

VEGETATION AND GEOLOGY OF LAKE PONTCHARTRAIN BAYOUS
An Independent Project for Environmental Studies 102
(Professors Art, Dethier, and Kegley)

by
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PREFACE

This independent project concerns two special places in South Louisiana, my home. Bayou St. John holds special memories of learning to row a boat with grandfather and evenings fishing with father. It is an urban waterbody, surrounded by the City of New Orleans. Bayou Labranche represents a more natural habitat of the area. Although somewhat altered and polluted, the natural beauty still stands out. In my pirogue along Bayou Labranche, I can feel like I am on another planet, far away from the stresses of everyday life, yet less than six miles away is New Orleans' International Airport. The city ends abruptly at the edge of the drained land, and the wetlands stretch out beyond. This proximity of the wild to the urban is one of my area's most special characteristics.

I hope that this report will help people to understand better the relationship between developed land, people, and unclaimed wetlands in South Louisiana. The field experience taught me a lot about the subject, but six days in my pirogue collecting data at these two sites had two much more important effects on me : they made me realize the fragility of the natural heritage of South Louisiana and they strengthened my commitment to do all I can to protect it from the adverse effects of human activities.

I would like to thank my father, John M. Kinabrew III, and my grandfather, J.M. Kinabrew, Jr., for their invaluable support and help with this project.

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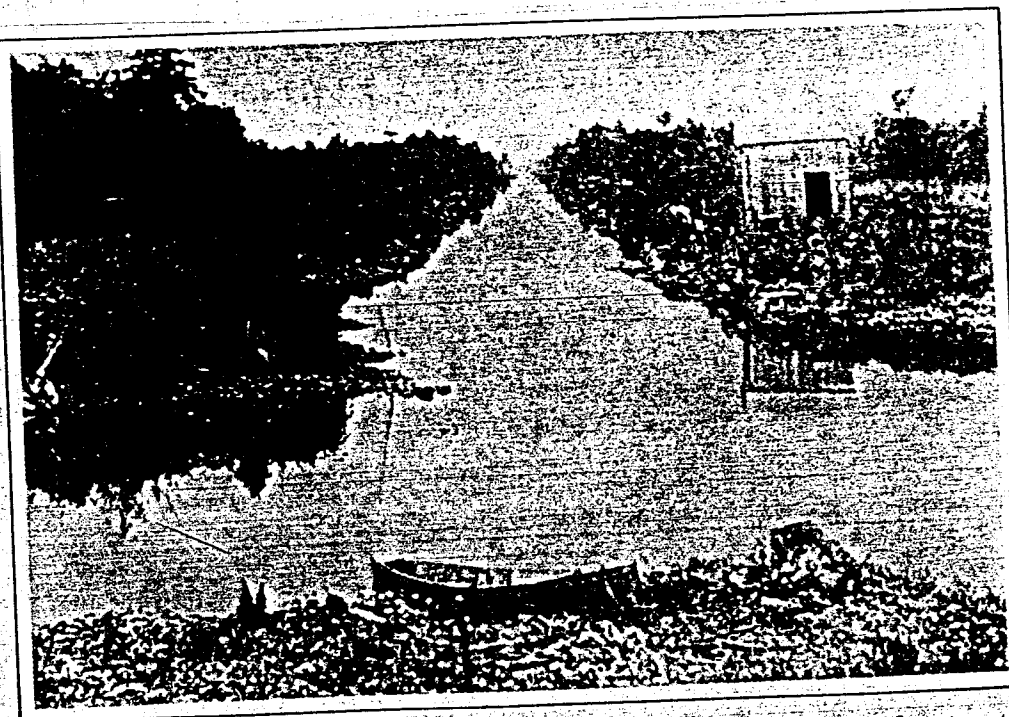
I. INTRODUCTION

This project aims to compare the geology and aquatic vegetation at the mouths of two bayous in the Lake Pontchartrain Basin, Louisiana. The Lake Pontchartrain Basin has been in a state of constant change since its beginnings 3000 - 5000 years ago. However, the alarming rate of ecological change occurring today has come to be of great concern. Human impacts on the basin's ecosystems are damaging the basin's ecology. One of the symptoms of this decline is the loss of underwater vegetation.

Bayous Labranche and St. John were chosen for comparison in this study because of their similar geologic beginnings and their very different human histories. Of all the waterways along the south shore of Lake Pontchartrain, they can best serve to illustrate the effects of different human activities. This report will first examine how the landforms and waterways of the south shore of Lake Pontchartrain were formed in the recent geologic past. It will then examine the historical relationship between man and Bayous St. John and Labranche. Geological, chemical, and vegetative data collected at the mouth of each bayou will be presented and evaluated in light of natural and human history in the area. The type and extent of underwater vegetation at the sites will be discussed as indications or reflections of trends in the health of the Lake Pontchartrain ecosystem.



Student's Father in Bayou LaBranche Wetlands, 1990. The similarities are evident between this area and the Bayou St. John-area wetlands of the early 20th century pictured below.



Adams Avenue (now Robert E. Lee Boulevard.) 1908. From "A Study in Investments" 1909. — Courtesy Howard Tilton Memorial Library, Tulane University.

II. BACKGROUND INFORMATION

A. GEOLOGIC HISTORY

The geologic history of the Lake Pontchartrain basin can be divided into two parts : the formation and weathering of the Pleistocene age Prairie formation north of Lake Pontchartrain and the later formation of the southern shore of the lake through deltaic processes.

marine or terrestrial deposits?

The Pleistocene age Prairie formation on the north shore of Lake Pontchartrain was deposited over 50,000 years ago and was predominated by poorly consolidated sands, silty clays, and clays. Sea level changes in the period from 50,000 - 30,000 years ago exposed the formation to weathering processes which caused a deeply weathered soil profile to be formed. The "Pleistocene Terrace" was thus formed north of Lake Pontchartrain and the shore of the Gulf of Mexico was near the present north shore of the lake. (Coastal Environments 1984)

This report is primarily concerned with the south shore of Lake Pontchartrain. This area was formed later and in a very different way. As the sea level rose to its present level after the last ice age between 7000 and 4000 years ago, sand deposits were eroded from the Pleistocene Terrace by the Pearl River. This sand was redistributed to form a string of sand spits and islands running southwest from the mouth of the Pearl River. A major barrier island trend of well-sorted sand was established, separating the open Gulf from a sheltered sound on its northern side. This sound was Lake Pontchartrain. Today these sand deposits lie 20 - 25 feet below mean sea level on the south shore of Lake Pontchartrain. (Coastal Environments 1984)

compaction

During the period from 4000 to 700 years ago, a major deltaic

lobe of the Mississippi River, the St. Bernard delta complex, developed in the area (see Figure 2-1). Natural ridges formed along Bayous Metarie and Sauvage in what is now New Orleans, as well as along the present channel of the Mississippi River in the section south of Lake Pontchartrain. The ridges were formed by bank deposition resulting from the yearly overflow of the Mississippi River. The interdistributary areas between these ridges became mudflats and were soon colonized by grasses, forming marshes. (Coastal Environments 1984)

About 700 years ago, the Mississippi River changed its course, abandoning the St. Bernard delta complex. Abandoned distributaries such as Bayous St. John and Labranche converted to minor tidal streams. Divorced from the freshwater of the Mississippi River, the St. Bernard delta complex took on a distinctive estuarine character as salinities increased. (Coastal Environments 1984)

The hydrology of the area has been greatly changed by Man and will be discussed in the next section.

