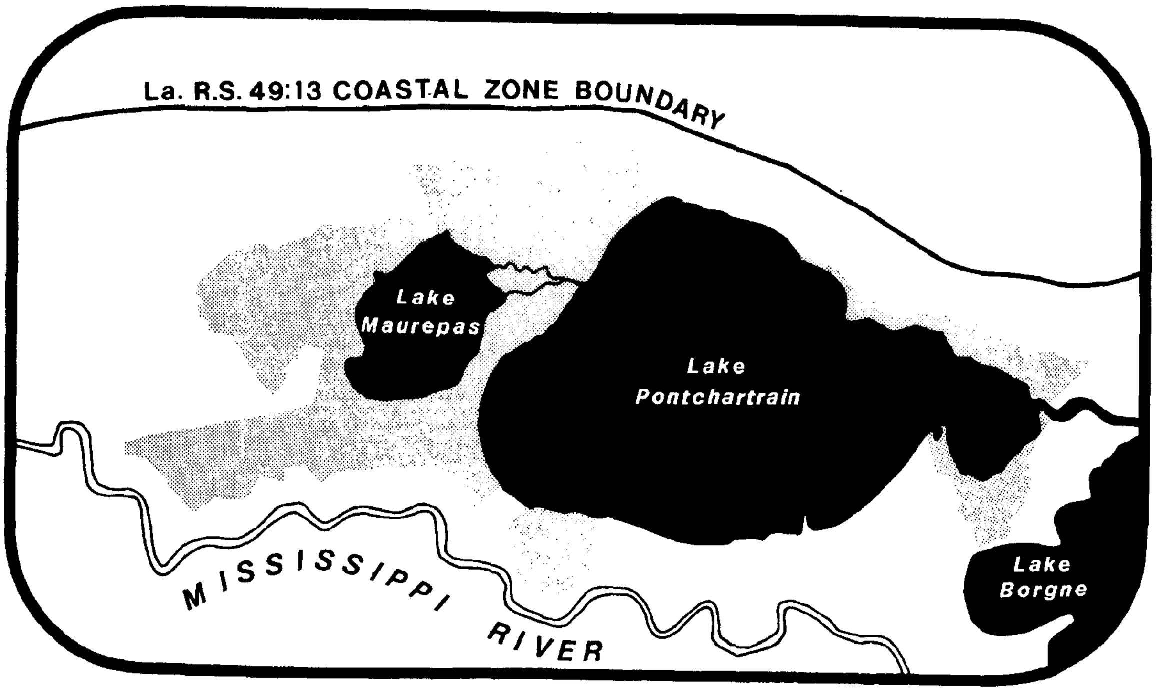
Environmental Characteristics of the Pontchartrain-Maurepas Basin and Identification of Management Issues

Prepared for the Lake Pontchartrain Task Force



Coastal Management Division
Louisiana Department of Natural Resources
Baton Rouge, Louisiana

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ENVIRONMENTAL CHARACTERISTICS OF THE PONTCHARTRAIN-MAUREPAS BASIN AND IDENTIFICATION OF MANAGEMENT ISSUES

Prepared for

Coastal Management Division
Louisiana Department of Natural Resources
Baton Rouge, Louisiana

Prepared by

Coastal Environments, Inc.
Baton Rouge, Louisiana

October

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These plates appear in the atlas on the Pontchartrain-Maurepas Basin, which is issued as a separate volume.

EXECUTIVE SUMMARY

The Pontchartrain-Maurepas Basin of southeast Louisiana includes river drainage basins that extend to the north across the uplands of the Florida Parishes and onto the hills of the state of Mississippi and to the south through the bayou watersheds to the U.S. Army Corps of Engineers' flood protection levees along the Mississippi River. Only a small portion of the basin (the study area) is within the Louisiana coastal zone and eligible for possible classification as a Special Area. Within the Louisiana coastal zone, coastal use permits from the Department of Natural Resources are not required for those activities above the 5-ft contour and inside of fastlands, except when an activity has a direct and significant impact on coastal waters. Therefore, the lands and activities which can be affected by implementing a Special Area method of coastal management through existing legislation are those occurring below 5 ft mean sea level (msl), those outside fastlands, and those which may have a direct and significant impact on coastal waters. Most of the Pontchartrain-Maurepas drainage basin remains unaffected by proposed Special Area plans and guidelines. The basin contains a rapidly increasing urban area which is, for the most part, beyond the legal control of the Department of Natural Resources. Larger communities are either outside of the coastal zone, above 5 ft msl, or within fastlands. Wetlands and lakes comprise the areas eligible for inclusion in the Special Area.

The purpose of the Task Force is to decide on the need for a Special Area within the coastal zone of the basin. To accomplish this purpose, the Task Force must determine whether this part of the coastal zone is a unique and valuable region which requires selective management procedures which are different from normal coastal management processes; that is, does the basin possess those physical, biological, and cultural characteristics which are not duplicated elsewhere in the state and is the area valuable because of it significant contributions to an estuarine system of regional, state, or national importance. If a Special Area is recommended by the Task Force, they must then prepare special guidelines to implement the process.

Several major problems which have a direct impact on the integrity of the possible Special Area have been identified through review of the existing data. Soil subsidence and shoreline erosion throughout the coastal zone are two major geologic problems. Water quality in the lakes and wetlands is deteriorating as a result of discharge of urban related nonpoint source runoff, release of inadequately or untreated sewage, saltwater intrusion from navigation projects, and resource extraction activities.

Wetland habitats have drastically changed within the past 25 years because of natural and man-related processes. Continued degradation of wetland (swamps and marshes) as well as aquatic systems such as the lake grassbeds, will result in the loss of a valuable renewable resource base for the basin. An abundant, diverse, and important fish, waterfowl, and wildlife resource is being stressed and impacted by the decline of the wetlands and the water quality of the basin. Most of the problems can be traced directly to the activities of man, such as dredging, filling, discharging, and changing the system to meet the needs of a growing population which, to a large degree, is outside of the coastal zone or the authority of the Department of Natural Resources. Numerous federal, state, and local agencies possess the authority to set standards, issue guidelines, and enforce regulations. The worsening environmental conditions in the basin, however, indicate that the present regulatory system is not sufficient.

One possible solution to the problems is to declare the coastal zone within the basin a Special Area. Selected activities occurring within the Special Area must then conform to guidelines and policies to avoid adverse impacts. Certain design, construction, operation, and maintenance standards that are now only optional and sporadically utilized will become essential and necessary to the successful implementation of the Special Area program. These special guidelines will assume a new, more enhanced degree of importance and frequency of application. The objective of Special Area status is to place the decisions beyond the parochial realm into a regional context that will benefit the entire ecosystem.

The Task Force has been appointed by the Governor to represent agencies, groups and concerned citizens who have an active interest in the renewable and nonrenewable resources of the Pontchartrain-Maurepas Basin. The Task Force functions as an advisory group to the Secretary of the Department of Natural Resources. It will assist in evaluating the available alternatives for protecting the resources of the basin through implementation of the Special Area planning concept and the preparation of special guidelines for reducing adverse impacts in each of the environmental management units.

CHAPTER 1: INTRODUCTION

In order for the Governor's Lake Pontchartrain Task Force to decide whether the concept of a Special Area is appropriate for solving the environmental problems within the Ponthchartrain-Maurepas Basin, it is necessary that the representatives understand the physical, biological, cultural, and institutional forms and processes active in the study area. At the same time, the Task Force must be introduced to the most critical problems within the basin, those issues which are so important as to jeopardize the integrity of the system if ignored.

It is the purpose of this report and the accompanying Atlas to provide a synthesis of technical information on the physical, biological, and cultural systems within the coastal zone of the Pontchartrain-Maurepas Basin. In addition, the report assembles and discusses the federal, state, local, and regional regulatory programs that affect resource use in the study area. In each section, the problems and conflicts associated with each issue are presented and summarized from existing published and unpublished reports and data. Finally, generic possible solutions are proposed for the identified problems. The companion Atlas provides 12 maps that depict the distribution of physical, biological, and cultural features within the basin. References throughout this text refer to the plates in the Atlas.

This report was prepared by Coastal Environments, Inc. under contract to the Coastal Management Division, Louisiana Department of Natural Resources and does not represent any opinions or official positions by the state. Findings, conclusions, and suggested solutions expressed in this report are those of the contractor as modified by the Department of Natural Resources. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the State government.

Special Area Definition

The purpose of the Task Force is to decide on the need for a Special Area. In order that everyone understand the concept of a Special Area and then relate all actions to it, we will first establish a common base and then work from there.

A Special Area (SA) is a unique and valuable region in the Louisiana coastal zone which requires selective management procedures which are different from the normal coastal management process because of its regional, state, or national importance. Unique indicates the area possesses those physical, biological, and cultural characteristics which are not duplicated in this manner elsewhere in the Louisiana coastal zone. The area must be valuable by contributing significantly to the estuarine system. The contribution may be in monetary terms such as in revenue generated from the fisheries or shellfisheries industry; in non-consumptive uses, such as recreational boating, aesthetics, or flood control; or consumptive uses, ranging from oil and gas extraction to water quality modification.

The SA must be within the Louisiana coastal zone delineated by Act 361 as amended in 1979 and 1980; thus it cannot include fastlands or lands above 5 ft msl. Activities occurring in an SA conform to guidelines and policies of Federal and state agencies to avoid adverse impacts. Certain design, construction, operation, and maintenance standards that are now only optional may become essential and necessary to the successful implementation of the SA program and therefore will assume a new, more enhanced degree of importance and frequency of application. Finally, the SA must have those properties and attributes that place it beyond the parochial realm and into the category of a resource that is influential and worthy of note and esteem beyond its borders.

Duties of the Lake Pontchartrain Task Force

The Task Force members have been selected by the Governor because they represent the important agencies, groups, and concerned citizens who have an active interest in the renewable and nonrenewable resources of the Pontchartrain-Maurepas coastal zone. The Task Force will function as an advisory group to the Secretary of the Department of Natural Resources and the Louisiana Coastal Advisory Council. If the plan of action proposed by CEI is followed, the main duties of the Task Force are to: 1) Become knowledgeable of the lake basin, 2) Assess the feasibility of having a Pontchartrain-Maurepas Special Area, and 3) Formulate guidelines for management. It will assist by evaluating the available alternatives for natural resource use within designated management units and by prescribing mechanisms for efficiently implementing those conditions which reduce or avoid adverse impacts that will degrade the estuarine systems. Parish designated management units are used because they reflect local goals and objectives and allow for building on existing information.

The responsibilities of each Task Force member are fourfold. First, each Task Force member should be familiar with the physical, biological, and cultural setting of the management units as described in the Atlas and discussed in the meetings. Additional references can be provided should anyone desire more information. It is suggested that each member review the local, parish, and state coastal zone program documents. Second, each member will find it beneficial to read the papers that describe the problems that presently exist in the Pontchartrain-Maurepas Basin, noting the conflicting uses of the same resource and the overlap and, more important, separation of jurisdictions of Federal, state, and local agencies. Third, each member should study a summary of the parish programs and a matrix of activities, and relate them to existing setting and described problems. Once each member has digested this information, we will move to determining mechanisms for reducing adverse impacts. This is the final and most important responsibility of the Task Force.

Description of Pontchartrain-Maurepas Basin

The Pontchartrain-Maurepas Basin is an area of low elevation and low relief in Southeast Louisiana and Southwest Mississippi. Pleistocene Terraces and uplands form the northern part of the basin; the Mississippi River deltaic plain encompasses the southern portion and includes Lakes Pontchartrain and Maurepas (Figure 1-1). Only a portion of the basin falls within the Louisiana coastal zone as defined by Act 361 of 1978, as amended (LRS 49:213). The study area boundaries are shown on Figure 1-1. Within this area coastal use permits from the Department of Natural Resources are not required for those activities above the 5-ft contour and inside of fastlands, except when an activity would have a direct and significant impact on coastal waters. Fastlands are defined by the statute as "lands surrounded by publicly owned, maintained, or otherwise validly existing levees, or natural formations, as of the effective date of this Act or as may be lawfully constructed in the future, which levees or natural formations would normally prevent activities, not to include the pumping of water for drainage purposes, within the surrounded area from having direct and significant impacts on coastal waters." Therefore, the lands and activities which can be impacted by implementing a Special Area through existing legislation are those occurring below 5 ft msl and those outside fastlands. A significant part of the drainage basin will remain unaffected by Special Area actions.

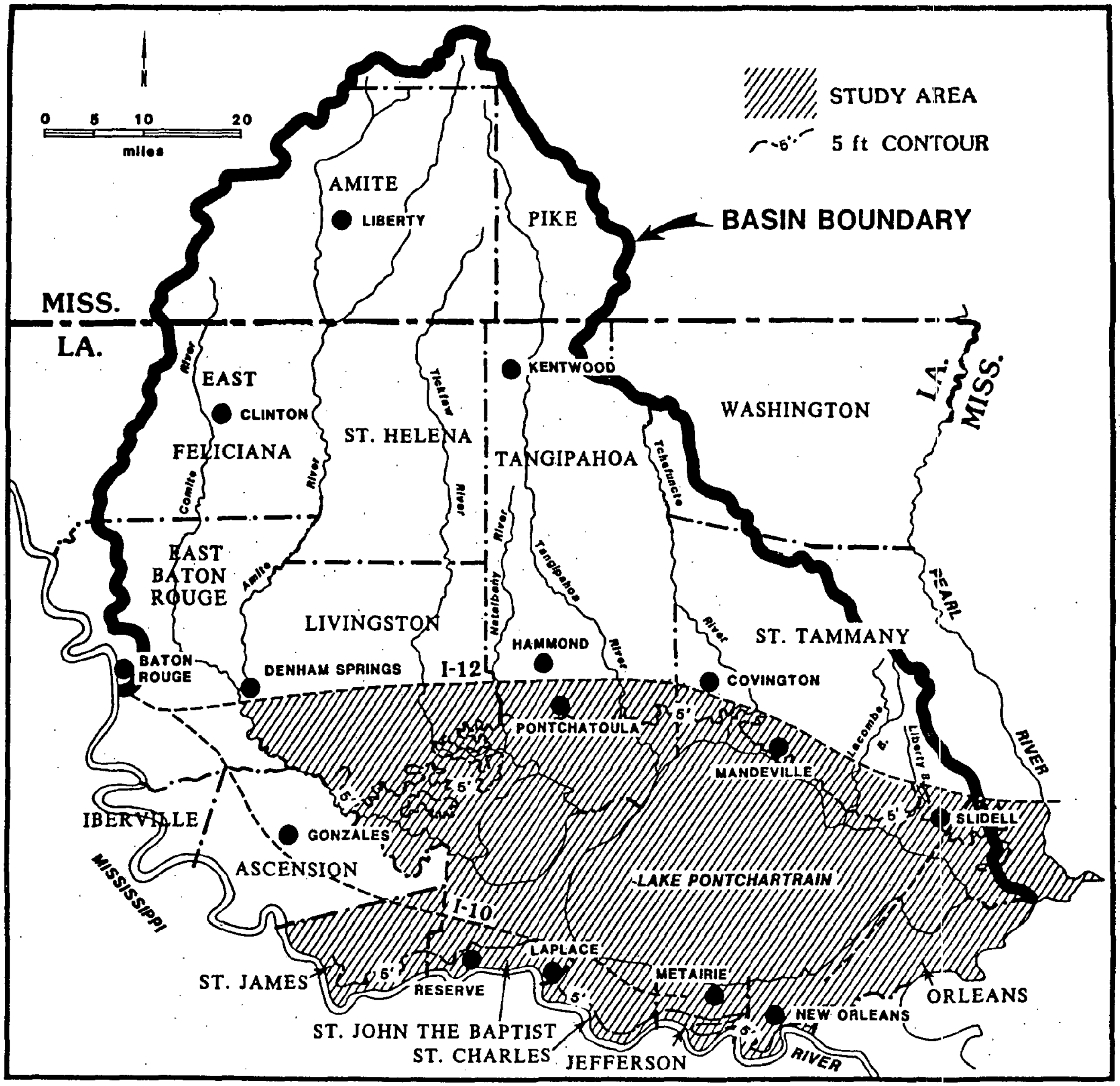

Figure 1-1. Study area within the Pontchartrain-Maurepas Drainage Basin.

The basin contains a rapidly increasing urban population with concentrations in St. Tammany Parish and along the Mississippi River from Baton Rouge to New Orleans. The deltaic plain is composed of wetlands, marshes, and swamps that make the estuarine system one of the nation's more valuable nursery grounds for major commercial fisheries. These wetlands, when included with the open water bodies of the basin, provide many opportunities for recreation, power boating, sailing, fishing and hunting. In addition, activities in the basin include extraction of renewable and nonrenewable resources. The expanding population pushing further into the wetlands while contributing pollutants from sewage and nonpoint sources conflicts with other activities and users. From 1980 to 1983, the Secretary of the Louisiana Department of Natural Resources permitted 261 activities in the basin (Table 1-1) for a variety of uses. As a result of extensive, multiple use of this limited area, alternative management techniques for resolving these conflicts are being considered.

In 1982 following the procedures specified in LRS 49:213, the Civic Council of East Jefferson and the Pontchartrain Shores Civic Association nominated Lake Pontchartrain to be designated as a Special Area (SA). Special Areas are [LRS 49:213.10(A)] "areas within the coastal zone which have unique and valuable characteristics requiring special management procedures. Special Areas may include important geological formations, such as beaches, barrier islands, shell deposits, salt domes, or formations containing deposits of oil, gas or other minerals; historical or archaeological sites; corridors for transportation, industrialization or urbanization; areas subject to flooding, subsidence, saltwater intrusion or the like; unique, scarce, fragile, vulnerable, highly productive or essential habitat for living resources; ports or other developments of facilities dependent upon access to water; recreational areas; freshwater storage areas; and such other areas as may be determined pursuant to this Section." Appendix C-4 of the Louisiana Coastal Resources Program Final Environmental Impact Statement establishes the rules for nomination of an area in the coastal zone which has unique and valuable characteristics that require special management.

Table 1-1. Activities Permitted in the Study Area by the Department of Natural Resources Through February 1984.

Parish	Activity										
	Dredge and/or Fill	Rig	Pipeline	Water Blocking Structure	Cables	Sewerage	Flood Control & Drainage	Commercial & Industrial	Marina	Residential	Miscel-laneous
Jefferson	10	5	3	2	0		1	1			1
Livingston	30	13	6	25	0			3		17	24
Orleans	25	4	4	13	0			6	2	7	10
St. Charles	7	2	2	4	0	2		5			2
St. James	3	3	0	1	0						1
St. John	13	8	1	1	0	1		2	1	1	6
St. Tammany	79	20	4	60	2	7		10	12	48	43
Tangipahoa	1	0	0	2	0	—	—	1	—	2	0
Total*	168	55	20	108	2	10	1	28	15	75	87

* An activity, when tabulated at the Coastal Management Division, may be placed in more than one classification. For example, an oil related action in Jefferson Parish may require dredge and/or fill, plus a rig, a pipeline to transport products, and a water blocking structure to inhibit saltwater intrusion. Therefore, this one application may be counted four times for the purposes of this table.

CHAPTER 2: GEOLOGY IN THE PROPOSED PONTCHARTRAIN-MAUREPAS SPECIAL AREA

Abstract

Soil subsidence induced by wetland drainage and shoreline erosion of Lake Pontchartrain and Lake Maurepas are two major geologic problems in the proposed Pontchartrain-Maurepas Special Area. Wetland Drainage can result in severe damage to subsequent development if inappropriate practices are undertaken. One solution is to bar drainage of wetlands altogether. More refined solutions involve careful attention to soil tests, water tables, waiting periods, building codes, and subdivision regulations. Shoreline erosion is a natural process that requires attention if development occurs near any shore. Natural coastal environments should be unaltered, but if development should proceed, attention must be given to the location of development, impacts of shore protection measures, and excavation in offshore areas for fill material and navigational improvements.

Introduction

History

The Lake Pontchartrain region is situated within a portion of the earth's crust that has been slowly subsiding for millions of years. Concurrent with this regional subsidence, Mississippi River deposits have been constantly accumulating, resulting in more than 30,000-ft thickness of sands, muds, and gravels interspersed with oil and gas reservoirs. These processes have continued well into recent geologic history (50,000 years to the present). In these "recent" years much of the substrate and landscape that we recognize today in the Lake Pontchartrain region was formed. Events significant in the understanding of the modern region are as follows:

A. More than 50,000 years ago - Deposition of the Pleistocene age Prairie formation. Sea level stood at approximately the same level as it does today. Poorly consolidated sands, silty clays, and clays predominated.

B. 50,000 - 30,000 years ago - During various falling and rising stages of sea level the Prairie formation was exposed to weathering processes and a deeply weathered soil profile was formed. Regional tilting of the Prairie formation occurred. When sea level reestablished itself at a high level 30,000 years ago, an uplifted segment of the Prairie formation north of Lake Pontchartrain remained high and dry, forming the Prairie Terrace.

C. 30,000 - 25,000 years ago - Sea level was approximately at its present stand. A Gulf shoreline with sandy beaches was well established through what is presently the northern half of Lake Pontchartrain.

D. 25,000 - 7,000 years ago - Sea level was again lowered some 300 ft in response to continental glaciation.

E. 7,000 - 4,000 years ago - During the last phases of the recent rise of sea level the area underwent significant morphological changes. Sand deposits, winnowed from eroding Pleistocene deposits and introduced to the coast by the Pearl River, were reworked and redistributed to form a series of sand spits and islands trending southwest from the present position of the Pearl River mouth into what is now eastern Orleans Parish. A major barrier island trend of well-sorted sand was established. It separated the open Gulf from a sheltered sound (now Lake Pontchartrain) on its northern side. The barrier island outcrops at Pine and Little Oak islands and slopes gently both north and south. At the south shore of Lake Pontchartrain it lies 20 to 25 ft below mean sea level (msl). The sands are permeable and porous and constitute a minor freshwater aquifer.

F. 4,000 - 700 years ago - During this interval a major deltaic lobe of the Mississippi River developed in the area (St. Bernard delta complex) (Figure 2-1). Natural levee ridges formed along Metairie Bayou, Bayous Sauvage, La Loutre, and Des Families; also, ridges formed along the present course of the Mississippi River through LaPlace and New Orleans. Mud flats developed in the interdistributary areas and were soon colonized by grasses, thereby forming marshes. The Pontchartrain Embayment was divorced from the Gulf and Lake Pontchartrain was formed. Sea level reached its present stand almost 300 years ago.

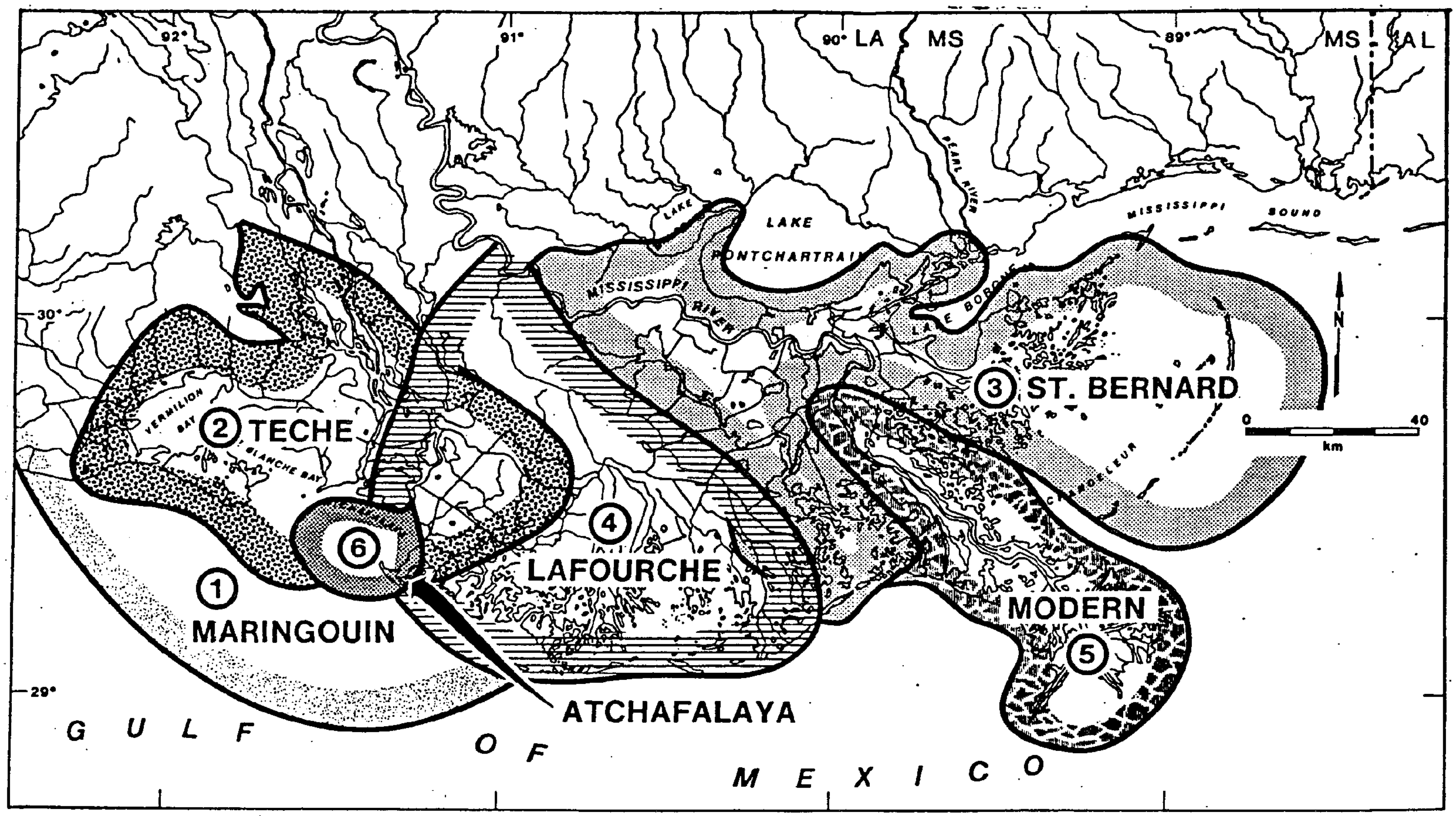

Figure 2-1. Subdelta chronology of the Mississippi River Deltaic Plain. Source: Frazier 1967.

G. <u>700 years ago - Present</u> - The Mississippi River changed its course and abandoned the St. Bernard Complex (leaving only the present river course through New Orleans active). The abandoned distributaries converted to minor tidal streams and their channels became largely clogged and filled, but deposition of organic debris continued in swamp and marsh areas resulting in the accumulation of peat deposits. Divorced from the freshwater of the Mississippi River, the abandoned St. Bernard complex took on a distinctive estuarine character as salinities increased.

Soil Distribution

Soils derived from the sedimentary deltaic processes of the Mississippi River dominate the environment; levee, marsh, and swamp soils comprise over 80% of the surface. In the northern areas, outside the deltaic plain, only two general soils are found: those from the Prairie Terrace and those formed within small alluvial valleys. A discussion of the major environments and their characteristics follows. A map depicting soil-type distribution is found on Plate 2.

<u>Natural levee.</u> The areas of slightly higher elevation bordering and confining distributary channels are called levees. Levees attain higher elevations upstream and slope seaward at an average rate of 0.25 ft/mi. Because of their elevation and firmness, they are usually covered by a dense growth of woody plants. Primarily because of their considerable age (1,900-700 years old, Frazier 1967), most of the natural levee deposits encountered in the study area are deeply weathered. The type and intensity of weathering are manifested mainly by soil color and mineral concentrations. With prolonged exposure to well-aerated conditions, the levee sediments, which are predominantly gray when deposited, become mottled with various shades of red and yellow as a result of oxidation of irons. The upper surfaces of the Mississippi River levees are relatively modern, and, therefore, have not been significantly weathered.

<u>Interdistributary.</u> Marshes and swamps cover much of the study area. Elevations in these environments are slight; surfaces are seldom more than a few feet above sea level. Sediment accumulation in these environments is slow and deposits are often highly organic. Peat and organic clays are widespread and may contain up to 90% vegetable matter. In addition, constituents containing varying quantities of clay may

be introduced into the low-lying basins from the sea through tidal channels and during storm surges, or from the river as overbank sediment during periods of flood. However, these clay additions are relatively small, and in situ organic deposits dominate; that is, sediment and minerals organically produced or chemically altered within the environment of deposition are characteristics of these deposits. The two broad soil types considered here are marsh and swamp.

Marsh is defined as an area of sedge, grass, or rush growth where water stands around the plant's roots; plants grow either in tufts with water between or with a continuous water-covered root mat. Although a variety of marsh types are recognized, only two are found within the study area: fresh marsh and brackish marsh. Typically, the fresh marsh has a 1 ft thick, dense, live root mat; some roots penetrate as deep as 3 ft. In areas where salinity increases with depth, this penetration does not occur. Peats often accumulate in fresh marshes. The brackish marsh occupies a complex transitional zone between fresh and saline areas. The soil profile may consist of a thin (up to 8 in) zone of live roots and organic muck. Below this are 4 to 10 ft of fibrous peat.

Swamps constitute low, flat areas periodically covered or saturated by water which support woody vegetation with or without an undergrowth of shrubs. In areas adjacent to a river system better drainage conditions are usually present, whereas in areas isolated from these active channels standing water is present year-round and drainage is very poor. Therefore, in well-drained swamps alternate oxidizing and reducing conditions exist during accumulation, whereas in poorly drained swamps reducing conditions exist. As in the natural levee sediments, subtle variations in oxidizing or reducing environments impart distinctive characteristics to the deposits. Poorly drained swamps are characterized by stagnant water conditions, resulting from an ineffective drainage network. Water levels are fairly stable and rarely exceed 2 to 3 ft except in times of high floods. The deposits laid down under such conditions generally consist of highly organic black clays and occasional thin laminations of silt introduced by floods. Woody peat beds are usually found randomly throughout and may attain considerable thickness locally. Large wood fragments and laminations consisting of compressed leaves, twigs, and seeds are common.

Well-drained swamp differs from poorly drained swamp only in that drainage channels are efficient enough to expose the swamp surface for much of the year. The sediments accumulating in both environments are similar. Both have essentially the same soil profile: an organic-rich zone grading into a light gray clay zone with few organics. This light gray clay zone is often referred to as an "underclay." Peat deposits are rarer in well-drained swamps, and if present, peats are restricted to small areas.

Prairie Terrace. The prairie terrace soil differs from the soil elsewhere in the study area, for this "upland" is of Pleistocene age and has undergone significant post-depositional change. The terrace has been exposed to subaerial processes, has undergone significant compaction, and has been oxidized. The composition ranges from clay to silty sand. The surface layer is loamy, and although drainage is certainly better than those in the deltaic plain, it is still classified as poorly drained.

Alluvial Valley. Numerous small rivers flow southward through the Prairie Terrace into Lake Maurepas, and Lake Pontchartrain. The most significant of these are the Pearl (the largest), Tchefuncte, and Tangipahoa Rivers. These rivers develop flat, narrow alluvial valleys within the terrace. Soils are comprised of gravel, sand, and silt. Thickness varies according to size of the floodplain and depth of entrenchment. The loamy soil at the surface is poorly drained and is subject to frequent flooding. At the southern ends of these valleys, the alluvial valley soil type grades into marsh and swamp.

