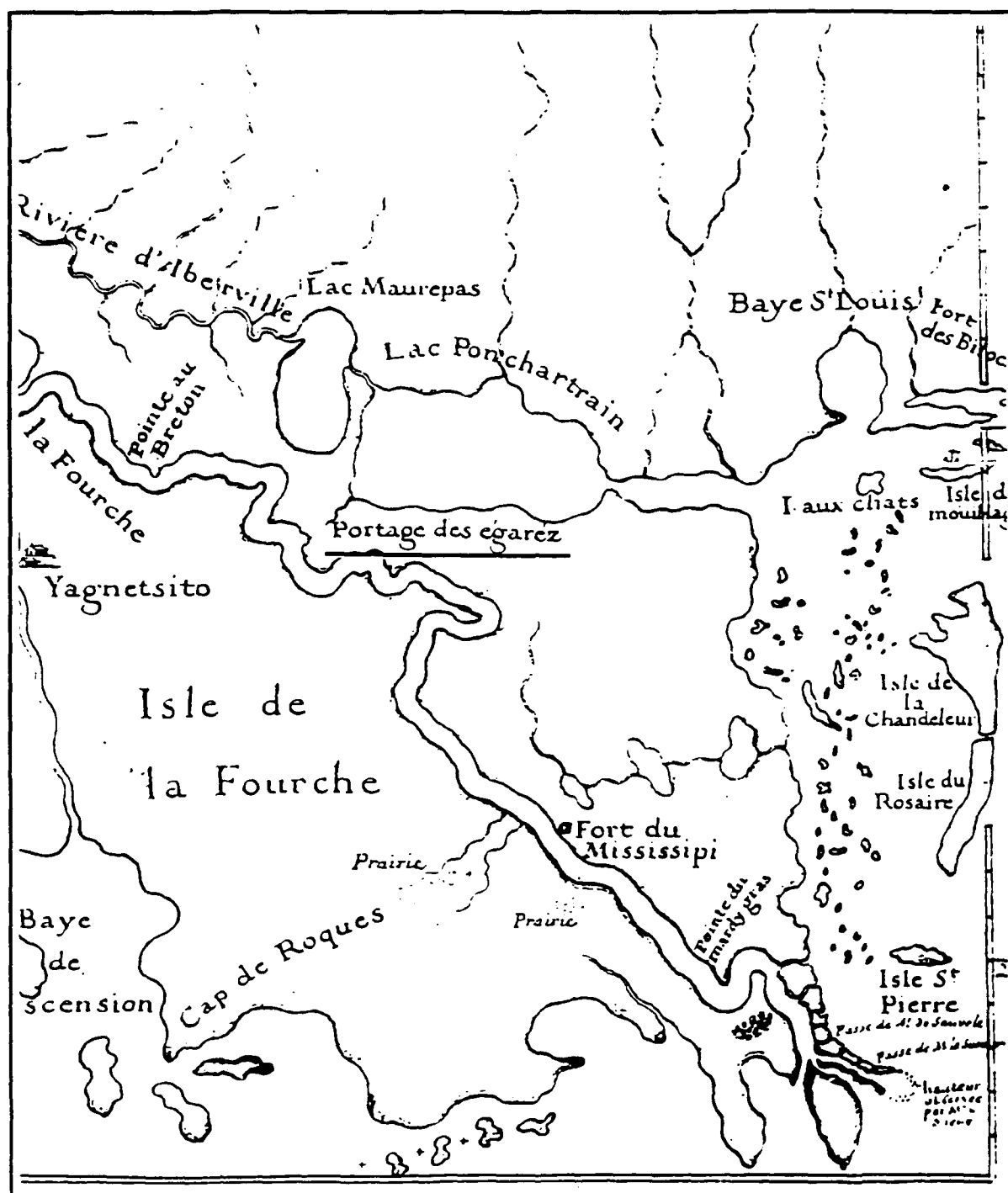


Figure 6. Detail of the Guillaume De L'Isle map of 1702 showing the *Portage des égarés* or the "Portage of the lost" (source: De L'Isle 1702, Cartographic Information Center, Louisiana State University, Baton Rouge).

In 1812 the United States Government confirmed the holdings of persons who had developed their land for ten or more years and of those who had received grants from the Spanish or French governments. These confirmations were registered in Volume II of the

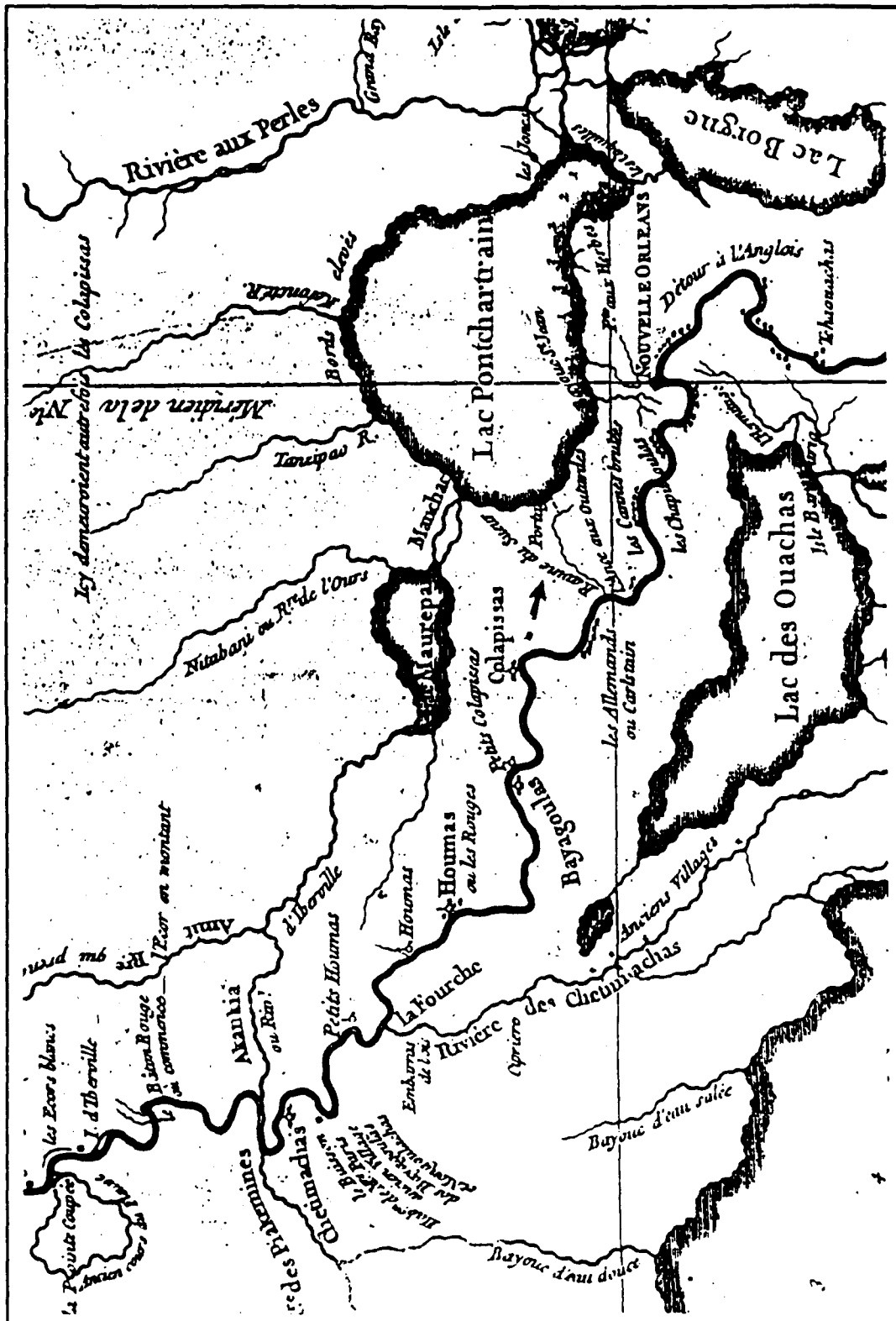


Figure 7. Detail of the D'Anville map of 1732 showing the Ravine du Sueur as a portage (source: Louisiana Collection, Tulane University).

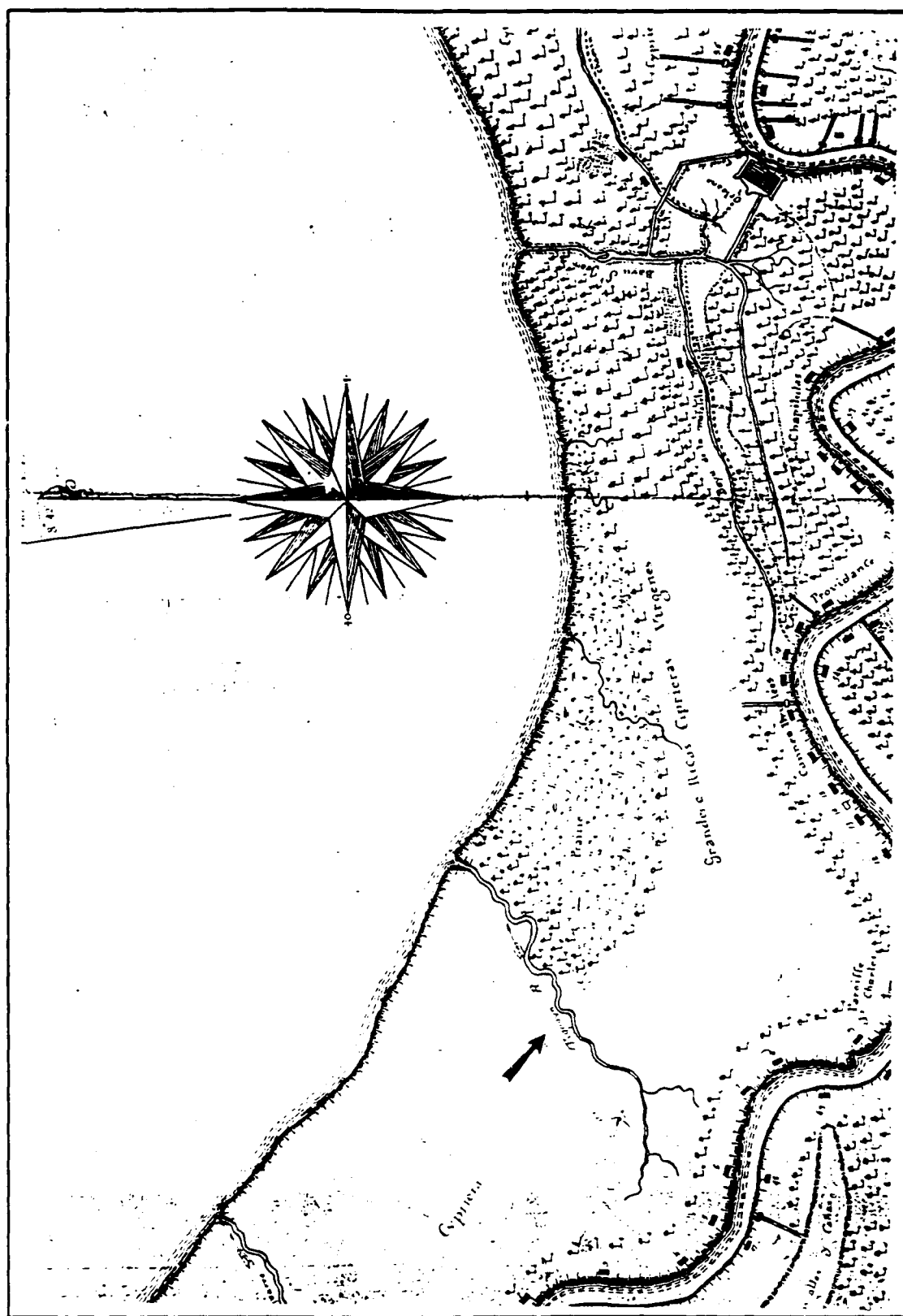


Figure 8. Detail of the Carlos Trudeau map, circa 1820, showing Bayou Labranche-Bayou Trepagnier as the Tigouyn River (source: Trudeau 1803).

American State Papers, titled "Public Lands" (Maduell 1975:iii). The claim of Pierre Marie Cabaret d'Etrepy was confirmed as having 15 arpents 11 toises and 9 links along the river with an extension to the lake. The records state that the first 40 arpents were granted under the "usual claims," and the extension to the lake was granted by the Spanish governor in 1777 (Maduell 1975:68). However, who the original grant was conferred upon is not listed. The tract of land claimed by Jean Francois Piseros is described as containing 15 arpents 1 toise and 2 feet and 4 inches fronting the Mississippi river and extending to the lake (Maduell 1975:72). Piseros' land was bounded by the land claims of Louis M. C. De Treppe and Louis Augustin Menillion. The original grant for Piseros' holdings was made to Estevan Boré by Governor Unzaga in 1773. Boré obtained the extension to the lake in 1779 from Governor Bernardo Galvez.

Cabaret died in 1820, leaving his estate of almost \$100,000 to his three children (St. Charles Parish:Original Acts of Judge Claude Dejean, Act 47:21). A few years later Jean Francois Piseros died, leaving half of his plantation to his daughter, Marie Cephise Piseros, the wife of Louis Labranche, and the other half to his son, Jean Francois Piseros Jr. In 1829 Labranche, after whom the bayou was named, purchased the nearby Cabaret d'Etrepy plantation from the three d'Etrepy heirs because it lay immediately upriver from his home on the Piseros plantation (New Orleans Notarial Archives [hereafter cited NONA]:Acts of Felix de Armas, January 28, 1829). Two years later Louis Labranche also purchased the half of the Piseros plantation that his wife did not already own from Jean Francois Piseros, Jr. The sale was for \$100,000, a large sum at the time for half of a plantation, but it also included 107 slaves (St. Charles Parish:Original Acts of Jean M. Guiramand 6:352). With the money, Jean Francois Piseros Jr. then bought the adjacent downriver plantation amounting to 20 1/2 arpents with 56 slaves, for which he paid \$114,164 (St. Charles Parish:Original Acts of Jean M. Guiramand 6:355).