B. HUMAN HISTORY / HYDROLOGY

1. Hydrology of the Lake Pontchartrain Basin

The relationship between human history and hydrology in the Lake Pontchartrain Basin cannot be ignored. Extreme alterations in the hydrology of the basin and its bayous have surely had an impact on aquatic vegetation.

Before man's intervention, Bayous St. John and Labranche mixed freely with the oligohaline Lake Pontchartrain, a large body of water with an average depth of only sixteen feet. The lake received freshwater from the surrounding wetlands, from the rivers of the Pleistocene Terrace to the north, and from the Mississippi River each

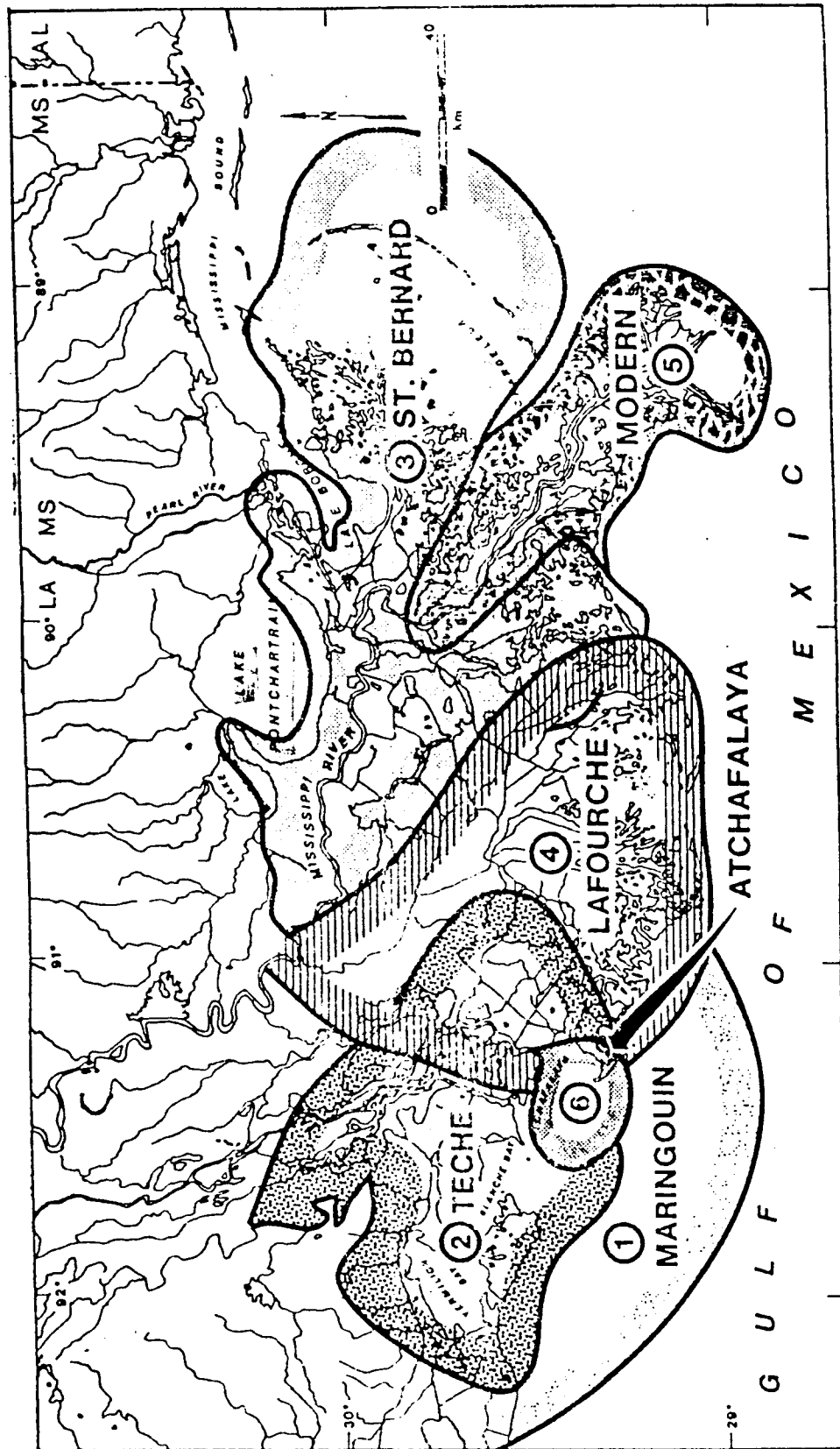


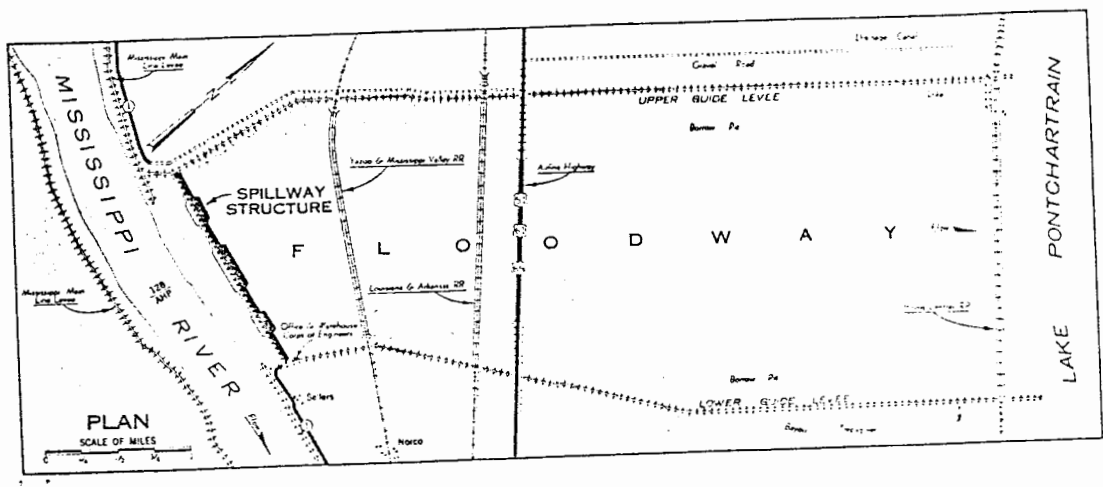
Figure 2-1. Subdelta chronology of the Mississippi River Deltaic Plain. Source: Frazier 1967.

year at the time of the spring floods. Lake Pontchartrain received saline waters from the east through two natural passes : the Rigolets and Chef Menteur Pass.