Man-Made. Marsh and swamp soils undergo significant change when dredged by man to create spoil banks or drained by man to create reclaimed land. The primary cause of change is dewatering and subsequent oxidation of organic components. Soils thus become clay-rich and highly acidic. Loss of volume occurs, resulting in lowering of spoil banks and lowering of land to horizons below sea-level in the case of reclaimed land.

A summary of each soil type is found in Table 2-1.

Table 2-1. Description of Soil Types in Study Area.

Soil Type	Description
Natural Levee	Slope very gently from crest into interdistributary basin; firm soils. Lower elevations are clayey and somewhat poorly drained; higher elevations are better drained and loamy. Interfingering layers of clay and silt throughout.
Interdistributary Marsh	Level, soft, very poorly drained, mineral and organic soils. Upper layer covered with root mat of grasses. Peat accumulation greatest in fresh marshes, where accumulation can represent up to 90% of the soil thickness.
Swamp	Level, poorly drained soils. Mucky surface layer underlain by semi-fluid clay. The better drained swamps tend to be clayey throughout and are rated as firm; the poorer drained soils have higher organic content and are soft.
Prairie Terrace	Level to nearly level, somewhat poorly drained, firm soils with a loamy surface layer. Particles grade from clay to silty sand.
Alluvial Valley	Level, poorly drained loamy soils subject to frequent flooding. Particles range from gravels to clays. This association is along drainageways that dissect the Prairie Terrace.
Man Made	Found in either spoil banks or reclaimed land. Generally created from marsh or swamp. Soil is poorly drained, firm, somewhat oxidized, and clay rich.

processes. Improper construction during the early subsidence phases can result in many impacts: tilted and cracked driveways, depressions in yards, undulating streets, cracked and warped sidewalks, tilted houses, cracked slabs, and broken utility lines (Earle 1975; Traughber et al. 1978).

The single most important hazard arises from the need for support pilings. Organic soils underlain by semi-fluid clays demands that piles be driven deep into the soil so that "skin friction" can provide adequate support for buildings. Once the pilings and concrete slabs are in place, the unit remains in a fixed position. As subsidence continues, the land surface lowers, thereby having the relative effect of raising the slab. From this situation there arises a series of problems: foundations may become exposed, unsupported driveways may crack and drop away from slab grade, and rigid utility lines may break.

Possible Solutions

1) Deter development of wetland areas.

2) Require detailed soil tests and analyses of subsidence potential on any wetland area that is to be developed.

3) Require developers to maintain high water tables in reclamation projects.

4) Impose waiting periods (10 to 20 years) that follow initial drainage and precede development.

5) Develop strict building codes and subdivision regulations that specifically address subsidence hazards.

Shoreline Erosion

Problems

Except where the shoreline is stabilized by engineering structures such as seawalls, nearly all the shoreline along both Lakes Maurepas and Pontchartrain is eroding, typically at a rate that ranges from 5 to 10 ft/year (Plate 3). The principal force causing this erosion is wave energy from storms (Adams et al. 1978). The variation in the erosion rates, which is evident on Plate 3, is not due to any real variation in wave energy, but to differences in beach configuration and sediment types. Some beaches are rapidly eroding points of land flanked by muddy swamp, others are recessed coves with discontinuous zones of fine sand and shell. Regardless of the various beach types and their behaviors, there is evidence that all shores are presently experiencing more erosion in recent years. A study of beach behavior in the 1950s and the 1970s (Adams et al. 1978), when compared to a study of beach behavior in the 1930s and 1950s (Saucier 1963), demonstrates that Lake Maurepas has increased its mean rate per year of shore erosion by 35% and Lake Pontchartrain by 45% in recent decades. The reason for this acceleration is unknown, but probably it is enhanced by continued subsidence and increased wave energy caused by lake enlargement.

Forty percent of the Lake Pontchartrain shore is presently "stabilized" (United States Army Corps of Engineers 1983). The term "stabilized" means that some method of shore protection has been imposed; it does not mean that erosion has been checked completely. The general imposed solution in these areas has been levees and seawalls. These "structural" solutions have been to a great degree effective, but they have not been without environmental impact. One consequence of these features has been to cut off nursery grounds found within inner marshes, another has been the interruption of the natural water exchange between the wetlands and the lake.

There are a series of other structural as well as nonstructural solutions that can be applied to the shores of these lakes. Breakwaters—offshore surface or subsurface barriers to wave attack—could provide shelter from erosive waves, but this solution tends to be very expensive. Revetments—piles of concrete, stone, asphalt, or sand bags laid along the beach—can be effectively employed if properly constructed, but this solution is generally considered to have very poor aesthetic value. Groins—structures built from the beach into the lake through the zone of common wave activity—provide a mechanism for trapping sand as it moves alongshore; but this technique tends to deprive sand from downdrift beaches and, therefore causes increased erosion elsewhere. Artifical nourishment—the direct application of sand to the beach—can be very effective and asethetically pleasing, but it is also very costly. The eroding shores of Lakes Pontchartrain and Maurepas seem to be a result of natural phenomenon that proposes a severe problem only when development exists along the shore. Once development proceeds, the benefit-to-cost ratio increases, and the problem can be addressed through the various structural and nonstructural solutions. And even at that point there is no 100% reliable, aesthetic, nondamaging, low cost solution that can be employed.

Possible Solutions

1) Restrict development immediately adjacent to the lake so that the eroding shore does not present a future problem.

2) Avoid construction of groins so that downdrift beaches are not subject to accelerated erosion.

3) Make future coastline developers aware of erosion, make them responsible for the cost consequences of retarding erosion and provide a mechanism for maintaining erosion control measures or structures.

4) Do not destroy protective shoreline vegetation. If destroyed by natural forces, restore immediately.

5) Proposed excavations in lake bottoms to obtain fill material or for navigation purposes should be carefully scrutinized for their impact on wave patterns that may enhance shoreline erosion.

Summary and Possible Solutions

Most of the geologic environments within the proposed Ponchartrain-Maurepas Special area were formed within the last 5,000 years. Natural levees, marshes, and swamps constitute the predominant soil types within this geologic framework. Within this area there are two geologic related problems that require careful attention:

1) Soil subsidence of wetland soils as a result of land reclaimation, and

2) Shoreline erosion of Lake Maurepas and Lake Pontchartrain.

Development of wetlands usually requires drainage. The resulting lowered water table allows for compaction and oxidation of highly organic soil. Subsidence can be severe, and if development procedes without regard to the associated hazards, very costly and potentially dangerous damages result. One solution is to bar wetland development altogether. If development is allowed, however, strict restriction should be placed on development practices. Possible restrictions include detailed soil tests and analyses of subsidence potential, maintenance of high water tables, waiting periods following drainage and preceding development, and finally, strict codes and regulations that address hazards associated with continued subsidence.

Enlargement of Lake Ponchartrain and Lake Maurepas through shoreline erosion is presently proceding at a rate averaging 5 to 10 feet/year. This erosion is occurring naturally through wave attack associated with storms and through natural subsidence. If development occurs near the shore, a problem is generated, for shoreline erosion will then become a threat. One reasonable solution is to place development away from the shore, but if shore-side construction is to procede, mitigative measures such as beach nourishment, rip rap, or seawalls will have to be undertaken to stabilize the shoreline. Care should be given to whatever natural protective mechanisms presently exist: vegetation should be protected and any lake bottom excavations should consider the impact on storm wave approach. If man-made shore protection mechanisms are required, careful consideration should be given to their aesthetic value and their potential for causing enhancing shore erosion in adjacent localities.

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CHAPTER 3: HYDROLOGY AND WATER QUALITY IN THE PROPOSED PONTCHARTRAIN-MAUREPAS SPECIAL AREA

Abstract

The hydrology of the Pontchartrain Basin is fairly well known. Freshwater resources included runoff from the 6200 sq mi Pontchartrain watershed, the 8000 sq mi Pearl River watershed, and aperiodic inputs from the Mississippi River via the Bonnet Carre Floodway. Marine waters enter the system through the Rigolets and Chef Menteur Passes and the Inner Harbor Navigation Canal. Mixing of the water resources results in salinities of 0 to 8 parts per thousand (ppt) in Lake Pontchartrain. Circulation within the lake is dominated by wind with tides playing a major role only in the eastern section. Little data exists to document the water quality of Lakes Maurepas and Pontchartrain, but ongoing studies will hopefully provide this information. Generally speaking, poorest water quality is confined to pump outfalls and drainage outlets into the lake and can be related to municipal sewerage contamination and urban stormwater input. Suggested solutions addressing these problems are given.

Introduction

Hydrology

The study area is within the Pontchartrain-Borgne-Chandeleur Sound estuary (Hydrologic Unit 1) of southeastern Louisiana. The major hydrologic elements in the Lake Pontchartrain portion of the estuary are runoff and streamflow from the 6200-sq-mi Pontchartrain watershed; wind-driven circulation over the open lake; tidal exchange through the Rigolets and Chef Menteur passes, and the Inner Harbor Navigation Canal (IHNC); and discharges from the Pearl River watershed (8,000 sq mi).

Discharges from the Pontchartrain watershed range from 16,700 cubic feet per second (cfs) in February to 4700 cfs in October (van Beek et al 1982). Freshwater inflow is derived from both the "gaged" upland areas (where flow is measured) and the "ungaged" low-lying areas and wetlands that are subject to tidal influence. In the Maurepas and Pontchartrain drainage basin, five major rivers conduct runoff to the lakes. Relative to the size of their gaged basin area these are the Amite/Comite (1280 sq mi), the Tangipahoa (646 sq mi), the Tickfaw (247 sq mi), the Tchefuncta

(96 sq mi), and the Natalbany (80 sq mi) Rivers. It can be seen that the Amite/Comite River system is the major one, serving more area than the other four rivers combined. Relative to the total discharge values mentioned above, the gaged uplands produce values of 8500 cfs in February to 1262 cfs in October. Therefore, from 49 to 73% of the freshwater supply to Lakes Maurepas and Pontchartrain are derived from the low-lying lands and wetlands within the basin (van Beek et al 1982).

This freshwater input, along with the indirect effects of Pearl River discharge (24,600 cfs in March to 3,900 cfs in October) largely determines the salinity regime of the lakes under average conditions. Salinity generally decreases from southeast to northwest in Lake Pontchartrain, ranging from 3 to 8 ppt at the Rigolets to 0 to 3 ppt at Pass Manchac under normal conditions. Saline conditions are not common, but may occur for short durations in the summer and fall near the IHNC (St. Pe' et al. 1983).

Lake Pontchartrain is a well-mixed, generally shallow body of water with a daily tidal range of about 3.5 in at Pass Manchac and a 9.7 in at the Rigolets. The water elevations tend to rise and fall as a unit over the main body of the lake due to the tidal signal; however, wind energy often predominates over the tides with regard to water levels (Swenson 1980a). Streamflow may also influence water levels in some areas. The three primary water transport mechanisms of wind, tide, and streamflow vary both seasonally and with location in the basin.

The Lake Maurepas drainage is least influenced by astronomical tides which lag seven hours behind tides in the Rigolets and produce daily fluctuations of only 0.25 ft at Pass Manchac (Swenson 1980a). In Figure 3-1, two peaks in water level are evident at Pass Manchac over the annual cycle, one in April and another in September. These correspond to times of predominant winds from the eastern quadrant (Wicker et al. 1981) with the fall peak also corresponding to highest annual levels of the Gulf of Mexico (Swenson 1980a). Figure 3-2 shows the average annual discharge pattern for the Tickfaw River. The highest discharges in the spring precede the peak spring water levels by approximately one month. As the effect of southeasterly winds begins, the "tailwater" stage at Pass Manchac increases and the net outflow from Lake Maurepas decreases. The freshwater then tends to back up into the wetland areas, as indicated by the salinity at Pass Manchac (Figure 3-1). During the fall water-level peak (Figure 3-1), discharge is at a low point for the year (Figure 3-2) and water tends to

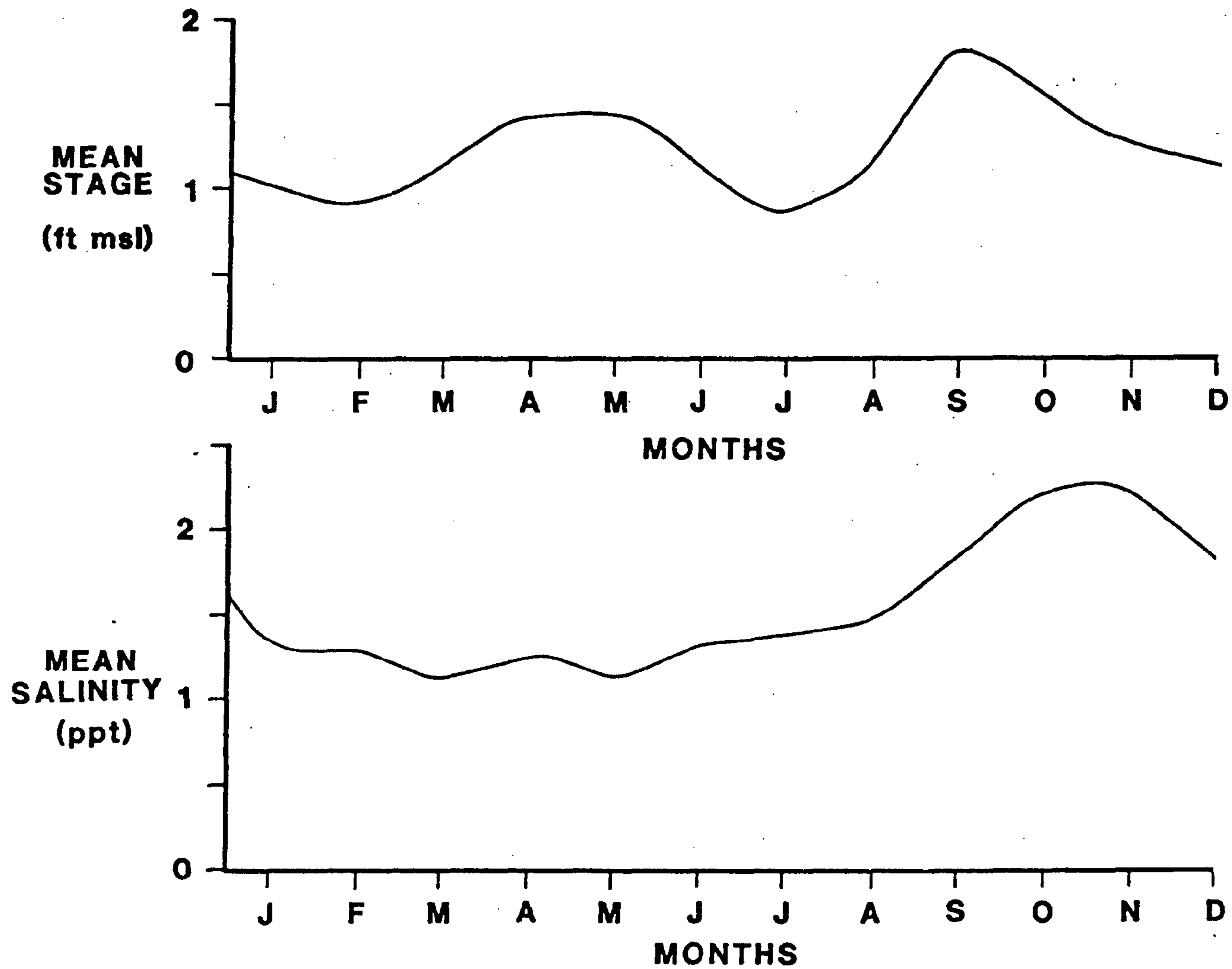

Figure 3-1. Mean monthly stage (1963-1977) and mean monthly salinity (1961-1977) for Pass Manchac. Source: Wicker et al. 1981.

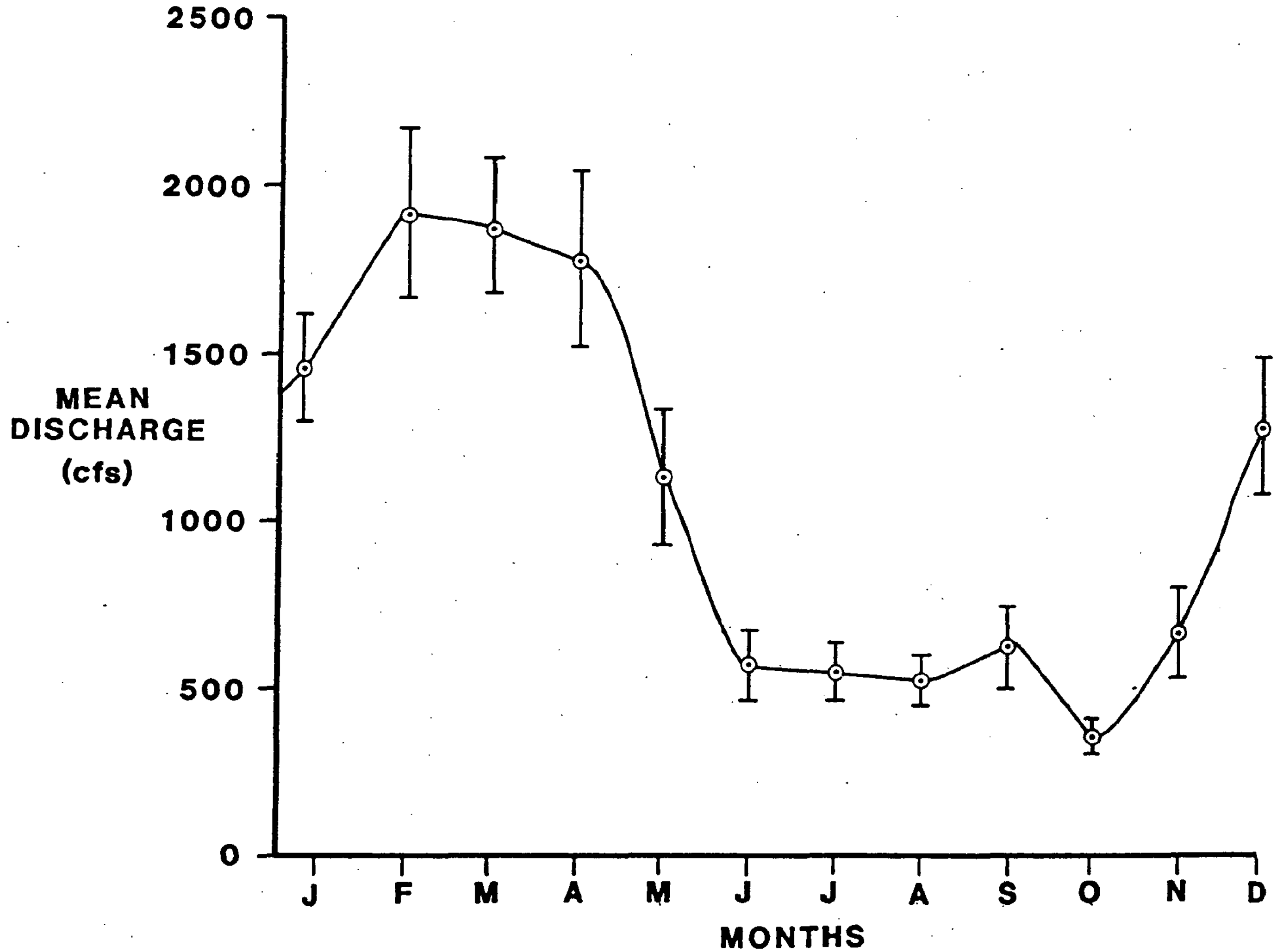

Figure 3-2. Mean monthly discharge and standard error (1943-1980), Tickfaw River at Lake Maurepas. Source: Wicker et al. 1981.

flow into Lake Maurepas from Lake Pontchartrain, as evidenced by an increase in salinity at Pass Manchac (Figure 3-1) (Wicker et al. 1981).

In the main portion of Lake Pontchartrain, wind is the dominant water transport mechanism and generally results in nearshore waters moving with the wind and counterflows developing in the deeper waters offshore (Gael 1980). For example, during conditions of southeasterly winds, the area of the lake west of a line between Lakefront Airport and Goose Point experiences westerly currents along the north, west, and south shores with a large, clockwise gyral forming in the open lake (Plate 4). Northeasterly winds also produce westerly currents along the north and west shores, but with easterly currents along the south shore and a counterclockwise gyral in the open lake (Gael 1980).

East of a line from the Lakefront Airport to Goose Point, tidal forcing becomes more important with westerly currents on flooding tides and easterly currents on ebbing tides (Gael 1980). The daily tidal range in the vicinity of the Rigolets and Chef Menteur is on the order of 0.8 to 1 ft, although wind and storm events frequently cause ranges of 1.5 ft or more. The north shore of the lake between Big Point and the Rigolets experiences westerly currents of about 0.66 ft/sec during flood tides and easterly currents of 0.60 ft/sec during ebb tides (estimated from Gael 1980). This difference is current speed between flooding and ebbing tides is even more pronounced in the Rigolets. Swenson (1980b) reports mean speeds of 1.6 ft/sec during flood tides and 1.1 ft/sec during ebb tides in the Rigolets. Conversely, for the Chef Menteur, flood currents average 1.3 ft/sec and ebb currents average 1.5 ft/sec (Swenson, 1980b), making the Chef Menteur ebb dominant.

The normal range and duration of the tides can be greatly influenced by wind, with southerly winds causing prolonged flood tides and northerly winds, prolonged ebb tides. Swenson (1980b) calculates that at wind speeds of 2 to 4 knots, tides predominate; at wind speeds of 4 to 6 knots, wind and tides contribute equally; and at wind speeds greater than 6 knots, wind dominates as the main water transport mechanism.

The IHNC functions as a third pass from Lake Pontchartrain to the Gulf of Mexico via the Mississipi River-Gulf Outlet (MRGO). Although it carries only 7% of the transported water, it accounts for 20% of the total salt entering the lake because of the presence of a "salt wedge" near the bottom (Swenson 1980b). Some implications of this man-made hydrologic alteration will be discussed later in this chapter.

Water Quality

A compilation of hydrology and water quality monitoring stations sampled by state and Federal agencies is given in the atlas. It is assumed that data have been taken at other locations in the Lower Pontchartrain Basin, but incorporation of stations used in short-term or special studies was beyond the scope of this analysis. In truth, an adequate and meaningful description of water quality and its effects on the Pontchartrain Basin cannot be accomplished utilizing presently published data for the reasons listed below.

First, there are few data (and even fewer analyses) on past water quality to form a baseline. Most of the stations on the map had not been instituted prior to the early 1970s when the environment became a public concern. Second, the sampling interval for most of the important water quality parameters has been once monthly, at best, and this has changed along with the number of stations sampled from year to year. This can probably be attributed to funding levels, as most water quality laboratory analyses are very expensive. Understanding environmental processes requires that time series of data be collected to account for the dynamic nature of the system. In other words, delineation of cause and effect relationships necessary to find solutions to some water quality problems will be more probable given 240 observations from 2 stations than 12 observations from 40 stations for a year. Finally, the in situ environmental effects of water quality degradation such as lethal limits, sublethal stress, and bio-accumulation are not well established, posing a question as to the utility of the largely laboratory based criteria presently in force.

Despite the short comings, much is known about water quality in the proposed SA and more information will soon be available. The 208 Plan for the Pontchartrain Basin serves as the most comprehensive generic description of present and projected water quality for the study area. Addition of data to the 208 framework will be forthcoming from a detailed survey of Lake Pontchartrain being conducted by the Water Pollution Control Division of the Department of Environmental Quality. In addition, ongoing data collection, funded by the Coastal Energy Impact Program through Section 308 of the Coastal Zone Management Act, in Lake Maurepas by the University of Southeastern Louisiana will provide information on water quality and hydrologic processes that is lacking at present. The discussion of water quality will focus on trends and problems that have been reported in the literature.

History of Changes

Turner and Bond (1980a) report that agricultural and urban land uses have replaced former forest areas in the Pontchartrain Basin since the 1950s, resulting in an increased rate of runoff and increased sediment and nutrient loading to Lakes Maurepas and Pontchartrain. Analyses of discharge records for the Comite and Amite Rivers indicate that peak flood discharges have increased 30 to 40% and flooding frequency has increased since 1951, while average annual and minimum flows have remained the same (Turner and Bond 1980b). Some implications of these changes are discussed below.

Land use changes have effects on both hydrology and water quality, with the clearing of forests for pasture having much less of an effect than clearing of forests for urban development. In fact, the only difference in terms of the theoretical water yield between pastures dominated by grasses and forested land is the rooting depth, with forests being able to draw moisture from deeper in the soil. This, however, does not affect peak runoff. Some pastureland may have a few drainage ditches where standing water is a problem, possibly increasing runoff rates relative to forests. Row-crop agriculture on the other hand has a very high drainage density and high soil loss, but this use has not increased dramatically in the study area.

The most plausible reason for the increase in peak discharge is the expansion of urban and suburban land uses that affect hydrology in two ways. First, permeable vegetated surfaces tend to be replaced by impermeable unvegetated ones. More runoff is generated per unit area per unit of rainfall; this runoff carries with it a large variety of substances that tend to be associated with human habitation. Second, since more water is generated, hydraulically efficient drains, ditches, and canals are constructed to replace or augment the then obsolete natural drainage system in the immediate area.

During low or moderate rainfalls, a rapid pulse of urban stormwater is shunted into the river systems and lakes, representing increased loading of pollutants, sediments, and nutrients. During high rainfall events, the increased rate of runoff overloads the virtually unimproved lower mainstems of the rivers, causing unprecedented flooding, and, ultimately, backwater flooding of the urbanized drainage systems themselves.

Urbanization Along the South Shore

Similar changes in runoff rates, peak discharge, and pollutant loading have accrued from the urban development of fastlands along the south shore of Lake Pontchartrain. The first changes resulted in the removal of hydrologic connection between a large area of wetlands and the lake. Although much of the resulting fastland was initially used for agriculture, former geochemical cycles were disrupted whereby nutrient elements in their mineral form entering the lake were fixed into an organic form in the wetlands. The extensive levee system also changed the overall tidal prism and volume of the lake, which must have affected the renewal rate of the estuary.

The major effects evident today, however, are the result of almost total urbanization of the former wetland areas that has taken place since the 1950s. The ecological impacts are concentrated at the point of entrance into Lake Pontchartrain. Eleven almost equally spaced outfalls presently exist along the south shore. During rainfall events, the nearshore waters become very polluted for a time until the discharges are dispersed into the open lake. In the absence of rainfall, septic conditions prevail in the surface sediments near the outfalls and wind events may resuspend these contaminated sediments leading to poor water quality.

Effects of the Mississippi River

Input of Mississippi River water into the Pontchartrain Basin has always occurred to some extent. In early historic times, flow through Bayou Manchac and annual overbank flooding in the spring introduced freshwater, sediments, and dissolved minerals into wetlands and, eventually, the lakes. Even after the initial leveeing of the river, periodic major inputs continued to occur from crevasses.

More recently, the Bonnet Carre Floodway was constructed at the site of four previous crevasses to alleviate pressure on the levee system and lessen the chances of levee failure during major floods. Regardless of whether river water enters from a crevasse or from the spillway, the effects are similar; that is, infrequent high inputs of Mississippi River water cause a total replacement of the ambient water of Lake Pontchartrain. Although some immediate short-term impacts may occur, the ecological system is attuned to these periodic changes in hydrology and water quality. One difference between past and present, however, is the present status of pollutant concentrations in the river. This status may represent a change in the level of exposure to industrial chemicals for the lake biota.

The U.S. Army Corps of Engineers (USACE) (1982) has proposed construction of a diversion system to allow controlled input of freshwater from the Mississippi River to Lake Pontchartrain on an "as-needed" basis to manage the salinity regime of the Pontchartrain-Borgne-Chandeleur Sound estuary (van Beek et al. 1982). As it will be seen from the discussion to follow, freshwater is needed during certain times of the year to combat saltwater intrusion into Lake Pontchartrain.

Effects of the MRGO and the IHNC

Construction of the MRGO in 1963 caused inumerable impacts to the wetland areas of St. Bernard Parish, primarily from saltwater intrusion. The connection of the MRGO to the Intracoastal Waterway and the IHNC provided a new corridor for input of saline water to Lake Pontchartrain. There has been considerable debate on whether Lake Pontchartrain is getting "saltier" or "fresher."

Turner and Bond (1980a) state that increased runoff should produce the net result of a fresher lake system, all else being equal. Swenson's (1980b) work, on the other hand, seems to indicate that the average salt content of the lake may have increased by as much as 20% since 1963. In a study of saltwater intrusion in the Pass Manchac area (Wicker et al. 1981) salt stress was implicated as the major cause of mortality of cypress swamp. However, the same study failed to identify a significant trend of increasing mean annual salinity at Pass Manchac (Figure 3-3). Recently, St. Pe' et al. (1983) presented data from a lakewide survey documenting the dispersal of very high salinity water (20 ppt) from the bottom of the IHNC into Lake Pontchartrain.

The data, in the form of isohalines, clearly show the greater influence of the INHC versus the passes in determining the salinity regime of the lake. The data were taken

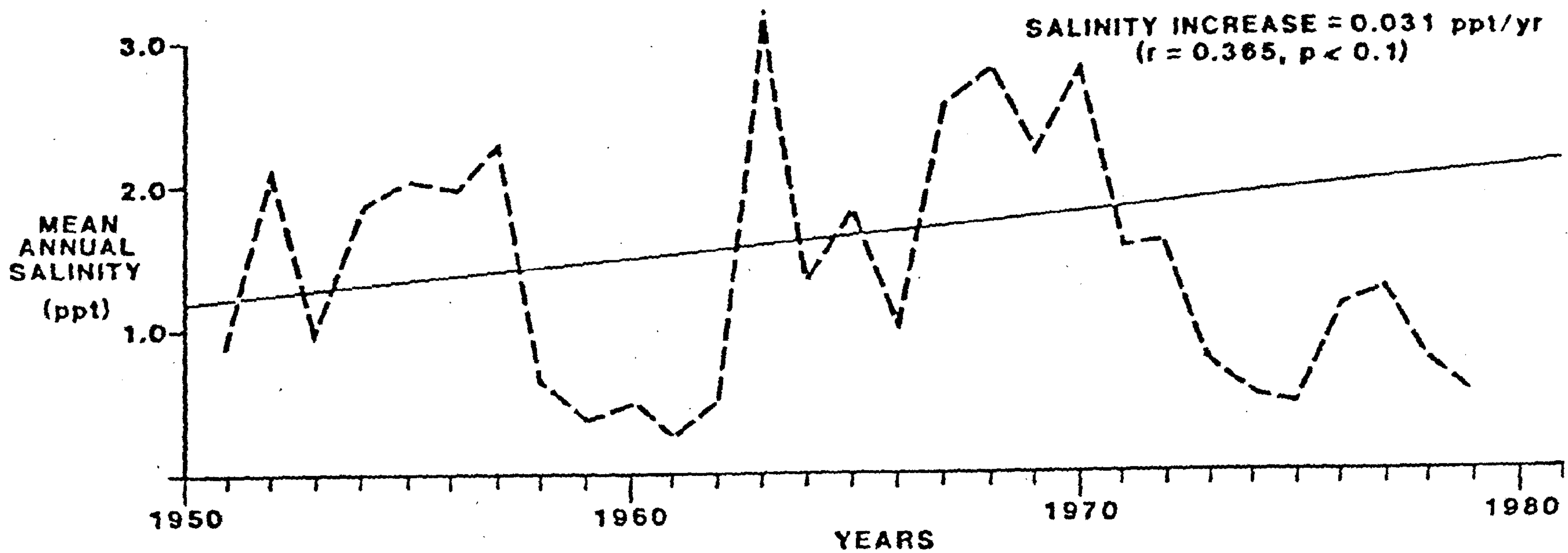

Figure 3-3. Trend line analysis of mean annual salinities in parts per thousand (ppt) at Pass Manchac from 1951-1979. Source: Wicker et al. 1981.

in July and August when wind-induced mixing and freshwater inflow are usually minimal. It is significant that salinities of 4 ppt were recorded near Pass Manchac (St. Pe' et al. 1983) in that this would more than explain the cypress mortality described by Wicker et al. (1981).