From 1831 until his death in 1843, Louis Labranche owned and lived on his plantation, now almost 34 arpents wide. Thirty four arpents amounts to a mile and quarter of river front, but this was small compared to the plantation's depth. Both of the underlying tracts extended all the way from the river to the lake, a distance of 6 mi. The whole covered 5,846 ac. Louisiana Governor Bernard de Galvez had granted the depth to the lake in 1779, but when the United States Commissioners considered the land claims nearly 25 years later, instead of allowing 18 1/2 arpents for the Piseros tract, they erroneously allowed only 15 arpents (Lowrie and Franklin 1834:2:383). This omission was evidently of some concern to the Labranche family, as the Widow Louis Labranche pursued the matter until 1856 when the Congress of the United States recognized her claim to an additional four arpents at the downriver end of her property (U. S. Congress 1856:Statutes at Large 455).

After the downriver neighbor, J. F. Piseros Jr., died, his widow decided to sell her plantation. The Widow Piseros and Marie Cephise reached an agreement where she would move from her big place just below the Louis Labranche plantation to a little 3 by 80-arpent plantation just above the Labranche plantation. The Widow Piseros sold out to A. M. Walker for \$120,000 in 1853, and purchased the little place for just \$3,600 (St. Charles Parish Conveyance Books [hereafter cited COB]:A/203; A/189).

With the coming of the Civil War, the former slave labor force disappeared, necessitating a new arrangement. During the war Madame Louis Labranche died. At that time her heirs, the Tricous, lived in Mexico. They commissioned Felix Grima, the distinguished

New Orleans notary, to watch out for their interests and in 1863 Grima began visiting the plantation regularly to assure that the crop was harvested. In the fall of 1864 the Tricous leased the land to a partnership headed by Francis Meteyé (COB:C/186; Historic New Orleans Collection:Grima Family Papers, folder 97).

On November 24, 1866, Marie Leocadie Labranche, the wife of Pierre Tricou, sold the plantation of 30 $\frac{2}{3}$ arpents to Felix Grima for \$57,000 (NONA:Acts of T. O. Stark, November 24, 1866). A portion of the plat of survey made in 1836-1837 and attached to the Act of Sale at that time is shown as Figure 9. Grima operated the plantation for eight years before he was forced to sell to Pedro and Marie Landreaux, from whom he had borrowed the purchase price. Aside from the normal implements of a sugar plantation, this sale included six old flat boats lying in the swamp (COB:D/525).

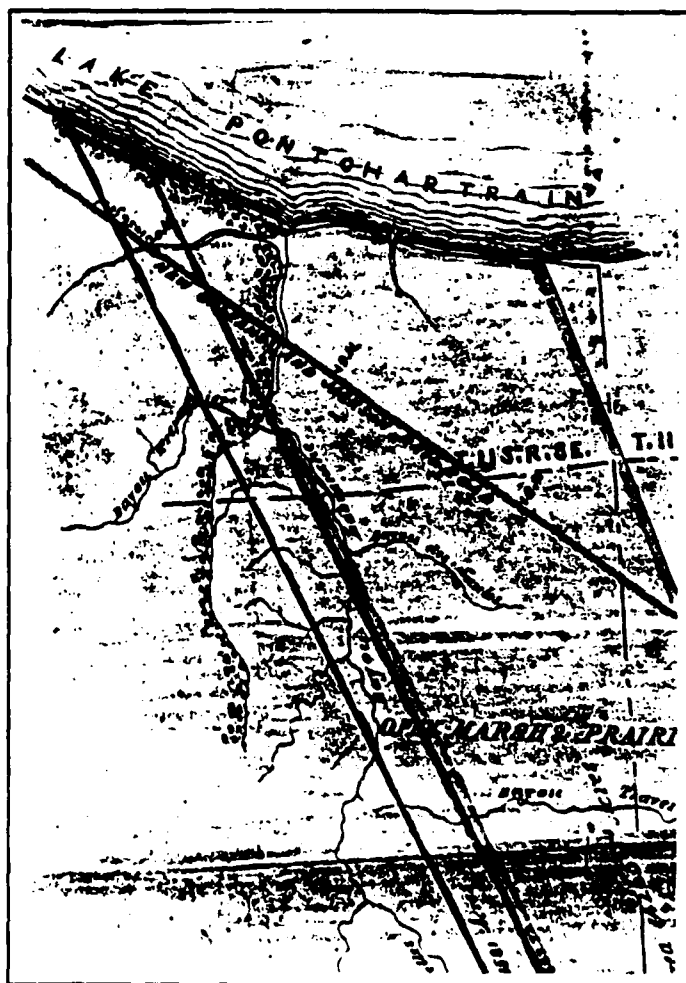


Figure 9. Survey of the claims of Pierre Marie Cabaret d'Etrepay and Jean Francois Piseros, December 1836 and January, 1837 (source: NONA:Acts of T. O. Stark, November 24, 1866).

The Landreauxs lived in Paris and were not interested in operating a sugar plantation. Through their agent Charles T. Dugazon of the commercial firm of A. Rocherau in New Orleans, they promptly leased the plantation to Leonce LeGardeur for the 1874 season at a rent of \$1185.50 with an option to buy for \$32,000 if exercised before December 15, 1874 (NONA:Acts of Gustave LeGardeur, Jr, March 28, 1874; St. Charles Parish Mortgage Book:Entry 2573). When LeGardeur did not renew, the Landreauxs leased to Norbert Louque for three years with the right to purchase the plantation for \$32,000. The dwelling house included in the lease was a one story, shingle roof brick home, with four rooms with two small cabinets. Other structures were a kitchen, another one story house, an overseer's house, two pigeon houses, a stable, a store, and seventeen Negro cabins. The large sugar house, listed in good condition, was located on the right side of the dwelling house. Fronting on the Mississippi were a cane shed, a large brick purgery, and a sugar mill with steam engine, boilers, and two sets of kettles. Attached to the sugar house were the carpenter's shop and the blacksmith shop. There was no mention of any items in or beyond the swamp or on the lakeshore (NONA:Acts of James Fahey, December 19, 1874). At the expiration of the three-year lease, Louque exercised his option to purchase the plantation, with the Landreauxs financing most of the purchase price. The property was still 30 2/3 of an arpents wide(COB:E/446; NONA:Acts of Octave de Armas, December 11, 1877).

Norbert Louque kept the plantation for 12 years, though early in his tenure he fell behind in his payments to the Landreauxs. On March 1, 1883, Louque leased the mouth of Bayou Labranche, identified also as T11S, R8E, Section 39, to one S. Bringier for one year. Who Bringier was or what he did at the mouth of the bayou has not been determined (COB:I/259); however, a United States Coast and Geodetic Survey map of a slightly later date, 1897, shows structures and cleared land at the mouth of the bayou (Figure 10). Figure 10 shows several buildings, some surrounded by fences and yards or cleared land, and some apparently representing outbuildings. Whether these buildings date to Bringier's ownership is unknown, but they do seem to represent a fairly substantive settlement. The Landreauxs forced Louque out through a sheriff sale of December 14, 1889, and the foreclosure of Louque's interest in the plantation terminated whatever rights Bringier may have had. The property still contained 30 2/3 arpents front with a surface area of 5,864 ac. The price was now \$20,000, meaning that of the original price of \$32,000, Louque had paid only \$12,000 (COB:I/259). The Landreaux family then found another local person to purchase the land. In 1890, Mrs. Lucien Cambre, the former Marcelite Montz, used her separate funds to purchase the plantation from them for \$18,000 (NONA:Acts of Charles G. Andry, September 18, 1890).

At this point the plantation started to be subdivided. Mrs Cambre soon sold two parcels amounting to 5 2/3 arpents at the lower edge of the plantation to John Lambert (NONA:Acts of N. B. Trist, April 1, 1891). She also sold a 1/2-arpent strip at the upper end to Charles P. Bossier. Various other frontage pieces were sold with a depth of only 60 arpents, which excluded the backlands near the mouth of Labranche. On the remainder of the land Mrs. Montz's husband Lucien Cambre attempted to grow sugar. In 1894 he had 60 square arpents of plant cane, 90 square arpents of first year stubble, and 20 square arpents of second year stubble (COB:22/303; NONA:Acts of Edgar Grima, May 25, 1894). However, Mrs. Montz was never able to earn enough to pay down the notes for the purchase price furnished by Augustine Lasseigne, a professional land developer. In 1901 he foreclosed on the approximate 10 remaining front arpents along with the bulk of the land lying in the swamp beyond the 60-arpent line (COB:L/472).

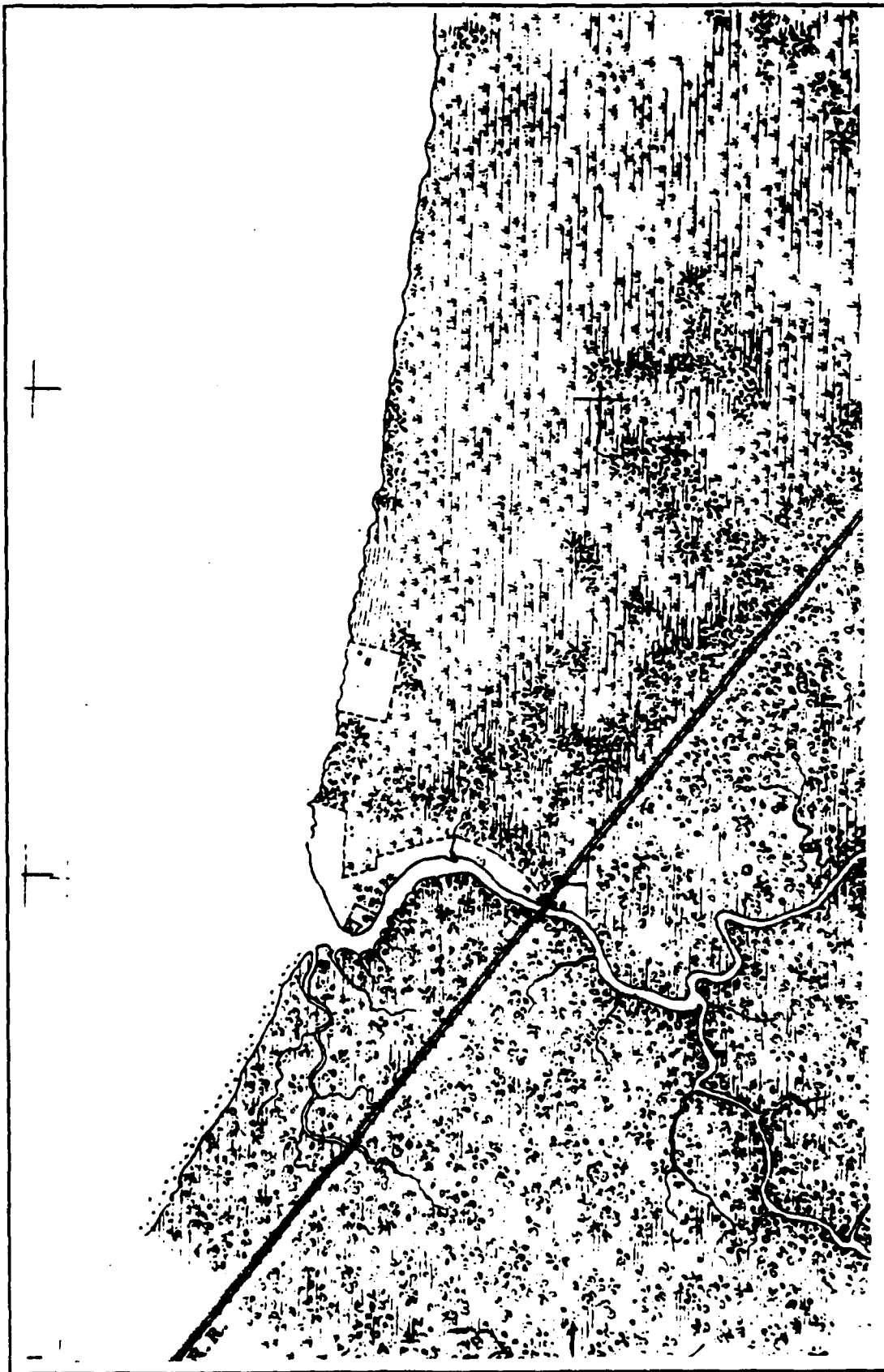


Figure 10. Detail of 1897 U.S. Coast and Geodetic Survey map showing structures, yards and other features in the vicinity of the mouth of Bayou Labranche (source: U.S. Coast and Geodetic Survey, Part of Lake Pontchartrain, Louisiana, 1897).

Lasseigne began in turn to sell river front strips, all the while looking for someone else to purchase the swamp land. He finally found a purchaser in 1905, selling everything beyond the 60-arpent line, including the mouth of Bayou Labranche, to John M. Dresser for \$18,902.84. Lasseigne carefully excluded from his warranty the sections of land included in a one-time land dispute between the claim of Jean Noel Destrehan and the claimants for the subject property. The Destrehan tract commenced at a point on the river above the Labranche land, but intersected the Labranche tract toward the rear as both claims proceeded to the lake. While ownership was eventually given to the Labranche claimants, the disputed land never included the mouth of Bayou Labranche which was located in Section 39 of T11S, R8E (COB:N/284).

Two months after his purchase, Dresser sold the entire Labranche property to the North Louisiana Land Company for \$32,976, thus doubling his money in the space of two months. The President of the North Louisiana Land Company was the eccentric Illinois land developer Edward Wisner (COB:N/335). A few months later Wisner increased the price while selling to another of his companies, Suburban Realty Company, Limited. Suburban was the company in the Wisner empire destined to develop the St. Charles Parish land (COB:N/373).

Wisner then proceeded to develop the swamp land for farming by building canals and constructing a pumping station. In 1910 he purchased swamp beyond the 60-arpent line of the adjacent plantation and so consolidated the so-called "Labranche Wetlands" under one owner (NONA:Acts of William H. Byrnes, Jr., March 14, 1910, No. 17). In the fall of 1910 Wisner borrowed \$50,000 on the property from Pierre Olivier (NONA:Acts of William H. Byrnes, Jr., November 6, 1910), and a few days later purchased the interest of Henry L. Sarpy in some adjoining disputed tracts. The act of sale mentions, however, that Sarpy was to retain a 50-ft right-of-way beginning at the intersection of the upper line of Section 7, T12S R8E, and section 39, of T12S, R8E, and proceeding to the lake along the upper boundary of the Pierre Marie Cabaret d'Etrepy tract (NONA:Acts of William H. Byrnes, Jr., November 15, 1910, No. 44). A few days after this act Suburban purchased the swamp land of John Lambert, who was living on his front $5 \frac{2}{3}$ arpents, with Lambert retaining the right to hunt and trap (NONA:Acts of William H. Byrnes, Jr., December 27, 1910, No. 53).