During the twentieth century, major flow changes have been imposed on these natural patterns. Between about 1890 and 1920, the U.S. Army Corps of Engineers leveed the lower Mississippi River for flood control purposes, completely cutting off its spring floodwaters from the Lake Pontchartrain Basin. However, since the pressure on the unbroken levees was causing breakages and flooding, spillways were constructed at strategic points in the system to relieve pressure on the levees. One of these points was at Bonnet Carre', a few dozen miles upriver from New Orleans. The spillway was constructed in 1931 in order to allow for the discharge of Mississippi River water and its carried sediment into Lake Pontchartrain during particularly high river stages. The Bonnet Carre' Spillway discharge enters Lake Pontchartrain just west of the mouth of Bayou Labranche. The spillway is only infrequently used. It was opened only seven times between 1931 and 1984. *particularly so with A+Chalaya —*

Another major hydrologic change in the Lake Pontchartrain Basin was the construction of the Mississippi River-Gulf Outlet canal in 1963. This canal connects to the Inner Harbor Navigational Canal, *— how deep?* thereby forming an unbroken, deepwater channel connecting Lake Pontchartrain directly to the Gulf of Mexico. Although it carries only 7% of the water coming into the lake, it accounts for 20% of the total salt entering the lake because of the presence of very high salinity water (20ppt) at its bottom depths. (St. Pe' et al. 1983)

The development of New Orleans and its suburbs on the south shore of the lake greatly increased runoff rates. Waters which had slowly



17 The Bonnet Carré spillway. After the flood of 1927, the United States government recognized its responsibility for flood control. In 1931, the Bonnet Carré spillway was built. This controlled outlet can divert 250 million cubic feet of water a second—nearly twice the flow of Niagara Falls—into Lake Pontchartrain and eventually into the Gulf of Mexico. The river was shortened by cutoffs, the great Atchafalaya floodway built, and levees strengthened, thus removing the fear of floods from New Orleans for good.

JK -
this
can't
be true - all of S.

Louisiana would be
long gone @ 1/10 this discharge -

from New Orleans: An Illustrated History by John Kemp

drained into the lake through winding waterways such as Bayou St. John were now forcefully pumped down straight drainage canals into Lake Pontchartrain, leading to increased peak flows and high pollutant loadings in nearshore areas after rainfalls. The levee systems associated with the suburban development changed the overall tidal system and the volume of the lake. (Coastal Environments 1984) Eleven almost equally spaced outfalls presently discharge along the south shore.

2. Human History of Bayou St. John

Bayou St. John has played a crucial role in the development of the city of New Orleans. In 1718 New Orleans was founded on relatively high land along the Mississippi River at one end of a portage leading to Bayou St. John. This portage was crucial to trade and travel because it formed part of the "lake route", which was used extensively until the late nineteenth century when the treacherous shoals at the mouth of the Mississippi were controlled. The "lake route" utilized the Mississippi Sound, Lake Borgne, the Rigolets, Lake Pontchartrain, and finally Bayou St. John to reach the portage.

From about 1720 on, settlers colonized the high ground near the intersection of Bayous Metairie and St. John. The land was used for agriculture. The portage road leading from these small plantations to the city crossed cypress swamps and was often impassable due to rain. To remedy this situation, in the late 1700s the Canal Carondelet was constructed, which greatly shortened the portage by connecting the head of Bayou St. John to the back of the old city. A turning and docking basin was built at the city end of this canal at the site of present day Basin Street.

The Lake Pontchartrain end of Bayou St. John, the study area, has

3

FORT ST JOHN

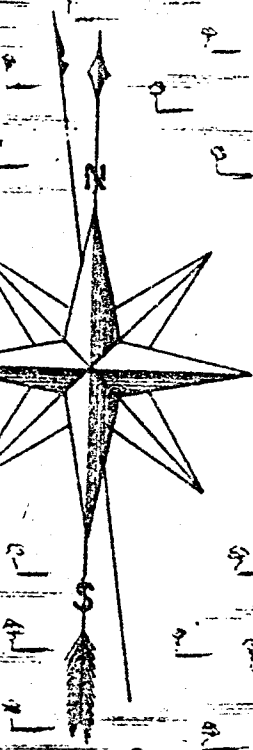
COPY AND TRANSLATION

From the Original Spanish Plan dated 1788,

SHOWING THE

City of New Orleans

ITS FORTIFICATIONS AND ENVIRONS



Area of Study

Old Portage (pre-Basil Carondelet)

Canal Carondelet and Bayou St. John

areas pictured

CYPRESS SWAMP

CYPRESS SWAMP

CYPRESS SWAMP

CYPRESS SWAMP

CYPRESS SWAMP

CYPRESS SWAMP

PRESS SWAMP

Bayou Tchoupitoulas
Metairie Road

Bayou Gentilly
Gentilly and Chef-Maure Road

Bayou de la Madeleine

LANDS OF STEPHAN REQUIRY, ESQ.
SUCCESSOR TO JOHN GIRARDY, OF
CLARKE PROPRIETOR OF THE FRONT BY
THE GOVERNMENT.

CONCESSION TO ANTONIO RIVAR
28 OCT. 1708 6 1/2
CONCESSION TO NICOLAS ALAS BOLON
26 OCT. 1708 6 1/2
CONCESSION TO BART. POSTON 23 OCT.
1708 6 1/2
MATURING BORDON SOLD TO ANTONIO RIVAR
JUN. 1ST. 1720 WITH CONVEYANCE OF
GOVERNOR BIENVILLE, THREE AND
PATER GROUP, ATTORNEY OF THE 1708, 2
SOLD TO ANTONIO RIVAR, 6 OCT. 1708
CONCESSION OF ANTONIO RIVAR, 6 OCT. 1708
SEVENTEEN ADJUTANT FRONT BELONGING TO
MADAME GUARANTE, AGENT HEREIN.
3 1/2 ADJUTANT.

CONCESSION OF STEPHAN LANGELOIS AND
DANIEL MONTAGNE, DATED 20 OCTOBER,
1728, AND APRIL 21ST. 1731. LANDS AT
PRESENT OCCUPIED BY MR. LOUIS BLANC.

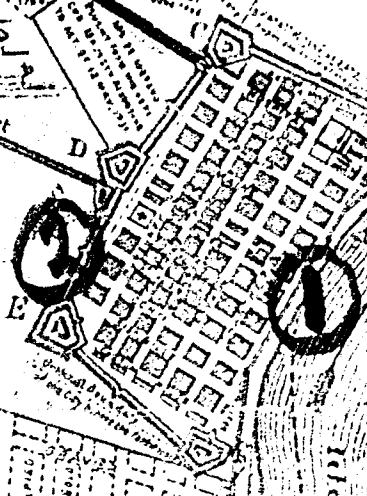
PLANTATION OF PETER
FROM LORENZO BAKER
LOCATION YOUR PLACE ON
AT THE BACKGROUND OF
THEY HAVE PLANTATION
PETER AND EIGHTEEN
IN THE ACT THAT THE
THE PLANTATION BELONGS
SHEEP AND WHEAT
AND TO THE BARR AND
THE MISCELLANEOUS
IT APPEARS THAT THE ADJUTANT
THE IS RECEIVING THE
THE LATE MR. BAKER
AND LATE FOR OTHER ADJUTANTS
AND TO THE BARR AND
THE IS RECEIVING THE
THE LATE MR. BAKER
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Lands of John Bie Maawty