The discrepancies reported by various researchers can perhaps be explained in terms of the annual cycle. Typically, the highest freshwater inflows and lower salinities occur in the spring. This is also true for the peak discharges and flooding frequencies that are increasing (Turner and Bond 1980b). Therefore, Lake Pontchartrain may be experiencing lower spring salinities in modern times. However, since the rate of runoff is increasing, the storage and gradual release of freshwater from the upper basin to Lake Pontchartrain has diminished. During the low discharge seasons of late summer and fall, the salt wedge from the MRGO/IHNC can cause a rapid short-term rise in salinity. Wind-induced peak water levels can then drive this more saline water into the swamp. In analyzing mean salinities (Wicker et al. 1981; Figure 3-3), the lower spring values mask the higher fall values, resulting in no disernible trend. The additional complication of wet/dry years also makes delineation of trends difficult, if not impossible, given the 28-year record. In fact, although the annual peak salinities have apparently increased since 1963, they may not be continuing to increase at present. The salinity-induced habitat changes reported simply may not have reached an equilibrium point over the 21 years since MRGO because of the short-term nature of the peak salinities.

Existing Problems

Below some of the major problems concerning hydrology and water quality in the Lower Pontchartrain Basin are presented. Although elements of these particular problems deal with subjects other than hydrology or water quality, the discussion will focus primarily on these two subjects.

Flooding and Development

Because of the land-use changes previously discussed, flooding has now become the most important socioeconomic problem in the Pontchartrain Basin due to existing and potential property damage. Chronic flooding not only affects residents along the Comite/Amite system but also increasingly the urbanzied areas along the smaller north shore tributary streams and the nearby Pearl River. Other than increased runoff, there are three elements that contribute to the problem.

First, there is the continuing trend toward development in the floodplain. Losses from damages to property are considerably higher now than in the past, probably even if flood levels were not increasing. Other than damages, placing of fill in floodplains for road beds and foundations increase flood stages even more by restricting overbank flow.

Second, sediment input from ditch and canal bank erosion, and from poorly managed sand and gravel mining operations has led to shoaling and channel deterioration along river mainstems. This is especially true of the Amite River, where there are the additional complicating factors of riverbank erosion from boat wakes and impedence of flow by man-made structures. In most instances where a river channel begins to experience increased discharges (e.g. the upper Atchafalaya River), the channel tends to scour and increase in cross section to accommodate the flow. This process has not occurred on the Amite River mainstem, perhaps because of the aperiodic nature of the peak flows and the abrupt decrease in the gradient of the river between I-12 and the Amite River Diversion Canal. In this reach of the river, low water stages begin to be influenced by wind tides from Lake Pontchartrain and the floodplain widens. Incoming sediments may tend to be increasingly and preferentially deposited in this portion of the river. The river builds natural levees that confine the peak flows with the result that flows scour the channel and move the material further downstream to build up more natural levees. The problem is that the area must experience a major flood for these natural processes to become active. Perhaps hundreds of floods may be required over many years for the Amite River to adjust naturally.

The final element of the problem deals with man-made restrictions of flow in the river channel and wetland overflow areas that create backwater flooding. For example, the low sill structure across the inlet of the Amite River Diversion Canal was originally constructed to keep the lower Amite River between Head of Island and Lake Maurepas from being shoaled up and eventually abandoned. This was thought necessary because the river was designated as a navigation route. However, major navigation use has never materialized as a result of these plans; in fact, major commercial navigation only takes place in the diversion canal itself (e.g. Louisiana Materials, Inc.), which is actually a more expedient route to Lake Maurepas. The only function of the low sill structure at present is to force a portion of the floodwaters to take a long and inefficient route to Lake Maurepas.

Possible Solutions

(1) It is not feasible to totally stop development in floodplains and floodprone areas, but various regulations are in place to help. Unfortunately, many times these regulations focus on making the developments themselves less prone to flooding. Such incidents on occasion may cause an unfounded sense of security in prospective property buyers. Minimum slab elevations and on-site responses do nothing to minimize the loss of floodplain volume or downstream effects. All of the watersheds need a comprehensive flood damage reduction program which combines structural and nonstructural techniques for protecting those who are threatened and for keeping others from becoming victims.

(2) Some solutions to the problems will likely require substantial dredging, and therefore, substantial spoil disposal needs. Much of the convenient area for disposal is forested wetland. In view of the severity of the flooding problem, suitable areas within affected management units could be designated for spoil disposal and that guidelines be drafted to govern their use in an environmentally sound manner.

(3) Diversion Canals may be considered on a case by case as partial solutions to flooding problems.

(4) Reservoirs are other partial solutions to flooding that would also effect environmental management policies in the Lake Maurepas drainage. Some additional benefits of reservoirs could include conservation of the freshwater resources of the basin with managed release of water for water quality enhancement and salinity control.

(5) Promotion of the use of small scale stormwater retention systems for developments within the SA, perhaps in conjunction with wetland management could improve the situation.

Sediment Loading and Turbidity

As previously mentioned, sediment loading in the rivers has increased and may contribute to flooding problems; however, the effect of suspended sediments on water clarity is also a water quality issue in the Pontchartrain Basin. Increased turbidity may result in lowered primary production of phytoplankton, decreased growth of submerged grassbeds, oxygen depletion, and lowered recreational and aesthetic values. Some of the major elements of the problem are discussed below.

Increased input of sediments into the rivers can be linked to land clearing, bank erosion, and sand/gravel mining operations. All of these can be reduced by the use of prudent soil conservation practices and guidelines for environmentally sound operation. However, these activities do not take place to a great extent within the boundaries of the proposed Special Area (SA).

The major factor that influences turbidity in Lakes Maurepas and Pontchartrain is wind and its resulting wave formation, a natural element that cannot be controlled. In fact, Louisiana estuaries are typically turbid to some degree. Sediment resuspension and transport are important mechanisms in maintaining the elevation of wetlands. Suspended sediments tend to be trapped by emergent vegetation in wetlands, partially offsetting subsidence and land loss (Baumann 1980). However, the effects of wind and waves on turbidity can be influenced by man's activities.

One activity that has been implicated in increasing turbidity is hydraulic dredging. Many reports have been done on the various effects of dredging, often with contradictory findings (Palmore 1983; Sikora et al. 1981). The theoretical influence of shell dredging on turbidity will be discussed in terms of direct and indirect effects.

Direct effects of dredging involves the mechanical resuspension of deposited sediments. The degree of change in turbidity can be described in terms of the sediment discharge rate of the dredge in relation to the volume of the water body, the ambient turbidity, and the rate of water replacement in the water body. In general, if the volume of the water body is small and dredging discharge rate therefore approaches or exceeds the rate of water replacement, then the dredging will cause an increase in turbidity (if the turbidity of the dredge effluent exceeds that of the water body initially). The direct effects of dredging on turbidity are more significant in small water bodies with slow water exchange rates. Noticeable localized increases in turbidity could occur in large water bodies when ambient turbidity levels are low. During major floods or high wind/wave events, turbidity increases due to dredging may be masked by high ambient levels of suspended sediment.

Indirect effects of hydraulic dredging involve the change in character of the bottom sediments that may make them more easily resuspended by wave action. Assume that dredges excavate in front and discharge the effluent back into the cut. If the bottom material consists of equal parts of course materials, silt, and clay, the courser materials will fall out of suspension rather quickly, followed by the silts. The courser materials have the greatest chance of filling the dredge cut. The clays, because they remain in suspension longer, have the greatest chance of being transported away from the site. DNR is preparing to contract for an independent study of hydraulic shell dredging by professionals to determine effects of shell extraction in the Lakes.

Sikora et al. (1981) investigated the change in character of bottom sediments due to dredging in terms of the sediment bulk density which is defined as the weight per unit volume of intact sediment including any "trapped" water. Experiments with dredge effluent showed that bulk density tended to increase from below in a column of effluent as water was gradually displaced upwards, with bulk density remaining low in the surface layer for a long period of time (Sikora et al. 1981). Each of these cases could result in an increased susceptibility for sediment resuspension by natural forces.

Because of these indirect effects, turbidity in Lake Pontchartrain will tend to remain at present levels since the bottom has been subjected to several decades of shell dredging. However, if for some reason the clarity of the water improves to the former state of the 1950s, the much higher rates of nutrient input at present may cause chronic problems with algae blooms and associated fish kills.

Possible Solutions

(1) Implementation and enforcement of soil conservation guidelines and practices.

(2) Comprehensive management of the shell dredging industry in Lakes Maurepas and Pontchartrain including elements discussed in the following section. An ongoing DNR study should better define the shell dredging impacts.

Water Quality, Sewage Contamination and Urban Runoff

Where water quality problems exist in Lake Pontchartrain, they can generally be attributed to sewage effluent and storm water runoff from urban areas. Problems are frequently found in the nearshore areas between the Rigolets and Goose Point to the north and along the leveed area of the south shore.

Water quality problems along the north shore include high fecal coliform levels, high nutrient concentrations, and low dissolved oxygen in the drainage bayous. Health department officials state that swimming in Lake Pontchartrain is not advisable within 200 yds of Bayous Castine, Cane, Lacombe, Bonfouca, or Salt Bayou because of bacterial pollution. Much of this problem may be attributed to inadequate sewage treatment from septic tanks in rural settings or raw discharges from the numerous camps in these areas. Expansion of the urban area of Slidell contributes storm water pollutants as well.

The most severe problems occur along the south shore from the St. Charles/Jefferson Parish line eastward to Irish Bayou Lagoon, and are related to pumped runoff from metropolitan New Orleans. Parameters of concern are fecal coliform counts, dissolved oxygen levels, and potentially harmful substances such as heavy metals and synthetic chemical compounds.

For the nearshore areas described above, health officials state that swimming is not advisable within 0.25 mi of shore because of bacterial contamination (Figure 3). A recent study by the Office of Health Services and Environmental Quality (1982) showed that the highest coliform levels were found near pumping station outfalls and occurred during wet weather. The most severe cases occurred in Jefferson Parish (Elmwood Canal) where comingling of sewage with runoff and bypassing of treatment plants frequently occurs. Levels tended to decrease between outfall points and with distance offshore, with counts decreasing from 10 to 50% at 0.25 mi out. No data was presented for further than 0.25 mi from shore. With these conditions come above-average nutrient concentrations (Stoessel 1980) and the possibility of organic enrichment of bottom sediments. There may be a connection between the septic bottom conditions near the pumping station outfalls and the occurrence of the reported "dead zones" in this part of the lake.

St. Pe' et al. (1983), in tracking the movement of the salt wedge from the IHNC into Lake Pontchartrain, also recorded very low dissolved oxygen levels near the bottom. It was concluded that the density differences associated with the salt wedge created a condition of non-mixing between surface and bottom waters. Biological demand tended to deplete oxygen from the bottom waters. If the salt wedge would become situated over an organically enriched area, totally anoxic conditions could occur in a short period of time. This would eliminate benthic organisms, possibly creating a "dead zone" which would gradually be repopulated.

A variety of hydrocarbons, heavy metals, PCB's, pesticides, and other synthetic chemicals have been known to reside in storm water runoff from highly urbanized areas. This is indeed the case for the pumped discharges from metropolitan New Orleans. However, recent sampling has shown that conditions are not as bad along the south shore as the descriptions of the news media may imply. A series of samples were taken in the passes and the IHNC as the first of a two phase study by the USACE relative to the proposed Hurricane Barrier Plan. Since the barrier plan was dropped, phase II of the study was never implemented, but eight reports are on file at the New Orleans District office. These reports contain data on heavy metals, pesticides, PCB's, and organic priority pollutants from samples of sediment and tissue (clams, crabs, and fish). Similar sampling is ongoing by the Water Pollution Control Division of DEQ, but the findings have not been released at this time. Personal communication with Dr. Christian Byrne (1984) of the University of New Orleans, Center for Bio-organic Studies, who has been involved with both of the above studies, indicated that the degree of pollution is a relative thing. Lake Pontchartrain is not as polluted as Lake Erie, for example, but it does contain small amounts of typical urban runoff constituents at levels similar to other urban influenced estuaries. Lead, cadmium, PCB's, and pesticides were found in the tissues of aquatic organisms, but at much lower levels than those of pure urban storm water.

There are no criteria to govern acceptable levels of most pollutants in living organisms, although there are criteria for lethal levels. The bio-accumulation factors are not well documented for many pollutants, making continued study and surveillance of the south shore area necessary.

Possible Solutions

(1) Water quality along the north shore of Lake Pontchartrain can be greatly improved by enforcement of point source discharge guidelines and by requiring environmentally sound surface water management plans to reduce non-point source pollution. For example, requiring periodic inspections and certifications for operation for the sewage treatment facilities of camps and other facilities not on a treatment network would reduce pollution from negligence and inadequacy. A program could be developed to help municipal sewage plants formulate plans for management of their effluent by using wetland treatment for existing or proposed facilities.

(2) Another mitigation measure to improve water quality would be to enhance and expand beds of submerged grasses, especially near the outlets of drainage bayous where problems occur most frequently. One way to accomplish this would be by construction of artificial "barrier islands" near the shore, to decrease wave energy and promote grass bed development in the resulting "lagoon" while providing recreational opportunities on the lakeward edge of the island (Wicker et al. 1982).

(3) Upgrading of sewage facilities in Jefferson Parish to increase the capacity and allow disposal of effluent into the Mississippi River will greatly improve the present situation along the south shore. However, the urban storm water problem will remain. The only mitigation element would be to continue monitoring the effects.

(3) Future urban development can be done in such a way that sewage effluent and urban storm water can be discharged into retention lagoons and filtered through wetland areas. Tertiary treatment objectives could be accomplished through wetland surface water management, with the additional benefit of wetland restoration and enhancement.

(4) To prevent further deterioration of water quality, it is desirable not to resuspend heavy metals, pesticides, and other pollutants already trapped in the bottom sediments. Sediment elutriate tests similar to those required for dredge and fill activities could be conducted in the areas of Lakes Maurepas and Pontchartrain

that are open to shell dredging. Closing contaminated areas to dredging would ensure that no concentrations or undesirable levels of pollutants are reinjected into the aquatic system. Areas with undesirable levels of pollutants can be avoided before they are disturbed, and bio-accumulation effects, etc., can then be studied.

(5) Management of hydraulic dredging operations should consider the seasonality of hydrologic conditions in the lakes as a management tool. For example, during the summer months it may be desirable to locate dredging activities in the eastern end of Lake Pontchartrain where tidal flushing is greatest. Summer water movements in the western area are sluggish, and dredging could contribute to oxygen depletion. Activity could be shifted to western Lake Pontchartrain in the winter and spring where the highest annual river flows and low temperatures would preclude oxygen depletion. This would also reduce possible impacts to incoming estuarine larvae and postlarvae in the eastern lake during the spring months.

(6) All dredging activities should be directed to avoid the areas within the saltwater wedge which periodically intrudes into the basin. This will prevent oxygen-consuming sediment material from contributing to the anoxic conditions in the lower water column.

Summary and Possible Solutions

Hydrologic processes in Lake Pontchartrain are fairly well known, but little research has been done within the Lake Maurepas drainage. This is especially true of the swamp areas to the south and west of the lake which comprises the majority of the remaining wetlands in the basin. A data collection program is needed for this area.

Several of the problems touched upon in this paper have possible solutions that are beyond the scope of the Special Area concept. Among these are sediment loading from sand and gravel operations and major flood control projects. Dredge spoil disposal areas may need to be planned. The proposed Amite Reservoir needs to be evaluated with regard to water quality enhancement and salinity control for Lake Maurepas.

Poor water quality is generally limited to the lower segments of rivers and other points of drainage input around the perimeter of the lakes. However, there are few sampling stations in the open water areas of Lakes Maurepas and Pontchartrain. Perhaps a series of baseline stations should be initiated near the middle of the lakes to determine whether the water quality problems are spreading. Expansion and conservation of submerged grass beds is recommended to combat water quality problems near drainage outlets.

Lake Pontchartrain is far from being a dead lake in terms of water quality. Future expansion of population along the north shore, in St. Charles Parish, and in the New Orleans East area need not result in further degradation of the lake if the remaining wetlands are preserved and prudently managed to treat runoff and sewage effluent. The most difficult problem to address is that occurring along the presently urbanized south shore of the lake. Upgrading of sewerage facilities and continued close monitoring are recommended.

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CHAPTER 4: VEGETATION AND LAND USE IN THE PROPOSED PONTCHARTRAIN-MAUREPAS SPECIAL AREA

Abstract

The Pontchartrain-Maurepas Basin has undergone extensive habitat changes within the past 25 years because of natural and man-made processes. During this period, wetland habitats decreased by 13% while upland and aquatic habitats increased by 14% and 3%, respectively. The continued loss of wetland habitats will result in the loss of a valuable renewable resource base for the area. Furthermore, it removes the option of using wetlands to buffer upland habitats from storm surges and to remove wastes, thereby enhancing the water quality of lakes and rivers. In order to preserve the valuable functions afforded by the area's wetlands and water bodies there must be a coordinated effort among the private interests and state and local agencies to devise for the region a comprehensive, though reasonably flexible, management plan with clearly defined and enforceable policies, goals, and objectives. The specific recommendations for lessening the destruction of wetland vegetation must be tailored to fit the type of habitat being impacted.

Introduction

The geomorphology of the region strongly influences the distribution of vegetation and land use through its influence on the hydrologic and salinity regimes. Much of the region lies below 5 ft in elevation and is susceptible to flooding from precipitation, freshwater drainage and saltwater storm surge. Only the Pleistocene Terrace, with its 10- to 15-ft escarpment 1 to 2 mi north of Lake Pontchartrain; the 5- to 10-ft natural Mississippi River levees; and the man-made, leveed fastlands fringing portions of the natural levees and Pleistocene Terrace are sufficiently drained by natural and man-made processes to support upland vegetation communities and developed sites. Lands lying below 5 ft in elevation are covered by freshwater swamps and fresh-to-brackish marshes.

A schematic diagram best illustrates the relationship between vegetation associations and landforms in the Pontchartrain Basin between the Mississippi River and Lake Pontchartrain (Figure 4-1). The diagram is generalized and includes saltwater habitats, such as saline marsh, not presently found in the basin area. The system,

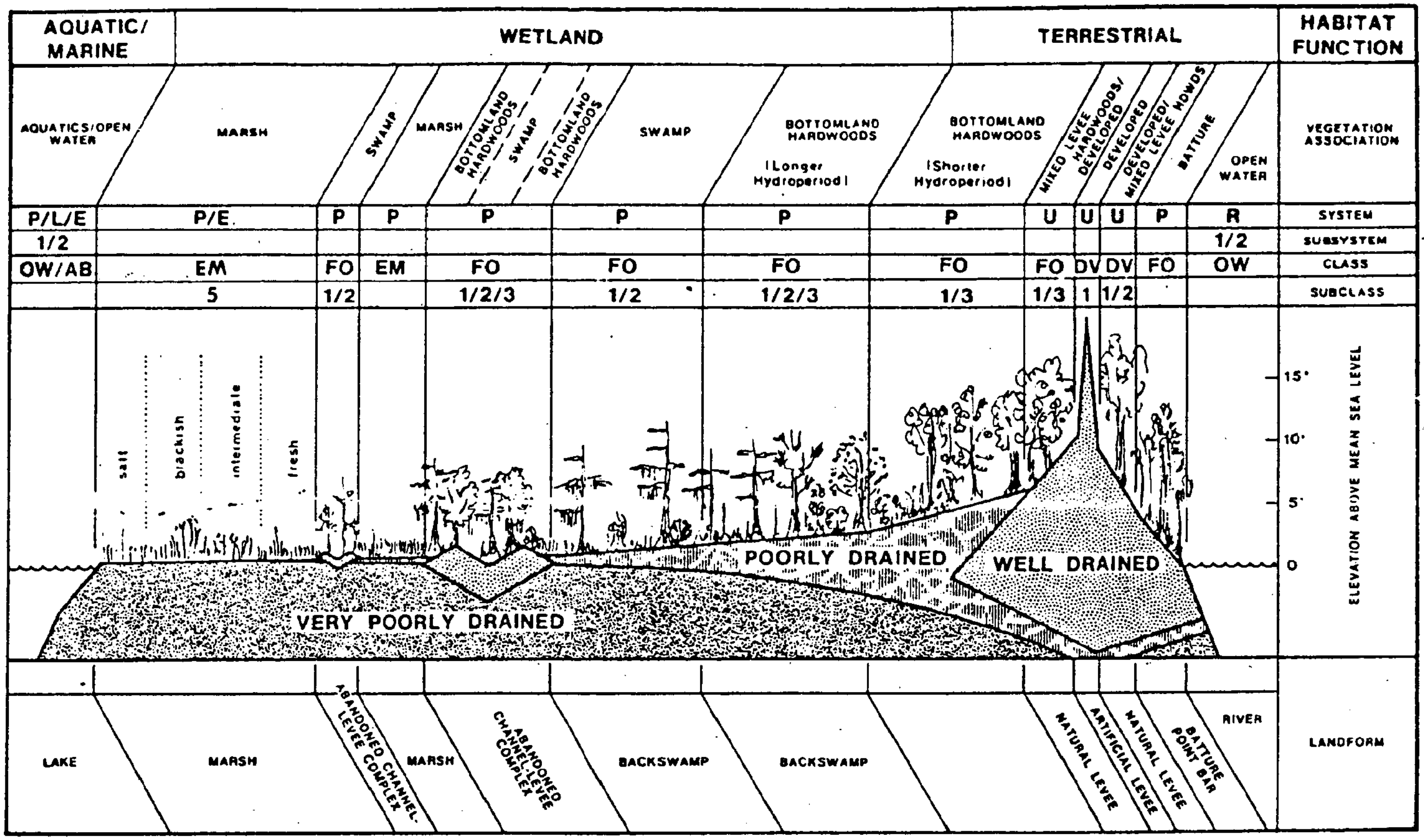

Figure 4-1. Relationship of habitat and vegetation associations to landforms in the Mississippi Deltaic Plain region (Wicker 1980).

System	Subsystem	Class	Subclass
E=Estuarine	Estuarine 1=Subtotal	AB=Aquatic Bed	DV1=Urban/Residential/ Commercial/Industrial
L=Lacustrine	Estuarine 2=Intertidal	DV=Developed	DV2=Agriculture/Pasture/ Modified Grassland
P=Palustrine	Lacustrine 1=Limnetic	EM=Emergent	EM5=Narrow-leaved Persistent
R=Riverine	Lacustrine 2=Littoral	FO=Forested	FO1=Broad-leaved Deciduous
U=Upland	Riverine 1=Tidal	OW=Open Water	FO2=Needle-leaved Deciduous
	Riverine 2=Lower Perennial		FO3= Broad-leaved Evergreen

subsystem, class, and subclass terms shown on the diagram relate to the habitat classification system used in compiling the 1956 and 1978 7.5 minute habitat maps of the coastal zone for the U. S. Fish and Wildlife Service (USFWS) (Wicker 1980; Wicker et al. 1980). Habitat data from this USFWS study is discussed later in this report. Table 4-1 lists vegetation species commonly associated with the major landforms in the Pontchartrain Basin.

History of Change

The most recent vegetation and land use map of the region was compiled from a December 5, 1982 Thematic Mapper Scene (U.S. Geological Survey [USGS] 1982) (Plate 5). Comparison of this photograph and interpretation with earlier aerial photographs and habitat maps of the region for 1955 and 1978 show the extent of vegetation and land use changes that have occurred (Wicker 1980; Wicker et al. 1980). While the recent vegetation and land use map was not planimetered, data from habitat maps compiled from 1955/56 and 1978 aerial photographs accurately convey the magnitude of changes that have occurred, and continue to occur, in the region (Table 4-2). When reviewing this table, note that the habitats in that portion of Livingston Parish which lie within the proposed Pontchartrain-Maurepas Special Area (SA) are omitted. No areal measurements were available for this area because at the time the habitat maps were made, this portion of Livingston Parish was outside the Coastal Zone.

Within the past 25 years, the major habitat changes characterizing the proposed Pontchartrain-Maurepas SA have been a decrease in freshwater habitats (i.e., swamp, fresh marsh, fresh water) and an increase in nonfreshwater habitats and urban-industrial-residential development. Agricultural lands have decreased in area and upland and natural levee hardwoods (second growth forests) have increased in area as former agricultural lands lay fallow awaiting development. The decrease in bottomland hardwoods is due largely to increases in development along the base of the natural Mississippi River levee. In general between 1955/56 and 1978, wetlands decreased from 34% of the area to 30%, uplands increased from 20% to 22% and water bodies increased from 46% to 48%.

Remnants of the historic vegetation community still remain. The Pleistocene Terrace, north of Lake Pontchartrain and east of the Mississippi River, was classified as a

Table 4-1. Vegetation Associations Characteristic of Major Physiographic Units in the Mississippi River Deltaic Plain Region.

PHYSIOGRAPHIC UNIT	VEGETATION ASSOCIATION/SPECIES
Uplands - Terrestrial Vegetation	
I. Upland Terrace (East of Mississippi River)	
a) uplands: cleared	a) agricultural crops such as soybeans, sweet potatoes, strawberries, pasture
b) uplands: uncleared (USDA,FS 1969;Brown 1945)	b) longleaf-slash pine: longleaf pine (Pinus palustris) slash pine (Pinus elloittii) shortleaf pine (Pinus eehinata) spruce pine (Pinus glabra)
c) uplands (USDA,FS 1969)	c) loblolly pine - hardwoods: loblolly pine (Pinus taeda) shortleaf pine (Pinus echinata) oaks (Quercus spp.) hickory (Carya spp.) red gum (Liquidambar styraciflua)
d) in sloughs and on poorly drained flatwood soils (Brown 1945)	d) pond cypress (Taxodium distichum var. nutans) swamp black gum (Nyssa sylvatica) magnolia (Magnolia spp.) water oak (Quercus nigra) obtusa oak (Quercus obtusa) swamp red maple (Acer rubrum var. drummondii) green ash (Fraxinus pennsylvanica) var. lanceolata) red gum (Liquidambar styraciflua)
e) "scrub oak" woods: cleared and/or burned areas (Brown 1945)	e) southern red oak (Quercus falcata) post oak (Quercus stellata) blackjack oak (Quercus marilandica) willow oak (Quercus phellos) treeless grasslands
II. Natural Levee	
a) higher natural levees (Brown 1945)	a) red gum - mixed hardwoods red gum (Liquidambar styraciflua)

Table 4-1 continued

PHYSIOGRAPHIC UNIT	VEGETATION ASSOCIATION/SPECIES
(Penfound and Howard 1940)	cherrybark oak (Quercus falcata var. pagadaefolia) cow oak (Quercus prinus) nutall oak Quercus nuttallii) Shumard oak (Quercus shumardii) water oak (Quercus nigra) honeylocust (Gleditsia triacanthos) American elm (Ulmus americana) winged elm (Ulmus alata) pecan (Carya sp.) persimmon (Diospyros virginiana)
b) lower natural leves (Brown 1945)	b) overcup oak - bitter pecan: overcup oak (Quercus lyrata) bitter pecan (Carya aquatica) red gum (Liquidambar styraciflua) persimmon (Diospyros virginiana) hackberry (Celtis laevigata) cherrybark oak (Quercus falcata var. pagadaefolia)
c) natural levees below Baton Rouge (Brown 1945)	c) live oak - mixed hardwoods: water oak (Quercus nigra) live oak (Quercus virginiana) hackberry (Celtis laevigata) American elm (Ulmus americana) honeylocust (Gleditsia triacanthos) hawthorn (Crataegus sp.)
d) natural levees, spoil banks, and ridges in marshes (vegetation ranked from highest to lowest landform elevation) (Brown 1945)	d) live oak (Quercus virginiana) tooth-ache tree (Zanthoxylum clava-herculis) hackberry (Celtis laevigata) hawthorn (Crataegus sp.) opopanax (Acacia farnesiana) marsh elder (Iva frutescens) eastern baccharis (Baccharis halimifolia)

Wetlands Vegetation

PHYSIOGRAPHIC UNIT	VEGETATION ASSOCIATION/SPECIES
III. Backswamp: Wetlands	
a) deep water swamp (Penfound 1952) (Winters and Ward 1934)	a) cypress - tupelo gum: baldcypress (Taxodium distichum) tupelogum (Nyssa aquatica)
b) swamp - bottomland hardwoods (Brown 1945, Environmental Laboratory 1978)	b) cypress - bottomland hardwoods: baldcypress (Taxodium distichum) tupelogum (Nyssa aquatica) swamp red maple (Acer rubrum

Table 4-1 continued

PHYSIOGRAPHIC UNIT	VEGETATION ASSOCIATION/SPECIES
	var. drummondii) water ash (Fraxinus caroliniana) pumpkin ash (Fraxinus profunda) Virginia willow (Itea virginica) buttonbush (Cephalanthus occidentalis) swamp-privet (Forestiera acuminata) water locust (Gleditsia aquatica) water elm (Planera aquatica) swamp blackgum (Nyssa sylvatica var. biflora)
IV. Batture - Frontlands	
a) mixed hardwoods (Brown 1945)	a) willow - mixed hardwoods: black willow (Salix nigra) cottonwood (Populus deltoides) American sycamore (Platanus occidentalis) red gum (Liquidambar styraciflua) hackberry (Celtis laevigata) swamp-privet (Forestiera acuminata) honeylocust (Gleditsia triacanthos) water locust (Gleditsia aquatica)
V. Bottomland Hardwoods	
a) poorly drained (Brown 1945)	a) overcup oak (Quercus lyrata) bitter pecan (Carya aquatica) green ash (Fraxinus pennsylvanica var. lanceolata) black willow (Salix nigra) water oak (Quercus nigra) hawthorn (Crataegus sp.)
VI. Marshes: Saline	
a) Louisiana (Chabreck 1972) (Chabreck and Linscombe 1978)	a) Smooth cordgrass (Spartina alterniflora) saltgrass (Distichlis spicata) blackrush (Juncus roemerianus) wiregrass (Spartina patens) glasswort (Salicornia sp.) batis (Batis maritima) black mangrove (Avicennia germinans)
Marshes: Brackish	
a) Louisiana (Chabreck 1972) (Chabreck and Linscombe 1978)	a) wiregrass (Spartina patens) saltgrass (Distichlis spicata) three-cornered grass (Scirpus olneyi) leafy three-square (Scirpus robustus) widgeongrass (Ruppia maritima)

Table 4-1 concluded

PHYSIOGRAPHIC UNIT	VEGETATION ASSOCIATION/SPECIES
Marshes: Intermediate	
a) Louisiana (Chabreck 1972) (Chabreck and Linscombe 1978)	a) wiregrass (Spartina patens) roseau cane (Phragmites australis) bulltongue (Sagittaria falcata) Walter's millet (Echinochloa walteri) bullwhip (Scirpus californicus) deer pea (Vigna repens) sawgrass (Cladium jamaicensis)
Marshes: Fresh	
a) Louisiana (Chabreck 1972) (Chabreck and Linscombe 1978)	a) maidencane (Panicum hemitomon) bulltongue (Sagittaria falcata) spikerush (Eleocharis sp.) alligatorweed (Alteranthera philoxeroides) pennywort (Hydrocotyl sp.) water hyacinth (Eichhornia crassipes) pickerelweed (Pontederia cordata)
Aquatic Vegetation	
VII. Floating and Submerged Aquatics: Freshwater	
a) lakes, ponds, rivers with no swift currents (Lemaire 1960)	a) water-lilies (Nymphaea odorata) water-lilies (Nuphar luteum) water-lilies (Nymphoides sp.) bladderwort (Utricularia sp.) watermilfoil (Myriophyllum sp.) mermaidweed (Proserpinaca sp.) watershield (Brasenia schreberi) fanwort (Cabomba caroliniana) water hyacinth (Eichhornia crassipes) duckweed (Lemna spp.) duckweed (Pontederia cordata)
VIII. Submerged Aquatics: Fresh to Slightly Brackish	
a) lakes, ponds, rivers with no swift currents (ranked from more salt tolerant to less salt tolerant). Species present in Lake Pontchartrain (Montz 1976)	a) widgeongrass (Ruppia maritima) horned pondweed (Zannichellia palustris) wild celery (Vallisneria americana) bushy pondweed (Najas quadalupensis) coontail (Ceratophyllum demersum) pondweed (Pontamogeton pusillus) watermilfoil (Myriophyllum sp.)