Acquisitions and drainage completed, Wisner was now ready to commence selling parcels for truck farming. The property at the mouth of Bayou Labranche, Section 39, went to sale first on June 16, 1911, when Suburban Realty sold 10 ac to Louis M. Rountree, a gardener in New Orleans, living at 2634 Laharpe Street (COB:P/371; New Orleans City Directory 1911). Suburban Realty sold the remaining 10 ac of Lot 1 to Rountree the following year. Both sales were for \$50 an acre (COB:Q/183). Six months later Rountree purchased approximately 10 acres more at the same price (COB:Q/429). After three years elapsed, Mrs. Annabelle Cauley, Rountree's wife, purchased 10 ac of Lot 2, at a price of \$100 an acre. The act referred to buildings that the purchaser had to keep insured (COB:S/178). In 1915 the company sold surrounding acreage in Section 39, amounting to 27.08 acres, to Louis Mouledous, who sold it to A. D. Danzinger in 1926 (COB:15/283).

Of the more than 8,000 ac that Wisner assembled in the Labranche Wetlands before his own death in 1915, virtually all remained unsold by 1925. In that year Suburban Realty sold the remaining 8,040 ac to Lake Front Land Company. Lake Front gave Suburban notes on which it later defaulted. In 1944 Frank J. Monteleone purchased the Lake Front Land notes

from the liquidation of Suburban Realty Company. The balance of the Labranche Plantation wetlands are now in the name of Frank J. Monteleone (NONA:Acts of Arthur L. Ballin, August 9, 1951).

Nineteenth-Century Settlement and Use of the Mouth of Bayou Labranche

The mouth of Bayou Labranche came specifically into the historical record during the nineteenth century with the construction of railroads north and west from New Orleans. The first railroad was the New Orleans and Nashville, launched in 1836. Mr. G. W. R. Bayley, an important mid-nineteenth-century construction engineer for the railroads of Louisiana, recorded a brief account of its history. With funding largely from the State of Louisiana, the Company began road building in 1836, continuing until March 1837, when it ran out of money. Work resumed in May 1838, after another state appropriation, and continued until July 1839, when the line reached the shores of Lake Pontchartrain about 5 mi from Bayou Labranche. Work then continued intermittently until March 1841, extending the line to 3 mi beyond Bayou Labranche (Pritchard 1947:1129). In 1844 the State of Louisiana foreclosed on its loans to the company and sold everything movable to the Mexican Gulf Railroad.

The route chosen for the New Orleans and Nashville was not the same as the one later selected for the New Orleans, Jackson, and Great Northern. The New Orleans and Nashville reached the lake considerably to the east of Bayou Labranche, and then apparently paralleled the shore (Pritchard 1947). The New Orleans, Jackson, and Great Northern headed straight to Kenner from New Orleans, before angling toward the lake at the mouth of Bayou Labranche. The New Orleans and Nashville route might have crossed the onshore disposal site, though what trace it would have left is unclear.

In 1852 entrepreneur James Robb and other New Orleanians organized the second major railroad building effort that culminated in the construction of the New Orleans, Jackson, and Great Northern Railroad. This road subsequently became the Mississippi and Louisiana portions of the Illinois Central. The survey for the new line departed from Calliope and Claiborne Avenue in the city, extended out Calliope to Canal [Carrollton] Avenue, then began a curve with a radius of 11,460 ft to the west, whereupon it continued straight to the plantation of Minor Kenner (the upriver portion of the modern city of Kenner). From there the line curved to the right by a similar radius. It then passed straight through 2 mi of swamp and 4 3/4 mi of prairie before intersecting Bayou Labranche about 1 mi from Lake Pontchartrain. From this point it continued parallel to the lakeshore.

The survey directions "about a mile from the lake," pose a problem as to the exact intersection of the line with Bayou Labranche. It is about 6/10 of a mile today, but the distance given in the original survey is no doubt correct in light of the amount of lake-shore erosion that has occurred in this area subsequently (see Figure 5). The railroad had to cross all the plantations extending from river to lake and it had secured right-of-way donations from all the landowners in July 1852 (COB:A/143).

In July and again in September 1852, the railroad solicited bids for the materials to construct the road. The company needed 17,000 piles of yellow pine, each 25 to 35 ft long and 10 in square. It needed an additional 90,000 linear ft of 8 x 10-in yellow pine or cypress, with lengths of 26 and 31 ft. One-third of these materials were to be delivered to North Pass Manchac, one-third to South Pass Manchac, and one-third to the western shore of Lake Pontchartrain. Certainly Bayou Labranche could have been the delivery point for some of these supplies, but so could Frenier, a beach area several miles westward.

The company also ordered cross ties of sawed or hewed red cedar, 9 ft long and 6 x 8-in square. The initial delivery points for these ties were one quarter to New Orleans and to Carrollton, and one half to the river bank of Minor Kenner (Tulane University, Scrapbook of the New Orleans, Jackson and Great Northern Railroad: September 4, 1852). As for the rails, they were ordered from England. It took 7,000 tons of rail to build the 65.5 mi of track from New Orleans to the Mississippi border.

The trembling prairie of Louis Labranche (owner of the land at the mouth of Bayou Labranche), along with the passes at Manchac, were the railroad's two major obstacles. Surveyor W. S. Campbell described the trembling prairie to the stockholders as extending 14 mil along the lakefront from Bayou Labranche eastward to within 2 mi of the New Basin Canal. The prairie extended towards the river in roughly a wedge shape. The previously-described railroad survey took the road as close as possible to the Metairie Ridge, then went to the high ground along the river at the Kenners, then proceeded diagonally toward the lake. For the first 2 mi past Kenner the land declined gradually in the customary grade away from the river, and then became the trembling prairie. This consisted of layers of vegetable matter and soil, so soft that frequently two men could drive a pole down to its base. This base of clay underlay the prairie for approximately 18 to 25 ft.

Construction of a plank road on which was erected a 4-ft-high crib work of pine solved the engineering problem. Campbell reported that the railroad plank section maintained its grade better than any other stretch (Tulane University, Scrapbook of the New Orleans, Jackson and Great Northern Railroad: April 9, 1855). Later the engineers' only regret was that the cribwork was not built above high water. The solution was not needed for the land north of Bayou Labranche, which the surveyor described as firm and comparatively high swamp with a ridge composed of sand and clay, having an admixture of lake shells. The railroad was constructed along this 9.5-mi-long ridge nearly parallel with and between 400 to 1500 ft from the lake.

The New Orleans, Jackson, and Great Northern opened for business in August 1854, and was an immediate success. Individual fares were three cents a mile until 1856, when they increased one third to four cents a mile. The initial depots were Kenner (fare, 30 cents), Frenier (fare, 70 cents) and Manchac (fare, \$1.10). Frenier was out of business for a time in 1859, following a crevasse at the Bonnet Carré plantation of Thomas Hoey. The crevasse flooded into the lake, overflowing the rails for three months. Following that crevasse, Frenier was not listed as a stop. While the line was out, freight and passengers were taken by Carrollton Railroad to the lakefront, where chartered steamers transported them to Pass Manchac. The road was back in operation by September 17, 1859, but the following fall storms in Lake Pontchartrain again submerged the track (Pritchard 1947:1138; Swamp Land Commissioners 1860).

Following the Civil War the State of Louisiana and the City of New Orleans both sold their stock in the railroad to Henry S. McComb, who later sold the line to the syndicate forming the Illinois Central. The Illinois Central employed the Bayou Labranche crossing as a stopping point, possibly because it was 20 mi from New Orleans, a reasonable distance for refilling engine boilers. Here they built a windmill, probably to draw water for the engine watering or pump station maintained at Bayou Labranche. By 1910 the company had added a bunkhouse and a station, plus other structures. A club known as the Owl Bayou Club also existed on the west bank of the Bayou at one time (NONA: Acts of William H. Byrnes, June

16, 1911). As noted in the title, S. Bringier received a lease of the land forming Section 39 T11S R8E from Norbert Louque in 1883. Perhaps Bringier was operating the hunting club.

The railroad was quite likely the agent that gave New Orleans land developer Edward Wisner an opportunity to see the swamp lands of Louisiana. Wisner, who came to Louisiana from Michigan about 1900 to recover from illness, conceived the idea that swamp lands would be potential farm lands if they could be drained. He soon began purchasing land at levee board sales and elsewhere. One author asserts that he paid only 12 1/2 cents an acre for most of his land (Harrison and Kollmorgen 1947:677). Wisner, however, paid almost 8 dollars an acre for the approximately 4,900 acres of Labranche wetlands that he purchased in 1906. Both the railroads and a new Federal agency, the Office of Experiment Stations in the U. S. Department of Agriculture, helped him along in this and other ventures. In 1909 Professor W. B. Gregory of Tulane University persuaded the office to endorse research on the ways by which swamps could be drained. The Experiment Station hired its first drainage engineer in the person of A. M. Shaw, who was replaced in 1910 by Charles W. Okey (Okey 1914:2). The railroads regularly issued promotional pamphlets to entice settlers from the north to the various reclamation projects.

From 1900 to 1915 Wisner acquired a million acres of wetlands, and developed 250,000 ac using the techniques of reclamation. He began at a project near Raceland, and developed 45 more sites (Wisner 1909; Fox 1917). Labranche was Wisner's first project. He began assembling the property in 1906; during the following years he dug canals, cleared land, and built a steam pumping station. Wisner concentrated his efforts on Section 39 at the mouth of Bayou Labranche and apparently did little elsewhere on the Labranche wetlands. He surveyed the east bank of the bayou and laid out subdivisions along the 2,000 ft of railroad track extending eastward from the bayou. Along the lakeshore he created farm sites of 20 ac and through the center of the tract he drew an "Avenue." The eastern boundary was another canal with a levee, running perpendicular to the railroad and extending to the lake. This canal emptied into a canal paralleling the railroad, which the pumping station emptied. Another canal, dug to provide earth for the levee, paralleled the lakeshore and the bayou just inside the levee. The entire track drained by the pumping station amounted to about 140 ac (NONA:Acts of Theodore McGiehen, September 16, 1925).

The pumping station was a corrugated tin shed with engine and pumping apparatus (Figure 11). It was situated to drain the east-west canal paralleling the railroad tracks and to pump the water into Bayou Labranche. The pump seems to have been a type known as the low lift, Menge pump. It contained an impeller wheel attached to a vertical shaft, set in a large wooden body. A belt attached to an engine drove the shaft. When the water reached the height of the discharge mouth, it spilled over into the outlet, in this case, Bayou Labranche (Gregory 1916:141). The discharge trough can be seen in Figure 11. Note that next to the trough was the covered beltway through which the belt moved from the shaft to the engine. The major part of the structure was the steam engine itself. In Figure 11 a residence, perhaps a keeper's house, appears to be attached to the pumping structure on the north end (Morehouse 1909:438-439), and the water tower for the railroad can be seen at the right.

By 1911 Wisner's Suburban Land Company was ready to begin selling parcels to individuals. The first purchaser was Louis M. Rountree, a former gardener in New Orleans. On June 16 Rountree purchased the point of land at the juncture of the lake and the bayou, identified in the act of sale as part of Lot 1 or the "ten acres of the northwest lot" (Figure 12).

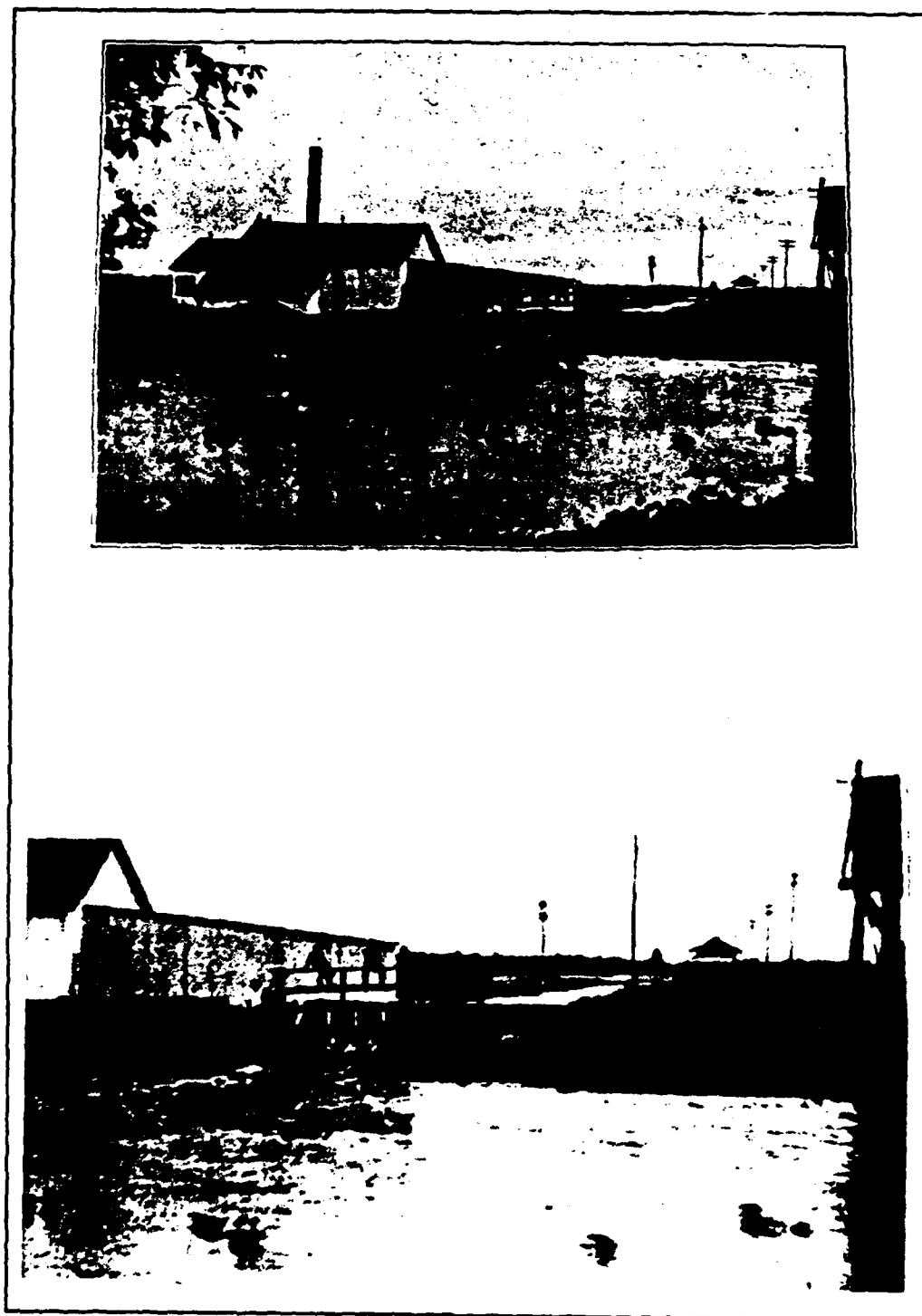


Figure 11. Circa 1909 photographs of the Wisner pumping facilities at Bayou Labranche (source: Morehouse 1909).