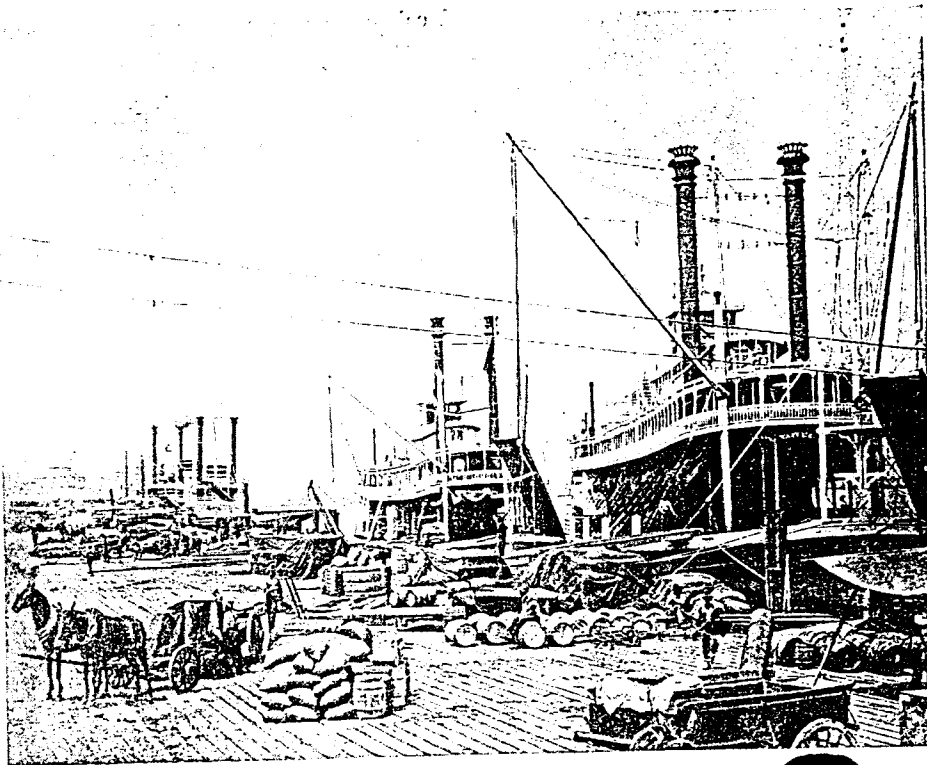
Boundary of John Bie Maawty

Boundary of the plantation of John Gensier

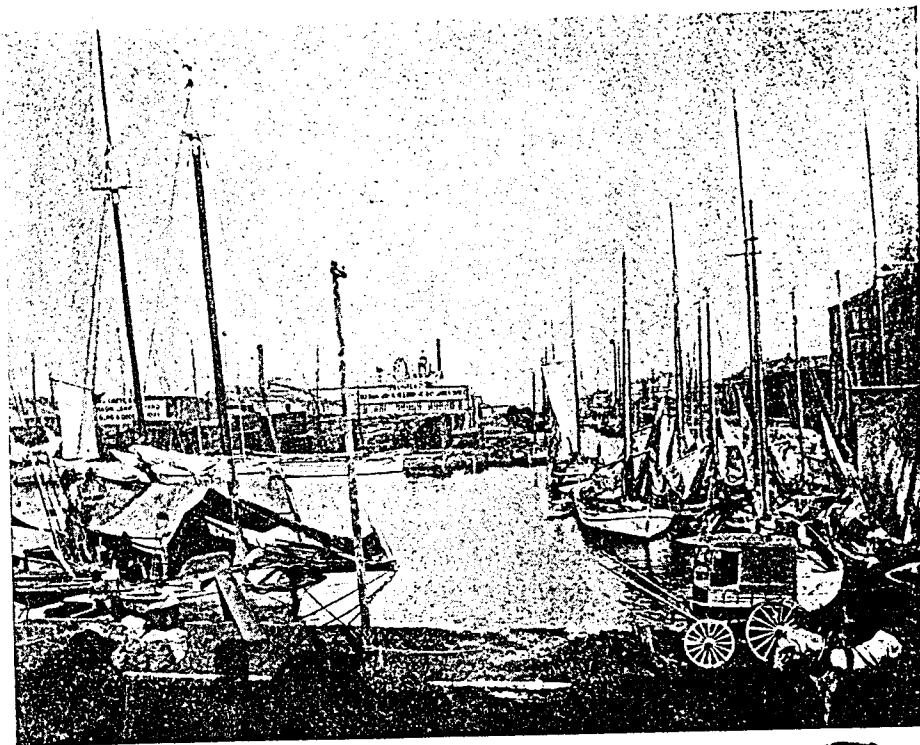
Land of Delors-Sargis



RIVER

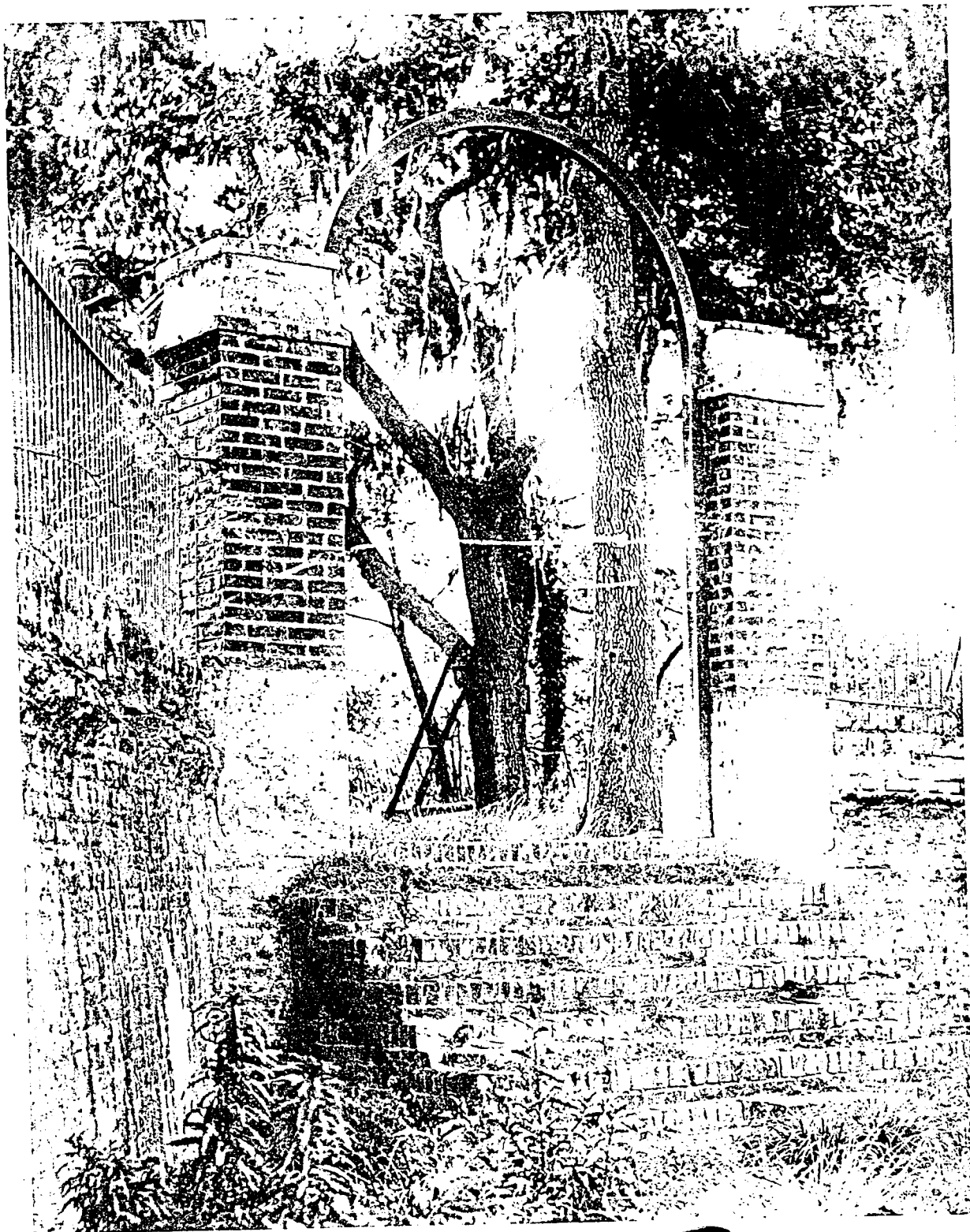


Landing of the River Steamers on the Levee.