Table 4-2. Habitat Area in the Proposed Pontchartrain-Maurepas Special Area (Excluding Livingston Parish) for 1955/56, 1978 and Change in Area Between 1955/56 and 1978. (Some habitats not delineated on Plate 5 because of their small areal extent.)

HABITAT CATEGORY	1955/56		1978		CHANGE 1955/56-1978	
	ACRES	%	ACRES	%	ACRES	%
Urban-Industrial-Residential	63,646	6	123,898	11	+60,252	+94
Agriculture-Pasture-Fallow Land	78,542	7	38,306	3	-40,236	-51
Spoil	3,767	< 1	4,739	< 1	+972	+26
Upland Hardwoods-Pine	71,619	6	80,854	7	+9,235	+12
Natural Levee Hardwoods	2,930	< 1	3,874	< 1	+944	+32
Bottomland Hardwoods	36,625	3	26,143	2	-10,482	-28
Cypress-Tupelo Swamp	187,601	16	166,294	14	-21,307	-11
Fresh Marsh	64,851	6	43,402	4	-21,449	-33
Non-Fresh Marsh (Intermediate and Brackish)	92,476	8	96,843	8	+4,367	+4
Beach	584	<1	147	<1	-437	-74
River Bars	0	0	2	0	+2	-
Reef	4	0	0	0	-4	-
Jetties	0	0	1	0	+1	-
Freshwater, Natural	82,970	7	4,271	< 1	-78,699	-94
Freshwater, Man-made	2,955	< 1	6,295	< 1	+3,340	+113
Non-Freshwater, Natural	427,751	38	522,493	46	+94,742	+22
Non-Freshwater, Man-made	6,347	< 1	5,125	< 1	-1,222	-19
	1,122,668		1,122,687			

Longleaf Pine Region by Brown (1945) and corresponds to the Upland Hardwoods/Pine habitat on Plate 5. Prior to the emergence of commercial cultivation of pine plantations, longleaf pine (Pinus palustris) was the dominant pine species in the region. After the virgin longleaf pine was harvested, other pine species invaded or were planted because they produced a commercial grade of timber in a shorter period of time. Today other pine species such as loblolly pine (Pinus taeda), slash pine (Pinus elliottii), shortleaf pine (Pinus echinata), and spruce pine (Pinus glabra) are more common than longleaf pine. The numerous sloughs draining the terrace uplands contain a variety of hardwoods including pond cypress (Taxodium distichum var. nutans), swamp blackgum (Nyssa sylvatica var. biflora), magnolias (Magnolia spp.), water oak (Quercus nigra), obtusa oak (Quercus obtusa), swamp red maple (Acer rubrum drummondii), green ash (Fraxinus pennsylvanica var. lanceolata), redgum (i.e., sweetgum) (Liquidambar styraciflua), and numerous ericaceous shrubs (Brown 1945). Areas of the terrace that have been cleared of pine and subjected to repeated burnings are often characterized by "scrub oak" communities containing southern red oak (Quercus falcata), post oak (Quercus stellata), blackjack oak (Quercus marilandica), and willow oak (Quercus phellos) (Brown 1945).

While much of the terrace between Hammond and Slidell is still maintained in commercial pine plantations, cropland, and pasture, the construction of I-10 and I-12 has lessened travel time to the area and fostered rapid development of recreational sites and bedroom communities serving Hammond, Covington, Slidell, and the Greater New Orleans metropolitan area. Data on population trends in the region illustrate the rapid growth responsible for much of the land clearing in the three parishes (Livingston, Tangipahoa, and St. Tammany) on the terrace (Plate 6). The town of Slidell, located approximately 20 mi northeast of New Orleans, is an example of one community which has undergone explosive expansion into the surrounding piney woods region in the process of increasing its population from 29,858 in 1970 to 66,382 in 1980 (a growth of 122.3%) (Daigre 1981).

The natural levees along the present Mississippi River and its abandoned main and distributary channels are naturally vegetated by bottomland hardwoods. The higher, better drained natural levees, corresponding to the natural levee hardwoods on Plate 5, support a redgum/mixed hardwood community containing redgum, cherrybark oak (Quercus falcata var. pagodaefolia), cow oak (Quercus michauxii), Nuttall oak (Quercus nuttallii), Shumard oak (Quercus shumardii), water oak, honeylocust (Gleditsia triacanthos), American elm (Ulmus americana), winged elm (Ulmus alata), pecan (Carya illinoensis), and persimmon (Diospyros virginiana) (Brown 1945; Penfound and Howard 1940). The lower-lying, less well-drained portions of the natural levees contain an overcup oak-bitter pecan community which include overcup oak (Quercus lyrata), bitter pecan (Carya aquatica), redgum, persimmon, hackberry, and cherrybark oak (Brown 1945). Live oak (Quercus virginiana) is also a conspicuous tree, often accentuating the presence of natural levees, in coastal Louisiana.

The very low-lying natural levees and spoil banks subsiding into the marshlands of coastal Louisiana are characterized by such trees and shrubs as live oak, tooth-ache tree (Zanthoxylum clava-herculis), hackberry (Celtis laevigata), hawthorn (Crataegus sp.), Chinese tallow (Melia azedarach), black willow (Salix nigra), marsh elder (Iva frutescens), and eastern baccharis (Baccharis halimifolia). Spoil deposits containing species common to the upland forests are not depicted in Plate 5 because of the small map scale.

The low-lying, low-relief, freshwater wetlands projecting from the base of the levees and lying below 5 ft mean sea level (msl) contain backswamp communities. The swamps having the longest hydroperiod (i.e., length of time area covered by water) consist almost entirely of even-aged stands of cypress (Taxodium distichum) and/or tupelogum (Nyssa aquatica) (Putnam et al. 1960). Backswamps along the levee base also contain swamp red maple, water ash (Fraxinus caroliniana), pumpkin ash (Fraxinus tomentosa), and small shrubs such as Virginia willow (Itea virginica) and buttonbush (Cephalanthus occidentalis) (Brown 1945).

The marshes in the Pontchartrain-Maurepas region generally lie between 0 and 1 ft msl and are saturated or covered regularly with water throughout the year. These marshes range from fresh in the interior, western portion of the basin through intermediate to brackish near the eastern end of Lake Pontchartrain. The fresh marshes, with optimum salinities of 0 to 2 parts per thousand (ppt) (van Beek et al. 1982), have the highest plant diversity (Palmisano and Chabreck 1972) with the major species being maidencane (Panicum hemitomum), bulltongue (Sagittaria lancifolia), spikerush (Eleocharis sp.), alligatorweed (Alternanthera philoxeroides) and wiregrass (Spartina patens) (Chabreck 1972). Plant diversity is also high in the intermediate marshes where optimum salinities range between 2 and 5 ppt (van Beek et al. 1982).

Intermediate marshes are an ecotone or transition zone between the freshwater and brackish-to-saline marshes and, therefore, contain some species present in both fresh and non-fresh marsh zones. While wiregrass is the dominant species in the intermediate marshes of southeastern Louisiana, other major species include three-cornered grass (Scirpus olneyi), bulltongue (Sagittaria falcata), dwarf spikerush (Eleocharis parvula), and roseau cane (Phragmites australis) (Chabreck 1972).

Brackish marshes have a variable, optimum salinity range of 5 to 10 ppt (van Beek et al. 1982) and are dominated by wiregrass. Other marsh species include saltgrass (Distichlis spicata), three-cornered grass, dwarf spikerush, and oystergrass or smooth cordgrass (Spartina alterniflora) (Chabreck 1972). There are no saline marshes in the proposed Pontchartrain-Maurepas SA.

The shallower, less turbid portions of water bodies in the Pontchartrain-Maurepas region contain a variety of aquatic plants including submerged moss, algae, and floating-leaved vascular species. Examples of floating and submerged aquatics commonly found in less turbid, relatively still freshwater bodies are: waterlilies (Nymphaea odorata, Nuphar luteum, Nymphoides sp.), bladderwort (Utricularia sp.), watermilfoil (Myriophyllum sp.), mermaidweed (Proserpinaca sp.), watershield (Brasenia schreberi), fanwort (Cabomba carolioniana), waterhyacinth (Eichhornia crassipes), and duckweed (Pontederia cordata, Lemna sp.) (Lemaire 1960).

Submerged aquatics found in the fresh-to-slightly brackish water bodies such as along the eastern perimeter of Lake Pontchartrain include: widgeongrass (Ruppia maritima), horned pondweed (Zannichellia palustris), wild celery (Vallisneria americana), bushy pondweed (Najas quadalupensis), coontail (Ceratophyllum demersum), pondweed (Potamogeton pusillus), and watermilfoil (Montz 1978, n.d.).

The submerged aquatics of Lake Pontchartrain have altered their distribution and composition in recent years. Comparison of studies by Darnell (1961) in the mid-1950s and Montz (1978) in the mid-1970s indicate an apparent decline in abundance of widgeongrass and wild celery and an increase in the distribution of pondweed and bushy pondweed (Turner et al. 1980). Causes for these changes have not been determined; however, it is possible that the declines in the widgeongrass and wild celery are related to increased turbidities associated with shoreline erosion, heavy boat traffic, various dredging activities, and eutrophication.

The agricultural lands along the Mississippi River, historically, have been almost exclusively in sugarcane production. In recent years, decreases in sugarcane prices and increases in soybean prices have resulted in some conversion of sugarcane lands to soybean production. Agricultural practices on the terrace north of Lake Pontchartrain have concentrated largely on production of truck garden crops in relatively small fields. The Pontchatoula-Hammond area was once considered the "Strawberry Capital of the World." While production has decreased in recent years, strawberries are still a major crop in this region. Chickens, dairy cattle, and beef cattle are also important farm products in the north shore region.

Natural and man-made processes have altered considerably the distribution and even the composition of many vegetation associations or habitats within the basin (Plate 6). The overall trend for all habitats has been a loss of vegetation resulting directly from extensive land clearing for agricultural production and construction of urban-industrial complexes and transportation facilities, including extensive borrow pits and canals associated with road construction (i.e., I-10 in St. Charles Parish and I-55 in Tangipahoa Parish), oil and gas exploration, navigation, marinas, and waterside communities.

Other human activities in and adjacent to the basin have indirectly caused habitat changes by affecting the hydrologic and salinity regimes. The stress and destruction of the cypress-tupelo swamps and destruction or inland displacement of the freshwater marshes are related directly to saltwater intrusion and salt buildup in the soils (Wicker et al. 1981). Recent studies reveal the conversion of approximately 25,000 ac of swamp and fresh marsh to intermediate and brackish marsh and open water between 1955 and 1978 (Wicker et al. 1980; van Beek et al. 1982). Of this total, 21,000 ac of baldcypress died and were replaced by fresh-to-intermediate marsh, and an additional 30,000 ac of baldcypress swamps are in a stressed condition (van Beek et al. 1982). Baldcypress dieback is common where soil salt levels reach 2 ppt or greater (Wicker et al. 1981).

Saltwater intrusion has also caused most of the freshwater marshes along the eastern perimeter of the basin to be replaced by intermediate-to-brackish marshes or open water. If these trends continue (and they will without implementation of extensive and comprehensive wetland management projects), the present-day low salinity marshes will disappear and interior swamps will die, being replaced by more salt-tolerant marshes and open water.

Saltwater intrusion and salt buildup in the soils are facilitated by several factors:

1. regional land subsidence and eustatic sea-level rise;
2. disruption of the natural, slow surface drainage by the dredging of deep, straight canals, (i.e., oil and gas canals, drainage canals, and highway canals and borrow pits) and deposition of continuous, cross-drainage spoil banks;
3. relic logging scars connecting baldcypress swamps with water bodies experiencing saltwater intrusion;
4. construction of the Mississippi River-Gulf Outlet (MRGO) and Inner Harbor Navigation (IHN) Canals;
5. effective leveeing of the Mississippi River and prevention of regular, seasonal overbank flooding; and
6. erosion of isthmus marshes and subsequent widening of tidal passes between Lake Pontchartrain and Lake Borgne.

The construction of the MRGO and IHN Canals and the widening of the tidal passes permit increased circulation of more saline waters into the lake. The numerous canals and logging scars in the wetlands, in turn, rapidly conduct the saltier water into the interior, formerly freshwater habitats. The canals and logging scars also rapidly direct freshwater from the uplands and interior wetlands, thereby removing the freshwater head that could have effectively buffered the impact of the more saline waters and flushed the salt out of the soil. Prevention of Mississippi River overbank flooding, the acceleration of the flooding and draining processes, and the short-circuiting of nutrients and sediments from the wetlands to the canal networks also deprive the vegetation of the physical, chemical, and biological processes conducive to promotion of viable habitats (van Beek et al. 1982; Connor and Day 1976).

Virtually all of the natural levee hardwood forests along the Mississippi River have been cleared for agriculture or development. Many of the former agricultural lands are now fallow, awaiting development. Most of the bottomland hardwoods along the river also have been replaced by cleared land (agricultural and fallow lands) and developments. Some destruction of the backswamp along the river corridor is occurring because of piecemeal land clearing, land filling, and development.

The little fallow land that remains in the leveed portions of Jefferson and Orleans Parishes will be developed in the immediate future. A large tract of leveed marsh undergoing a transition from brackish-to-intermediate marsh in the eastern portion of

Orleans Parish is also a prime candidate for future development. The unleveed, brackish marshes in eastern Orleans Parish are gradually disappearing because of erosional processes and piecemeal development and boat slip dredging along highways such as U.S. 90.

Two types of processes have altered the historic vegetation distribution and composition on the terrace: lumbering and development. The lumber industry harvested the longleaf pine and instituted tree farming. Today, this area has two forest regions; loblolly-shortleaf pine to the west and longleaf-slash pine to the east (Mixon n.d.). However, both of these tree regions are being displaced rapidly along I-12 by residential and urban development. Major foci for development are the junctions of I-12 and three major roads leading north—I-55, Pontchartrain Causeway, and I-10. Several parcels of former marshlands in the I-10 to I-12 corridor (between the terrace and Lake Pontchartrain) were leveed and drained for agriculture in the early-to mid-twentieth century and are now being converted to residential communities. A large tract of land west of Madisonville is undergoing the same process.

Projected Problems

Natural causes responsible for future vegetation loss will be shoreline erosion, subsidence, and sea level rise. These are natural processes associated with the degradational phase of an abandoned delta lobe and cyclic climatic changes. With these processes, vegetation is lost because the vegetated substrate becomes flooded or erodes. These natural processes are compounded by man-made processes and it is often difficult to clearly distinguish between natural and man-made cause and effect relationships, especially with regard to losses caused by saltwater intrusion. Vegetation loss to shoreline erosion may be more severe in areas where the natural, buffering shoreline vegetation has been damaged or destroyed, where the natural slope of the shoreline has been altered, and where there is heavy boat traffic and consequently high wave action

Man-made impacts to vegetation composition and distribution will continue to be extensive and detrimental. The Pleistocene Terrace pine forest will be systematically removed as residential and industrial development spreads northward along major transportation arteries. As the well-drained farm and fallow lands along the Mississippi levee are rapidly developed, there will be increased pressure for piecemeal encroachment into the wet bottomland hardwoods and backswamp by means of small leveed and drained development projects. There will be very intense pressure to develop wetlands north of the Mississippi River as far as I-10 and even beyond to the shores of Lake Pontchartrain. The need to dispose of waste material generated by the rapidly expanding urban population in this area provides the excuse for sequential filling of the wetlands. This would create new, well-drained and very valuable land adjacent to urban areas and well suited for development.

Oil and gas exploration will continue to destroy wetlands directly by canal dredging and spoil deposition and indirectly by creating new avenues for saltwater intrusion. Wetlands will continue to be destroyed as they are developed for water-based residential and recreational communities, marinas, boat canals, roads, camp sites, and land fills. Increased boat traffic along the lakeshore will increase wave erosion and turbidities, and will further damage the submerged aquatics.

Increases in highway borrow pits and drainage and navigation canals will permit saltier water to intrude further into interior marshes. The demand for better flood prevention within the basin will result in construction of more drainage ditches to rapidly remove water from the basin. This will remove the freshwater head in the interior swamps and marshes that previously buffered the impact of saltwater intrusion. Consequently, salinities will increase in the soil and surface waters and destroy the freshwater vegetation, including swamps.

The continued loss of wetlands in the Pontchartrain-Maurepas Basin is a severe problem because wetlands are valuable areas which serve a multitude of purposes. By definition, wetlands are "lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water" (Cowardin et al. 1979:3). In 1978, wetlands consisting of fresh-to-brackish marshes, swamps, and bottomland hardwoods composed 30% of the proposed Special Area (excluding Livingston Parish). Historically, such areas were considered to be wastelands to be ignored on where possible reclaimed for agriculture and development. Recent surges in environmental awareness, accompanied by research into the form and function of wetlands, has begun to provide the evidence required to enlighten attitudes toward the value and necessity of preserving wetlands. Table 4-3 contains examples of some of the services provided by wetlands.

Table 4-3. Examples of the Functions and/or Utilization of Wetlands.

1. Primary productivity at base of food chain.
2. Watershed protection and maintenance (floodwater storage and groundwater recharge).
3. "Giant kidneys" which function as a natural hydro-geo-biological water treatment system[1].
4. Preservation of species diversity.
5. Preservation of rare and endangered species.
6. Sport and commercial renewable resource harvesting via hunting, fishing, trapping, and lumbering.
7. General, non-consumptive recreational experiences such as boating, swimming, hiking, camping, bird watching, nature studies.
8. Enhanced aquaculture production.
9. Outdoor laboratory for study of fundamental interrelationships of physical and biotic components of an ecosystem.
10. An accessible wilderness experience with aesthetic and scenic vistas.
11. Estuarine nursery areas (in low salinity marsh-shallow water areas).

[1]Wharton 1970

While productivity varies with location and type of habitat, wetlands are among the most productive of the world's environments (Wharton 1970). Productivitiy measurements for a swamp comprised of water tupelo (Nyssa aquatica), red maple, ash, black willow, cypress and buttonbush, in the Blind River area indicated a standing biomass of 36.2 kg/m^2 (Conner et al. 1980). A baldcypress swamp in the LaBranche area of St. Charles Parish had a standing biomass of 27.8/kg dry wt/m^2 (Conner et al. 1980). On the average, studies indicate that the total net primary productivity of a bottomland hardwood forest in this region ranges from a minimum of 1574 g dry wt/m^2/yr to a total of 1933 g dry wt/m^2/yr (Conner and Day 1976). Comparison of productivity figures indicates that the southeastern swamps with flowing water regimes have the highest forest productivity (Conner and Day 1976).

Fresh marshes (dominated by bulltongue [Sagittaria lancifolia]) in the Pontchartrain Basin had an average total biomass of 889 g dry wt/m^2 (Conner et al. 1980). Brackish marshes dominated by wiregrass (Spartina patens) had an average total biomass which ranged from 657 g dry wt/m^2 to 3410 g dry wt/m^2 (Conner et al. 1980).

When evaluating the relevance or significance of productivity figures, it is important to realize that green plants are "the ultimate source of all animal food" (van Beek et al. 1982). Secondary productivity, such as fish, shellfish, and crabs in water bodies depends on green plant productivity within and adjacent to the water bodies. For this reason, high productivity of fish and shellfish areas near tidal wetlands and in riverine systems is directly related to the primary productivity levels of green plants within the wetlands and water bodies. The destruction of wetlands, therefore, will decrease primary productivity, which will in turn reduce secondary productivity which translates into a reduction in harvestable renewable resources such as fish, shrimp, crabs, and shellfish.

Possible Solutions

The two major threats to vegetation in the proposed Pontchartrain-Maurepas SA are destruction of vegetation by development activities and spacial displacement of vegetation communities because of changes in the hydrologic and salinity regimes.

There are several measures which must be taken if the vegetation within the proposed Pontchartrain-Maurepas SA is to be preserved and enhanced. First, there must be a clear delineation between those areas which are to be altered for developmental purposes and those areas which are to be conserved for recreational uses, aesthetic purposes, fish and wildlife habitat, and a renewable resource base. Second, these conservation areas must be extensively and intensively managed to enhance their productivity and to buffer them from negative impacts of human activities in and adjacent to these developed areas. Such areas must be managed in order to allow them to continue to function as wildlife habitat, nursery areas, a timber resource, a pollution buffer zone for the lakes, a storm buffer for the uplands and fastlands, an aquaculture site, a recreation area, a floodplain reservoir, and a source of numerous other renewable resources. In order to do this, there must be a coordinated effort among the private interests, and local and state agencies to devise a comprehensive, though somewhat flexible, management plan with clearly defined polices, goals, and objectives. The local parish and state coastal zone programs provide an initial basis for such a comprehensive management plan.

Hurricane protection levees have historically served as major boundaries between developable and renewable resource base areas. Areas, even wetlands, enclosed by levees are more likely to be developed than those which are outside the protection levees and subject to storm surges. Therefore, new protection levees should enclose the minimum area possible.

Some examples of measures that are set forth in local and state coastal zone programs and that can be taken to achieve goals and objectives for wetland conservation yet allow adequate development in suitable areas are:

1. Prevent leveeing and draining of wetlands for development (confine development to uplands and existing fastlands).

2. Curtail, as much as possible, new canal dredging by encouraging directional drilling and board road construction. Plug or construct water management control structures in abandoned canals.

3. Stabilize eroding shorelines in an environmentally sound manner such as with vegetation plantings or flow-through structures (matting materials).

4. Rehabilitate deteriorating wetlands through wetland management programs.

5. Prevent deposition of spoil banks which would disrupt natural drainage, impound water, and destroy wetlands.

6. Encourage wise (i.e. sustained yield) renewable resource harvesting and maintenance of wetlands.

7. Implement public acquisition of particularly valuable wetland areas for conservation, wildlife habitat, and public access.

8. Minimize new pipeline and power transmission corridors.

9. Improve water quality (including lowering man-generated turbidity).

10. Improve public awareness of coastal ecosystem functions and value in order to enhance proper land utilization.

11. Increase freshwater, nutrient, and sediment input to basin wetlands (i.e., sustained freshwater diversion).

12. Prevent saltwater intrusion and its negative environmental impacts on freshwater systems (through freshwater diversion; wetland management; moratorium on open, i.e. unplugged or uncontrolled, canals).

Summary and Possible Solutions

The vast majority of the changes in vegetation distribution on both the uplands and wetlands are directly or indirectly related to human activity. The direct causes include lumbering and tree farming; land clearing for agriculture and development; land filling; and dredge and spoil deposition operations relating to oil and gas activities, marina and harbor development, and water-based recreational community development. This latter action has also indirectly altered habitat distribution in the vicinity of the activity within the wetland areas by altering the hydrologic and salinity regimes. At present the wetland plant communities in the region are trying to readjust their spatial distribution according to new hydrologic and salinity parameters. However, given the present circumstances of increasing salinity, subsidence, shoreline erosion, lack of sediment, nutrient and freshwater input, and continued development, there can only be continued deterioration and loss of wetland vegetation communities.

Loss of wetland habitats diminishes to the point of extinction the ability of the Pontchartrain-Maurepas region to support a renewable resource base which includes timber, furbearers, crabs, shrimp, fish, alligators, waterfowl and numerous non-game wildlife and fisheries species. By failing to maintain and effectively utilize wetlands to provide storm buffer zones and waste water treatment areas, lakeside communities will be forced to either cease utilizing the lakes and rivers for recreational purposes, such as swimming and fishing, or to expend enormous sums of money to improve water quality and maintain storm levees and pumping stations.

Strict adherance to the guidelines for granting permits and attaching conditions as contained in the Exerpts (Office of Coastal Zone Management and Louisiana Coastal Resources Program 1980) and implementation of the parishes' goals, objectives, and policies for the environmental management units within the proposed special area would alleviate many of the causes for habitat degradation and loss. Specific recommendations regarding proposed activities can only be devised when the activity is scrutinized with regard to project need, environmental impact, project alternatives, and mitigation possibilities. These decisions should be made in consultation with environmental experts, project proponents, state and local officials, and citizens.

More specific solutions regarding the best ways to alleviate the major problem confronting vegetation within the proposed Special Area can be categorized according to the type of vegetation community impacted:

Bottomland Hardwoods

Bottomland hardwoods are a unique and valuable habitat in the region because of their diminishing area and their function as a wildlife habitat and renewable resource base. For this reason, those bottomland hardwoods lying below 5 ft in elevation in the coastal zone should not be destroyed to make room for other habitat types such as agriculture and development. They should be managed for renewable resource production, such as timber and furbearers, recreation, and green-tree floodwater reservoirs.

Any temporary destruction of vegetation, such as for oil and gas exploration or production or for lumbering should be monitored so as to prevent unnecessary soil erosion and pollutant discharge in the area's water suply. Pollutants associated with oil and gas activities should be contained to prevent destruction of vegetation around the well site. Alterations to the site of activity which would impact surface hydrology and stress or destroy adjacent vegetation should also be prevented.

Swamps

Swamps are well adapted to long-term hydroperiods and freshwater. To insure their survival, the natural hydrologic conditions must be maintained. Soil water salinities must not go above 2 ppt and fluctuating, rather than permanently high, standing water levels, must be sustained.

Cross-drainage impediments, such as on-grade roads, levees, and spoil banks, without adequate hydraulic crossings must be prohibited in order to prevent permanent impounding of water on the upflow side and the eventual destruction of the vegetation. Sediment deposition which covers the roots and portions of the trunks of wetland trees must also be prevented to avoid wetland vegetation destruction.

Lumbering of swamps must be done in an environmentally sound manner with the surface topography being returned to its pre-lumbering condition. Logging canals, especially those connected with water bodies subject to saltwater intrusion, should be permanently plugged if not refilled. This action also prevents rapid drainage of the swamp and eventual displacement of swamp vegetation because of lowered water level conditions. Spoil banks along abandoned logging canals, abandoned roads and railroads, or other ebankments should also be graded to prevent water impoundment and to encourage pre-lumbering overland flow. These same actions should be taken in swamps were mineral exploration and production is occurring.

Water from rivers and uplands should be encouraged to flow slowly through the swamps to the lakes and rivers rather than rapidly short-circuited out of the wetlands via drainage (or so-called flood protection) canals. Overland surface drainage increases wetland plant productivity and provides time for harmful substances, if present, to be removed from the water before it reaches aquatic habitats where it could degrade water quality. Sediment and nutrients retained in the wetlands can aid the wetlands in maintaining their surface elevation through enhancement of vegetation growth and peat production while preventing the overloading or eutrophication of the aquatic systems.

Fresh Marshes

Fresh marshes, once established, can withstand very long-term, standing water conditions. However, if vegetation is destroyed, the marsh can be recolonized by emergent plants only if the substrate is exposed to air during the period of seed germination. Furthermore, optimum salinity ranges for fresh marshes are 0 to 2 ppt, but generally less than 0.5 ppt (van Beek et al. 1982, Cowardin et al. 1979).

Under these circumstances, fresh marshes in the Pontchartrain Basin can be maintained only if salinities are kept below 2 ppt and water levels can be lowered to promote seed germination or root attachment in areas where marshes have been destroyed by natural or man-made causes.

To accomplish this, freshwater must be encouraged to remain on the wetlands to buffer any intruding saltwater and to flush out salts that reach the area during storms. Canals, therefore, which facilitate saltwater intrusion or the rapid drainage of the freshwater head from the system must be prohibited; however, if canals must be built, they should be isolated from the freshwater wetlands by continuous and permanently maintained spoil banks. Where possible, these banks should be oriented with the drainage pattern to prevent overly deep impoundments. Otherwise, a wetland management plan must be implemented to provide for wetland drainage, revegetation and reflooding as needed. Temporary canals in fresh marshes, once unneeded for their original purpose, should be permanently blocked at their junction with other water bodies and their spoil banks should be graded to marsh level. This is especially important to prevent the scouring and washing away of the highly organic, unconsolidated substrate that is often exposed when vegetation is temporarily destroyed. Because freshwater marshes are disappearing so rapidly in coastal Louisiana, every concerted effort should be undertaken to actively manage them. They should be managed in such a manner as to preserve their existence and maximize their productivity in order to compensate for their scarcity.

The previous discussion of the necessity of freshwater flow through swamps is also applicable to freshwater marshes. Sediment and nutrient impact is essential in aiding marsh plants to sustain their substrate level in a subsiding, deltaic environment.

<u>Intermediate Marshes</u>

Intermediate marshes with an optimum salinity range of 2 to 5 ppt can withstand temporary intrusions of higher salinity waters better than freshwater marshes. However, they also depend on a freshwater flow to buffer the higher salinities and prevent build up of salts in their soils. For these reasons, the solutions regarding preservation of fresh marshes are applicable here.

Brackish Marshes

Brackish marshes, with a variable optimum salinity range of 5 to 10 ppt for low salinity brackish and 10 to 15 ppt for high salinity brackish marshes, are subject to daily tidal inundation (van Beek et al. 1982). They can tolerate a wide range of salinities but will convert to a saline marsh community if the optimum salinity range exceeds 15 ppt.