This point was also referred to as the junction of the main drainage canal and Bayou Labranche. Although Lot 1 contained 20 ac, Rountree bought only 10 ac at first and apparently

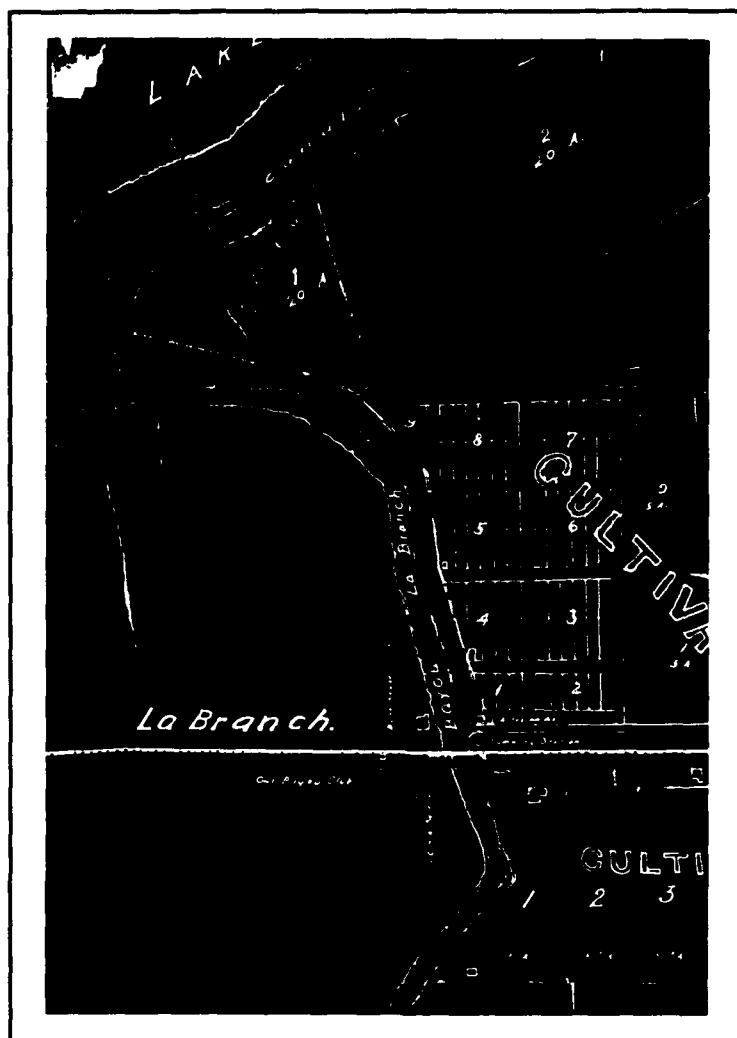


Figure 12. Sketch map of the area at the mouth of Bayou Labranche attached to a June 16, 1911, Act of Sale. Note the 10 acres of Lot 1 and the "Owl Bayou Club" (source: NONA:Acts of William H. Byrnes, June 16, 1911).

moved to his new property soon after the purchase. The following March he acquired the other 10 ac , and then six months later purchased the adjoining lots 7 and 8. Mr. Rountree presumably cultivated corn and vegetables there, typical truck farming crops of the suburbs, perhaps with some early success (Harrison and Kollmorgen 1947:677). In 1915 his wife used her separate funds to purchase 10 ac of Lot 2 adjoining their tract. The plan attached to the act of sale clearly shows their house sitting at the northwest corner of Lot 1 on Bayou Labranche at the lake (Figure 13). The authorizing resolution referred to Rountree as residing at "Labranche, La" (NONA:Acts of William H. Byrnes, Jr., February 10, 1915). The price of this lot was at twice the rate of the earlier sales, but the act of sale referred to the existence of buildings which the purchaser was to keep insured. The accompanying sketch, however, shows buildings on Lot 1 only.

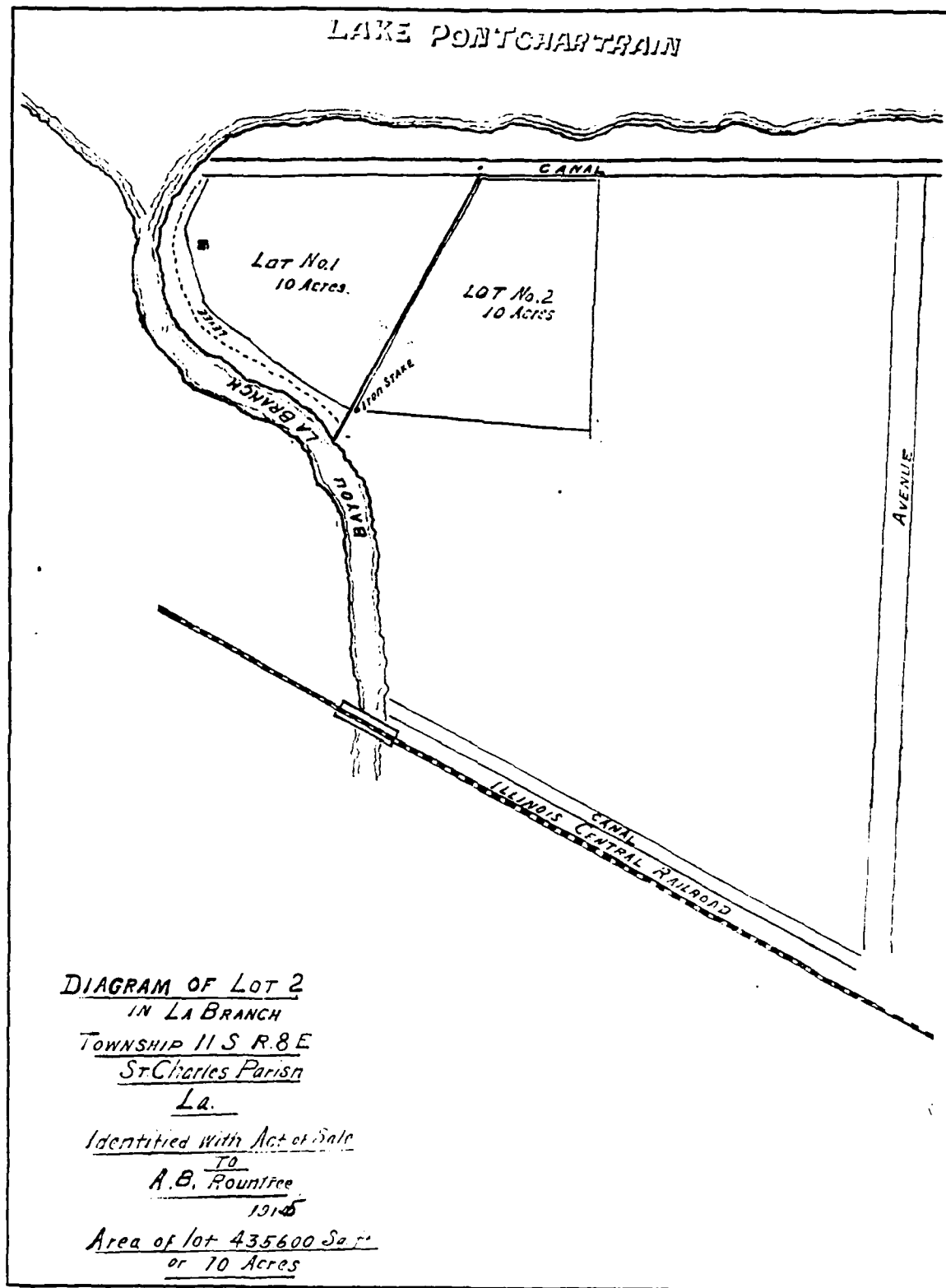


Figure 13. 1915 map of the two lots at the mouth of Bayou Labranche owned by A. B. Rountree (source: NONA:Acts of William H. Byrnes, Jr. 1915).

Six months after the fourth sale to Rountree, the land company sold the remaining lots lying between Rountree and the Illinois Central Railroad to Louis Mouldous for \$2,208 (NONA:Acts of William H. Byrnes, Jr., September 13, 1915). These were numbered 1 through 6, totaling 27.08 ac. The price of the sale was close to the \$1,000 an acre paid by No evidence has been found to show that Mouldous lived there.

Louis Mouldous purchased his lot on September 13, just 15 days before the giant hurricane of 1915. The storm approached New Orleans from the south and pounded Grande Isle with 140-mi-an-hour winds. The eye passed over Tulane University, where the barometer was measured at 28.11 in of mercury. Damage was widespread through the area. The windows in the Hibernia Bank and the St. Charles Hotel were blown out, and 90 percent of the structures in New Orleans suffered damage. After passing over New Orleans, the eye continued over Lakes Pontchartrain and Maurepas with a course that pushed an enormous storm surge onto the south shores of these lakes. At the Rigolets 50 people drowned in a 13-ft tide that swept the Rigolets railroad bridge away. In Lake Borgne and the Louisiana marshes 70 Biloxi schooners were sunk (Sullivan 1966:53-55).

The water that poured into Lake Pontchartrain is probably what ended the Labranche Reclamation project. The *Times Picayune* reported that 35 people died at Labranche, and 23 at Frenier (*New Orleans Item*, October 1, 1915; *Times Picayune*, October 1, 1915). The double tracks of the Illinois Central from Labranche westward to Pass Manchac were torn up and twisted around trees in the swamp (*Times Picayune*, October 2, 1915). The pumping station and levees, not to mention the house, were quite likely also destroyed.

A month after the storm, Suburban Realty purchased a 12 ft by 40 ft houseboat with three rooms and brought it to Labranche (NONA:Acts of William H. Byrnes, Jr., October 12, 1915). It proved to be a futile effort, as between 1916 and 1925 the Labranche swamplands were abandoned. In 1925 Suburban Realty sold its 8,000 ac of lakefront to Lake Front Land Company (NONA:Acts of Theodore H. McGiehn, September 17, 1925). The survey attached to the sale noted that the individual parcels owned by Rountree and Mouldous were no longer surveyable (Figure 14), implying that the owners were not present or the land was too damaged by the Hurricane of 1915 to traverse. The following year Mouldous sold his 27 ac to Alfred D. Danzinger, another land speculator (COB:Y/213; NONA:Acts of Percival Stern, February 26, 1926).

Even without the hurricane, the fate of virtually all of the Wisner developments would have been the same. Cultivation, after a few years, made the peat-like soil extremely acidic, making crops increasingly difficult to grow. Cultivation also caused compaction of the soil, making the land level drop 3 to 4 ft. Not long after abandonment, a break in the levee would flood the leveed land, creating a regular-shaped pond. "The sunken fields of abandoned reclamation projects stand out as large square or rectangular ponds on the topographic sheets of southern Louisiana" wrote Harrison and Kolimorgen in 1947. Indeed, current maps of Section 39 clearly show the pond that was once the land of Rountree and Mouldous; this, in fact, is the pond which is being filled and restored by the Labranche Wetlands Project.

In very recent years, the land at the mouth of Bayou Labranche has seen relatively little use. The area south of the bayou has been used primarily for duck hunting, and there are still a couple of hunting camps located in the vicinity. The construction of Interstate 10 in the early 1970s would have destroyed any structures associated with the Wisner pumping facilities, if any even remained at that time. The area north of Bayou Labranche was incorporated into the

Bonnet Carré Floodway when it was constructed in 1931 and has since been used primarily for recreational hunting and fishing.