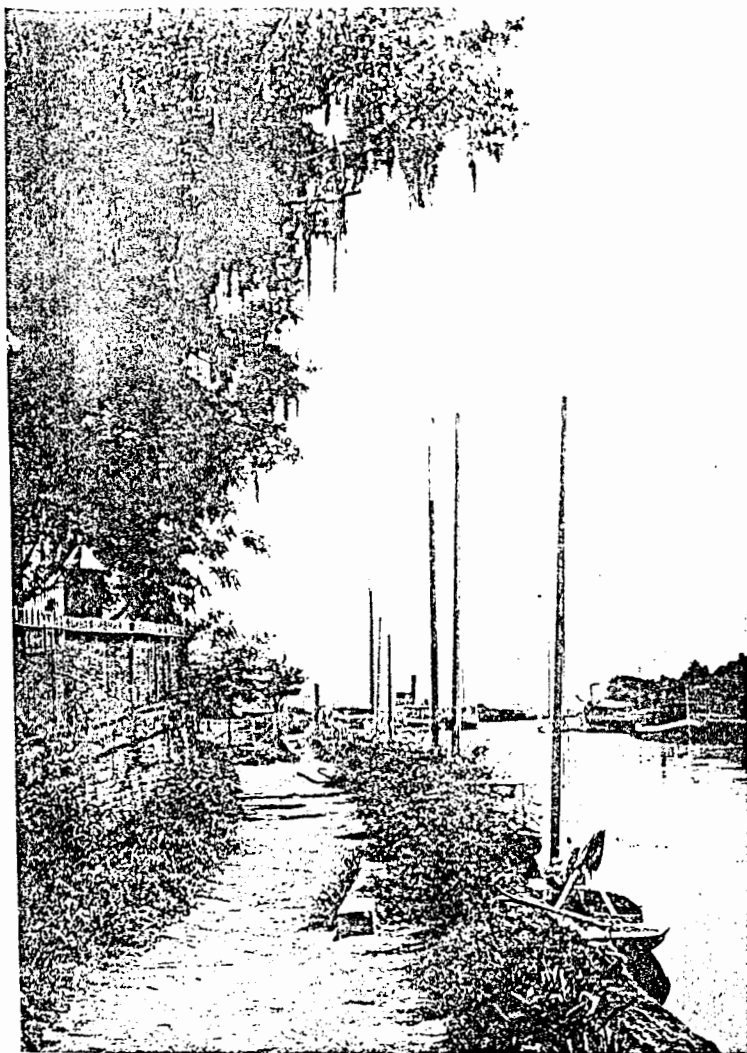
"Old Basin," Head of Canal Carondelet.





Gate, Spanish Fort, Bayou St. John, New Orleans, ca. 1910 (B-152)

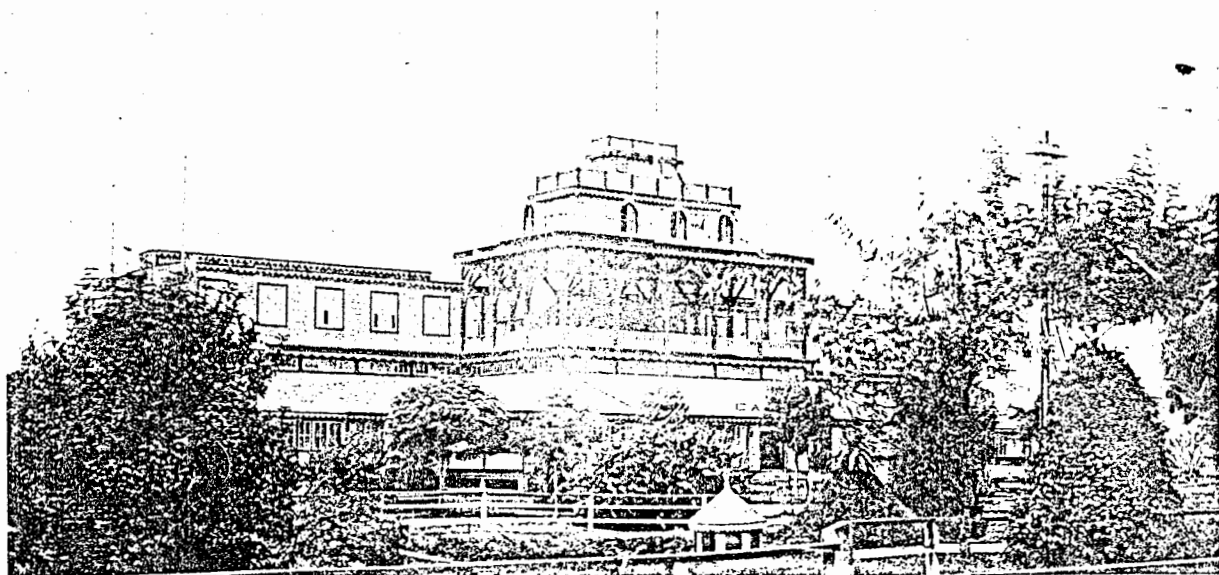
3



Boats along Spanish Fort, Old Basin Canal, ca. 1900 (C-238)
BAYON ST. JOHN

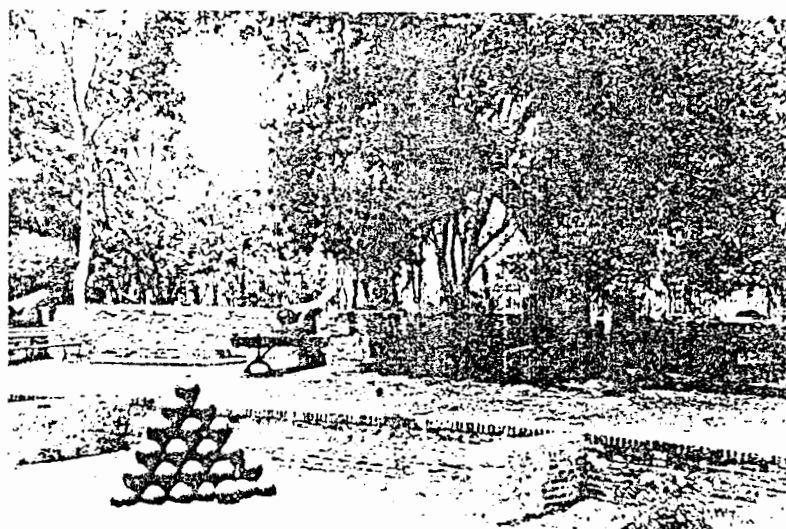


Pavillions [sic], Spanish Fort, ca. 1895 (C-228)