To maintain brackish marshes, canals connecting high salinity water bodies to the lower salinity marshes should be permanently plugged to prevent saltwater intrusion, or water control structures should be installed on the canals to regulate the water and salinity regimes. Spoil banks along the canals should be graded to marsh level where there is a possibility of water impoundment because of blocked surface drainage or they should be incorporated into an actively monitored, long-term, wetland management program.

If brackish marshes are being managed for fur production, trapping must be extensive enough to prevent eatouts. Where eatouts or other types of marsh destruction occur, immediate attempts should be made to revegetate the area or prevent the removal of the substrate by tidal scour or wave energy until natural revegetation occurs. This may mean temporary blockage of tidal channels into the area and drawdown of water levels to enhance revegetation.

While burning is often used to encourage production of vegetation preferred by furbearers and waterfowl, it should be done only in connection with an active wetland management program. Indiscriminate burning may have detrimental effects on the marsh, especially with regard to retarding the elevation of the marsh substrate via organic material accumulation to compensate for subsidence. There should be more research into the long-term effects of burning.

In view of the extensive canal and pipeline network already in place in coastal Louisiana, serious consideration should be given to banning all future canal construction. New exploration and production for oil and gas should be done from existing canals using directional drilling technology or overland board roads where possible. New development sites which require dredging of canals or draining or filling of wetlands without adequate mitigation measures should be discouraged or prohibited. If a parish feels such an activity is essential to economnic growth, the project should be viewed in terms of immediate and long-term, cumulative impacts in the parish wetlands and the entire Special Area. The project should be permitted only if it fits into a comprehensive land use plan and the damage is mitigated by a substantial contribution to enhancement of other wetland areas in the Special Area. Developments should not be permitted to adversely affect unique or valuable habitats, habitats for endangered species, important wildlife or fishery breeding areas, wildlife management areas or sanctuaries, or areas utilized by migratory species such as birds and waterfowl.

Submerged Aquatics

Submerged aquatics in the Pontchartrain-Maurepas Basin generally occupy areas with lower salinities, lower turbidities and lower wave energy regimes. The presence of submerged aquatics under such conditions provides both food and protection for aquatic organisms, especially those in the early stage of development (i.e. postlarval forms). Because of this valuable function, submerged aquatic beds should be protected from destruction due to removal or smothering by canal dredging and spoil deposition. Water quality must be maintained so that harmful toxins and excessive temperature ranges, associated with thermal discharges, do not destroy the plants. Excessive nutrient inputs which accelerate the eutrophication process and restrict light penetration to the submerged aquatics must also be prevented by strict adherence to water quality standards.

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CHAPTER 5: FISH AND WILDLIFE IN THE PROPOSED PONTCHARTRAIN-MAUREPAS SPECIAL AREA

Abstract

The coastal zone within the Pontchartrain-Maurepas Basin includes over one million acres with an abundant, diverse, and important fish, waterfowl, and wildlife resource base. Habitat varies from upland type on the north shore to a strictly freshwater swamp environment west of Lake Maurepas to an increasingly estuarine tidal system of brackish marshes on the eastern end of Lake Pontchartrain. The fish and wildlife resources are presently being stressed and impacted by wetland loss due to subsidence, erosion, dredge and fill, and drainage. Grassbeds are being reduced. Possible solutions to restoring, enhancing, or rehabilitating these losses include freshwater diversion from the Mississippi River, public acquisition of critical areas, development controls, and enforcement of water quality standards.

Introduction

The proposed Pontchartrain-Maurepas Special Area (SA) is that portion of the larger Pontchartrain Basin that lies within the Louisiana coastal zone. The special area encompasses over one million acres with an abundant, diverse, and impressive fish and wildlife resource base. Upland habitat exists in the form of over 80,000 ac of mixed pine hardwood forest within the prairie terraces of the Florida parishes and as remnant stands of natural levee hardwood forest along the Mississippi River. Agricultural and pasture lands are heavily interspersed in both these upland regions. However, between the Mississippi River on the west and south, and the upland terrace formation to the north lies an extensive system of low-lying wetlands and large water bodies which serves as a large catchment for all the waters that are routed through the Pontchartrain drainage basin into Lakes Maurepas and Pontchartrain and finally through tidal passes into Lake Borgne and Mississippi Sound.

The waters of the system flow along an elevational and salinity gradient which generally runs west to east. Water salinities increase from a strictly freshwater environment west of Lake Maurepas to increasingly estuarine tidal conditions in Lake Pontchartrain. Whereas tidal influence is slight to nonexistent in the wetlands to the west of Lake Maurepas, tidal energy within the Rigolets and Chef Menteur Pass on the east shore is substantial. These environmental gradients produce a variety of wetland and aquatic habitats with important fish and wildlife resources. Surrounding Lake Maurepas and along the western shore of Lake Pontchartrain a vast expanse of baldcypress-tupelogum swamp of almost 260 sq mi forms the predominant habitat. Other forested wetlands, including bottomland hardwood forest, form the lower flank of the Mississippi River natural levee but have diminished substantially (28%) in the last 30 years. Eastward of the Bonnet Carre spillway on the south shore and Mandeville on the north shore of Lake Pontchartrain, marsh environments with salinity regimes ranging from fresh to brackish are the principal wildlife habitats. The waters of Lake Maurepas, Lake Pontchartrain, and inflowing vicinity streams support a varied fish and shellfish resource including resident freshwater forms, estuarine dependent seasonal species, and a few strictly marine seasonal transients. Several species are of sport and commercial interest.

This chapter provides an overview of important fish and wildlife resources within the proposed SA. It will point out some of the more unique and valuable resources, discuss the pertinent problems related to fish and wildlife resources in the area at present, attempt to bring out future projected problems, and suggest some possible mitigation measures.

Fish and Wildlife Resources

Wildlife

Baldcypress swamps, which are extensive in the proposed SA, provide important nesting, brood rearing, and wintering habitat for the Wood Duck (Aix sponsa), a resident species that is dependent on tree cavities for nest sites (Bellrose 1976; Sincock et al. 1964). Wood Duck populations are increased in fall and winter months with the arrival of migrants from nesting areas in midwestern and northeastern states. A variety of other waterfowl, particularly Mallards (Anas platyrhynchos), also utilize swamp forest as wintering areas. As overflow bottomland hardwood areas continue to diminish in areal extent in Louisiana (U.S. Fish and Wildlife Service [USFWS] 1979), swamp forest will likely increase in importance to these waterfowl species. The USFWS has mapped important biological resources such as waterfowl concentration areas, wading bird rookeries, and seabird nesting sites within the Mississippi Deltaic Plain (Garofalo 1982). The large area of baldcypress swamp south of Lake Maurepas and extending to the swamps northwest of Lake Pontchartrain has been mapped as an important waterfowl concentration area (Plate 7) and has been identified as one of 10 key waterfowl wetland units in Louisiana in the Category 9 (Central Gulf Coast) system of the USFWS earmarked for preservation and protection (USFWS 1982). On the average over 60,000 dabbling ducks winter here annually USFWS (1982).

Other avian species utilizing swamp forests to a large degree include wading birds such as herons, egrets, and ibises which feed largely on small fish and crustacean populations in shallow water areas. Great Egrets (Casmerodius albus) and Great Blue Herons (Ardea herodias) commonly nest in swamp forests, and the White Ibis (Eudocimus albus) is known to nest in substantial numbers in some years in the baldcypress swamps of Tangipahoa Parish (Lowery 1974a; Portnoy 1977). Several wading bird rookeries of these species have been identified within the swamp forests adjacent to Lake Maurepas within the proposed SA (Plate 7) totalling several thousand birds (Portnoy 1977).

The Bald Eagle (Haliaeetus leucocephalus) is an endangered species in Louisiana and finds suitable nest sites within baldcypress swamps. Important nest site requirements usually include tall, mature trees for nest construction, an unobstructed view for perching, and nearby large, open water bodies for fishing (Dugoni 1980). Three active nest sites of the Bald Eagle have been identified within the swamps adjacent to Lakes Maurepas and Pontchartrain (Plate 7).

In addition to these unique wildlife resources, the baldcypress swamps also provide important sport hunting for game mammals, including white-tailed deer (Odocoileus virginianus), swamp rabbit (Sylvilagus aquaticus), gray squirrel (Sciurus carolinensis), and fox squirrel (Sciurus niger). Important furbearers utilized in the commercial fur industry include nutria (Myocastor coypus), raccoon (Procyon lotor), and mink (Mustela vison). During the early part of this century, mink were particularly abundant and heavily trapped in the cut-over swamps around Lake Maurepas (Palmisano 1971), but populations have since declined considerably.

Natural levee forests along the Mississippi River have been almost totally cleared and converted to agricultural, residential, and industrial land-use practices. They no longer constitute a major component of wildlife habitat within the proposed SA. A relatively small band of bottomland hardwood forest exists along the lower flank of the Mississippi River natural levee, although the extent of this habitat has been drastically reduced in Louisiana within the last 20 years (USFWS 1979). Bottomland hardwoods are some of the most highly productive wildlife habitats in the state (Yancey 1970). Carrying capacities are generally high for game mammals, such as white-tailed deer, gray squirrel, fox squirrel, and swamp rabbit. These seasonally inundated forested areas also provide feeding, nesting, and brood rearing habitat for Wood Ducks and wintering habitat for migratory waterfowl. The woodcock (Philohela minor) is a popular gamebird which also finds suitable wintering habitat in these moist woodlands where brushy undercover is available.

Marsh environments are important wildlife habitat within the proposed SA and include those along the north shore of Lake Pontchartrain, the marshes upriver from New Orleans in St. Charles Parish, the marsh along Pass Manchac between Lake Maurepas and Lake Pontchartrain, and those on the south shore east of New Orleans. The marsh habitats vary from fresh-to-intermediate to brackish by salinity regime and vegetation type (Chabreck and Linscombe 1978).

Fresh marshes usually occur at slightly lower elevations and are subject to more frequent flooding than adjacent swamp forests. Water salinities in the fresh marsh vegetative type have been reported to range up to 6 parts per thousand (ppt) (Chabreck 1972), but typically average less than 2 ppt (Palmisano and Chabreck 1972). Fresh marsh habitat displays high plant species diversity. Chabreck (1972) reported 93 species occupying the fresh marshes across coastal Louisiana. The high diversity and low salinity range make fresh marsh habitat valuable for wildlife. In some years the coastal marshes of Louisiana may winter up to 4,000,000 ducks and 500,000 geese (Sanderson 1976; Bellrose 1976), which can account for more than two-thirds of the migratory waterfowl population in the Mississippi Flyway.

The value of fresh marshes in southeastern Louisiana is exemplified by the fact that about 65% of the puddle ducks recorded here in some years utilize this vegetative type (Palmisano 1973). Important environmental factors influencing waterfowl usage of winter habitat include water depth, food availability, distribution of aquatic habitat, climatic conditions, and soil and water salinity (Chabreck et al. 1974; Chabreck 1979). Tradition can also be important because areas presently in use are generally those that have been used in the past. However, continued use during the winter is dependent upon habitat quality and particular preferences of individual species (Chabreck 1979). The several species of waterfowl that annually winter in Louisiana have varying food preferences, water depth requirements, and pond size needs. The fresh marsh type appears to meet the various requirements to the greatest extent.

Fresh marshes are also important for commercial furbearers. Although catch records are not always completely indicative of population levels due to variations in trapping techniques and intensity of effort, fresh marsh evidently produces the highest mean and maximum harvests of nutria and mink, as well as the greatest maximum catches of raccoon (Palmisano 1973). The nutria is the most important furbearer in Louisiana in terms of number of animals harvested and total monetary value to the trapper, having overtaken the muskrat in this regard in the early 1960s (Lowery 1974b).

Since the 1960s, alligator (Alligator mississippiensis) populations have increased continually through protection, research, and management efforts of the Louisiana Department of Wildlife and Fisheries (LDWF) (O'Neil and Linscombe 1977). A legal harvest season now takes place each fall throughout coastal Louisiana. The estimated population by 1977 was about 92,000 in the subdelta marshes, with fresh marsh holding 41.4% of the alligators present (McNease and Joanen 1978). The substantial nutria populations in fresh marsh are an important food source for alligators (McNease and Joanen 1977) and contribute to the value of this vegetative type as alligator habitat.

Fresh marshes also serve as valuable feeding and nesting areas for wading birds. Species most commonly present include the Snowy Egret (Egretta thula), Great Egret (Casmerodius albus), Cattle Egret (Bubulcus ibis), Little Blue Heron (Florida cerulea), and Yellow-crowned Night Heron (Nyctanassa violacea) (Portnoy 1977). Most wading bird nest sites in fresh marsh habitats are associated with adjacent shrub or swamp forest outliers that project into the marsh proper.

Marshes of intermediate salinity represent an ecotone or transition zone between the fresh and nonfresh marshes and usually make up only a small percentage of the total acreage of marsh. The relatively low salinity range (2 to 5 ppt) and high plant diversity contribute to its value as wildlife habitat. Per acre, intermediate marsh receives high utilization by waterfowl in southeastern Louisiana and also produces substantial yields of nutria and mink (Palmisano 1973). In addition, intermediate marsh supports substantial alligator populations in southeastern Louisiana (McNease and Joanen 1978).

Seaward of intermediate marsh, higher water salinities and increased tidal energy lead to establishment of brackish marsh. This marsh type has a wide range of salinities, with Chabreck (1972) reporting a range for Hydrologic Units I and II of about 5 to 15 ppt. Brackish marshes historically have been the major producer of muskrat (O'Neil 1949), which constituted the strength of the trapping industry in coastal Louisiana for many years until the nutria took its place in the 1960s (Lowery 1974b). Brackish marshes, particularly three-cornered grass (Scirpus olneyi) marsh, produce the maximum yields of muskrat. Brackish marshes within the lower half of the salinity range (5 to 10 ppt) in southeastern Louisiana support alligator populations at densities only slightly lower than fresh marshes (McNease and Joanen 1978). Alligator populations are normally sparse in waters of moderate to high salinities, and nesting is seldom observed in high salinity, brackish marsh (McNease and Joanen 1978). Evidently, prolonged exposure of newly hatched alligators to salinity levels above 10 ppt can be lethal, although salinity tolerance tends to increase with age (Joanen and McNease 1972).

Waterfowl usage of brackish marshes is not as great as fresh or intermediate types on a unit basis but is still important because of the large expanse of the brackish type present in southeast Louisiana subdelta marshes (Palmisano 1973). The brackish vegetative type has the greatest density of ponds and lakes (Chabreck 1972), increasing its attractiveness to ducks. Widgeongrass (Ruppia maritima) is an important waterfowl food within the brackish marsh and is most prolific in conditions of low turbidity and stabilized water levels in shallow, brackish-water ponds (Chabreck and Condrey 1979). It also occurs in the extensive grassbeds along the north shore of Lake Pontchartrain. These grassbeds, along with the adjacent intermediate-to-brackish marshes, have been identified as an important waterfowl concentration area (Garofalo 1982). The intermediate-to-brackish marshes of St. Charles Parish within the proposed SA have also been mapped as an important waterfowl wintering area (Plate 7). This area is included in the Category 9 (Central Gulf Coast) status as a key wetland unit needing protection and preservation in the acquisition program of the USFWS focusing on important waterfowl habitats (USFWS 1982). The area annually winters an average of 36,000 ducks (USFWS 1982).

Wading birds and seabirds do not nest as abundantly in brackish marshes, although several species do commonly nest on spoil ridges (Portnoy 1977). Within the proposed

SA, no wading bird nests or seabird nests were found in any of the marsh environments. All rookeries were restricted to the forested wetlands (Portnoy 1977; Garofalo 1982).

In addition to the waterfowl resources already mentioned, Lake Pontchartrain is an important wintering area for Lesser Scaup (Aythya affinis), the most abundant diving duck in Louisiana. Of the Lesser Scaups found wintering in the United States, almost 60% (870,000) occur in the Mississippi Flyway (Bellrose 1976). Of these, over 90% occur in Louisiana, concentrating in Lake Pontchartrain and Lake Borgne as well as off the coast in Gulf waters (Bellrose 1976). Scaups feed primarily on animal matter and are attracted to the abundant snail and clam populations in Lake Pontchartrain. Important species associated with various wetland habitats in the SA are listed in Table 5-1.

Fisheries

The water bodies of Lakes Pontchartrain and Maurepas predominate an estuarine system that makes up about 46% of the total proposed SA. The aquatic resources of the area are diverse and substantial and support both sport and commercial fisheries and the clamshell dredge industry.

The most recent analysis of the Lake Pontchartrain fish community found a total of 85 species inhabiting the lake either as permanent or seasonal residents (Thompson and Verret 1980). The bay anchovy (Anchoa mitchilli) was the most abundant species taken during this study. Atlantic croaker (Micropogonias undulatus), menhaden (Brevoortia patronus), tidewater silverside (Menidia beryllinas), Gulf pipefish (Syngnathus scovelli), and sea catfish (Arius felis) were other abundant species taken (Thompson and Verret 1980). The 10 most abundant species comprised about 90% of the fish population. The fish community is transient in nature and is dominated by temporary species that move into the lake for one to several months and then emigrate from the lake (Thompson and Verret 1980). Some species can be found in the lake during the entire year but normally part of their population is entering or leaving the lake. These species, which include bay anchovy, Atlantic croaker, and menhaden, are called long-term, periodic, or semi-resident species (Thompson and Verret 1980; Suttkus 1954, 1956) and dominate the lake fish fauna.

Table 5-1. Typical Wetland Habitats and Important Floral and Faunal Species Within the Pontchartrain-Maurepas SA.

Habitat	Flora	Fauna
Bottomland Hardwoods	Hackberry, Green Ash, Red Maple, Boxelder, Water Oak, Sweetgum Overcup Oak, Nuttall Oak, Cottonwood, Sycamore	White-tailed deer, Grey Squirrel, Fox Squirrel, Swamp Rabbit, Raccoon, Mink, Migratory Waterfowl (Dabbling Ducks)
Swamp	Baldcypress, Water Tupelo Swamp Blackgum, Swamp Maple	White-tailed Deer, Nutria, Great Blue Heron, Little Blue Heron, White Ibis, Cattle Egret, Migratory Waterfowl (Dabbling Ducks), Wood Ducks, Raccoon, Swamp Rabbit, Prothonotary Warbler, Alligator, Bald Eagle
Fresh Marsh	Sawgrass, Bulltongue, Maidencane, Cattail Spikerush	Nutria, Mink, Alligator, River Otter, Little Blue Heron, Migratory Waterfowl (Dabbling Ducks)
Intermediate Marsh	Wiregrass, Bulltongue, Three-cornered grass, Flatsedge	Alligator, Nutria, River Otter, Muskrat, Migratory Waterfowl (Dabbling Ducks)
Brackish Marsh	Wiregrass, Three-cornered grass, Leafy Three Square, Saltgrass, Blackrush	Muskrat, Migratory waterfowl (Dabbling Ducks)
Open Water (Lake Pontchartrain)	Widgeongrass, Wild celery	Migratory Waterfowl Brown Shrimp, White Shrimp, Blue Crab, Rangia Clam, Menhaden, Bay Anchovy, Atlantic Croaker, Spotted Seatrout (Speckled Trout), Red Drum (Redfish), Blue Catfish, Tidewater Silverside, Gulf Pipefish, Sheepshead Minnow, Spot, Sea Catfish

Lake Pontchartrain and its surrounding grassbeds and wetlands serves as an important nursery ground for many estuarine-dependent species. In the study by Thompson and Verret (1980) 47 species of fishes (many of commercial significance) were found in Lake Pontchartrain as young or immature stages. In addition, 36 species of young or immature fishes were taken in the surrounding marshes. Nine species of marine fish were found in the lake only as young or small juveniles on a transient basis. This recruitment of young into the lake results in changes in distribution and abundance of the fish community. Abundant species showing this pattern include bay anchovy, Atlantic croaker, menhaden, spot (Leiostomus xanthurus), sea catfish, mullet (Mugil cephalus), sand seatrout (Cynoscion arenarius), and spotted seatrout (Cynoscion nebulosus) (Thompson and Verret 1980). Spotted seatrout (or speckled trout) were found to move into the lake as young between June and September and were found exclusively in grassbeds along the lake shoreline. They tend to use these grassbeds throughout summer and fall and then move into the more open lake body (Thompson and Verret 1980).

That portion of the fish community endemic to freshwater environments also showed seasonal change in Lake Pontchartrain. The blue catfish (Ictalurus furcatus) provides an important commercial fishery in Lake Maurepas and surrounding freshwaters and extends its range seasonally into Lake Pontchartrain. Blue catfish are most abundant in Lake Pontchartrain during the colder, less saline periods and then move back into Lake Maurepas and tributary rivers when salinities and temperatures increase in late spring and summer (Thompson and Verret 1980).

Invertebrate shellfish species also utilize the Lake Pontchartrain estuarine system and provide important sport and commercial fisheries. Both brown shrimp (Penaeus aztecus) and white shrimp (Penaeus seitiferus) were taken at trawl and seine stations by Thompson and Verret (1980) but in relatively low numbers. Spawning of these crustaceans takes place offshore in Gulf waters and postlarval forms enter the estuary through the tidal passes. Adult brown shrimp were taken between May and August and adult white shrimp between July and September (Thompson and Verret 1980). Blue crabs (Callinectes sapidus) form the most important commercial fishery in the lake; they are present in the lake year-round but are most abundant in summer and early fall. Subsequent to mating in the lake, females migrate to higher saline waters. Young, immature crabs begin migrating into the lake and estuary the following spring. The grassbeds are evidently important nursery areas for both shrimp and crabs.

Food habit analyses have been performed on Lake Pontchartrain fishes by Darnell (1961) and more recently by Levine (1980). Lake Pontchartrain is an open system and food habits are generally broad based and somewhat opportunistic in nature. Darnell (1961) made the following points: (1) Phytoplankton and vascular plant material was utilized directly by few species. (2) Organic detritus was used to some extent by almost all consumer groups and was used more consistently than any other food category. (3) Zooplankton is ingested by immature stages of consumers. (4) Small and large bottom animals and fishes were taken in large quantity by a variety of species. Many consumers fed from several different categories during any given period of time. (5) No sharp dividing lines existed between consumers of different categories. Darnell (1961) noted that abundant fish and invertebrate species tended to fall into one of two groups: one fed largely on organic detritus and included such species as rangia clam (Rangia cuneata), striped mullet, menhaden, and white shrimp; the second included species that were very omnivorous with a wide range of food tolerance. Representatives of this group include sea catfish, bay anchovy, spot, Atlantic croaker, and blue crab.

Although Levine (1980) agreed generally with Darnell's assessment, he did not think organic detritus was as important in the food web. Two prey-predator pathways that were much broader than Darnell's and not mutually exclusive were described by Levine (1980). The first is based on six major benthic and infaunal taxa: polychaete worms; mollusks; the xanthid crab, Rhithropanopeus harrisii; chironomid larvae; amphipods; and the isopod, Cyathura polita. Each was fed upon by at least 10 fish species (Levine 1980). The second pathway is based on taxa associated with the water column: mysids, copepods, decapods, and fishes. Levine (1980) shows a higher dependence on mollusks.

Crabs, shrimp, and catfish are the dominant species making up Lake Pontchartrain's commercial fishery. In most years the blue crab fishery is the largest in Lake Pontchartrain in both poundage and monetary value, with an annual average catch of over 800,000 pounds worth about $130,000 per year (Thompson and Stone 1980). The Lake Pontchartrain shrimp fishery utilizes both white and brown shrimp. Between 1965 and 1975 the average shrimp catch was 129,000 pounds and averaged $45,500 in worth. These figures for both crabs and shrimp are definitely underestimates of the actual harvest and monetary worth, because a substantial local fishery, both commercial and recreational in nature, exists around Lake Pontchartrain. Thousands of individuals fish part-time for shrimp and crabs and much of this catch is sold locally, and such catch data never reach landing statistics.

Important commercial fish species include blue catfish, red drum, and spotted seatrout. The catfish harvest is predominant in Lake Maurepas and the western shore of Lake Pontchartrain, while the eastern section of Lake Pontchartrain consists mostly of spotted seatrout, red drum, and, to an extent, alligator gar (Lepisosteus spatula). Total fish catch from 1963 to 1975 averaged 86,447 pounds worth on the average $18,821 (Thompson and Stone 1980). In 11 of 13 years, catfish were the dominant species in the fish harvest of Lakes Maurepas and Pontchartrain.

The benthic community of Lake Pontchartrain is an important component in the aquatic system forming an important part of the overall food web complex. The shell of one species, rangia clam (Rangia cuneata), is commercially harvested by hydraulic dredge for a variety of on-land uses as well as in-water uses such as oyster reef creation and maintenance.

A macrobenthic survey of the lake revealed a list of 24 species or groups identified from 104 samples collected at 85 stations throughout Lake Pontchartrain (Bahr et al. 1980). The mean number of organisms per sample was 3116 per sq mi. Eight species comprised 97% of the samples. The general conclusion from the survey was that the majority of the lake bottom was relatively sparse in terms of species richness and density of organisms (Bahr et al. 1980). It became apparent that the edge of the lake supported a much denser benthic fauna than the interior. One of the more striking features of the survey showed that a distinctive size difference exists between rangia clams in the open lake and those at the edge (between .25 and 1 km from shore). Where shell dredging is prohibited, shallow areas were dominated by large rangia (30 mm and above), but clams larger than 10 mm were rare at the 85 open lake stations. The distribution of rangia is shown in the atlas.

The generally poor condition of the benthic community was believed to represent a historic decline (Bahr et al. 1980). Statistical analyses of the macrofaunal distribution in relation to various factors including dredging intensity, time of collection, conductivity, organic carbon, and sediment distribution showed different species sensitive to different parameters. However, when taken together, the distribution was best accounted for by intensity of dredging.

The effects of hydraulic dredging include the production of fluid mud and lowered sediment bulk densities. This in turn creates a situation in which sediments can be more easily resuspended by wind and wave action. It is likely that this phenomenon has played a role in the increased turbidity levels in Lake Pontchartrain and the resulting reduction in grass beds. The resuspended sediments also are more likely to contain particular contaminants whose impact on the biological system is not yet well understood (Sikora et al. 1981). Primary production in the water column is reduced and a benthic community of low biomass and diversity is maintained. Therefore, less food is provided for benthic-feeding fish and crabs (Sikora et al. 1981). DNR is preparing to contract for another study of the shell dredging activities in the lakes which hopefully will settle the impact issues.

Present and Projected Problems

The abundant fish and wildlife resources of the proposed Lake Pontchartrain SA are presently being stressed and impacted by both natural and man-induced causes. Below is a discussion of the primary problems now facing these resources with projections made where feasible.

Wetland Transition and Loss

Between 1956 and 1978 fresh marsh habitat was reduced from nearly 65,000 ac to 43,400 ac, a reduction of 33%. Some of this change is actual marsh loss--that is, transition of marsh to open water—while part of the change is transition of fresh marsh to intermediate and brackish marshes due to increases in salinity regimes. Total acreage of marsh of all types was reduced by about 17,000 ac between 1956 and 1978. Although difficult to detect on a lakewide basis, a slowly increasing salinity regime is causing transitions of wetlands and, in some cases, marsh breakup. Fresh marsh is valuable habitat for waterfowl and furbearers, and its loss is a major problem. In addition to saltwater intrusion, a great deal of marsh has been impounded and drained for urban expansion, particularly along the south shore in the New Orleans region, but recently also along the north shore. The north shore marshes appear on aerial photography to be experiencing substantial transition to open water. Although the causes are unclear, natural subsidence of the marsh substrate in this region may be exacerbating the salinity intrusion problem, resulting in transition to open water.

In addition to being important wildlife habitats, marshes also are important nursery grounds for a variety of estuarine-dependent fish of which some are important commercially. Marsh also supplies the Lake Pontchartrain system with detrital input. Detritus forms an important part of the aquatic food chain for various consumer species. Although the fish population of Lake Pontchartrain is believed to still be moderately healthy (Thompson and Verret 1980), modeling of the system's energy pathways indicates that fish populations may have declined by as much as 49% since the turn of the century because of loss of marsh wetlands (Stone and Deegan 1980). The projected continuing loss of wetlands surrounding Lake Pontchartrain will have serious results. Fish and wildlife populations will be drastically reduced if marsh losses are not slowed.

The baldcypress-tupelogum swamps bordering Lake Maurepas are being stressed by salinity intrusion and have shown transition in some areas to marsh habitats (Wicker et al. 1981).

The construction of the Mississippi River Gulf Outlet has evidently increased peak salinities in the Pass Manchac area such that those swamps are being stressed and are dying. Salinity-stressed areas are also showing up within the forested wetlands just south of Lake Maurepas (van Beek et al. 1982). Between 1956 and 1978, about 21,000 ac of swamp in the proposed SA have been lost to primarily salinity intrusion and urban development. In this same time period, bottomland hardwoods have been reduced by 28%, mostly because of encroachment of the natural levee of the Mississippi River by industrial expansion, agriculture, and urban developments. These forested wetlands are important wintering areas for waterfowl, support viable populations of game mammals such as white-tailed deer, provide nesting sites for the federally endangered Bald Eagle, and are important colonial nesting habitats for various wading birds. Continuing loss of these wetlands will greatly reduce the abundance and diversity of wildlife resources in the region.

Possible Solutions

1. Provide for freshwater diversion from the Mississippi River into the Pontchartrain-Maurepas Basin.
2. Establish growth lines to protect wetlands from encroachment of development.
3. Acquire critical areas for public ownership.

Loss of Grassbeds

Since 1954, the grassbeds of Lake Pontchartrain, composed primarily of widgeongrass (Rappia mantima) and wild celery (Vallisneria americana), have evidently been reduced in extent by approximately 25%. This reduction is especially evident along the south shore of the lake in the New Orleans area. Although it is unclear why there has been a grassbed decline, a variety of reasons have been offered. The turbidity of the lake waters has increased 62% since 1953 (Stone 1980). Other salient factors include urban expansion, modification of the lake shoreline, marsh impoundment and drainage, and slight salinity increases. An increase of pollutants in Lake Pontchartrain waters, particularly the presence of chlorinated hydrocarbons, could also produce toxic effects. Shell dredging has also been identified as an important factor in increased turbidities, grassbed reduction, resuspension of contaminated sediments, and lowered benthic production (Sikora et al. 1981).

The grassbeds, an important component of the region's ecosystem, are quality habitat for some waterfowl species and spawning sites for a variety of fishes. Perhaps the major importance lies in their function as quality nursery grounds for young, immature forms of several estuarine-dependent fish. Several species migrate into the lake as postlarvae in spring and summer and seek these grassbeds for protective shelter and food, particularly Speckled trout, which tend to use grassbeds exclusively until the adult stage is reached. It has been estimated through ecosystem modeling that grassbeds account for about 26% of the fish production, but their value as nursery areas far exceeds this (Stone and Deegan 1980). Like all other plant material in the lake, grassbeds contribute to detritus production, which can be an important link in the feeding web of both sport and commercial fisheries. The continuing reduction in extent of these submerged aquatic beds will further decrease fish production and will likely decrease survival of estuarine dependent species using these areas as nursery grounds. The result will likely be negative impacts on sport and commercial fishing in the lake.