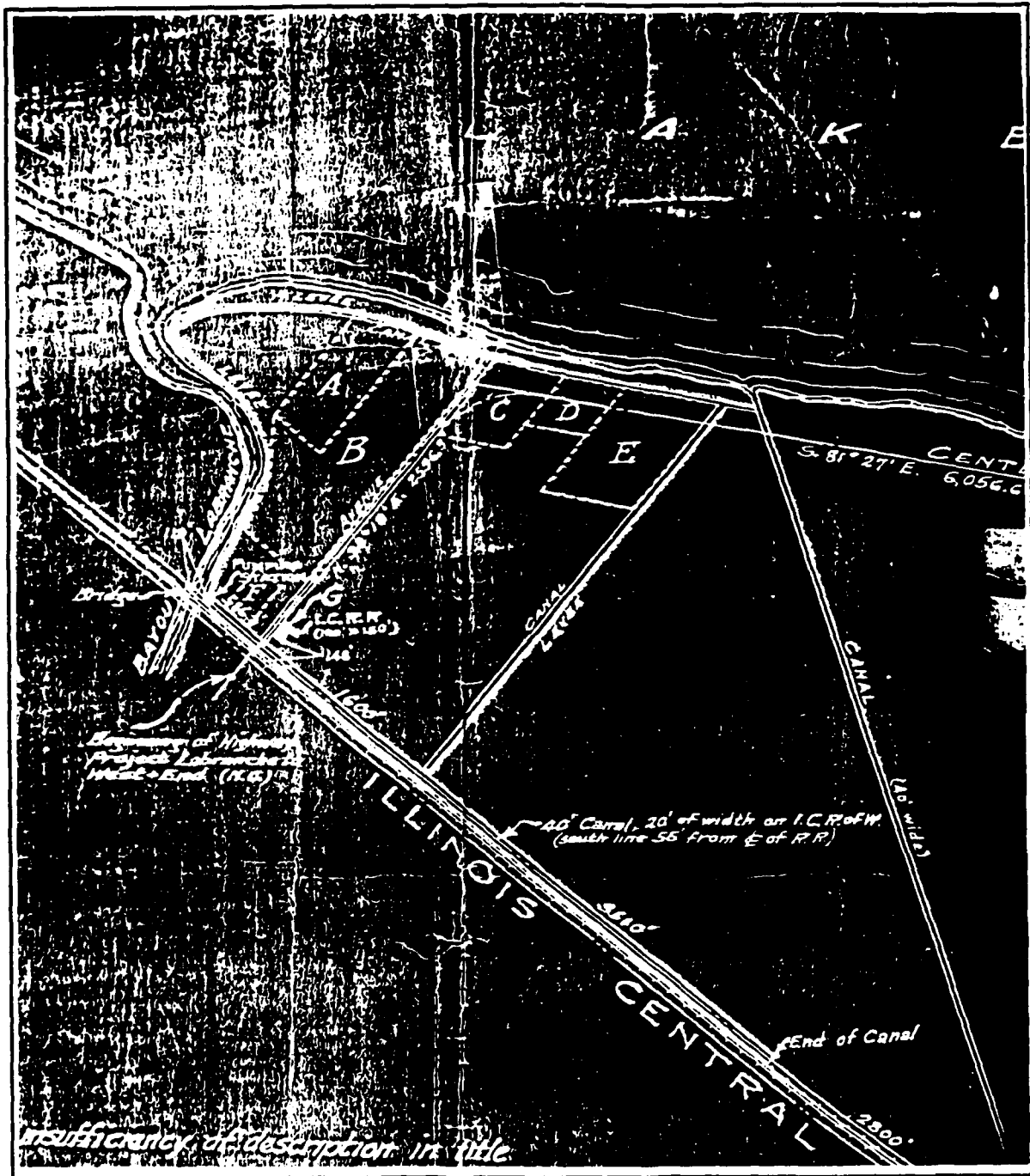


Figure 14. Plan of the property at the mouth of Bayou Labranche attached to the September 17, 1925, Act of Sale to Lake Front Land Company (source: NONA:Acts of Theodore H. McGiehan, September 17, 1925).

CHAPTER 4:

FIELD INVESTIGATIONS AND RESULTS

Introduction

The field investigations for this study involved a remote-sensing survey of the 500-ac borrow area and physical examination of a selection of targets considered likely to be significant cultural properties, particularly vessel remains. The instruments used in the field survey were a proton precession magnetometer and a fathometer. The original Scope of Services for the project included the use of a side-scan sonar; however, this instrument was eliminated because water depths in the project area were considered too shallow for its practical use. The remote-sensing survey was conducted using a crew of three persons between the period October 19 and October 29, 1992. The actual time expended conducting on-the-water survey during this period was only four days, but adverse weather conditions during October prevented survey work through most of the period. The location of the project area at the exposed western end of Lake Pontchartrain, and the shallow water, created a weather-sensitive setting. Any winds over 8 mi an hour or more out of the north, northeast, or east produced waves over 2 ft high in the project area, essentially eliminating our ability to conduct the survey and the subsequent diving operations safely or efficiently. Unfortunately, periodic cold fronts begin to move through the area in the fall, commonly bringing with them strong north and northeast winds. As a result, fall and winter are the worst times of the year to conduct this type of work on the lake.

The remote-sensing survey, finally completed on October 29, recorded a number of magnetic anomalies in the borrow area. Most of these were eliminated from additional consideration because they were single, small objects, probably modern trash and debris. In addition, a pipeline was identified running across the eastern end of the borrow area. Consultation with the Corps of Engineers led to the selection of five targets for examination by diving. Relocation of the selected targets and initial diver examination began on November 15, having been delayed by adverse weather for almost two weeks. The resurvey of the selected target locations failed to relocate one target: this probably represented a small ferrous object resting on the lake bottom which had been removed by shrimp trawlers subsequent to the initial survey. The resurvey of another target location revealed it produced a very small magnetic signature; too small to represent a shipwreck. Diving on the remaining three targets utilized a dive team of four persons and was conducted on November 15, 16, 21, and 22. None of the targets produced significant cultural remains. Detailed discussions on the conduct and results of the field study are provided below.

Remote-Sensing Survey and Data Interpretation

The use of remote-sensing technology in the search for shipwrecks has become an increasingly common aspect of underwater archeology in recent years. As a result, there has developed a relatively comprehensive archeological literature on the application and utility of various remote-sensing instruments. The magnetometer, the primary instrument used in the present study, is among the most commonly used and, also, one of the most productive. The principles of how magnetometers work and their early application to marine archeology were reported by Breiner and MacNaughton (1965). Pioneering work to plot the distribution of segments of a specific marine wreck as an interpretive aid was done by Clausen off the Florida east coast (Clausen 1966). Since that time, many researchers have contributed to the growing body of data involving the use of magnetics to locate shipwrecks.

A number of projects have been undertaken that have dealt, primarily, with watercraft or shipwrecks in the central Gulf area, particularly in Louisiana and Alabama, although very little research had been directed specifically at shipwrecks in Lake Pontchartrain. In Louisiana, studies have included historical overviews of navigation history and vessel use, evaluations and enumerations of shipwrecks, remote sensing surveys and archeological investigations of specific wrecks. The historical overviews have included a compilation of shipwrecks along the Mississippi from Cairo to Head of Passes (Gulf South Research Institute 1974) and a more detailed evaluation and identification of wrecks along the Mississippi River below Baton Rouge (Detro et al. 1979). Recently Pearson et al. (1989) have compiled a history of waterborne commerce and navigation for the area of the New Orleans District that includes a compilation of shipwrecks and assessments concerning the nature and potential of shipwreck remains within the confines of the district, including Lake Pontchartrain.

Several remote-sensing surveys, designed primarily to locate shipwrecks, have been conducted along stretches of the Mississippi River below New Orleans and most have been sponsored by the U.S. Army Corps of Engineers (Muller 1985; Saltus 1983; 1984; United States Army Corps of Engineers 1983). Other studies have been conducted in Bayou Grand Caillou in Terrebonne Parish (Flayharty and Muller 1983), off Grand Terre and Grande Isle (Saltus 1990; Stout 1984), and in the Atchafalaya River area (Castille et al. 1990; Pearson and Saltus 1989, 1990).

Several magnetometer surveys have been undertaken along the southern shores of Lake Pontchartrain (New World Research 1983; Stout 1985a, 1985b). One of these led to the discovery of a sunken vessel, presumed to be a schooner or schooner barge. This wreck, designated the Citrus Lakefront Shipwreck (16OR97), was deemed potentially eligible for nomination to the National Register (Stout 1985a), and represents the only known historic wreck recorded in Lake Pontchartrain. Recently, Coastal Environments, Inc., completed a remote-sensing survey of portions of the lower Pearl and West Pearl rivers at the eastern end of Lake Pontchartrain for the Vicksburg District (Pearson et al. 1991). That study located several historic land- g areas containing sunken and buried vessel remains, plus the wreck of a steam vessel tentatively identified as a Civil War-period Lake Pontchartrain steamer named the *Arrow* (16ST99).

Among the most productive of the remote-sensing studies conducted in south Louisiana has been the work of Allen Saltus (1985, 1986, 1988, 1992). This research has involved remote-sensing surveys of several rivers flowing into Lakes Maurepas and Lake Pontchartrain

in the Florida Parish region of southeastern Louisiana. These surveys have recorded a number of potential shipwreck targets and subsequent diving has discovered several sunken vessels or portions of vessels. In addition, these various studies provide a considerable amount of information on the history of the maritime economy of the North Shore-Lake Pontchartrain region and on the history of vessel use in the area.

Only one sunken shipwreck in Louisiana has received extensive archeological examination. This was the wreck of *El Nuevo Constante* (16CM112), a Spanish merchantman that sank off the coast of Cameron Parish in 1766 (Pearson et al. 1981). An intensive structural and historical study has been undertaken of the *M.V. Fox*, a small lugger-like boat found onshore in LaRose, Louisiana (Goodwin et al. 1984), and the remains of a wooden barge or flat found along the Morgan City docks have been excavated and documented (Goodwin and Selby 1984).

Magnetometer Survey and Data Interpretation

Interpretation of data collected by remote-sensing instruments is not always straightforward, and, generally, relies on a combination of sound scientific knowledge and practical experience. This is particularly true of the magnetometer, which produces data that can be processed, manipulated, and displayed in a variety of ways to arrive at a variety of interpretations and conclusions. Therefore, a brief discussion of magnetometer survey and anomaly interpretation, as conducted in this survey, is presented.

Magnetic surveying involves the measurement of the earth's magnetic field intensity (measured in "gammas") using an instrument known as a magnetometer. The present study is concerned with the application of magnetometers in the search for shipwrecks and details on the physics and mechanics of magnetometers are not discussed here but can be found elsewhere (e.g., Aitken 1958 and Breiner 1973). An assortment of objects and materials, including buried archeological features, cause localized disturbances, or "anomalies," in the earth's magnetic field that can be detected with a magnetometer. In terms of physical structure, archeological objects typically found by magnetic search can be divided into three groups: (1) iron and other ferrous materials; (2) burned features such as fire hearths, kilns, daub, brick, etc.; and (3) unfired features such as wall trenches, ditches, walls, storage pits, etc. The first category of items is most easily identified since ferrous objects cause significant magnetic disturbances. The other two classes of items tend to be less easily detected. The objects of primary concern in this study, sunken boats, are variable in detectability because of differences in size, mode of construction, amount of iron on them, etc. We know that larger vessels such as steamboats, that contain large amounts of ferrous metal, will be much easier to detect than will small boats, such as wooden skiffs, flats, etc. It must be recognized, therefore, that these latter types of boats might easily go undetected in a magnetometer survey.

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, including the size, shape, and mass of the source object; its magnetic susceptibility; its distance from the point of measurement; and the magnetic properties of the surrounding soil. 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 along 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 than is the

negative. Historic shipwreck remains, because they generally contain numerous ferrous objects, most commonly will produce a magnetic signature composed of a cluster or group of dipoles and monopoles. This class of signature is particularly apparent when the wreck remains are scattered and dispersed.

Even though a considerable body of magnetic signature data for shipwrecks is now available, it is impossible to positively associate a specific signature with a shipwreck or any other feature. The variations in the content (particularly iron), 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. This includes, among other factors, the spacing of survey lanes, the direction of survey lines, and distance of sensor from the source object. Despite these problems, shipwreck remains do tend to exhibit a class of magnetic signatures, with broad similarities in attributes, that aid in differentiating them from other types of anomalies. Larger shipwrecks, because they generally contain numerous ferrous objects, commonly will produce a magnetic signature composed of a cluster of multiple anomalies (both dipoles and monopoles) 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 about 10,000 and 50,000 m². Their estimates are related primarily to larger vessels lost in the Gulf of Mexico, and smaller types of vessels, such as many of those that plied the waters of Lake Pontchartrain, would produce signatures of a smaller size. Even these smaller vessels, however, should produce the characteristic multiple anomaly (sometimes termed "complex") signature which often can be distinguished from the isolated, individual anomaly signature that is more representative 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 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 (assuming constant distance from the sensor), distinct from the variability seen in shipwreck signatures (Garrison et al. 1989:122).

The amplitudes of magnetic anomalies associated with shipwrecks vary considerably, but, in general, the signature of larger watercraft, or portions of watercraft, range from moderate to high intensity (>50 gammas) when the sensor is at distances of 20 ft or so. Table 2 provides information on magnetic signatures produced by a variety of identified sources. These data suggest that at a distance of 20 ft or less watercraft of moderate size are likely to produce a magnetic anomaly (this would be a complex signature, i.e., a cluster of dipoles and/or monopoles) greater than 80 or 90 ft across the smallest dimension and have an intensity of greater than about 50 gammas. While recognizing that a considerable amount of Magnetic data variability does occur, this information establishes a beginning point for the identification of the sources of magnetic anomalies in the two study areas.

Table 2. Magnetic Anomaly Data for a Variety of Sources.

Object	Size of Object	Magnetic Intensity in Gammas	Area (at 10 gamma contour level)	Sensor Distance (Ft)
Single Objects				
Engine camshaft	20 ft x 2 in	45	45 x 50 feet	15
Cast iron soil pipe	10 ft long, 100 lbs	1407	45 x 65 feet	4
Iron anvil	150 lbs.	598	26 x 26 feet	4
Iron kettle	22 in diameter	200	23 x 23 feet	4
Iron anchor	6-foot-long shaft	30	80 x 270 feet	16
Multiple Objects				
Pipe and bucket	8 ft x 1 in	250	60 x 50 feet	5
Cable and chain	5 ft	30	50 x 40 feet	15
Burn pile, charcoal	8 ft x 3 in	20	40 x 30 feet	5
Scattered ferrous metal	14 ft x 3 ft x 0.8 ft	100	110 x 90	15
Shipwrecks				
Wooden, sailing trader	90 x 20	35	250 x 150	16
Wooden steamer "Lotawanna"	180 x 47	310	350 x 300	12
Wooden steamer "Spray"	140 x 90	520	160 X 210 feet	10
55-ft long, wooden schooner "James Stockton"	55 x 19	80	90 X 130 feet	8
126-ft long, wooden ship "El Nuevo Constante"	126 x 26	65	150 X 250 feet	20
150-ft long, Civil War ironclad "CSS Tuscaloosa"	150 x 40	4000	200 x 300 feet	20
Segment of modern shrimp boat	27 x 5	350	90 x 50	3
Gasoline sternwheeler	50 x 10	450	140 x 200	8
1840s tow boat	65 x 13	110	110 x 60	12

While the generalizations discussed above are of use in establishing a basis for interpretation of remote-sensing data, a final evaluation must also take into account the specific natural conditions and history of use of the area under study. It is critical that magnetic data collection and signature interpretation be conducted within the context of the regional and locale-specific natural, settlement, and navigation history. This historical framework should include an understanding of the navigation history of an area over time, encompassing the types of vessels used; the relative intensity of use; the cargoes carried; the locations of navigation routes, landings, docks, wharfs, etc.; and the shipwrecks which have occurred. The discussions presented in earlier chapters of this report have provided this context.