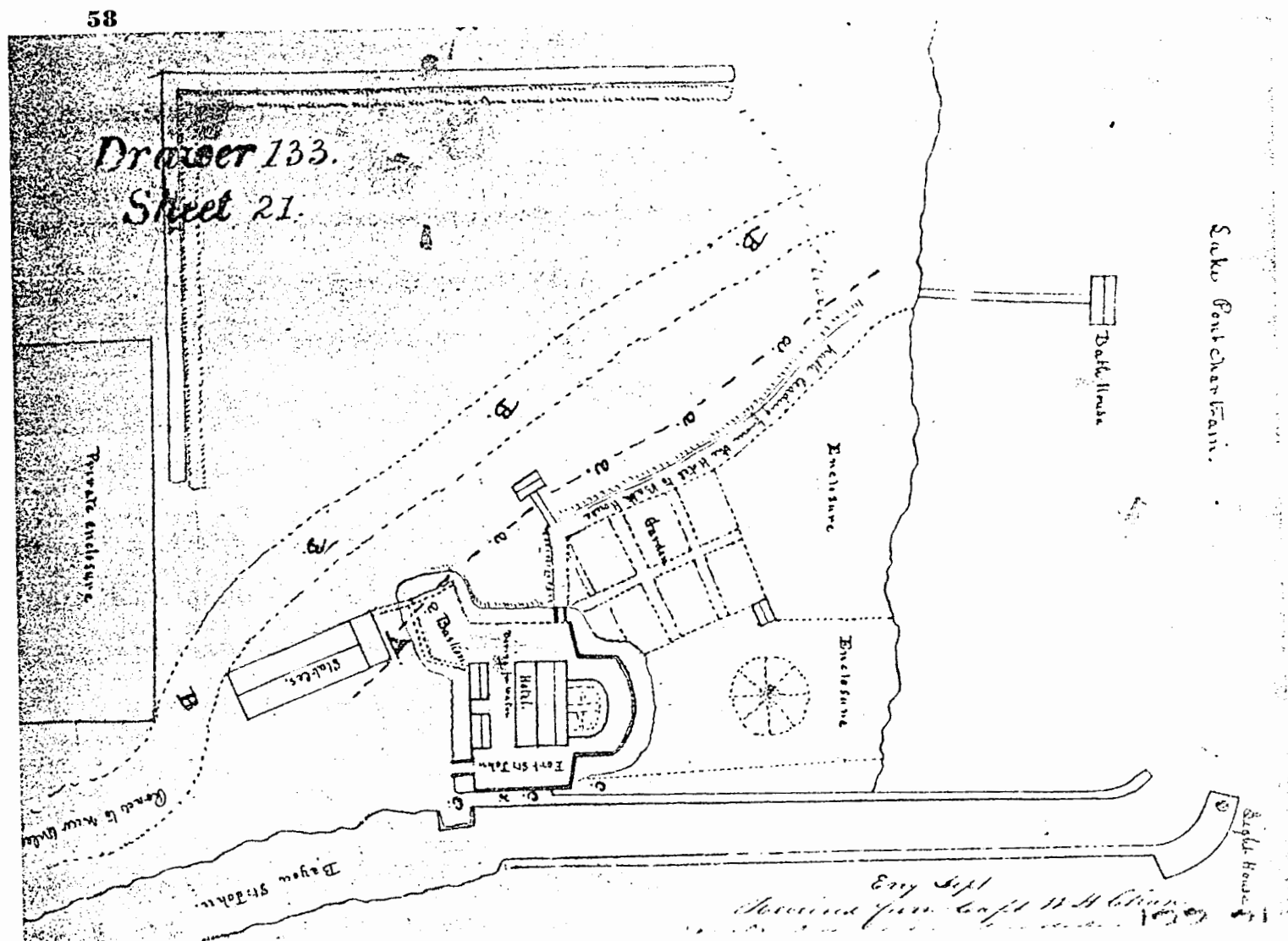
Casino, Spanish Fort, ca. 1895 (C-217)

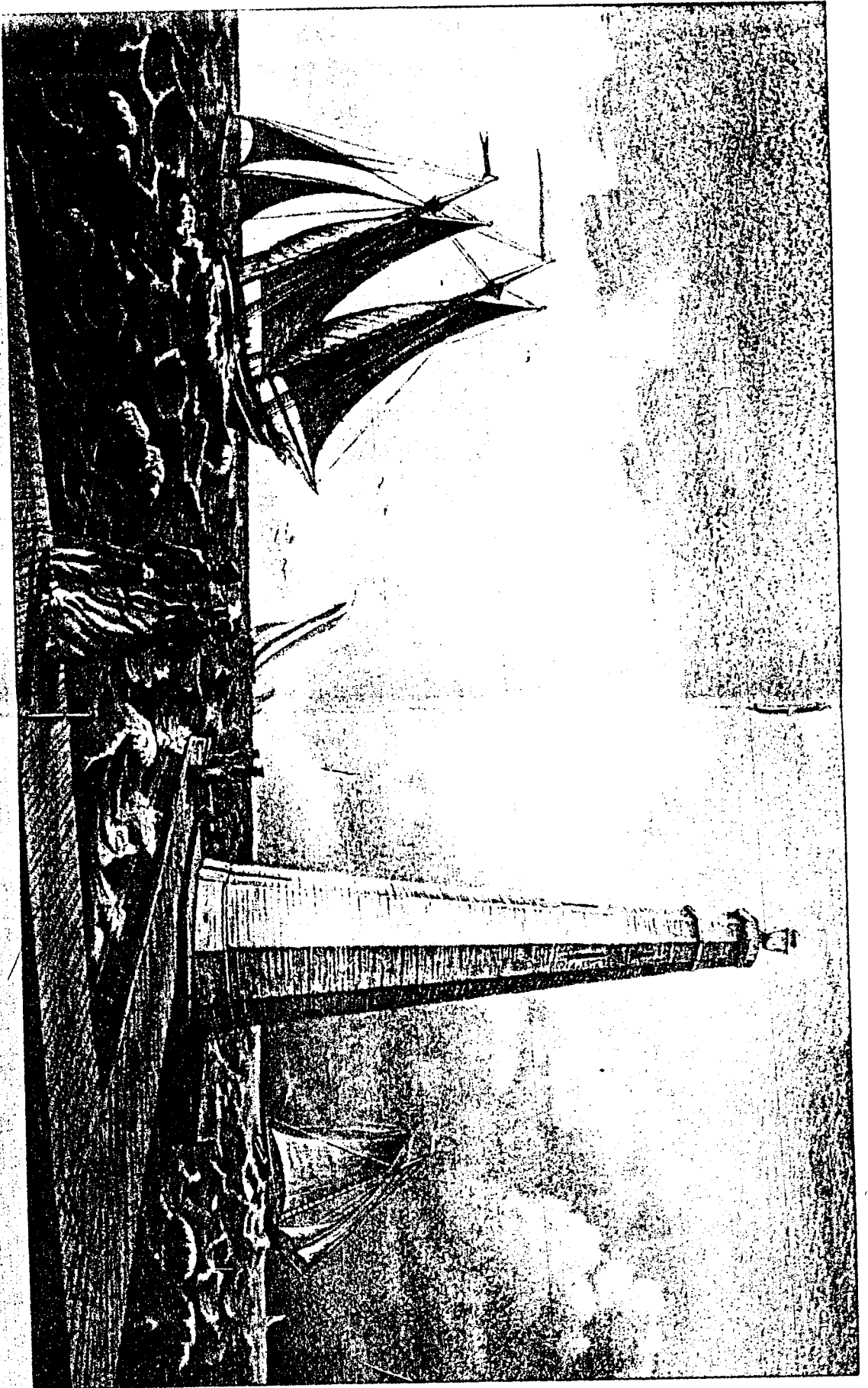
58 Plan of Spanish Fort and other areas showing hotel, bathhouse, etc., built April 30, 1828. Fort San Juan (Spanish Fort) was constructed at the mouth of Bayou St. John after the Spanish took over Louisiana in 1769. By 1793, it was in need of repairs, and Governor Carondelet made these and stationed a garrison there. At the time of the Battle of New Orleans, General Jackson sent Major Jean Baptiste Plauché's battalion and a company of artillery under the command of Captain Zacheus Shaw to the fort, more for observation than for defense. The land occupied by the old fort was sold as surplus by the government in 1823 to Harvey Elkins who erected the Pontchartrain Hotel within its walls and laid out a pleasure garden, which became very popular. *Courtesy National Archives, Washington, D.C.*