Possible Solutions

1. Provide for freshwater diversion from the Mississippi River into the Pontchartrain-Maurepas Basin.

2. Strictly enforce water quality standards and control activities through and around the grassbeds.

Population Growth and Urban Expansion

The population of the New Orleans region and the Pontchartrain Basin in general is expected to increase by several hundred thousand in the next few decades. Accompanying this growth will be an increased need to provide suitable land for urban and industrial expansion and commerce. As a result, greater pressure to drain and develop wetlands, which are so important to fish and wildlife resources, will likely be exerted in the future. Between 1956 and 1978, acreage of residential/industrial land expanded from 63,646 ac to 123,898 ac within the proposed Lake Pontchartrain SA, an increase of 94%. Such expansion in the future will not only reduce habitat acreage for fish and wildlife but also increase potential for pollution of remaining wetlands and basin waters from urban runoff, industrial effluents, storm water discharge in forced drainage areas, and a general increase in nutrient loading of basin waters. While fish and wildlife habitat will possibly decline in quantity and quality from these increased stresses, the demand for sport hunting and sport and commercial fishing will continue to increase with the expanding population base. Based on projections by USFWS (1980), demands for all types of sport hunting will surpass supply in terms of potential man-days provided by 1990 within this portion of Louisiana. The same is true for saltwater finfishing, sport shrimping, sport crabbing, and sport crawfishing (USFWS 1980). The expected result is that quality of sport fishing and sport hunting will continue to decline with a reduced fish and wildlife resource base and increasing hunting and fishing pressures.

Possible Solutions

1. Establish growth lines to protect wetlands from encroachment of development.
2. Acquire critical areas for public ownership.
3. Strictly enforce water quality standards.

Summary and Possible Solutions

Although fish and wildlife resources within the proposed SA are subject to various present and projected problem issues, proper management of the Pontchartrain Basin can at least partially alleviate some of these deteriorating environmental conditions. The following are a few possible measures that can be taken to protect and preserve the resource base.

__Freshwater Diversion__

Several reports have cited the positive benefits of freshwater diversion in southeastern Louisiana (USFWS 1980; van Beek et al. 1982; Wicker et al. 1981; Roberts et al. 1983). Salinity intrusion is evidently playing a major role in the transition of wetland habitats surrounding the Pontchartrain-Maurepas Basin. Seasonal and controlled diversion of freshwater from the Mississippi River into Lake Pontchartrain could relieve salinity stresses on the baldcypress swamps in the Lake Maurepas area. An area in conjunction with the Bonnet Carre spillway has been identified as a potential site for the diversion structure (van Beek et al. 1982). Implementation of freshwater diversion at this site is expected to maintain salinities below 2 ppt at Pass Manchac, except possibly under extreme drought conditions, thereby insuring the maintenance of the baldcypress-tupelo gum swamps in the region and inhibiting further loss of swamplands to saltwater stress. The commercial fishing for catfish should be enhanced by this diversion as well as freshwater sportfishing in nearby waters. The St. Charles marshes and the swamps surrounding Lake Maurepas have been identified as important waterfowl wintering areas.

Freshwater diversion should enhance these areas as wintering grounds for migratory waterfowl. The St. Charles marshes would experience a lowered salinity regime with an increase in the intermediate and fresh marsh types. Conditions would be enhanced not only for waterfowl but also for furbearers such as nutria and raccoon and game mammals including white-tailed deer. It is also possible that ongoing deterioration of the marshes along the north shore from Green Point to Goose Point would be somewhat attenuated. An increase in the intermediate marsh type would be expected. Generally freshwater diversion will have the most direct positive effects on wildlife resources and the freshwater fishery. However, by helping to maintain health of all wetlands surrounding Lake Pontchartrain, particularly the marsh habitats, diversion may also help to maintain detrital import into the lake. This will have a beneficial effect on all fishing resources.

Wetland Protection and Preservation

Loss of wetlands in the proposed SA will potentially continue due to development needs of an expanding population and urban/residential land use. Guidelines that restrict development of wetland habitats should be established through the SA; for example, a positive step would be to simply not allow future development in unleveed, nonfastland wetlands. Alternatively, a line could be established on a map between nonwetland areas and the lakeshore which would act as a development boundary; in other words, no impoundment or drainage of wetlands would be allowed between the line and obvious aquatic habitats. In some way, these wetland areas should be given protection to insure future fish and wildlife resources.

Aquisition Programs

Both the USFWS and the LDWF are government agencies which have programs that attempt to aquire title to important wildlife habitats. These programs should be supported and emphasized within the proposed SA. The Nature Conservancy is a private, nonprofit organization which also acquires habitat for conservation and is presently interested in Louisiana.

Enforcement of Water Quality Standards

Chlorinated hydrocarbons and some heavy metals are now being found in the water column and sediments of Lake Pontchartrain. At present these toxins are generally below harmful levels, as published in the guidelines of the Environmental Protection Agency (EPA). There is potential, however, for biomagnification of some materials in the food chain to hazardous levels in fish and wildlife, particularly in predators near the apex of the food web. Strict enforcement of allowable EPA discharge levels of these materials will minimize negative impacts to fish and wildlife resources and reduce danger of human consumption of harvestable species. This is difficult at best for non-point source discharges such as pesticides.

In conjunction with this, the clamshell dredging industry needs continued regulation. The protected zone around the lake shoreline should be emphatically enforced and preserved in the future. The degree of dredging should not be based on simply the number of dredges working at any one time. Intensity of dredging should be limited by a maximum volume of discharge and concentration of effluent allowed per permit.

This upper limit should be fixed and established through research such that Lakes Pontchartrain and Maurepas would be given time for recovery. Clamshell in these lakes should be recognized as a nonrenewable resource under present conditions and managed as such.

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CHAPTER 6: DEVELOPMENT IN THE PROPOSED PONTCHARTRAIN-MAUREPAS SPECIAL AREA

Abstract

The Lake Pontchartrain Basin is one of the most rapidly developing regions in the state. Population in the basin is expected to increase significantly during the next 50 years, placing increased stress on an already overburdened estuarine system. Drainage and fill of wetlands, disposal of hazardous and solid wastes and other pollutants, resource exploitation, and commercial and recreational use all contribute to the decline of the estuarine system at the same time they conflict with each other. Mitigation programs and land use policies must be implemented to prevent further deterioration of the estuarine system. Point source and non-point sources of pollution must be controlled and further pollution prevented. Development must be better planned to reduce adverse impacts. Resource exploitation projects must be implemented so as not to degrade the environment. Existing standards and regulations must be strictly enforced.

Introduction

Definition of System

Development in the context of the Pontchartrain-Maurepas Special Area (SA) may be thought of as an organized unit made up of diverse man-made elements that are operating together toward some end—that is, a system. Simply, the development system consists of the structures of urban areas, transportation networks, utilities infrastructure, oil and gas extraction, and other such changes to the natural environment needed to serve human need for use of the land.

Odum (1977) defines an industrialized economy model that is appropriate to this discussion because it defines the three major components with which we are involved in the study area. These components—urban sector (development), agriculture sector, and life-support wilderness sector (nature)—are each present to some degree. The natural systems of the study area have been discussed previously. The development system, its relationship to other systems, and its problem areas are discussed in this chapter.

The agriculture sector is mentioned where appropriate in relation to development and and modification of the natural system.

Limits of System

There is virtually no portion of the Pontchartrain-Maurepas Basin of any significant size that has not felt the impact of development or, under present conditions, is free from further modification. While highly urbanized areas have been very obviously changed through development, subtle changes have also taken place in lands lumbered for pine or cypress resources or used for agriculture. Development, as a system, varies in intensity of use and in society's commitment to permanence of the modifications. The regional growth pressures of increasing population and industrialization have produced a system evolving from lower to higher intensity uses and from less to more commitment to permanence. Present growth trends are expected to continue so that patterns of land-use change observed in the past may be expected to reoccur in the future.

The development system is limited by broad economic forces and public policy. Economic forces control rate and time of land-use change and the character of the change. Public action controls change by expenditure of funds for flood protection and utility or transportation extension, and institution of zoning, building codes, permitting, and other such policies and programs. Public actions have an influence on location, and, to some degree, quality and quantity of change.

Relation of Development to Pontchartrain Region

The Pontchartrain-Maurepas Basin region supports greatly diversified types of development. At the one extreme is the high density urban center of New Orleans; on the other extreme are near wild swamplands affected only by past lumber activities and an occasional camp structure. In between are other highly urbanized areas; smaller towns; agriculture and forestlands; and wetlands modified by canals, oil and gas extraction, pipelines, and utility rights-of-way.

The natural physical characteristics of the region and the human ability—or lack of ability—to deal with them are major controls to development type. Various land units such as natural levees, Pleistocene Terraces, swamps, and marshes offer varied opportunities and constraints to types of development that might occur on them. One can readily see that site factors have greatly influenced the form and type of development that has occurred. Intense and high value development types, such as urban structures, only move off of the higher lands at great expense for protection against periodic threat of flood and storm.

Purpose

The purpose of this chapter is to review the history of development activities in the Pontchartrain-Maurepas Basin, to summarize present and potential future problems, and to present possible solutions for planning actions that may be implemented to resolve environmental conflicts related to land-use modification. The chapter is organized sequentially by each of the above topics.

History of Change

Original Distribution

Looking back at the first Paleo-Indian cultures in southern Louisiana, some 10,000 to 12,000 years ago, the archaeologic record shows that topography and food availability were the primary controls of population distribution. Centers of encampment and villages are found concentrated on the edges of bluffs north of Lake Pontchartrain and on the higher banks of river distributaries in the wetland areas. In both cases, banks of streams and other water bodies provided fresh water and access to a variety of food sources. Just as today, those cultures had to contend with the potential ravages of storm and flood. The only available response was settlement on high ground and evacuation under extreme conditions of hazard.

First European settlement took place in the early 1700s in New Orleans. Like the Indian population that it displaced, the early settlers were forced to deal with storm and flood on a very basic level. Settlement took place on the high grounds offered by natural levees of the Mississippi River and smaller natural banks of bayous. Some attempt at levee embankment to restrain Mississippi River floods was made. Hurricanes and other intense storms caused extensive flooding. North of Lake Pontchartrain, development took place on the higher Pleistocene Terraces where danger of flooding and hurricane storm surge were less. Low levels of technology forced populations to live within natural restraints over which they had relatively little control.

Along with the development of settlements, early European settlers also began intensive use of natural levees, swamps, and forested upland areas. Agriculture developed along the higher, well drained, and fertile natural levee banks of the Mississippi River. Even today this is considered some of the best agricultural land in the region. The vast swamp areas were used primarily for their cypress timber resource, while the uplands north of Lake Pontchartrain were a source of pine and hardwoods. Hunting, fishing, and trapping occurred throughout the region. In this early development stage vast natural wooded and wetlands supported relatively small areas of intense settlement.

Present Occurrence

Today, the Pontchartrain-Maurepas Basin may be seen as a great urbanizing necklace around an interior core of wetlands and lakes of the basin (Figure 6-1). Along this urbanizing necklace are nodes of settlement and industrial development separated by forest, agriculture, and arms of the wetlands. Over 1,737,000 people live in the parishes that make up the study area, with 82% of this population in the urban concentrations of greater New Orleans/Slidell on the east, and Baton Rouge on the west.

The nature of development along the links of the urbanizing necklace varies considerably. The Baton Rouge to New Orleans segment along the Mississippi River corridor has gradually evolved from plantation agricultural to heavy industry. The New Orleans to Slidell segment has evolved from wetland to increasingly dense suburban development. The Slidell/Hammond and Hammond/Baton Rouge segments still remain largely in forest and agriculture, with increasing occurrence of low density suburban growth making some inroads. The Hammond/LaPlace north/south axis segment is essentially a wetland corridor free of major settlement.

Development in the wetland interior of the urbanizing necklace is mostly related to recreation, natural resource extraction, utility corridors, or flood control. Recreation is a major development consideration. Access to the rivers, bayous, lakes, and wetlands is enhanced by boat landings and marinas, designated scenic streams, and

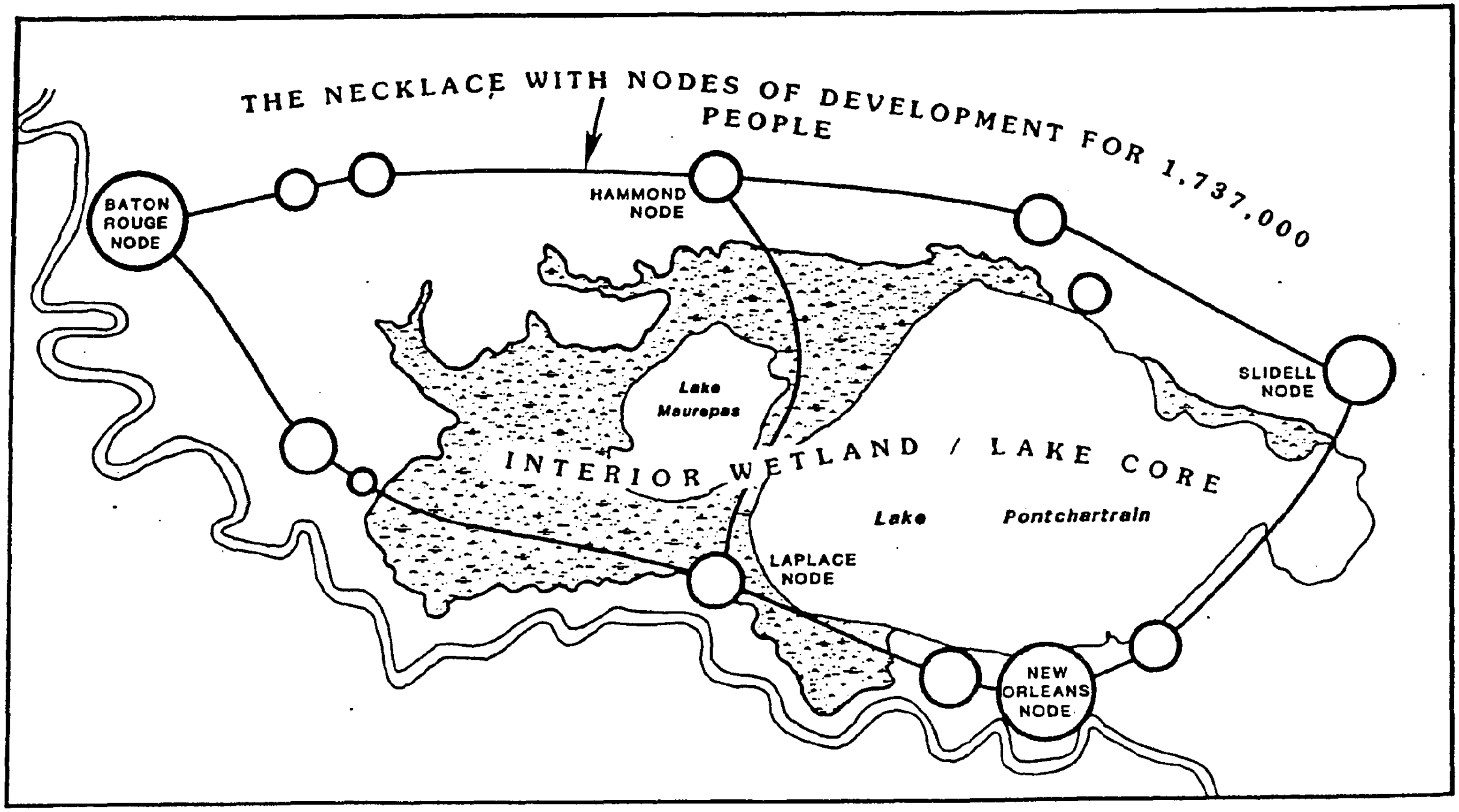

Figure 6-1. The urbanizing necklace of the Pontchartrain-Maurepas Basin.

state parks and wildlife management areas (Plate 11). Oil and gas are major resources. Besides direct extraction facilities, the area is crossed by an extensive network of pipelines and powerlines. Urbanized areas near or carved from the wetlands are low or below sea level in elevation. Levees, diversion canals, and dredged natural streams are common elements in the wetland portions of the Pontchartrain-Maurepas Basin. The Bonnet Carre Floodway, connecting the Mississippi River with Lake Pontchartrain, is the largest and most apparent manifestation of this vast flood protection and relief system.

Oil and gas activity within the Pontchartrain region is concentrated in the southwest quadrant, along the Mississippi River, and in Lake Pontchartain (Plate 8). Within this area, the activity is divided among three basic environments: 1) the relatively high Mississippi River levee, 2) the wetlands adjacent to Lake Maurepas and Lake Pontchartrain, and 3) within Lake Pontchartrain itself. In addition to this concentration of activity, there are a series of transmission lines leading northward, across Lake Pontchartrain into the uplands and out of the region. A potential exists for increased drilling into the Tuscaloosa Trend, the high pressure gas horizon that underlies part of the basin. When the price of gas increases, the demand for greater drilling in the basin will result in accelerated activity.

Reasons for Change

Population increases, industrialization, and attendant service sector activities are the driving forces behind changes in land use that have occurred in the study area.

Population of the region has increased by over 600,000 people in the last 30 years, with the majority being concentrated in the Baton Rouge-New Orleans-Slidell arc along the Mississippi River and Lake Borgne coast (Plate 6). It is within this corridor that the majority of petrochemical and other industrial development has occurred. As industry moved into the area, agriculture was displaced. New Orleans, as the major urban center, has spawned service sector activities and greatly contributed to the growth of Jefferson Parish and the Slidell urban area. Baton Rouge's industrial, governmental, and academic cluster has also spawned population growth.

The Slidell to Baton Rouge arc, less affected by industrialization, has retained reliance on forestry and agricultural business. Urban growth in the arc north of Lakes

Maurepas and Pontchartrain is not as extensive as in the southern arc. Low density suburban and planned unit development is a common land-use pattern in the corridor between I-12 and Lake Pontchartrain, particularly in the Slidell and Mandeville-Madisonville areas.

Forms and Processes within the System

The distribution of population within the Pontchartain-Maurepas Basin has been largely defined by the processes of technology of levees and drainage systems, ports, and the location of major highway systems for access (Plate 9).

Prior to the 1900s, the locations of various land uses were regulated to a great degree by natural system factors. Intense agriculture and settlement took place on the highest elevations along the Mississippi River, with both using fertile, well drained soils. Flooding and the potential for flooding (Plate 10) were periodic and hazardous in these areas but frequent and disastrous in lower-lying areas toward the swamps, marshes, and lakes of the basin. North of Lakes Pontchartrain and Maurepas, although land was safe from flooding, the economic base of forestry and agriculture on the less fertile soils was not sufficient to support major population expansion.

With the introduction of the high speed electric pump in the 1920s and subsequent expenditure of public funds on levee protection along the Mississippi River and around wetlands on the edge of Lake Pontchartrain, urbanization of formerly uninhabitable areas became possible. Flood control and drainage improvements set the die for the form of the New Orleans metropolitan area.

To a lesser degree, other areas in the Mississippi River corridor and lands north of the lakes were, likewise, influenced by potential for flooding. Major rivers were, and are, subject to seasonal flood, and hurricanes can raise the level of water in the lakes and surrounding wetlands to life-threatening levels. Urbanization and agriculture tended to take place outside of flood hazard areas which were left in wooded hardwood habitat which was harvested and hunted.

The next generation of forces to influence land-use distribution was the improvement of the transportation system. Although railroads came first, they mostly connected nodes of development in the study area and were not as important to shaping the form of land-use arrangement here as they were in other areas. The building of major highway links—Highways 190, 61, and 90 and the Pontchartrain Causeway at first, and later the east-west Interstates 10 and 12 and the northern links, I-55 and I-59—made rapid expansion possible.

The relationship between development forms and natural and cultural processes in the study area is clear. The long-term trend in the region has been for an increase of population with greater mobility and greater income (Plate 5). Mobility and income place demands on land for change from less intense to more intense types of development—from agriculture and wetland to urbanization. Form, or distribution, of urbanization has been related to availability of employment in industry and ports, resource use, or service sectors of the economy and then ability to convert wetlands to fastlands, to protect lowland areas from flooding, to make forest and agricultural land available for other uses, and to provide a manageable relationship between transportation time and cost between centers of employment and housing.

Existing Problems

Natural—Distribution and Magnitude

The purpose of this section is to provide a summary of existing problems of interest to those concerned specifically with development issues. Further discussion of a number of these topics may be found in appropriate previous chapters where the problem is examined from the natural system rather than from the development perspective.

Natural problems of the region may be defined as those problems that affect settlements or those which change the relationship between natural systems that in the long term may affect human use of resources. In other words, problems are defined in terms of man-nature relationships. In the Pontchartrain-Maurepas Basin the major naturally occurring problems that affect settlements or long-term use of land areas are:

1. Riverine and Coastal Flooding
2. Intense Storms
3. Hurricanes
4. Subsidence
5. Shoreline Erosion

Riverine and Coastal Flooding

Riverine flooding may occur through flooding of the Mississippi River or through flooding of rivers feeding into the Pontchartrain-Maurepas Basin from the north. The Mississippi River is essentially controlled by levees and, short of a major disaster, offers little problem to human use of the land at present. Of more serious concern is riverine and coastal flooding of communities that have development in floodprone areas (Plate 10). Such flooding occurs when there is a combination of elevated lake levels, an extended rainy period, and intense rainfall associated with frontal stalls. Such conditions are not infrequent. All parishes of the study area, except the study area portions of Jefferson and Orleans, are subject to riverine flooding or flooding related to coastal water levels.

Intense Storms

Orleans and Jefferson Parishes, protected by levees and dependent upon pumping systems (Plate 9) to remove all water from the drainage system, are susceptible to flooding by intense storms. Such flooding is usually localized to small portions of the urban area. Property damage and inconvenience are the normal consequence of rainfall exceeding canal or pump capacity or breakdown of the pumping system.

Hurricanes

Of serious consequence to the entire study area is the occurrence of tropical storms and hurricanes that strike the region on the average of about once in three years (USACE 1983). The unleveed wetland portions of the study area are inundated. The higher areas along the north shore of the Pontchartrain-Maurepas Basin, although not flooded, are usually battered by intense rainfall and wind. Elevated water levels extend up the rivers and bayous connected to the lakes and may cause backwater flooding in floodprone areas. Orleans and Jefferson Parishes are particularly vulnerable to hurricane threat; serious property damage and loss of life may occur. Since most of the urbanized land area of these parishes is below sea level, pump failure, breaches of levees, storm surge, and intense rainfall can be disastrous.

Subsidence

Virtually all of the land surface of the study area south of the edge of the Pleistocene Terrace and off of the natural levees of the Mississippi River is subject to subsidence (Plate 3). These vast wetland areas are composed of water-deposited silts and clays and/or organic matter formed by plants. The problem of subsidence is most severe in the parishes of Jefferson and Orleans where land has been reclaimed and urban development has taken place on land surfaces that are still in the process of sinking. Subsidence takes its toll in the form of increased costs of building and maintenance of all structures, utilities, and roads. At best, subsidence is an annoyance, and at worst, life-threatening, as when accumulated gas from broken utility connections under buildings explodes. Continued lowering of the earth surface compounds problems of drainage and flooding for the future.

Shoreline Erosion

Shoreline erosion is a natural process. It took place in the Pontchartrain-Maurepas Basin at a rate of under 2 ac per sq mi/year in the 1955-1978 period (USACE 1983). However, in some areas shoreline retreat is as high as 25 ft/year (Plate 3). The lakes, left as water area when the Mississippi River deposited the land mass of the delta in the ancient Gulf, have been enlarging in size as a result of erosion of the edge by wave action. Such erosion, although not caused by human actions, has an impact on development. Land loss takes areas out of production as wildlife habitat or forest, reduces the storm buffer zone, and directly attacks urban and recreational uses on the lake edge.

Man Caused—Distribution and Magnitude

The man-caused problems to be discussed in this report are those that deal with man in relationship to the natural or cultural environment. Problems are defined as those actions that place stress on life support systems by development, use, or destruction of resources. The problems include:

1. water pollution
2. air pollution
3. solid waste disposal

4. hazardous waste disposal
5. oil and gas extraction
6. flooding
7. loss of wetland
8. loss of prime agricultural land
9. loss of cultural resources

Water Pollution

Water, one of Louisiana's most valuable resources, seems to be in abundant supply. However, pure water for use by people and industry is not a readily available resource. The major river source, the Mississippi, is classified "water quality limited" primarily because of consistently high total and fecal coliform bacteria, and taste and odor problems (USACE 1983) before it arrives in the study area and is treated as a waste disposal line as it passes by. Communities and industries along its path use it as a source and a sewer, and discharges from river traffic affect its quality. Other rivers flowing into the study area, although not as extensively used as the Mississippi, are affected by both urban and agricultural runoff. Virtually all major streams and rivers entering and flowing through the study area have water quality problems associated with municipal discharges—oxygen demand, coliforms, and nutrients (USACE 1981b).

Existing municipal waste water treatment facilities and projections for future waste water flow were identified in the NOBRMA (New Orleans-Baton Rouge Metropolitan Area) Water Resources Study (USACE 1981b). The study area is included in this survey and pertinent data is summarized here.

There are approximately 30 municipal waste water treatment facilities in the study area with treatment ranging from collection with no treatment to advanced treatment. The metropolitan areas of Baton Rouge and New Orleans account for the largest percent of the total average daily municipal waste water flow.

Most of the treatment facilities use activated sludge and trickling filter processes and oxidation ponds. Sludge and trickling processes are more common in urban centers. Oxidation ponds are more common in built-up areas along the Mississippi and north of Lake Pontchartrain.

The present estimated municipal wastewater flow for the NOBRMA area is 294 million gallons per day. This is expected to increase to about 418 million gallons per day by 2020. Although these projections are for an area larger than the Pontchartrain-Maurepas study area, much of the flow, heated or not, eventually finds its way into the basin and could be a significant future problem. The USACE has presented management strategies and alternative plans for future treatment (USACE 1981b).

Water quality problems associated with industrial waste water discharges occur on only one stream segment of the study area. This is in the area south of Lake Maurepas in St. John the Baptist Parish and is associated with the industrialization in the Gramercy to LaPlace corridor along the Mississippi River.

Serious surface water pollution problems occur in the shallow nearshore areas of Lake Pontchartrain in Jefferson and Orleans Parishes (Plate 4). This zone of the lake is affected by urban street and storm sewer runoff, by sewage outfall, and by recreational camps (Plate 11) posing health hazard and aesthetic degradation (Mumphrey et al. 1976). LSPO estimates that over $1.8 billion is needed statewide (1983-2000) for sewage treatment and stormwater construction costs just to meet current Environmental Protection Agency (EPA) goals (LSPO 1983). Marinas and the rush to develop water-oriented recreational facilities (Plate 11) without proper water quality safeguards pose a problem.

Fresh groundwater in the study area is in increasingly short supply east of Baton Rouge and south of the parishes on the north shore of Lake Pontchartrain. In particular, the area south and east of Lake Pontchartrain experiences difficulty in obtaining sufficient quantities of fresh groundwater for public supply or industrial requirements (USACE 1981a). Although studies indicate that surface water contamination has been greater than groundwater contamination, the resource has experienced some pollution through injection of wastes—a problem that is still in the early stages of definition in the region (Governor's Task Force on Environmental Health 1984).

Air Pollution

The Mississippi River corridor between New Orleans and Baton Rouge, forming the southern edge of the study area, has developed a concentration of urban areas and petrochemical and other industries with the potential to become sources of regional air quality problems (Figure 6-2). Major sources of air pollution, such as transportation (55%), industrial processes (15%), and stationary fuel consumption (17%) (Governor's Task Force on Environmental Health 1984), are increasingly prevalent in this area. Since transportation is such a major contributor of pollutants to the lower atmosphere, any concentration of traffic associated with increased urbanization may affect the air quality of the Pontchartrain-Maurepas Basin.

Solid Waste Disposal

Disposal of nonhazardous solid waste is a problem in any urbanized area. In this region, the prime method of disposal is land fill. The lands affected by waste are frequently wetlands or land areas with drainage connections to water bodies. Leachate from solid waste disposal areas is frequently found to be toxic and a source of water pollution. Solid waste sites in the state have been identified by concentration in parishes (Figure 6-3). A review of this figure indicates that, compared to other areas of the state, the Pontchartrain-Maurepas Basin parishes, except for East Baton Rouge, only have moderate concentrations of solid waste sites. However, volume of material may be expected to be great near urbanized areas, even if number of sites is low. The LSPO estimates that over $2.3 billion is needed statewide (1983-2000) to fund solid waste disposal needs (LSPO 1983).

Hazardous Waste Disposal

Hazardous waste disposal takes place in the study area through deep well injection and through surface disposal areas and pits. Approximately 300 waste sites in Louisiana have been targeted by EPA for evaluation of potential hazards (Governor's Task Force on Environmental Health 1984). Four sites are on the Superfund list for assistance in management and clean-up. Three of these sites (Inger Oil, Cleve Reber, and American Creosote) are in parishes of the Pontchartrain-Maurepas Basin. A number of other identified hazardous waste sites, not necessarily eligible for Superfund money, are located in the study area (Figure 6-4). These sites include Combustion, Inc.; sixteen sites in East Baton Rouge Parish; two more sites besides Reber and Inger in Ascension Parish; one site besides American Creosote in St. Tammany Parish; and four of the St. Charles Parish sites.

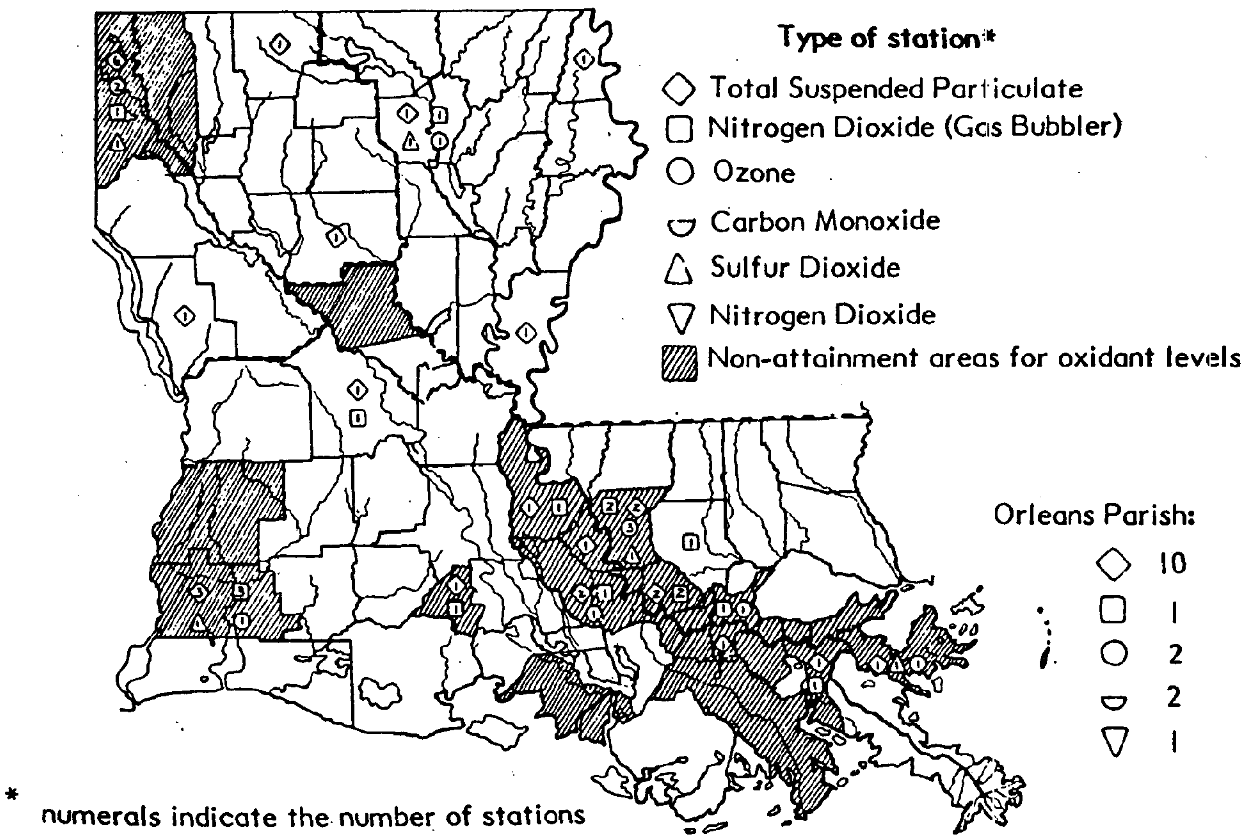

Figure 6-2. Louisiana air monitoring network. Source: Governor's Task Force on Environmental Health 1984.