The known history of the Bayou Labranche area suggests the bayou had been used as a route of transportation between Lake Pontchartrain and the Mississippi River in prehistoric and early historic times. Its use for navigation in more recent times is not well known; however, it

probably was utilized to some extent during the late-nineteenth and early-twentieth century when the area was settled. During all of this period, however, the type of boats using Bayou Labranche would have been small vessels; pirogues early on, followed by other small lake craft, such as bateaus and skiffs, and possibly by small sailing sloops or luggers. The bayou has probably never served larger craft and has probably never been utilized by large numbers of vessels.

Sedimentation and lake-shore erosion are the two natural factors which are of most concern in the search for shipwrecks in the environment found within the study area. It is known that extensive amounts of sediment have accumulated in the area, particularly since the mid-nineteenth century as a result of various crevasses at Bonnet Carré. Thus, it is likely that small craft lost or abandoned in the area at any time in the distant past may be buried under 5 ft or more of sediment. As discussed earlier, there has been a considerable amount of lakeshore erosion along the perimeter of Lake Pontchartrain. Reliable data on erosion for the study area are available since the late nineteenth century and, as shown above in Figure 5, the indications are that the lakeshore has retreated almost 900 ft since 1897. Assuming that this rate can be extended into the past, it is possible that the shoreline and the channel of Bayou Labranche passed through the project area in the eighteenth and nineteenth centuries. Vessels lost or abandoned in the bayou or along the lake could, conceivably, exist within the boundary of the borrow area, although they would now be covered by crevasse sediments. Burial of any wrecks would act to preserve them, but the deeper they are buried the more difficult they will be to locate with a magnetometer because of the small amount of iron they are likely to contain.

Survey Methodology and Results

The remote-sensing survey covered the entire 3000-ft-by-7600-ft borrow area delineated on maps provided by the Corps of Engineers prior to the start of the project. The survey vessel used was a 21-ft, aluminum boat powered by an 80-horsepower outboard engine. The magnetometer used was a Geometrics Model 806 proton precession magnetometer with a Soltec VP-67239 analog recorder. A King 1060 chart recording fathometer was used to gather bathymetric data. Positioning control was obtained with a Magnovox Differential Global Positioning System (GPS). This GPS utilized a single, onshore station to establish the differential in signals received from a suite of satellites. Onboard the survey vessel the GPS was linked to a monitor which provided navigation and steering information, and all of the positioning data were stored on computer.

The magnetometer sensor was mounted on an aluminum pole extended 6 ft forward of the survey vessel and 2 ft above the water. Prior to each day's survey, tests were run to insure that the sensor was beyond the magnetic influence of the survey boat. The magnetometer was operated on a 100-gamma scale and readings were taken every 1 second. A boat speed of about 4 mi per hour was maintained during the survey, resulting in a magnetic reading approximately every 7 ft. The magnetic data collected during the study were, generally, of good quality, with background noises less than ± 3 gammas.

Coverage of the borrow area was obtained by running a series of 20 transects parallel to the long axes of the borrow area. Transects were spaced 150 ft apart and positioning points, or "shot points," were taken every 100 ft along survey lines. Figure 15 presents a computer-derived post plot showing the survey transects and shot points on which the locations of recorded magnetic anomalies of interest have been plotted. Strong winds and high waves

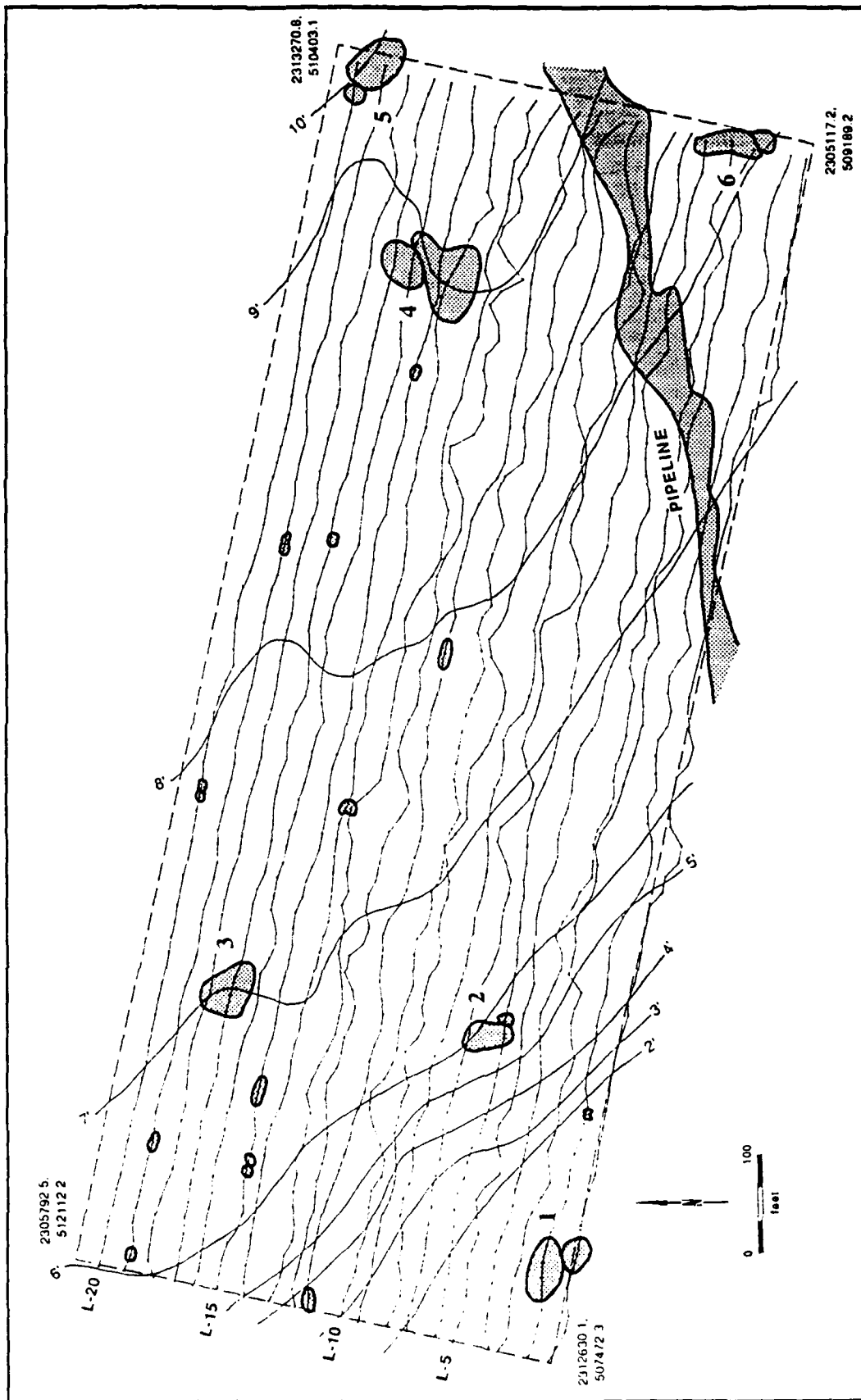


Figure 15. Initial remote-sensing survey data collected in the project area. Shown are the survey transects, shot points, bathymetry, and locations and extent of all magnetic anomalies recorded. The six magnetic anomalies determined to be targets of interest are numbered.

during one day of survey resulted in the zigzagging lines shown in Figure 15. This did not interfere with achieving full and adequate coverage of the project area.

As noted, a large number of magnetic anomalies were recorded during the survey, however, most of these consisted of very small magnetic signatures with deviations of only a few gammas and covering an area of less than 20 ft across. These signatures are almost certainly reflective of small, individual, metal objects, probably lost or discarded trash and debris derived from the fairly extensive commercial (shrimping and crabbing) and recreational fishing which takes place in the area. Similar findings have been made at other heavily-used water bodies (e.g., Pearson and Saltus 1990). Selection of anomalies as potential targets of interest (i.e., possible cultural remains) involved the following criteria: magnetic anomalies were selected if they covered an area greater than 50 ft along a single survey line, if they were recorded on adjacent survey lines, and if they displayed a magnetic intensity of greater than 25 gammas. Relying on these criteria, all but seven anomalies were eliminated from further consideration. These anomalies included six individual signatures, plus an elongated series of signatures that ran across most of the eastern end of the borrow area (see Figure 15). This anomaly had the characteristics of a pipeline, and subsequent examination of pipeline maps confirms that it is a 6 in Shell Oil Company pipeline running from the end of the south Bonnet Carré Floodway Guide Levee out into Lake Pontchartrain.

Consultations with the Corps of Engineers resulted in the selection of five targets for diver examination. These are numbered 1 through 5 in Figure 15. The sixth was eliminated because it lay in the extreme southeastern corner of the project area, an area to be avoided by dredging because of the presence of the pipeline.

Diving Investigations and Results

Relocation of selected targets and initial diver examination began on November 15, having been delayed by bad weather for almost two weeks. The same remote-sensing and positioning equipment used in the original survey was used in the resurvey. The resurvey of the selected target locations failed to relocate one, Target 2, and the magnetics recorded at Target 5 indicated that it was too small to be considered further. Figure 16 presents survey data from the project area which includes the additional lines run over the various target locations. It is currently believed that the sources for Targets 2 and 5 were small, ferrous objects resting on the lake bottom and that at least the source for Target 2 had been removed by shrimp trawlers subsequent to the initial survey. Diving was conducted on the other three targets on November 15, 16, 21, and 22. During the resurvey, buoys were dropped at the identified focus of magnetics at each target to aid and direct divers. Additionally, buoys were left at Targets 3 and 4 to mark their positions and alert the dredging contractor in the event it is necessary to avoid these locations or remove the buried objects discovered there.

The dive vessel was the same boat used during the remote-sensing survey. The dive crew consisted of four individuals: dive supervisor, diver, stand-by diver, and tender. A surface-supplied air system was used, with air supplied by an Emglo air compressor capable of delivering 4.5 ft³ per minute to the diver. The compressor was equipped with a reserve volume tank supplying 20 minutes of air. The dive helmet used was a Kirby Morgan band mask fed by 150 ft of Gates 33 H/B air hose. The system was fitted with a hard-wired surface to diver radio, which was monitored by the tender and the diver supervisor during all diving operations. During all periods of diving, the stand-by diver maintained a fully-rigged SCUBA

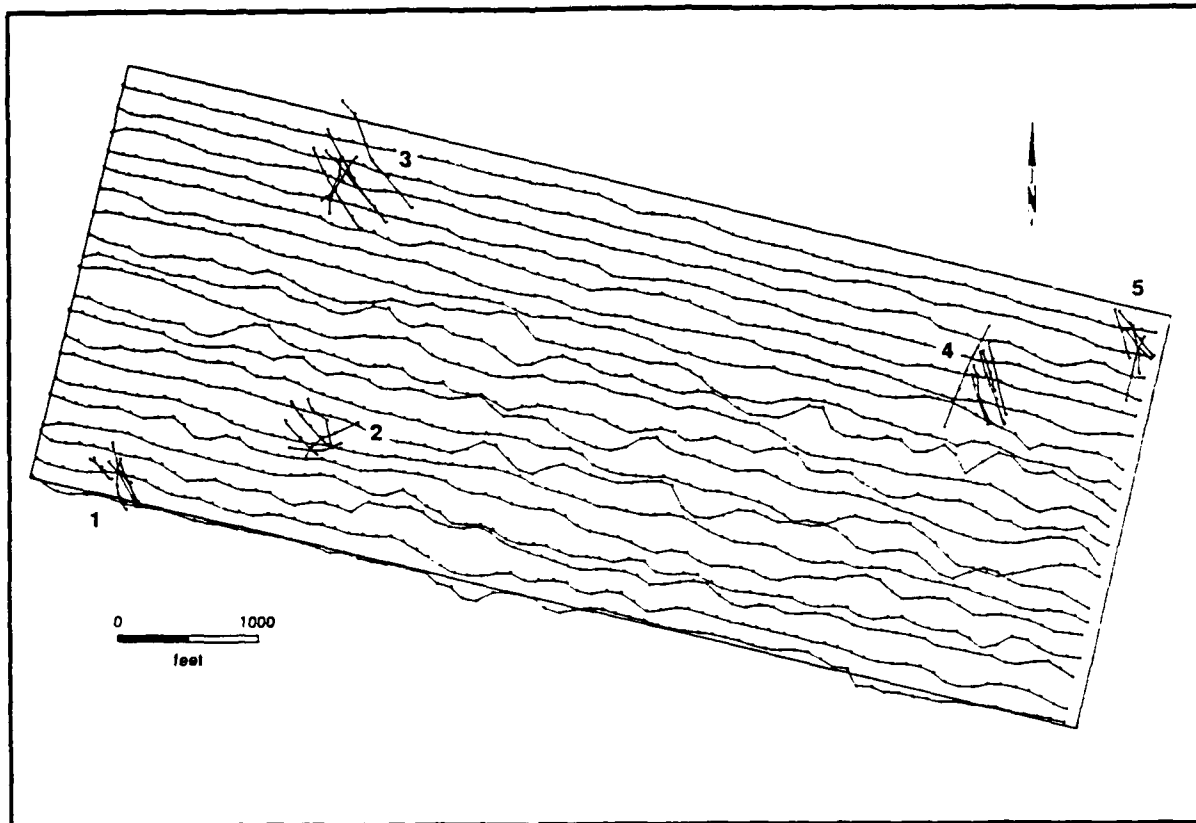


Figure 16. Post plot showing the locations of the additional survey lines obtained in the resurvey of the five selected target locations in relation to the original survey lines.

set on the dive boat to serve as a back-up emergency system. Visibility at the bottom in all of the areas examined was near zero and water temperatures were about 59 degrees during all of the diving operations. Water depths ranged from about 2 ft to about 11 ft. All of the requirements established in ER 385-1-86 were met and followed during the diving operations.

Target 1. Target 1 (see figure 16, Figure 17) consists of a magnetic signature with a maximum magnetic inflection (i.e., the difference between the magnetic high and the magnetic low) of 1,191 gammas covering an area measuring 240 by 400 ft. Located in only 2 to 3 ft of water, the anomaly location was carefully examined with a Schonstadt Magnetic Locator (i.e., a gradiometer), by the diver, and with 5- and 10-ft-long hydraulic probes. The area examined by probing included the entire magnetic focus of the anomaly, an area about 75 by 75 ft in size. No cultural remains of any type were found at this location, however, the gradiometer indicated that the object(s) here was small, linear, and looping in shape, almost certainly a small bar, pipe or, most likely, piece of cable. The examination did reveal that the lake bottom was fairly heavily covered with live *Rangia cuneata*, also, a condition encountered at the other target locations.