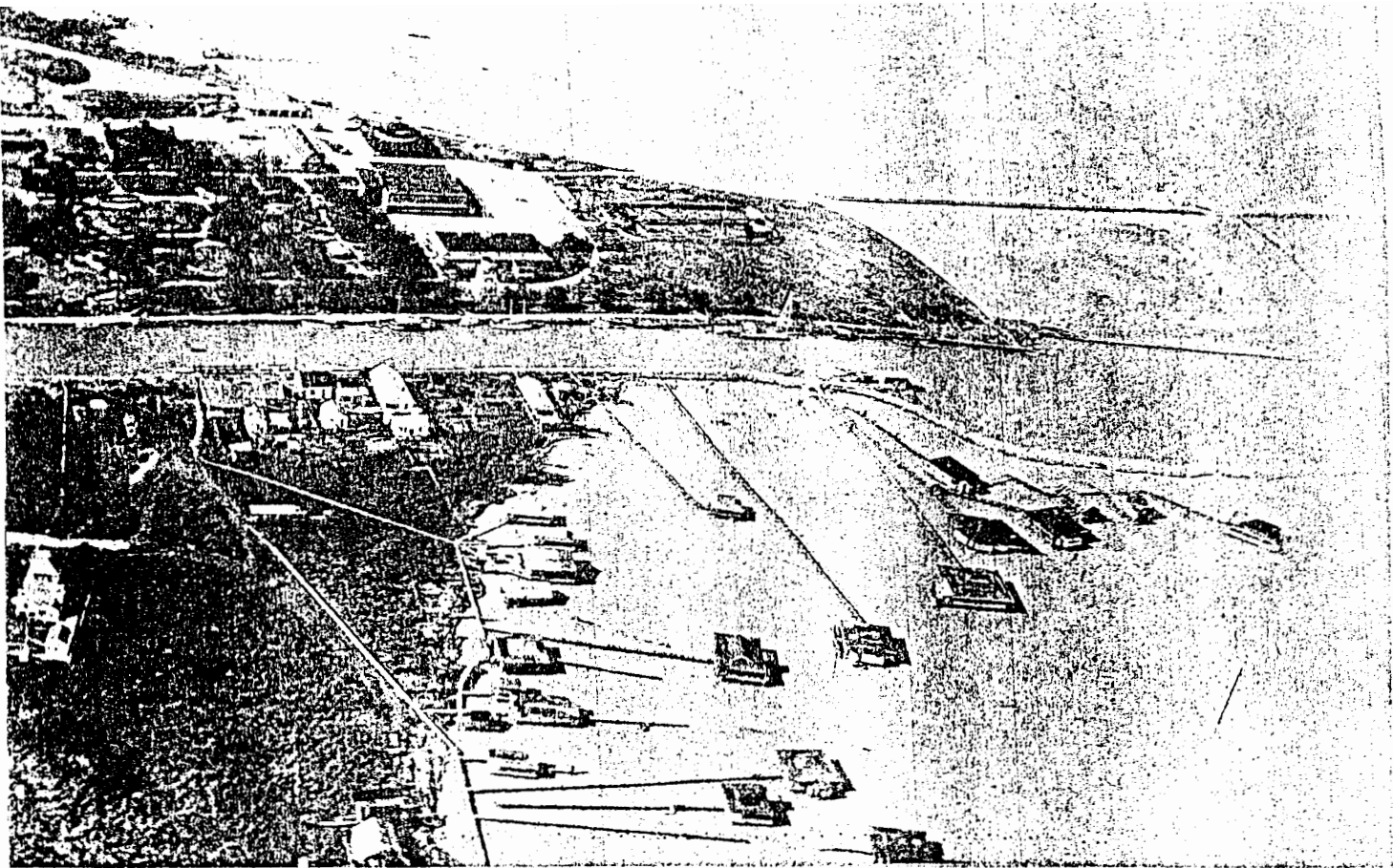
61 Ruins of Fort San Juan (Spanish Fort) on Bayou St. John, ca. 1890. Photo by George F. Mugnier