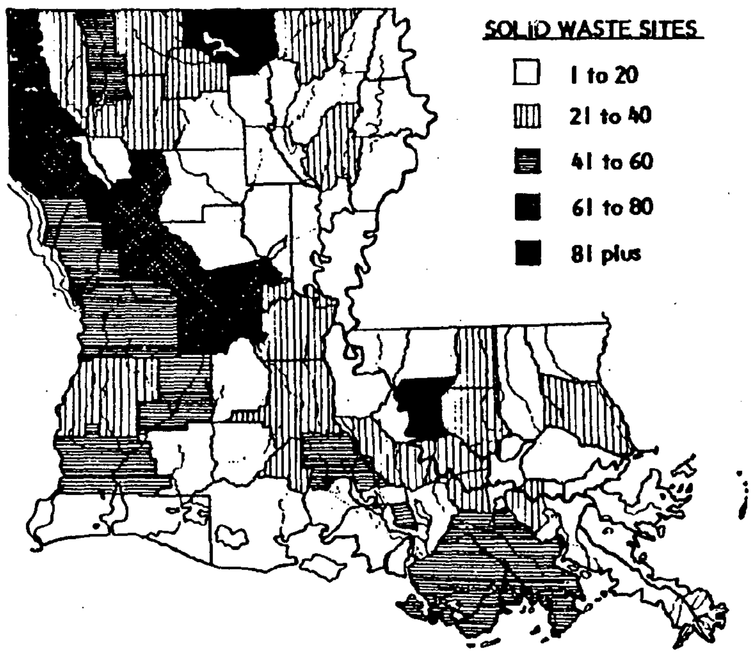

Figure 6-3. Solid waste sites in Louisiana. Source: Governor's Task Force on Environmental Health 1984.

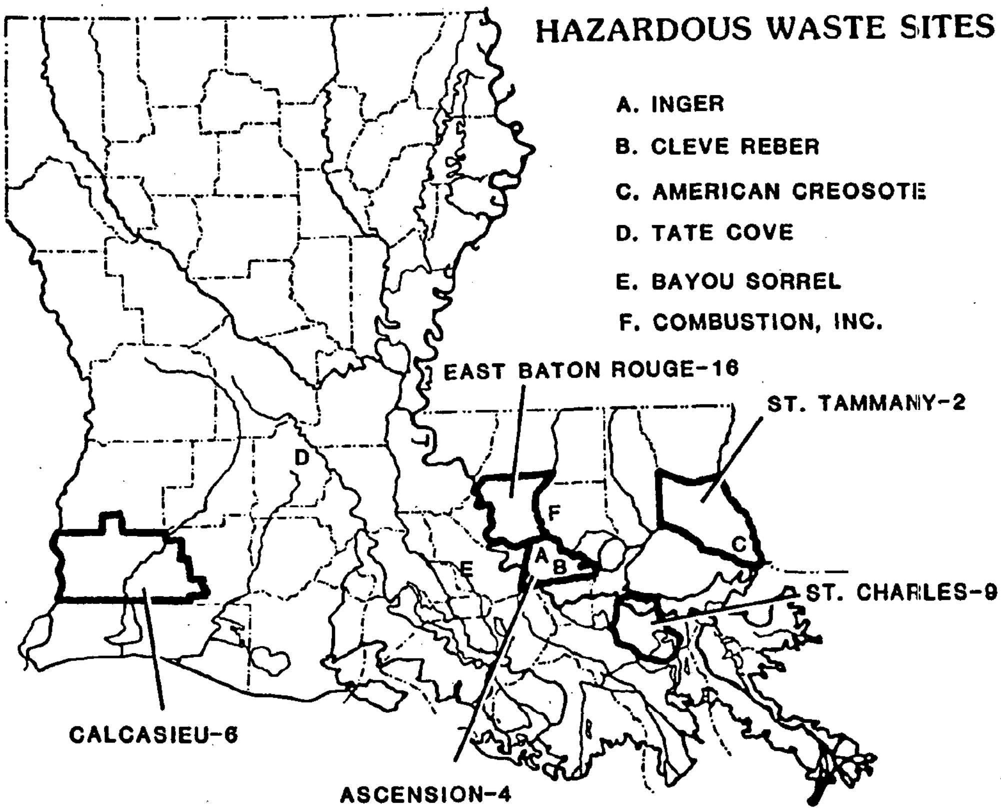

Figure 6-4. Hazardous waste sites in Louisiana Source: Governor's Task Force on Environmental Health 1984.

All solid and hazardous waste sites in the watersheds of the Pontchartrain-Maurepas Basin have the potential to create problems of water quality, land degradation, or health problems. For example, "...chemicals...at the BFI Darrow site have migrated through the landfill cap and eventually into the Amite River and Lake Maurepas. Analysis of clams from Lake Pontchartrain has indicated the presence of chemicals from this waste site" (Governor's Task Force on Environmental Health 1984, pg. 87). It is reasonable to project that waste disposal will be a problem associated with further urban and industrial development of the study area.

Oil and Gas Extraction

Nearly all oil and gas activities, whether related to the earlier phases of exploration or the later phases of production, have the potential to adversly affect all environments of the region. Access to oil and gas sites encompasses the need for roads or canals in dry land or swamp areas, and ports and sea lanes when sites are located in the lakes. Drilling can cause potential local disturbances to the environment through noise pollution, habitat change and destruction, pollution from fluid storage (drilling muds, brines, and petroleum products), from leaks and accidental spills, and an increased potential for subsidence of adjacent lands because of petroleum extraction. Furthermore, in any extraction activity there is the potential for catastrophic events such as blowouts and oil spills.

In general terms, it is the natural levee regions that provide the most compatible environment for oil and gas activities (van Beek et al. 1981). Here, relatively high and dry ground provides a natural framework for conventional practices. Access can be made through existing roads or through newly created roads with little additional cultural and environmental impacts. Pipelines can be excavated and covered quickly with only a temporary adverse impact to vegetation and animal life. Potential subsidence caused by extraction is largely unimportant because the ground level is relatively high. Finally, after the reservoir has been exploited, and the activity ceases, the environment can be restored to a resemblance of its original condition if proper techniques have been employed.

Wetlands, in contrast, can be severely affected by petroleum development (Gundlach et al. 1979). Preliminary seismic work during the early exploration phase can cause irreparable harm in the form of access canals and scars created by specialized wetland vehicles (Langley et al. 1981). These impacts take the form of direct land loss, disruption of natural vegetation, and the alteration of natural hydraulic regimes. Pipelines always require some form of dredging. The impacts can be minimized, but there always exists a potential for damage similar to the damage capability that access canals carry.

Oil and gas activity within the lakes (Plate 8) is accomplished through techniques developed and designed for use in offshore areas. For example, access is provided by boat, drilling and production is made through use of a platform, and pipelines are laid as submarine line below lake bottom. In many ways, these water borne constraints, albeit more expensive, are more environmentally sound when compared to activities that occur in the adjacent wetlands. Access damage is basically limited to any pollution which may be derived from vessel effluents. Buried pipelines provide potential for impact when installed or maintained, by involving dredge and fill operations which generate excessive turbidity. The one potential for severe impact with lake-borne activity revolves around the oil spill. If an accident were to occur, oil could be carried to any or all parts of the lake, creating an environmental disaster of major proportions.

Catastrophic oil spills are always a possibility, and if they occur, they may affect shorelines and wetlands, destroy marine life, and disrupt other activities. Analysis by La Belle (1983) for estimating the probability of an oil spill occurrence established that a "spill rate for platform spills of 1,000 barrels, or larger, is 1.0 spills per billion barrels produced; and the spill rate for platform spills of 10,000 barrels or larger, is 0.44 spills per billion barrels." Nakassis (1982) concluded that the spill rate has decreased significantly between 1964 and 1980. An oil spill in the Pontchartrain-Maurepas Basin could be disastrous no matter how small the probability. The spill could be contained and cleaned effectively along the north and south shorelines because of the relative few and small openings to the interior wetlands and the protected shoreline in front of developments. Containment and cleanup problems would be more severe along the swamp shorelines in the western part of Lake Pontchartrain and in Lake Maurepas should a spill occur there.

Flooding

Flooding, although a natural occurrence, is aggravated by human actions. Building of structures in floodprone areas makes them susceptible to flooding, and at the same time decreases the potential of the floodplain to store flood waters. Urban development on floodplains combined with upland urbanization that increases runoff quantity and rate compound the problem both locally and regionally. The actions of any one parish to improve its conditions may well increase problems for others downstream.

Flood control was examined in the NOBRMA Water Resources Study (USACE 1981b). The Pontchartrain-Maurepas Basin is a part of the Corps' larger study area. The number of acres flooded by a 100-year frequency flood for selected areas include 30,050 ac in Baton Rouge; 15,985 ac in Jefferson Parish (east bank); 750 ac in Denham Springs; 33,722 ac in New Orleans; 195 ac in St. James; 11,034 ac in Covington; 3000 ac in Slidell; 767 ac in Hammond; and 861 ac in Pontchatoula. Total average annual damages (1980 dollars) for these areas is approximately $3,218,000. Structural and nonstructural flood control measures were examined. According to guidelines and criteria used, none of the structural measures considered were economically justifiable for construction with Corps participation. Nonstructural measures of flood damage reduction were recommended.

Loss of Wetland

Wetland zones of the study area are under constant pressure for change. Major changes include drainage and flood protection for urban construction, channelization for navigation or drainage, dissection by pipelines and powerlines, embankments for roads or flood protection, impoundment, timber harvesting, and use for camps and recreation. Past urbanization has taken place at the expense of wetland loss, and the pressures for such change continue today.

Loss of Prime Agricultural Land

The natural levees of the Mississippi River have some of the best soils in the region for agriculture. Historically, these lands have been extensively farmed for a variety of crops, the most recent being use for large sugarcane plantations. With pressures on the river corridor for industrial and housing development, much of this agricultural land has been taken out of production. Prime agricultural areas are being lost to other uses.

Loss of Cultural Resources

Louisiana has a long record of settlement from prehistory to the present. Evidence of the state's cultural heritage is found in every parish of the study area and ranges from Indian middens and encampment sites to grand plantation homes and the more ordinary artifacts of the common people of the past. This heritage, with it its educational and recreational potential, has been largely unappreciated in the past and as a result much of it has been lost to posterity.

Projected Problems

Natural—Distribution and Magnitude

The previously defined natural system related problems of riverine and backwater flooding, intense storms, hurricanes, subsidence, and shoreline erosion cannot be expected to suddenly disappear. They are the result of large-scale geological and climatic forces that are largely outside of the control of human force.

Flooding is distributed in all of the low-lying wetland areas and riverine floodplains of the study area. Potential flood areas are defined on USGS and FEMA maps available to communities throughout the region. Areas that have been flooded in the past are well known to parish engineers and agencies. The magnitude of the problem is serious. Rarely a week passes without some concern for flood control expressed in public meetings or in the press.

In the future, flooding may be expected to increase in intensity, frequency, and area. The world is experiencing a period of sea-level rise. Since much of the Pontchartain-Maurepas Basin is at or near sea level, even small changes will have a great effect on inundation of land surfaces. A more immediate and serious impact is the change of drainage basin land uses from forest and wetland habitat to agriculture and urbanized uses. Such changes increase both runoff rate and volume and force natural rivers to flow at increased capacities that they cannot contain. Filling and developing floodplains themselves, which reduces their capacity to store and gradually release excess water, compounds the problem of flooding even further.

Subsidence, likewise, is a well defined problem. Areas of high subsidence soils have been mapped by the Soil Conservation Service for all parishes of the study area. The problem is concentrated in areas that were once wetland and are now developed or developing, primarily Jefferson and Orleans Parishes. Subsidence, or other poor foundation conditions, is potentially a problem wherever organic or certain clay soils occur. Regional geological subsidence is also occurring.

Problems of land loss are less well known to the general public and have less effect on human settlement, at least in the short term. Land loss in the Pontchartrain-Maurepas Basin takes place at approximately 1 to 2 ac per sq mi/year (USACE 1983). In the short term, some camps and other lake edge activity may be affected by rapid shoreline retreat. In the long term, biologically rich wetlands are converted to water and the buffer effect of wetlands on storm surge is reduced.

Man Caused—Distribution and Magnitude

Problems related to human use of the land previously mentioned—water and air pollution; solid waste and hazardous waste disposal; oil and gas extraction; flooding; and loss of wetland, prime agricultural land, and cultural resources—are largely the result of uncontrolled and unplanned industrial and urban development. These problems are distributed throughout the study area but are concentrated in localized areas north of Lake Pontchartrain and in the Mississippi River corridor between Baton Rouge and New Orleans. Collectively, their impact is great and in the future may be expected to become more serious.

Much of the study area now has access to a plentiful and pure groundwater supply shared by urban and industrial development. Surface water is also available, although not in as pure a state as the ground water supply. The use and abuse of water resources is a potentially significant future problem as recognized in the 1981 Baton Rouge-New Orleans Metropolitan Area, Water Resources Study (USACE 1981a). Water withdrawal may decrease availability and injection of wastes may make it unpotable. Future urbanization and waste disposal may further degrade surface water.

Future problems of the Pontchartrain-Maurepas Basin will revolve around the basic conflict between human use of the land and conservation of sensitive natural resources and natural areas. Population is projected to increase. Wetlands, floodplains, and other hazard-prone landscapes near present urban areas become vulnerable to pressure for development, particularly if the protection and access costs may be spread over the population as a whole. All lands available for development may become battlegrounds for conflicting types of development. Agriculture, industry, and suburban development, for example, all share the need for firm, well-drained land. Recreation may come into conflict with resource extraction industries in the wetlands or upland forest areas. Without a comprehensive approach to regional land use and resource issues, we can expect present problems to become worse. There is little chance that piecemeal planning, regulation, and permit processes as they are presently practiced will be adequate to resolve problems of the future since they have not been adequate to solve problems of the past.

Summary and Possible Solutions

The issues of development in this region are quite clear. Various land areas and landscape types have varying opportunities and constraints for different types of development. Prime agricultural lands offer the best opportunities to provide a contribution to a lasting food supply and world market for Louisiana farmers. Marginal agricultural lands of higher elevation offer good sites for industrial, urban, and suburban development. High lands in the northern part of the study area have a good supply of water and firm, well drained land suitable for urban and suburban use. They also offer forest product and recreation opportunities. Floodplains offer opportunities for excess water storage, wildlife habitat, and many forms of recreation. Wetlands play an important role in biological productivity for coastal fisheries, offer opportunities for renewable timber harvest, are extensively used for hunting and fishing for recreation, serve as buffers to storms and flood, and are only developed at great initial and long-term expense.

Two major land-use problems of the region—flooding of developed property and wetland loss to development—can be solved at minimal public expense. Urban and suburban development is only flooded if it is built in floodprone areas that are usually riverine floodplains or coastal wetlands. These areas have been specifically identified and mapped; therefore, they may be preserved in natural system habitat. The most efficient planning approach for the future is to develop policy based on recognition of natural hazards and values. The effect would be to allow areas that flood to be controlled by natural processes and absorb the region's excess water and remain as wetland or floodplain for recreational use or forest harvest. Building and development on the higher grounds will be safe and secure. Such an approach eliminates the need for flood insurance on dwellings and expensive installation and maintenance of large-scale protective systems of levees, canals, and pumps.

Problems of the region have been largely generated by human action, frequently by lack of attention to natural processes. Land, free of flooding and out of wetland zones, is available for development. However, land in flood areas and wetlands has been developed and causes personal and community expense. Problems of the region can be solved by human action. Air and water purification, solid and hazardous waste disposal, preservation of cultural and historic resources, and accommodation of growth within the framework of the basin's natural resources are achievable goals.

Possible Solutions

1. Institute a comprehensive planning approach to Pontchartrain-Maurepas Basin issues that includes a mechanism for maintenance of an up-to-date data base, development of regional guidelines and approaches to growth management, and decision-making ability.

2. Define a permanent line between urbanization and the wetlands of the interior of the Pontchartrain-Maurepas Basin. This line may define several zones based on degree of present commitment to or opportunity for urban development of former or present wetland areas. One zone could be those areas most highly protected by being in the public ownership as parks, wildlife management areas, or other designated uses. Another zone would define those areas without adequate flood protection or drainage district designation for urbanization in their present state. These would be the critical wetlands that lack protection and are under pressure for development of access and flood protection systems to benefit the forces of urbanization. Another zone would be areas that have been designated as drainage districts or are leveed and managed and designated for urbanization.

3. Develop adequate structural measures to protect present urban or suburban development within each drainage basin that is most vulnerable to flooding without encouraging further development in these areas; that is, correct problems caused by past actions but do not generate new problems in the lower portions of the basin.

4. Develop institutional controls to eliminate potential for urban or suburban development in floodprone areas and wetlands.

5. Develop institutional controls to protect prime farmland, forest habitat, and other economically productive natural resource areas to assure their continued productivity.

6. Develop planning approaches, including infill development, to accommodate urban growth on those lands most easily served by the existing or readily expanded urban infrastructure of water, sewerage, electricity, schools, and fire and police protection.

7. Strengthen public law and enforcement of air, water, and waste issues and develop mechanisms to resolve problems on at least a basinwide level of consideration.

8. Continue to enforce existing state and federal guidelines for oil, gas, and other mineral activity; have responsible parties develop spill response plans for the Pontchartrain-Maurepas Basin; and develop guidelines for activity for each management unit.

9. Concentrate attention on the potential for tourism, which makes use of the full range of the basin's cultural and natural resources as a unit. Too often these resources are seen as a historic house here, and a spot to fish there, with a local festival somewhere else. Cultural and natural resources are frequently clustered and should be emphasized as a package.

10. Institute broad reaching educational programs to influence actions of the general public and potential "users" of the land and resources of the basin.

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CHAPTER 7: ENVIRONMENTAL REGULATORY PROGRAMS APPLICABLE TO THE COASTAL ZONE, PONCHARTRAIN-MAUREPAS BASIN

Abstract

Numerous Federal and state agencies now regulate activities within the coastal zone. The Corps of Engineers and the Environmental Protection Agency in coordination with the U. S. Fish and Wildlife Service and the National Marine Fisheries Service are the principal federal environmental agencies involved in the basin. At the state level, the Coastal Management Division of the Department of Natural Resources, the Department of Wildlife and Fisheries, and the Department of Environmental Quality are the agencies which have jurisdiction over most landuse activities in the coastal zone.

Introduction

The nation's coastal zones, including the Pontchartrain-Maurepas Basin, are regulated by numerous federal, state, and local agencies and independent bodies. Thirty-eight federal programs in six departments and four agencies now affect wetlands (Zinn and Copeland 1982), and innumerable Federal water resources programs (Holmes 1972, 1979; DeWeerdt and Glick 1973; Hildreth and Johnson 1983; Rose 1983) subject the hydrologic system to modification, regulation, and use. In Louisiana, at the state level, at least 25 programs in six departments and one commission have jurisdiction over some aspect of activities or conditions within the coastal zone. In addition, four regional and/or local regulators exert some degree of control on activities at the parish or basin level. Due to the large number of agencies involved, there is an overlap of program objectives and jurisdictions, which often may result in conflicting program objectives and agencies.

The purpose of this section is to 1) identify the federal, state, and various other programs that have an important role in basin planning by virtue of their permitting or review mandates and to 2) present possible solutions for resolving the management conflict of the basin's resources. It is not intended to be either a compendium of regulations which has been accomplished elsewhere (Conner 1977; Office of Coastal Zone Management and Coastal Management Section 1980) or an evaluation of the implementation and effectiveness of programs (Houck 1983; Hall 1983; U. S. Army Corps of Engineers 1982; Wascom 1984).

Federal Programs

The federal programs regulate land use only on those reservations where they exercise ownership, such as navigation projects, wildlife refuges, and parks or on lands associated with federal projects, such as rights-of-way for flood and hurricane protection levees. However, federal programs do significantly influence the intensity and types of land use by way of the regulatory and permitting process and by coordination of planning efforts with state and local governments. Federal programs have assumed the dominant policy formulating role by setting the scope of state and local programs; providing funds to achieve the formalized objectives; and most importantly, defining and setting restrictions and prerequisites for program participation. Five Federal agencies prescribe policies and set standards which control or influence the many resource uses in the coastal zone. These are: the Office of Coastal Resource Management (OCRM); the Environmental Protection Agency (EPA); the U. S. Army Corps of Engineers (USACE); the U.S. Fish and Wildlife Service (FWS); and the National Marine Fisheries Service (NMFS) (Table 7-1). A sixth agency, the Council on Environmental Quality, indirectly affects policy through the National Environmental Policy Act and the environmental impact statement.

Office of Coastal Resource Management

The OCRM administers the provisions of the Coastal Zone Management Act (CZMA), as amended, which provides for management programs that are developed by state and local governments. OCRM, which provides support for research and planning, is not intended to function as a regulatory program for pollution control (Murley 1982). Probably the most important part of the act concerns federal consistency [CZMA, Sections 307 (c) and (d)] within the state's coastal zone; that is, federal actions "directly affecting the coastal zone must be consistent to the maximum extent practicable" with the state's approved program. Consistency includes federally supported and conducted activities, development projects, licensing and permits, and federal grants and assistance to state and local governments (Hildreth and Johnson 1983). Examples of activities or projects that are generally considered to be affecting

Table 7-1. **Selected Federal Government Programs that Affect the Pontchartrain-Maurepas Coastal Zone.**

Lead Agency	Authority	Statute	Action Required	Regulation
Office of Coastal Resource Management (OCRM)	Coastal Zone Management Act, as amended	16USC1451-1464	Develop coastal zone plan	States and parishes develop and implement, long range management plan approved by Federal government.
Environmental Protection Agency (EPA)	Clean Water Act, as amended, Section 402	33USC1251-1376	Permit	Effluent limitations of point sources of pollution.
EPA	Clean Water Act, as amended, Section 404	33USC1251-1376	Identification of Wetlands	Makes final determination on all wetland permit proposals; determines where 404 permit is applicable.
U. S. Army Corps of Engineers (USACE)	Clean Water Act, as amended, Section 404	33USC1251-1376	Permit	Applies to discharges or fill material placed in wetlands and waters of the U.S.
USACE	Rivers and Harbors Act of 1899, Section 10	33USC401-406n	Permit	Prohibits obstructing by dams, dikes, bridges navigable waters or excavating or filling in any wetlands and waters of the U.S.
U. S. Fish and Wildlife Service and National Marine Fisheries Service (USFWS-NMFS)	Fish and Wildlife Coordination Act	16USC661-668	Consultation in permit decisions	Integrates concern for fish and wildlife resources into permit process.
Council on Environmental Quality	National Environmental Policy Act	42USC4321-4347	EIS	Preparation of environmental document identifying alternatives considered and beneficial and adverse primary and secondary impacts.

the coastal zone are: development projects; activities that affect runoff quantity and quality; dredge; fill; construction or waste discharge in or into coastal waters; activities which, if conducted by the private sector, require a state or local coastal use permit or in-lieu permit; and, acquisition and disposal of Federal property in the coastal zone [for a more detailed summary: OCZM and CMS 1980 pp. 133-143]. A state can block or place conditions on federal financial assistance to state and local agencies for projects in the coastal zone. Federal agencies must take state concerns into account so that conflicts can be avoided (Houck 1983).

U. S. Army Corps of Engineers

The USACE is authorized by the Rivers and Harbors Act of 1899 to protect navigable waters from obstruction and pollution and to protect wetlands in or adjacent (bordering, contiguous or neighboring) to waters of the United States by the Federal Water Pollution Control Amendments of 1972, as amended. In the former case, the Corps may issue a Section 10 Permit for dredge and fill activities, a modification of navigable waterways or the construction of dams, dikes or bridges in a navigable waterway. Under the Federal Water Pollution Control Act Amendments of 1972 (changed to the Clean Water Act in 1977) Congress expanded wetland and water protection and placed the discharge of pollutants into waters of the United States under the control the USACE and the Environmental Protection Agency (EPA). The Corps administers a permitting program for discharge of dredged and fill material into the waters of the United States thereby including: coastal and inland waters; navigable lakes, rivers, and streams, including adjacent wetlands; tributaries to navigable waters; and interstate waters and their tributaries, including adjacent wetlands. Typical activities requiring permits are artificial canals, beach nourishment, boat ramps, bulkheads, dams, dredging, fill, jetties and groins, levees, piers, roadfill, outfall pipes, and signs (USACE 1977).

To obtain a permit, an applicant submits to the District Engineer through the Coastal Management Division Joint Public Notice System, a Corps of Engineers' application (Eng Form 4345) and appropriate drawings. Each permit application is evaluated and if the Louisiana Department of Natural Resources concurs with the consistency statement on the application and if the District Engineer concludes ". . .that the benefits of the proposed alteration outweigh the damage to the wetland resource and the proposed alteration is necessary to realize those benefits," [33 CFR 320.4(c)] a permit is issued. Should problems arise, however, the project must be altered to an acceptable degree before a permit can be granted. Every project must be evaluated on an individual basis unless it is covered by a nationwide permit (a blanket permit "issued for discharges of dredged or fill material into certain smaller or minor waters of the United States" or "for certain types of activities in all waters of the United States") (USACE 1977) or a general permit, similar to a nationwide permit but applicable to smaller, regions as specified by the District Engineer.

The USACE actively evaluates projects in the Pontchartrain-Maurepas Basin and takes action on those that affect navigation and wetlands. As part of its processing, the USACE may require some form of environmental document as prescribed by the National Environmental Policy Act (NEPA), as amended. NEPA requires that full consideration be given to a project's anticipated physical, biological, and socioeconomic impacts. Alternatives to the proposed action must be studied and evaluated to the same level as the proposed action. Mitigation measures are to be proposed and implemented to either reduce, eliminate, or compensate for adverse impacts. An environmental impact document which discloses how environmental considerations were incorporated into the planning process must be prepared. NEPA is an important part of the permitting process because agencies use the environmental impact document as one of the tools of decision making.

Environmental Protection Agency

EPA, the second federal agency which has an important regulatory role in the Pontchartrain-Maurepas Basin, works to protect wetlands from dredged and fill activities and coordinates permit (Section 404) review with the USACE. However, EPA has been given the authority to prevent issuance of a 404 permit if it determines that the fill will have an unacceptable impact on the receiving waters of the United States. A second permit that involves EPA is the National Pollutant Discharge Elimination System (NPDES) permit (Section 402 of the Federal Water Pollution Control Amendments of 1972, as amended). The NPDES permit is the primary mechanism for control of pollutants from point sources by establishing effluent limitations, by requiring the application of necessary technology, and by scheduling of compliance with water quality standards. Pollutants are dredge spoil, solid waste, improperly treated sewage, garbage, sewage sludge, chemical wastes, and biological materials discharged into waters of the U. S. A point source is any discernible, confined, and discrete conveyance including, but not limited to, any pipe, ditch, channel, conduit, well, or discrete fissure from which pollutants are or may be discharged. EPA will turn over permitting to a state, if the state requests it, and will implement the program in a way satisfactory to the federal government. However, in the event EPA deems a permit not in compliance with either the law or federal regulations, it can rescind a state decision.

EPA takes an active role on the large and potentially more controversial projects in the basin. Some of these are the Almonaster-Michoud Industrial District (A-MID) project in eastern New Orleans, the I-310 highway across the LaBranche wetlands in St. Charles Parish, the Lake Pontchartrain and Vicinity Hurricane Protection Project, and the water quality problems associated with Jefferson Parish. The Coastal Management Division reports that smaller projects do not receive a similar level of interest (Lindsey 1984); consequently, coordination with EPA has been very limited.

<u>Fish and Wildlife Service and National Marine Fisheries Service</u>

FWS and NMFS have review privilege through the Fish and Wildlife Coordination Act. Fish and wildlife resources must be given equal consideration when evaluating water resources development. A memorandum of understanding between the Secretary of the Interior and the Secretary of the Army in 1967 set procedures for coordination and consultation on projects.

If an FWS District Director advises the USACE that a project will adversely affect threatened or endangered species, the USACE will not approve a permit until the objections have been resolved. Appeals are possible up to the secretary level in Washington, D. C. (Cox 1977).

The principal concern of the National Marine Fisheries Service is protection of the marine fisheries resources and its habitat; they "do not take socioeconomic factors into account in determining the public interest..." (Dehart and Glazer 1980, p. 92).

FWS's perspective on projects emphasizes the preservation of wildlife habitat (Dedmon 1980) and threatened and endangered species. Thus the Services can conduct similar reviews and provide quite different recommendations (Dehart and Glazer 1980) because they represent varied interests.

FWS and NMFS have been active in reviewing projects and permits in the Pontchartrain-Maurepas Basin (Lindsey 1984). They provide comments and suggest mitigation measures that offset adverse impacts of the proposed projects.

State Programs

The state agencies function as coordinating agencies between local and federal agencies and among local agencies. State agencies also react to federal programs and policies and implement those requirements established by the federal government. Four departments have taken a lead role in regulating activities in the coastal zone: The Louisiana Department of Natural Resources (DNR); Louisiana Department of Environmental Quality (DEQ); Louisiana Department of Health and Human Resources (DHHR); and the Louisiana Department of Wildlife and Fisheries (LDWF) (Table 7-2).

Coastal Management Division

Probably the most active state agency affecting the wetlands of the Pontchartrain-Maurepas Basin is the Coastal Management Division (CMD) of DNR. The state's coastal zone program began in the early 1970's and was formally established with the passage of the State and Local Resources Management Act of 1978 (Act 361; LRS 213.2). The DNR manages activities below 5 ft mean sea level (msl) and not within fastlands except when the Secretary of DNR finds that the particular activity will have direct and significant impacts on coastal waters. Coastal waters are those bays, lakes, inlets, estuaries, rivers, bayous, and other bodies of water within the boundaries of the coastal zone which have a measurable seawater content (under normal weather conditions over a period of years).