Probing provided some information on the bottom stratigraphy at this location. The upper 1 to 2 ft consists of a soft silt to sandy silt deposit containing fairly high numbers of live and dead *Rangia cuneata*. This soft silt deposit extends to a depth of about 9 to 9.5 ft, but

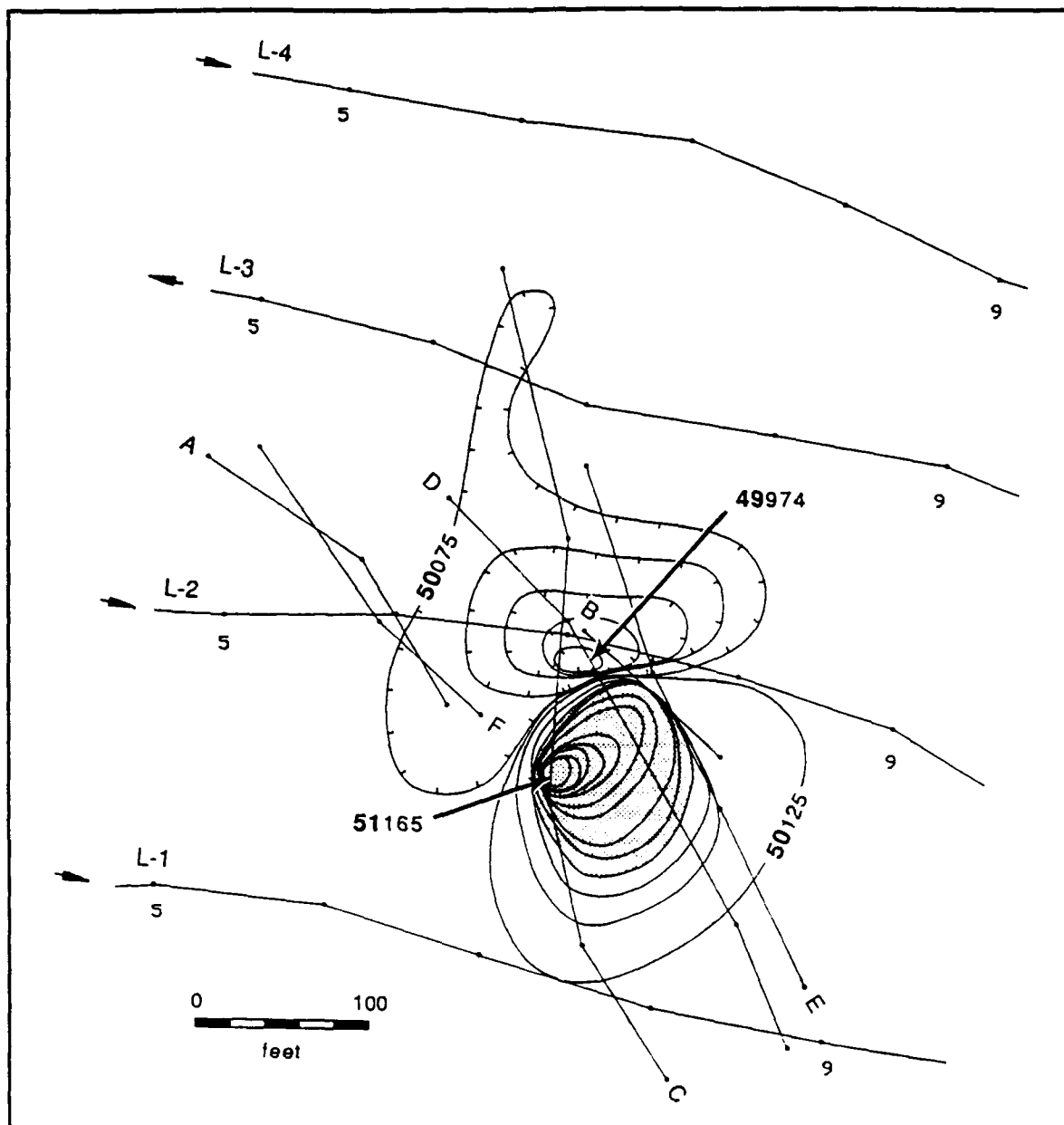


Figure 17. Magnetic contour and survey data collected at Target 1. Numbered survey lines represent those conducted in the original survey; lettered lines represent those conducted in the resurvey. Contour intervals are irregular and patterned areas represent intense magnetics.

few *Rangia* seem to be present below the 2-ft depth. At 9 to 9.5 ft below the lake bottom, the probe encountered a harder and more compact lens which, on the basis of feel, is believed to consist of shell and, possibly, sand. In some probes, this deposit appeared to be less than a foot or so thick, underlain by more soft silty (?) sediments. However, because this lens lay at the extreme limits of the probe, it was not penetrated in all instances. The current interpretation is that the upper 9 to 9.5 ft of sediments consist primarily of material deposited in the area by

the various Bonnet Carré crevasses and by subsequent openings of the Bonnet Carré Spillway. The deep shell lens may represent an earlier, pre-crevasse surface, possibly an eroded shoreline deposit, or an old *Rangia cuneata* bed.

There was no indication that intact boat remains existed at this location and no further work is recommended.

Target 3. Target 3, located in about 9 ft of water (see Figure 16, and Figure 18), was examined in the same manner as Target 1. The magnetic signature covered an area of 300 by 400 ft and had a maximum magnetic inflection of 2,386 gammas (Figure 18). The very high magnetic intensity of this, and Target 1, suggests metallic objects fairly close to the lake bottom. Systematic examination of the lake bottom and systematic probing to a depth of 10 ft over the entire area of the focus of the magnetic target failed to locate any significant remains. The probing did contact solid objects at a depth of 3 ft and a depth of 6 ft below the lake bottom. These contacts were immediately adjacent to one another, in the very center of the magnetic focus, and it appears as if a single object is represented (Figure 18). Closely-spaced probing indicated that the object is less than 3 or 4 in across, although it may be linear. No excavations were conducted at this location since it appears as if the object is a piece of pipe or cable; and there is no indication that intact vessel remains exist. No further work is recommended for this location.

Target 4. Target 4, actually consisting of a pair of magnetic anomalies, is located in about 11 ft of water in the eastern end of the borrow area (see Figure 16, and Figure 19). These magnetics cover an area measuring 350 by 550 feet and produced a maximum magnetic inflection of 494 gammas. The greater water depth and, thus, the increased distance between source and sensor, is probably a major contributor to the low magnetic deflection at the target when compared to Targets 1 and 3. Target 4 was examined in the same manner as the others. Diver examination located a 4-ft-long piece of 4-in-diameter iron pipe partially buried on the lake bottom in the vicinity of the southernmost anomaly (Figure 19). Attached to the pipe (welded?) were two, flat, iron pieces that extended to a depth of at least 2 ft below the lake bottom. These may extend farther, but because it was determined that the object was modern and did not represent historic vessel remains, no additional examinations were conducted. An effort was made to remove the object, but it was too firmly buried to be moved. Careful examination of the lake bottom in the vicinity of the iron pipe and in the area of the northern magnetic focus failed to locate any other objects. It is presumed that the other anomaly is created by a similar object and that neither represent significant cultural properties. No additional work is recommended at this location.

Target 5. A magnetic anomaly was found in the area of Target 5 during the resurvey; but, as shown in Figure 20, the signature was not sufficiently large or intense to warrant further examination. It is not known whether the source for this anomaly is the same as was recorded during the initial survey.

None of the targets examined appear to represent the remains of historic cultural resources and no further cultural resources work is recommended in the project area.

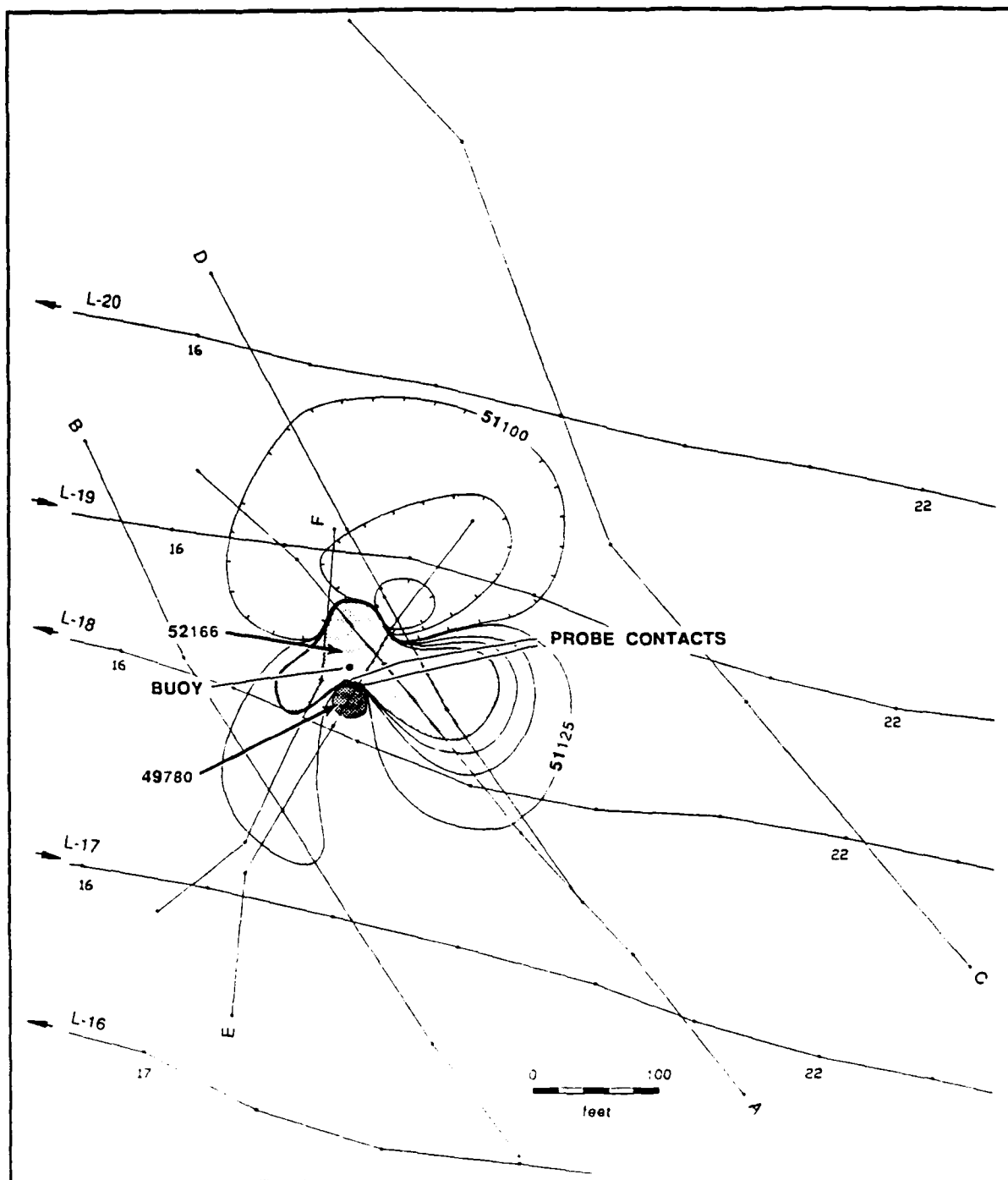


Figure 18. Magnetic contour and survey data collected at Target 3. Contour intervals are irregular and patterned areas represent intense magnetics. Note the location of the hydraulic probe contacts.

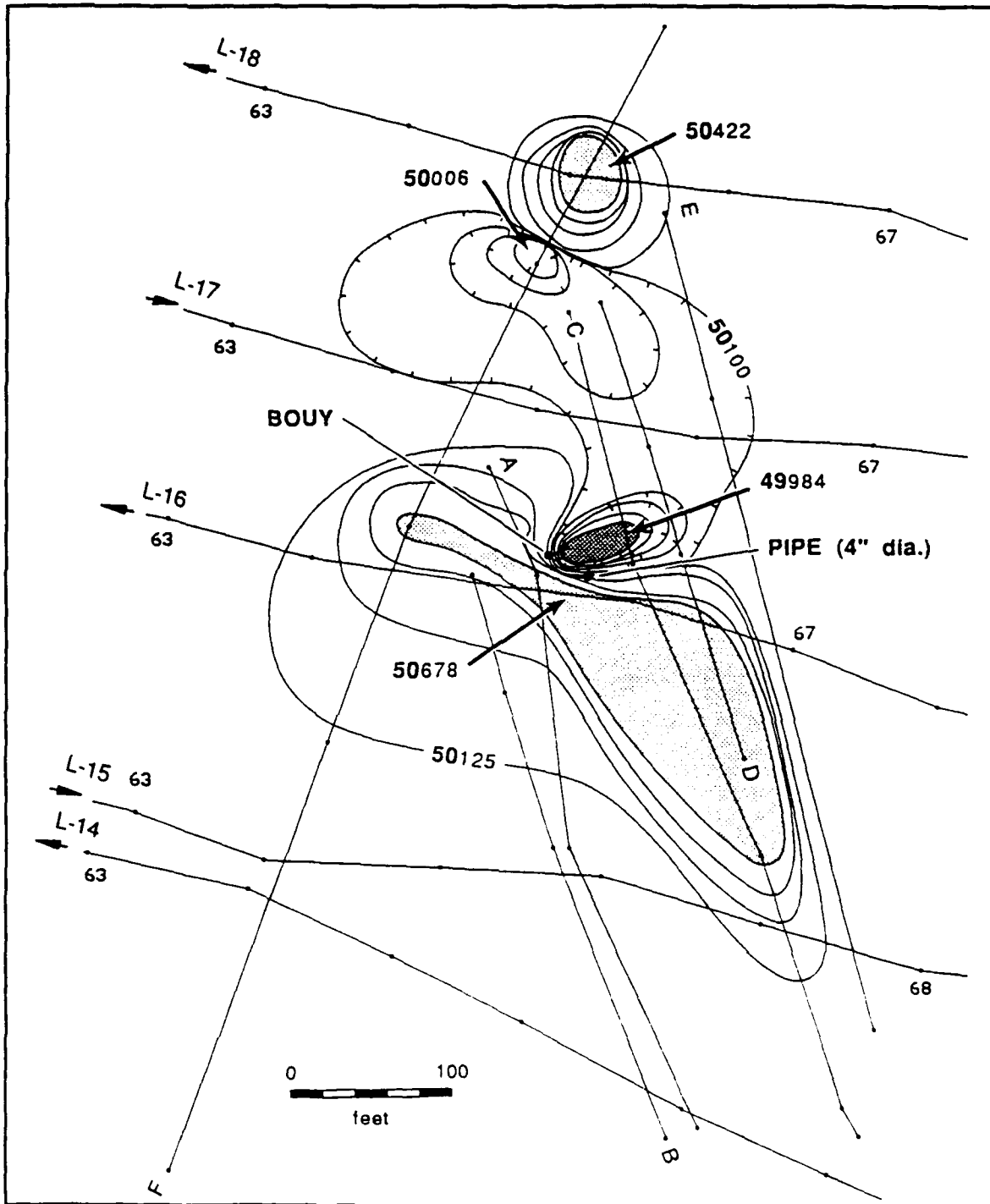


Figure 19. Magnetic contour and survey data collected at Target 4. Contour intervals are irregular and patterned areas represent intense magnetics. Note the location of the iron pipe.