61





*Vue sur le fort Pontchartrain à l'embouchure du bayou St Jean
(Louisiane)*

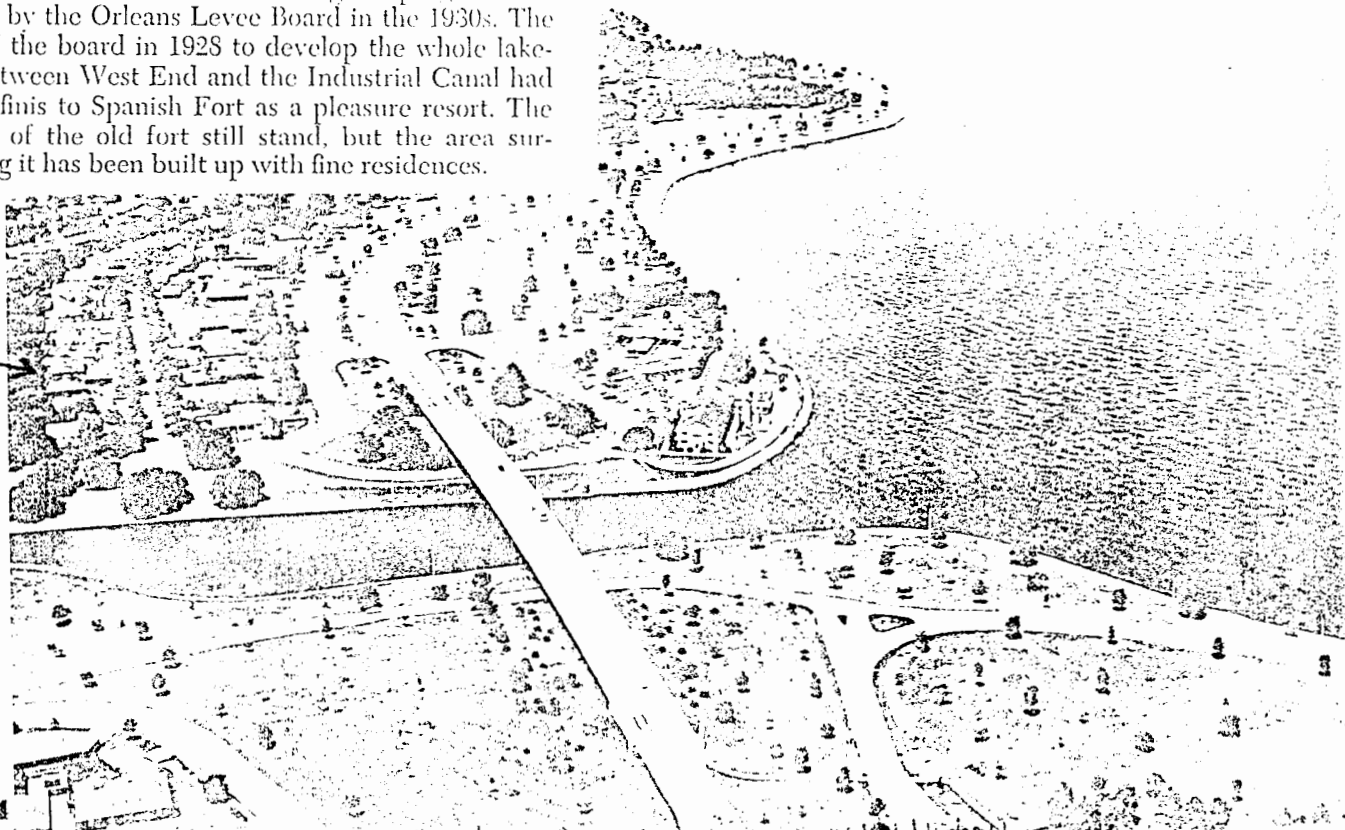


Upper half of this photo shows Spanish Fort amusement park after "filling operations" had begun—the camps are gone and the bulkhead outlines the area to be filled. Lower half, east of Bayou St. John, shows camps still standing where filling operations had not begun. (Courtesy Abe L. Shushan Sr. Collection, Earl K. Long Library, UNO)

(from Widmer, *New Orleans in the Thirties*, 1989
Pelican Press

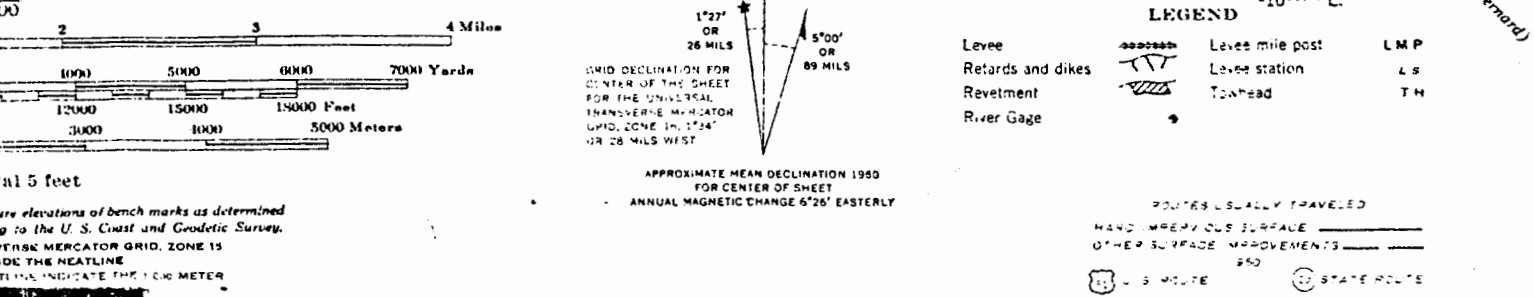
64 An aerial view of Lakeshore Drive as it crosses Bayou St. John. All the land in this view was reclaimed from the lake bottom in a giant program carried out by the Orleans Levee Board in the 1930s. The plans of the board in 1928 to develop the whole lake-front between West End and the Industrial Canal had written finis to Spanish Fort as a pleasure resort. The remains of the old fort still stand, but the area surrounding it has been built up with fine residences.

Student's
House



64

Note: This photo and others similarly numbered are from *New Orleans: An Illustrated History* by John Kemp



MAP CO.
 PURPOSE
 FOREIGN
 GUIDES
 S ST.
 16, LA.

from
 mission
 copy

Area of study (inlet)
 Sources of pollution or saline water
 Outlet of altered Bayou St. John system

SPANISH FORT, LA.
 (EDITION OF 1953)
 N30C0-W9000/15

seen much activity since the building of the first fort there by the Spanish in 1769. In the late 1800s, an amusement park, a hotel, and restaurants sprung up around "Spanish Fort". The area was serviced from New Orleans by means of an electrified railway which carried passengers out to "the lake" for a day of swimming or picnicking. Boatyards and docks lined the mouth of the bayou in this period. To aid in navigation, a lighthouse was constructed at the mouth of the bayou at the end of a pair of jetties.

In 1928 the Orleans Levee Board unveiled a plan to develop the New Orleans lakefront at Bayou St. John. Filling operations in the 1930s extended Bayou St. John out into what had been nearshore Lake Pontchartrain. The docks and boatsheds were cleared from the mouth of the bayou. The amusement park was moved to a different location. The reclaimed lakebottom was turned into residential subdivisions.

Locks were constructed at Robert E. Lee Boulevard in 1931, cutting off the natural waterflow into and out of the lake. In 1962, these locks were replaced by a flood-control structure. Movement of brackish water through this structure is maintained through three valve-controlled culverts: two 1.5m ones opened occasionally to maintain the depth of the bayou, and one 0.5m one which usually remains open to allow movement of water through the bayou. (Ward, 1982)

Today only the area of Bayou St. John north of Robert E. Lee Boulevard (the study area) is an integral part of the Lake Pontchartrain system. South of the water-control structure, a gravity drain allows water to flow from the bayou into the City Park pond system. These ponds are open to the Orleans Avenue Outfall Canal through a 0.5m culvert. (Ward, 1982) This canal drains into Lake

Pontchartrain, thus completing the circuit.

The study area is bounded by a concrete wall, a continuation of the Lake Pontchartrain sea wall that connects with the flood-control structure at Robert E. Lee Boulevard. The Orleans Levee Board maintains a hurricane-protection levee that rises beyond this wall on both banks. Along the levee are large live oak trees whose leaves pile up along with other debris against the flood control structure.

A new bridge was built over the mouth of Bayou St. John in 1989.

3. Human History of Bayou Labranche

Bayou Labranche has had a very different human history than Bayou St. John. The bayou has never been utilized for trade. It has primarily been used for recreation, fishing, and trapping. The negative effects of these activities have been minimal. The most major human effects on the bayou have been those coming from the oil industry and the transportation sector.

The New Orleans Refining Company opened up an oil refinery at Norco, Louisiana in 1916. Outfalls were constructed from the refinery to Bayou Trepagnier, a major tributary of Bayou Labranche. As the refinery grew, its discharge of effluent increased. Today, the Norco refining and manufacturing complex has an average effluent discharge of over 10,000 gallons per minute into Bayou Trepagnier!

In the late 1930s, the Goodhope Oil and Gas Field was discovered in the Bayou Labranche area. It soon developed into one of the most important oil and gas fields in Louisiana. Production and exploration activity is still continuing in Goodhope field. Oil pipeline canals in other areas of the Bayou Labranche drainage have interrupted waterflows and increased drainage rates.



Warning Sign at Entrance
to Bayou Trepagnier



Water Control Structure
at Robert E. Lee Boulevard



View from Top of Levee,
Bayou St. John on Left
Student's Subdivision on Right