Implementation is through the processing of the coastal use permit (CUP) that subjects uses of state concern and uses of local concern (LRS 213.5) to guidelines that incorporate general and specific provisions to certain types of uses. Once local plans have been approved, the parishes shall assume responsibility for all uses of local concern. Because of an interagency agreement between the USACE and the DNR,

Table 7-2. Selected State Programs that Affect the Pontchartrain-Maurepas Coastal Zone.

Lead Agency	Authority	Statute	Action Required	Regulation
Coastal Management Division, DNR (CMD)	Louisiana Coastal Resources Management Act of 1978, as amended	LRS49:213.1-.21	Coastal Use Permit	Enforces guidelines designed to reduce adverse impacts on the coastal zone.
Louisiana Department of Wildlife and Fisheries (LDWF)		LRS56:450, 541, 609(c)(1)	lease granted	Schedules dredging in dredging zones.
LDWF	Scenic Stream Act, as amended, Act 398	LRS56:1841-1849	Permit	Regulates uses and activities associated with Scenic Streams.
LDWF		LRS56:109, 651-659; 701-801	Coordination	Establishes, manages and regulates wildlife management areas, preserves, refuges, and sanctuaries.
LDWF		LRS30:1068, 1091-1096; 38:216	Permit	Controls discharges of polluting substances.
DSL, DNR	Act 645	LRS41:1131 and LRS41:1701-1714	Permit	Reclaiming land lost through erosion or the maintenance to prevent encroachment on non-eroded state land.
Department of Health and Human Resources, Office of Health Services and Environmental Quality	State Sanitary Code	LRS40:4-6	Permit	Establish and direct water quality parameters and compliance with standards and regulations.
Office of Conservation, Department of Natural Resources, CMD, OC, DSL		LRS30:151-159 171, 208, 209	Lease and Permit from Office of Conservation	Regulates exploration and production of minerals from state owned lands and waterbottoms.
Department of Culture, Recreation and Tourism (DCRT)		LRS41:1601-1613	Review procedure	Review permit application to protect and archaeological and historical remains.
Department of Environmental Quality		LRS30:1068, 1091-1096; 38:216	Water Quality Certification	Controls discharge of polluting substances.

applicants for a state coastal use permit now file a Corps of Engineers Form 4345 with the DNR rather than both agencies. Both agencies still review permits independently, decide their actions, and issue separate permits.

The CMD assumes a comprehensive review of activities within the coastal zone. General guidelines have been established for all uses and for such specific activities as levees; linear facilities; shoreline modification; surface alterations; hydrologic and sediment transport modification; alteration of waters draining into coastal waters; and oil, gas, and other mineral activities. Applicants must demonstrate that their proposed project conforms to the guidelines to the maximum extent practicable so as to reduce adverse impacts on the physical, biological, cultural, and economic systems.

To assist in achieving these goals, the DNR has a Memorandum of Understanding (MOU) with a number of other agencies who have agreed to coordinate their coastal activities to help achieve minimal adverse impacts. These agencies include: the Office of Conservation of DNR, which issues drilling permits for oil and gas activities in lieu of a CMD CUP; the Department of Environmental Quality (formerly the Office of Environmental Affairs) which will coordinate permit applications, provide appropriate comments, and coordinate permit conditions to assure consistency; the Department of Health and Human Resources, which likewise will exchange permit applications, review comments, and condition permits so as not to conflict with the terms of the coastal use permit; the Department of Culture, Recreation, and Tourism (DCRT) for protection of cultural resources and consistency with state parks and recreational facilities; the Divison of State Lands of DNR, which comments on projects that may alienate state owned properties; the Department of Agriculture for activities in the coastal zone, including misuse of pesticides, so that the programs are compatible; and the Department of Transportation and Development (DOTD), which coordinates activities in the coastal zone.

Office of Conservation

The second DNR division active in the basin is the Office of Conservation (OC). OC issues in-lieu permits for the location, drilling, exploration, and production of oil, gas, sulphur, and other minerals. Selected sections of the Louisiana Revised Statutes and statewide orders provide for the regulation of these activities. OC has agreed to issue in-lieu permits only if the proposed activity is consistent with the Coastal Use

Guidelines. OC presently regulates the oil and gas industry in the basin and works with CMD to reduce adverse impacts of some of the oil and gas activities. For example, with consultation from OC and the Louisiana Geological Survey, CMD has been able to require that wetlands be avoided when directional drilling or board roads and pads were possible (CMD 1984).

Division of State Lands

The third DNR agency in the basin is the Division of State Lands (DSL), which issues permits for: reclamation or recovery of lands lost through erosion (Class A Permit); constructing and/or maintaining bulkheads and flood protection structures (Class B Permit); construction of commercial and/or noncommercial wharves and pier (Class C Permit); construction and/or maintenance of structures other than wharves and piers (Class D Permit); and construction and/or maintenance of landfills upon noneroded state lands (Class E Permit). An applicant must coordinate activities with the Corps and their permitting process and may substitute the standard Corps forms for state forms. DSL will not issue a permit until the application has been approved by the parish governing body, the Louisiana Office of Public Works (OPW), LDWF, State Mineral Board, CMD, and other parochial or state agencies who may have jurisdiction. Permits can be denied if the activity obstructs or hinders navigable waters, imposes undue or unreasonable restraints on the state or public rights which have been vested in such areas, or the activity will result in unacceptable adverse impacts to the environment. CMD and the Division of State Lands frequently coordinate on the issue of ownership of lands.

Louisiana Department of Wildlife & Fisheries

LDWF performs several tasks. First, they review and comment on water resource development proposals by federal, state, and private interests under the Fish and Wildlife Coordination Act. The department works closely with the FWS when reviewing permit applications. Second, the department coordinates the shell dredging activities in the two lakes by granting leases and designating seasonal dredging of zones. Third, they regulate the uses and activities associated with state designated scenic streams and issue permits for allowable actions. Prohibited activities include: channelization, clearing and snagging, channel realignment, and reservoir construction. Finally, they regulate and coordinate the programs and projects of state wildlife management areas, preserves, refuges and sanctuaries. The LDWF reviews CMD permit applications and strives to coordinate activities through a memorandum of understanding.

Department of Environmental Quality

DEQ is authorized to adopt rules and regulations to protect water quality. As the cooperating state agency under the Federal Water Pollution Control Act, they issue state permits for the discharge of polluted waters. At the present time, EPA is still the controlling agency for NPDES permits. In additon, DEQ is responsible for the regulation of hazardous wastes, air quality permits, use and disposal of hazardous wastes, and solid waste disposal. DEQ has coordinated actions with CMD in two principal areas, unauthorized solid waste dumps and shell dredging (CMD 1984).

Department of Health & Human Resources

The Division of Environmental Services (DES) in the Department of Health and Human Resources issues permits for and monitors activities associated with human health. They prepare the State Sanitary Code, which among other things regulates discharges of sewage and controls the oyster and shellfishing industries. DES routinely comments on CMD permit applications (CMD 1984).

Department of Culture, Recreation and Tourism

DCRT is responsible for state parks and other cultural resources, such as archaeological or historic sites, within the coastal zone. DCRT reviews permit application and comments on the impact of the actions on the cultural systems and recreational facilities, and it routinely comments on CMD permit applications (CMD 1984).

Regional and Local Level

Regional level agencies include 1) levee boards and port commissions and at the local level, 2) drainage districts; and, 3) parish governing bodies. Several port commissions are active in the basin and coordinate port-related development activities within their boundaries. Only the Board of Commissioners of the Port of New Orleans has a MOU with the CMD to coordinate projects and assure consistency with the state's coastal zone program. Levee boards are responsible for the maintenance of the protective systems within their jurisdictions. The levee boards are subject to the approval and supervision of the Office of Public Works (OPW) and coordinate their activities closely with them. The boards normally refer technical questions to OPW for a decision.

Parishes and cities are authorized to zone, enact subdivision regulations, and adopt building codes (J.A. Kusler Associates 1976; Mumphrey et al 1976). These authorities also can construct, operate, and regulate waterworks and sewerage systems (Due, Dodson, de Gravelles, Robinson, and Caskey 1983). All of the parishes in the coastal zone of the basin except for St. John the Baptist have submitted draft coastal zone programs to the Secretary of the DNR. Each is being reviewed for state consistency and a decision will be made in the near future. Each of the parishes in the basin has been active in implementing some of the powers they possess. The degree of control they exert varies greatly from one to the other.

Finally, several drainage districts are in operation in the basin. Drainage districts exist for "the purpose of draining and reclaiming the marsh, swamp, and overflowed lands of Louisiana that must be pumped and leveed in order to be reclaimed." Cooperation on such projects is through the OPW. Drainage districts coordinate their actions with the CMD for a CUP.

Differing Resource Uses and Regulation

Physical and biological resources within the Pontchartrain-Maurepas Basin are subject to regulation by many federal, state, and local agencies. The basic resources within the basin are wetlands, wildlife and fisheries, water, soils, extractive, recreational, and cultural. Table 7-3 shows the resource and the agencies which in some way regulate them. A conflict exists among agencies because there is an overlap of jurisdictions and responsibilites for regulating the resources within the Pontchartrain-Maurepas Basin. Each agency has specified goals and objectives and as a result has occasionally disagreed with the decisions and techniques of other agencies. For example, resource conservation is an important aspect of the programs administered by the DNR, EPA, FWS, NMFS, OCRM, LDWF, DHHR, DEQ, and DCRT.

Table 7-3. Resources and Agencies Who Regulate Either Directly or Indirectly.

Agency/Resource	Wetlands	Wildlife and Fisheries	Water	Soils	Extractive	Recreational	Cultural
USACE	X	X	X	X	X	X	
EPA	X		X		X		
FWS*	X	X				X	
NMFS*	X	X					
CMD, DNR	X		X		X	X	
DSL, DNR					X		
DWLF	X	X	X			X	
DEQ	X		X				
DHHR			X				
CRT*						X	X
Ports	X						
Levee Boards	X						
Parishes	X			X			
Drainage Districts	X						

* Agencies with review and coordination authority.

EPA concentrates its efforts on protecting water quality from point sources of pollution while at the same time placing little effort on controlling non-point sources (Jaksch and Peskin 1984). The FWS protects wildlife habitats and threatened and endangered species. The NMFS is concerned with living marine resources. The OCRM funds planning programs that comply with federal and state laws. At the state level, the LDWF cooperates with FWS and NMFS to protect and enhance the living resources. The state's scenic stream systems are protected by LDWF. DHHR and DEQ concentrate on the hydrologic system, particularly sewerage discharges, point discharges, and runoff from solid waste sites. OCRT strives to protect the region's historical and archaeological sites through the review process. DNR administers the Coastal Resources Program and through State Lands and Forestry administers 3 million acres of lands and water bottoms (van Sickle 1984).

A second type of conflict may arise in exercising the program objectives of different agencies within this group. For example, the NMFS protects the living marine resource while the FWS protects wildlife and enhances wetland habitat (Dehart and Glazer 1980). Review of projects and proposals by the two agencies can result in greatly different recommendations. For example, modification of freshwater wetlands (hydrologic regime, vegetation, and salinity conditions) due to canal dredging and saltwater intrusion will be opposed by FWS because it reduces migratory bird habitat. They would normally recommend a management program to restore the area to its former status. NMFS prefers the change because it provides more nursery habitat for marine species, and, all other things being equal, NMFS would recommend that no remedial actions be taken. When such problems happen they are very difficult to resolve (Dehart and Glazer 1980); negotiation and compromise frequently result.

The USACE, EPA, DEQ, DNR, LDWF are the principal agencies which set standards, publish guidelines, and enforce regulations designed to reduce adverse impacts of projects and activities on the estuary. However, these agencies are not blindly opposed to development and economic expansion per se; their role is to be certain that adverse impacts are minimized and/or mitigated, and that everyone operates within the limits that will assure a healthy and productive wetlands and aquatic system.

Other agencies active in the basin have goals and objectives which support development of the region. Included in this category are the Office of Conservation, the levee boards, port commissions, and drainage districts. In the past, this meant unlimited and unrestricted growth with little regard for the natural systems. Attitudes are changing to some degree within these agencies because of the recently enacted laws and the permitting processes. Engineers and developers are becoming more aware of their responsibility to protect the natural systems and mitigate the adverse impacts their projects and programs may cause. Local governments fit within this category but, in general, oscillate between conservation and development.

Attempting to maintain an objective, neutral position when reviewing other projects and programs are the USACE and the CMD/DNR, Louisiana. The permitting procedure followed by the USACE on larger projects relies heavily on preparation of an environmental document as outlined by the Council on Environmental Quality in which alternatives are evaluated, primary and secondary beneficial and adverse impacts are described, and mitigation measures are prescribed. The state has promulgated its own guidelines for project review but coordinates activities with numerous Federal and state agencies through memoranda of understanding (OCZM and CMS 1980).

The DSL's concern is centered on the management of state water bottoms and lands (van Sickle 1984). This agency appears to be completely neutral on environmental issues relative to wetlands and water quality. They will not issue a permit until an application has already been approved by the governing authority of the parish in which the project will take place—the OPW, LDWF, the State Mineral Board, the CMD, and any other parochial or state agency which may have jurisdiction over such matters.

Possible Solutions

1. Coordinate and simplify the procedure for permitting activities.

2. Implement a special area management program so that those seeking permits or reviewing permit applications will be more consistent in results.

Summary and Possible Solutions

The potential multiple uses for the physical and biological resources within the Pontchartrain-Maurepas Basin often result in an overlap in jurisdictions and conflicts among agency objectives and goals. An applicant attempting to obtain a permit for a resource use is forced to deal with several agencies and spends much time and many dollars complying with the regulations. Even after completing the proper procedures, he is not certain whether he has a real chance of approval because projects are decided on a case-by-case basis. Other resource users in the basin face similar problems of not knowing what to expect.

One potential solution to these problems is the establishment of a Special Area. A special area program and methodology has been developed and tried in other parts of the country (Gray's Harbor, Washington; Coos Bay, Oregon; and Port Bienville, Mississippi). The goal of these programs was to develop comprehensive plans for specific geographical areas with the objective of avoiding future conflicts. Plans were for geographic areas small enough to manage but large enough to solve problems on a systems basis. Management units were defined, permissible and nonpermissible uses were assigned, and guidelines for implementing the decisions promulgated. The methodology encourages collaborative planning and cooperation on solutions of conflicting resource uses. A committee of federal, state, and local agency personnel and special interest groups agreed on identified issues. Balanced solutions that were consistent with all federal and state permit guidelines and regulations were derived by consensus of all parties. Caution is important because the special area process is not a cure-all. It does, however, lead to long-term predictibility for developers and other users as well as a savings in time and costs to applicants on revisions.

Special area planning can be readily adapted to the Pontchartrain-Maurepas Basin. The lessons learned by reviewing other state's programs will assist in avoiding problems which caused them delays. In Louisiana, a program can be built on the state and parish's coastal zone programs in which management units and goals and objectives have been defined. In order to protect and preserve a valuable estuarine system without excessively impeding resource development, it is important to initiate a comprehensive regional approach to conflict resolution.

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CHAPTER 8: HOW A SPECIAL AREA PLAN FOR THE LAKE PONTCHARTRAIN-MAUREPAS BASIN MIGHT BE ADOPTED AND IMPLEMENTED IN LOUISIANA

Abstract

National policy encourages the preparation of plans for special area management to protect significant natural resources, provide for reasonable coastal-dependent economic growth, improve protection of life and property in hazardous areas, and improve predictability in governmental decision making. Federal statutory authority is in place for states to adopt and implement special area plans. In accordance with the State and Local Coastal Resources Management Act of 1978, the state can establish a special area management program for areas within the coastal zone which have unique and valuable characteristics requiring special management procedures.

Introduction

Federal Guidelines

The Federal Coastal Zone Management Act of 1972, 16 U.S.C. Sec. 1451, et seq, is primarily designed to develop, on the state and local levels, planning mechanisms and administrative coordination procedures to implement criteria for decision making regarding competing uses in the coastal zone. In this Act, Congress specifically finds and declares that it is the national policy:

> "To encourage the preparation of special area management plans which provide for increased specificity in protecting significant natural resources, reasonable coastal-dependent economic growth, improved protection of life and property in hazardous areas, and improved predictability in governmental decision making." 16 U.S.C. Sec. 1452(3).

The Act goes on to define the term "special area management plan" as follows:

> "...a comprehensive plan providing for natural resource protection and reasonable coastal-dependent economic growth containing a detailed and comprehensive statement of policies; standards and criteria to guide public and private usage of lands and waters; and mechanisms for timely implementation in specific geographic areas within the coastal zone." 16 U.S.C. Sec. 1453(17).

The Federal Act also requires the state management program to contain an inventory of areas of particular concern within the coastal zone and to provide guidelines for priorities of uses. 16 U.S.C. Sec. 1454(b)(3)(5).

In addition, Federal "Resource Management Improvement Grants" are statutorily authorized for the preservation or restoration of specific areas of the state which are designated for the purpose of preserving or restoring them for conservation, recreation, ecological, or aesthetic values or which contain coastal resources of national significance. 16 U.S.C. Sec. 1455(a)(b)(1); 16 U.S.C. 1455(c)(a).

The state coastal management program is subject to continuing review and approval by the Secretary of the United States Department of Commerce.[1] For example, if the Secretary determines that the coastal state has not made satisfactory progress toward inventorying and designating areas that contain one or more coastal areas of national significance and/or has not made satisfactory progress in providing specific and enforceable standards to protect such resources, he may, thereafter, decline to make federal management program grants to the coastal state. 16 U.S.C. Sec. 1455 (i). To date only two Special Areas have been designated in Louisiana: the Louisiana Offshore Oil Port and the Marsh Island Wildlife Refuge.

State Statutory Authority

From a legal standpoint, the statutory and administrative procedures are already in place in Louisiana law for the adoption of "special area management plans."

Pursuant to the Federal Coastal Zone Management Act, the Louisiana Legislature adopted the State and Local Coastal Resources Management Act of 1978, LRS 49:213.1 et seq, which establishes the Louisiana Coastal Resources Program within the Louisiana Department of Natural Resources. LRS 49:213.6. This program is administered by the Coastal Management Division (CMD), Office of the Secretary of the Department of Natural Resources. Charged with statutory permitting authority over "any use or activity within the coastal zone which has a direct and significant

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[1]The Federal Act is administered by the Office of Ocean and Coastal Resource Management, National Oceanic and Atmospheric Administration, United States Department of Commerce.

impact on coastal waters," LRS 49:213.3(8), the CMD, in making recommendations to the Secretary regarding permit applications, examines each project for its potential for cumulative impacts and its overall social, economic, and environmental costs and benefits, as well as the project's individual merit.

The state Department of Natural Resources retains the exclusive authority to regulate "uses of state concern." "Uses of state concern" are statutorily defined as:

> "Those uses which directly and significantly affect coastal waters and which are in need of coastal management and which have impacts of greater than local significance or which significantly affect interests of regional, state, or national concern. Uses of state concern shall include, but no be limited to:
>
> a) Any dredge or fill activity which intersects with more than one water body.
> b) Projects involving use of state owned lands or water bottoms.
> c) State publicly funded projects.
> d) National interest projects.
> e) Projects occurring in more than one parish.
> f) All mineral activities, including exploration for, and production of oil, gas, and other minerals, all dredge and fill uses associated therewith, and all other associated uses.
> g) All pipelines for the gathering, transportation or transmission of oil, gas, and other minerals.
> h) Energy facility siting and development.
> i) Uses of local concern which might significantly affect interests of regional, state or national concern." LRS 49:213.5(A)

On the other hand, "uses of local concern" are statutorily defined as:

> a) Privately funded projects which are not uses of state concern.
> b) Publicly funded projects which are not uses of state concern.
> c) Maintenance of uses of local concern.
> d) Jetties or breakwaters.
> e) Dredge or fill projects not intersecting more than one water body.
> f) Bulkheads.
> g) Piers.
> h) Camps and cattlewalks.
> i) Maintenance dredging.
> j) Private water control structures of less than $15,000 in cost.
> k) Uses on cheniers, salt domes, or similar land forms. LRS 49:213.5(B).

Parishes, after having a local program approved by the state, are delegated the responsibility of managing uses of local concern, although they have no jurisdiction over uses of state concern[2]. LRS 49:213.9. Coordination and consistency with other federal and state agencies is required by the state act. LRS 49:213.1(4).

Moreover, the State Act specifically approves the establishment of a special area management program in "special areas" which are defined as "areas within the coastal zone which have unique and valuable characteristics requiring special management procedures." LRS 49:213.10. Moreover, the state Act gives the Secretary of the Department of Natural Resources the specific statutory authority to adopt, after notice and public hearing, rules for the identification, designation, and utilization of special areas and for the establishment of guidelines on priorities of uses in each area, subject to the approval of the Louisiana Coastal Advisory Council created by the 1984 Legislature.

The Administrative Rules Regarding Special Areas

In accordance with the state Act, the Department of Natural Resources has adopted, as part of the Louisiana Coastal Resources Plan (LCRP), procedural rules for the identification, designation, and utilization of special areas and for the establishment of guidelines and priorities of uses for each area. Appendix C-4 to LCRP.

The rules provide that special management areas may be nominated by any person, local governing body, or state agency. The East Jefferson Civic Council has already nominated the Pontchartrain-Basin as a special area under these administrative rules. Moreover, by Executive Order EWE-84-23, signed on August 21, 1984, Governor Edwin W. Edwards established a Lake Pontchartrain Task Force in the Office of the Secretary of the Department of Natural Resources, appointed 17 persons to serve on the Task Force, and directed the Task Force to study the feasibility of designating the Lake Pontchartrain-Lake Maurepas Basin a special management area and to advise the Secretary of its findings.

Under the law, in order to be designated as a special area, the area nominated must meet certain criteria: 1) it must be within the coastal zone; 2) it must have unique and valuable characteristics; 3) it must require special management procedures

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[2]All parishes within the Pontchartrain Basin have submitted local programs for review or approval and the approval processes are now pending. The only exception is the Parish of St. John the Baptist which has withdrawn the application for approval of its proposed local program.

different from normal coastal management procedures, and 4) it must be managed for a purpose of regional, state, or national importance. After a nomination has been reviewed by the Secretary of the Department of Natural Resources for its suitability and consistency with these criteria, the Secretary, if he finds the nomination acceptable, will prepare a proposal for a special area consisting of a delineation of the proposed area and suggested guidelines and procedures for the management of usages. The Louisiana Coastal Advisory Council, newly created by La. Act 408 of 1984, may advise the Secretary with regard to the proposed guidelines. Notice will be given and a public hearing on the proposal will be held. After the hearing, the Secretary will make a decision as to whether to adopt the special program. Should the Secretary decide to adopt the proposed special area program, the Secretary should then comply with the rule-making procedures established by LRS 49:953 of the Administrative Procedure Act before the program can become effective.

Conclusion

Although existing Louisiana statutory law is sufficient for the identification and designation of special management areas, no special area program is yet in place for the Pontchartrain-Maurepas Basin. A major purpose of a special area is to adopt specific economic, environmental, and social criteria for the consideration and determination of permit applications. These criteria should include specific methods for coordinating existing land and water uses and coastal management expertise in order to properly utilize the Lake Pontchartrain-Maurepas Basin. In such a manner, the important federally-mandated purposes of achieving increased specificity and improved predictibility in governmental decision making can be achieved.

CHAPTER 9: SUMMARY AND CONCLUSIONS

This report is a synthesis of information describing the environmental characteristics of the coastal zone of the Pontchartrain-Maurepas Basin, an area partially on the higher and older Pleistocene Terrace, but mostly on the Mississippi River deltaic plain. The coastal zone is subject to many natural and man-related uses and as a result, numerous problems have evolved and conflicts arisen. These problems are discussed in the previous sections and are summarized here.

The report was prepared to provide information for the Task Force when evaluating the potential for designating part of the Pontchartrain-Maurepas Basin as a Special Area. Because of existing Louisiana legislation, Special Areas are limited to those areas that are subject to the Department of Natural Resources Coastal Use Permits (CUP) processing. CUPs may be required for activities below the 5-ft contour, outside of fastlands, or on surrounding lands which have a direct and significant impact on coastal waters. Activities within the coastal zone or that have a direct and significant impact on coastal waters and are not exempt by the program will be affected by designation of a Special Area.

Two significant geologic issues of the study area center on common problems of the deltaic plain where: 1) soil subsidence results from drainage of swamp and marsh soils and 2) shoreline erosion rates along Lakes Maurepas and Pontchartrain typically range from 5 to 10 ft/year. Possible solutions to reduce adverse impacts of subsidence include maintaining a high water table to minimize oxidation and consolidation of soils, the imposition of a waiting period after initial drainage to allow time for subsidence to occur, and development and enforcement of strict building codes when swamp and marsh soils are drained. Erosion can be reduced by better wetland management and planning, restriction of development at the shoreline, maintenance of natural shorelines and vegetation, and selective implementation of shoreline structures (jetties, groins).

Shoreline erosion, regional subsidence, and sea-level rise are the natural causes of vegetation loss in the Pontchartrain-Maurepas Basin. Loss occurs because the vegetated substrate becomes flooded or erodes; natural vegetation loss is compounded and accelerated by man-caused processes. Industrial and residential development on the Pleistocene Terrace is systematically removing the pine forest; while at the same time, industrial and urban expansion on the natural levees are increasing pressures to encroach into the bottomland hardwoods and backswamps of the basin. Indirect effects of population growth include the desire for recreation camps, marinas, canals, and solid waste sites in association with the urban areas. Oil and gas extraction activities destroy wetlands by dredging canals, depositing spoil, and providing routes for saltwater intrusion. Transportation systems (highways, canals, airports) cause the dredge or fill of wetlands and open areas to saltwater intrusion.

Adverse impacts can be mitigated by strict enforcement of coastal use guidelines, as outlined in the state's coastal zone program. Wetland management plans need to be developed and implemented for each parish and coordinated between parishes so that specific recommendations can be made for every management unit once the priorities are delineated. It is possible to reduce the impacts of unnecessary canal dredging, spoil disposal, and saltwater intrusion by minimizing activities and isolating canals.

The fish and wildlife resources of the basin are one of the most important aspects of the estuarine system; however, both are stressed from natural and man-induced causes. The principal problem is the loss of wetland habitat from regional subsidence, urban encroachment in its many forms, saltwater intrusion, and lack of sediment input from normal river floods. Aquatic grassbeds are being reduced especially along the south shore of Lake Pontchartrain.

Possible solutions which will reduce these impacts, for example, diversion of freshwater into the basin from the Mississippi River would reduce salinity in the lake and surrounding wetlands and introduce much needed sediment into the system. Second, uncontrolled urban and associated expansion into the valuable wetlands must be restrained and plans prepared which better direct resource use. Finally, federal, state, and local agencies can acquire the important and critical habitat of the basin and actively manage it for its renewable resources.

Water quality problems in the coastal zone are the result of man-related actions. Overloaded treatment plants or septic tanks must bypass sewage and flush it, only partially treated, into the lakes and wetlands of the basin. Swimming and water-contact sports are restricted in zones along the south shore and in the rivers and bayous of the north shore. Gulf water intrusion from the Inner Harbor Navigation Canal (IHNC) pushes a wedge of saltwater into the lake and eventually into the fringing wetlands, contributing to wetland loss. When combined with infrequent and restricted flooding from the Mississippi River, the problem becomes greater. Urban runoff and other nonpoint sources contribute hydrocarbons, heavy metals, PCBs, pesticides, and other synthetic chemicals to the aquatic system. Finally, sediment is introduced to the lakes from construction sites, agricultural activities, and sand and gravel mining along rivers in the upper basin. Hydraulic dredging increases turbidity by stirring up lake bottom sediments.

Several actions can be implemented to improve the water quality of the coastal zone. Treatment plants and septic tanks can be upgraded to handle the expected load and, therefore, not bypass the process. Rerouting effluents into the Mississippi River will contribute to improving water quality in the lakes. Artifical barrier islands will promote submerged grass beds that will assist in water quality enhancement. Tertiary treatment can be accomplished through wetland surface water management and has the additional benefit of wetland restoration. Navigation structures on the IHNC will help reduce the saltwater input to the lakes. Resuspension of pollutants can be avoided by first testing areas before they are dredged and then avoiding the zones of concentration.

Conflicts exist between the many uses of the coastal zone and general development of the basin because of increasing population. Natural disasters within the coastal zone cause millions of dollars in property damage and require the dedication of millions of dollars of public funds annually. Riverine and coastal flooding from precipitation, high tides, and hurricanes are the principal causes; when combined with a subsiding topography the problem is intensified. Shoreline erosion becomes a problem when development occurs at the land-water interface. Development of the coastal zone directly contributes to stressing the surrounding physical and biological systems by degrading the air and water quality through pollutant discharge, building and not controlling solid and hazardous wates disposal sites, dredging and filling of wetlands, developmental encroachment into wetlands, conversion of prime farmlands to industrial and residential uses, and the destruction of archaeological and historical resources.

Mitigating natural hazards is accomplished through implementation of nonstructural flood damage reduction techniques, such as flood-proofing, avoidance of floodplains for development, or evacuation, but,it has been demonstrated on numerous occasions that structures (levees, dams, diversions) only encourage a false sense of security and greater losses in the long term. Building in zones of soil subsidence requires special construction practices such as piers, flexible utility systems, and control of drainage methods. Floodplains offer excellent opportunities for water storage, wildlife and fisheries habitat, and recreation. Coastal wetlands are biologically productive, used for recreation, and serve as buffers to storm-surge. Development in these areas is very expensive to maintain and therefore should be avoided. Solid and hazardous waste sites must be controlled to prevent deterioration of surrounding areas and new methods must be designed to solve the waste problem, such as recycling materials or requiring deposits on all plastic, glass, or metal containers. Finally, state, local and federal regulatory agencies must enforce guidelines and standards developed to protect the environment.

Many regulatory activities in the Pontchartrain-Maurepas Basin overlap. Federal, state, and local agencies permit projects, but the coordination and cooperation between groups is sometimes not all it should be for the long-term benefit of the state. Studies also indicate that regulatory programs may not be as effective for protecting the environment as they could be. The most significant problem in the basin is the uncertainty inherent in the permitting system when an applicant seeks compliance with generic, coast-wide regulations. This problem costs the applicant and the reviewing agency time and money because modifications and revisions which could have been avoided had more site specific guidelines been available are required.

Conflict of resource use and deterioration of the physical and biological base caused by an increasing population must be immediately addressed before the entire Pontchartrain-Maurepas estuarine system collapses. It must however be accomplished in a more innovative way than in the past. Federal agencies are limited to a case-by-case review of projects and have not undertaken the long-term planning necessary to restore and protect the basin resources. The responsibility lies with the state to initiate a comprehensive effort to act in the coastal zone rather than react to what others do. The state has the authority to prepare the program and the capacity to analyze the full scope of problems and solutions from a systems or regional prespective, should they choose to do so.

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