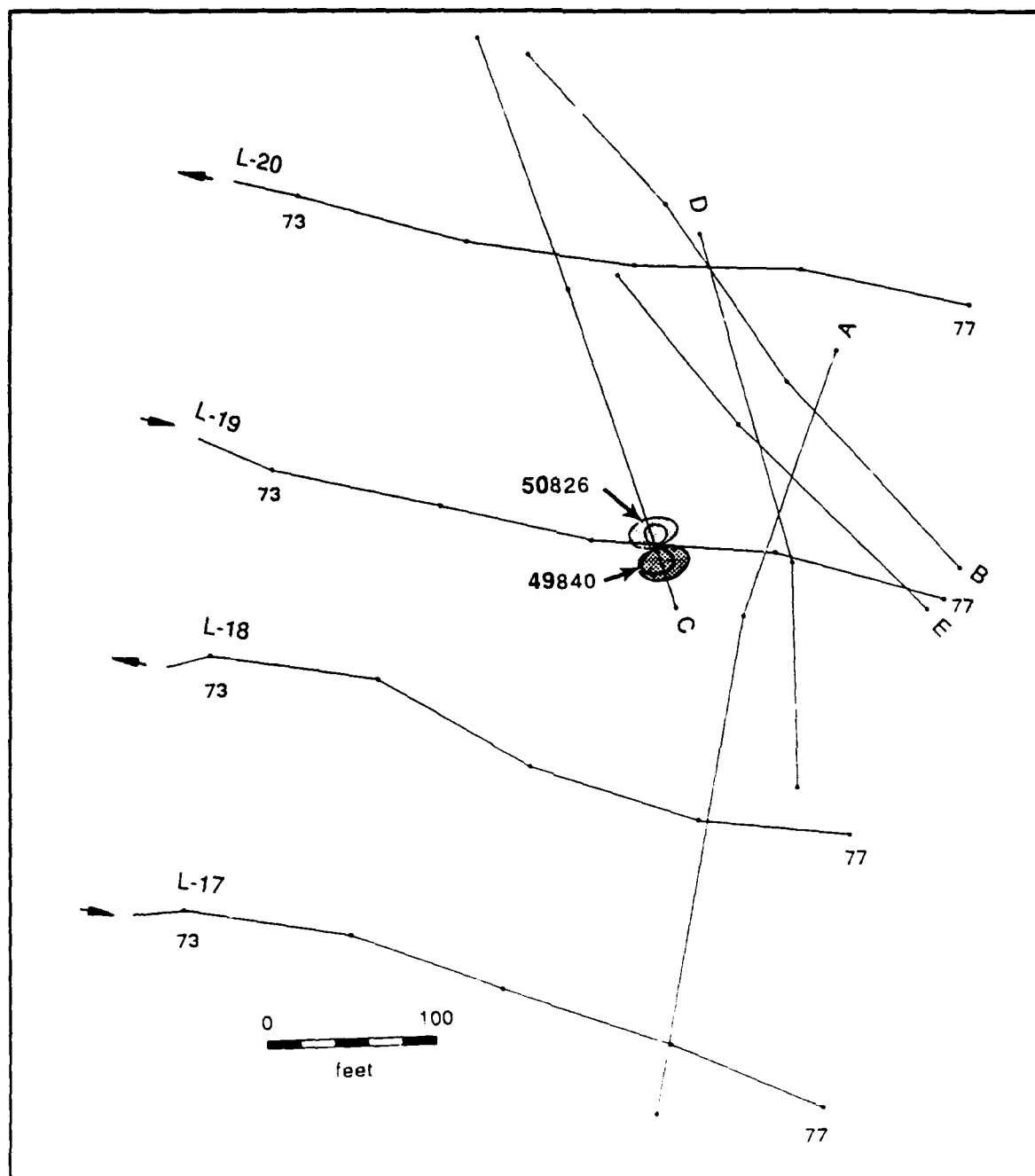


Figure 20. Magnetic contour and survey data collected at Target 5.

CHAPTER 5:

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The remote-sensing survey and diving operations discovered no significant cultural remains in the project area. While a number of remote-sensing targets were located, most were eliminated from consideration because they are believed to represent modern debris and trash. Only two objects were encountered during diving; one of these is questionable. Both are presumed to be modern debris.

The remote-sensing survey did reveal the presence of a then-unrecognized gas pipeline running across the selected borrow area. When this was brought to the attention of the Corps of Engineers, it did require some modifications in their dredging program. This study also served to bring together a considerable amount of information on the natural and human histories of the Bayou Labranche mouth area and this portion of Lake Pontchartrain. This information suggests that the old, now-buried course of Bayou Labranche very likely runs across the project area. This old channel may have contained prehistoric sites along its natural levees, and, while any intact portions of these natural levees are now presumed to be buried 10 or more feet below the present lake bottom, remains of sites may still exist. However, there seems to be no feasible way to assess the possible existence of sites on these buried landforms.

The information collected in this study particularly highlights two periods of interest in the history of Bayou Labranche. One of these is the period from about 1700 to 1720 when Bayou Labranche seems to have regularly served as a portage between Lake Pontchartrain and the Mississippi River. As far as the authors know, the identification of Bayou Labranche as an important portage and its correlation with the activities of early French explorers, such as Pierre-Charles la Sœur, have never before been recognized. It is possible that if Bayou Labranche had been a slightly better route for travel, it, rather than Bayou St. John, could have been selected for the site of New Orleans.

The other intriguing period in the history of Bayou Labranche is the early twentieth century, when it was the site for the development of one of Edward Wisner's experimental land reclamation and farming projects. During the period from 1906 to 1915, the Labranche area was quite active as a farm, supplying produce and, possibly, cattle to the New Orleans market. Maps of the period depict several structures around the mouth of Bayou Labranche, as well as adjacent field areas. These structures seem to have been concentrated along the higher natural levees of Bayou Labranche, and possibly on the elevated area provided by the prehistoric

Rangia shell midden of the Bayou Labranche mouth site. The historic artifacts collected from this site are likely to be associated with this occupation. Maps produced by the U.S. Coast and Geodetic Survey in 1897 indicate that several structures and yard or field areas were already located around the mouth of Bayou Labranche (see Figure 10). A couple of the buildings located near the railroad track are probably associated with the Illinois Central railroad, but the others seem to be actual residences or small farms. Some of these structures could date from the 1880s, when an S. Bringier leased the land around the mouth of Bayou Labranche, but this cannot be verified with the information at hand.

The Hurricane of 1915 so damaged the area around the mouth of Bayou Labranche, that it was abandoned, at least for agricultural purposes. As shown above in Figure 5, most of the structure locations near the lake have since been lost to shoreline erosion, while others were obliterated when Interstate 10 was built. With the abandonment of the land, the levees fell into disrepair and water flooded the now seriously compacted and subsided lands in the Wisner impoundment, producing the open water pond found there today.

Recommendations

No significant cultural resources were located in the project area during this study and no further archeological work is recommended. The several targets located during the survey all are presumed to represent modern, nonsignificant material, possibly debris lost or discarded by fisherman, or during the construction of the Shell pipeline or the nearby Louisiana Power and Light power line. The pipeline represents a significant hazard and should be avoided during dredging operations. Likewise, Targets 1, 3, and 4 should be avoided or removed prior to dredging because their source objects could damage dredge machinery. To aid in this avoidance, the Louisiana State Plane Coordinates for these three targets are: Target 1: X=2305751.82, Y=509204.97; Target 3: X=2307335.60, Y=511298.20; Target 4: X=2311949.60, Y=509961.70.

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APPENDIX 1: SCOPE OF SERVICES

SCOPE OF SERVICES

Remote Sensing Survey of the Bayou Labranche Wetlands Restoration Borrow Area, St. Charles Parish, Louisiana

1. Introduction. The Labranche borrow area is located in Lake Pontchartrain in an area beginning approximately 2,000 feet from the south shore of the lake and extending 3,000 feet into the lake. The project objective is to create new vegetated wetlands and restore and nourish deteriorated marshes in the Bayou Labranche area. The proposed project involves dredging of sediments from Lake Pontchartrain to create vegetated wetlands.

2. Study Area. The study area consists of a 500 acre borrow area located in Lake Pontchartrain (see attached map).

3. Background Information. The study area has not been surveyed for cultural resources. A general history of Louisiana's maritime heritage and an inventory of reported shipwrecks in the study area is provided in the cultural resources 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. This report shows a total of 175 boat wrecks in Lake Pontchartrain.

4. General Nature of the Work. The study consists of a systematic magnetometer and side scan sonar survey of the study area using precise navigation control and a fathometer to record bathymetric data. At least five potentially significant anomalies located by the survey will be briefly investigated by probing and diving. The purpose of the study is to locate any historic shipwrecks which may exist in the areas. All magnetic, bathymetric, and sonar anomalies will be interpreted based on expectations of the character of shipwreck signatures.

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

the National Register Bulletin 15 entitled, "How to Apply the National Register Criteria for Evaluation";

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

the Louisiana Division of Archeology's Comprehensive Archeological Plan dated October 1, 1983 and the Cultural Resources Code of Louisiana, dated June 1960;

the Advisory Council on Historic Preservation's regulation 36 CFR Part 800 entitled, "Protection of Historic Properties."

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

A. Phase 1. Background Research. This phase will begin with research of available literature and records necessary to establish the historic setting, predict the nature of the resource base in the project area, and refine the survey methodology. This background research will include a literature review of the geomorphology and research of historic maps and records.

B. Phase 2. Remote Sensing Survey.

Upon completion of Phase 1, the contractor shall proceed with execution of the fieldwork. The equipment array required for this survey effort is:

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

The contractor will begin by establishing the shore reference stations for the positioning system, if necessary. The following requirements apply to the survey:

- (1) transect lane spacing will be no more than 150 feet for the magnetometer survey and 600 feet for the sonar survey,
- (2) two separate runs will be made along the transects, one with the side scan sonar and another with the magnetometer,
- (3) 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 placed to avoid noise from the survey boat (eg. towed a minimum of 2 1/2 times the length of the boat or projected in front of the survey vessel,
- (7) the survey will utilize the Louisiana Coordinate System,
- (8) additional transects will be run over all potentially significant anomalies, and
- (9) Probing of the water bottom and diving will be conducted at potentially significant anomalies (selected by the contractor in consultation with the COR).

Upon completion of the remote sensing portion of the survey, the survey data will be briefly analyzed to allow selection of potentially significant anomalies for further

evaluation by probing and diving. Anomalies selected for further evaluation will consist of those anomalies with the greatest potential of representing historic shipwrecks. This selection of limited anomalies will be coordinated with and approved by the COR upon completion of the survey. A minimum of 5 anomalies will be investigated. The evaluation will consist of appropriate measures designed to identify the source(s) and historical significance of the selected magnetic and sonar anomalies. This will require diving and possibly some excavation. The methods will include, but not be limited to, the following:

- (1) relocation of the anomaly locations;
- (2) physical search of the water bottom at the anomaly location;
- (3) use of a metal detector to determine if source is deeply buried;
- (4) probing of the bottom to locate buried sources;
- (5) excavations, if necessary, to uncover the anomaly sources.

Two copies of a brief management summary which presents the results of the fieldwork will be submitted to the COR within 6 weeks after delivery order award. The report will include a brief description of each anomaly located during the survey and recommendations for further work if necessary. A preliminary map will be included showing the locations of each anomaly.

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

- (1) post-plots of survey transects, data points and bathymetry;
- (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 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 additional work. Equipment and methodology to be employed in further evaluation studies must be discussed in detail. 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 eligible for inclusion in the National Register, potentially eligible, or not eligible. The Contractor shall fully support his recommendations regarding site significance. The report will include a summary table listing all anomalies, the assessment of potential significance, and recommendations for further work.

One set of project area maps with the locations of all anomalies accurately plotted thereon will be submitted with the draft reports. This map will indicate the location of the borrow area, any anomalies located as well as the location of the Bayou Labranche site. The base project maps will be provided by the COR. In addition to the locations of all anomalies, the maps will also show other pertinent features such as: channel beacons and buoys, channel alignments, bridges, cables and pipeline crossings. The maps will be accompanied by tables listing all magnetic anomalies recorded during the survey. 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).

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 report are contained in Section 6 of this Scope of Services.

6. Reports:

Management Summary Two copies of a brief management summary will be submitted to the COR within 6 weeks after delivery order award.

Draft and Final Reports (Phase 1-3). Eight copies of the draft report integrating all phases of this investigation will be submitted to the COR for review and comment within 9 weeks after work item award. As an appendix to the draft report, the Contractor shall submit the state site forms. The written 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 (15 weeks after work item award). 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 3 weeks (18 weeks after work item award). Upon approval of the preliminary final report by the COR, the Contractor will submit 30 copies and one reproducible master copy of the final report to the COR within 22 weeks after work item award.

7. Weather Contingencies. The potential for weather-related delays during the survey necessitates provision of weather contingency days in the delivery order. Two weather contingency days have been added to the fieldwork. The Contractor assumes the risk

for any additional costs associated with weather delays in excess of two days. If the Contractor experiences unusual weather conditions, he will be allowed additional time on the delivery schedule but no cost adjustment.