LOUISIANA COASTAL WETLANDS RESTORATION PLAN

ATCHAFALAYA BASIN
APPENDIX F

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LOUISIANA COASTAL WETLANDS CONSERVATION AND RESTORATION TASK FORCE

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RESTORATION PLAN

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APPENDIX F

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INTRODUCTION

STUDY AREA

The Atchafalaya Basin boundaries, as defined herein, are the Mississippi River and Tributaries (MR&T) system levees below Berwick and Calumet to the north, Bayou Shaffer southward along the bank of the Lower Atchafalaya River to its mouth then following the shoreline around the Atchafalaya Bay to Point Au Fer to the east, and a north-south line extending through Point Chevreuil to the west (Figure 1). The Atchafalaya Basin study area consists of three distinct areas, or subbasins. Subbasin 1, the Mainland Subbasin, consists of an area south of the levee system protecting the Berwick and Calumet areas, west of Bayou Shaffer, east of the East Bayou Sale levee, and north of the Atchafalaya Bay. Subbasin 2, the Bay Subbasin, consists of the Atchafalaya Bay and a portion of the Gulf of Mexico south of East Cote Blanche Bay and west of Marsh Island. Subbasin 3, the Bayou Sale Subbasin, consists of an area within the Bayou Sale levee system south of the Gulf Intracoastal Waterway (GIWW).

The majority of land within the Mainland and Bayou Sale Subbasins is privately owned. The State of Louisiana owns the land in the Atchafalaya Bay.

EXISTING PROTECTS

U.S. ARMY CORES OF ENGINEERS

In the Atchafalaya Basin, the Atchafalaya River and Bayous Chene, Boeuf, and Black navigation project, a 20 foot x 400 foot channel, extends from the Avoca Island Cutoff Channel, down the Lower Atchafalaya River to its mouth, and through the Point Au Fer shell reef near Eugene Island to the -20 foot contour in the Gulf of Mexico. The U.S. Army Corps of Engineers (USACE) performs maintenance dredging on an annual basis, dredging approximately 2,100,000 cubic yards of material from the bay channel and approximately 8,800,000 cubic yards of material from the bar channel beyond Eugene Island. USACE also infrequently dredges the navigation channel in the Lower Atchafalaya River.

USACE works with Louisiana Department of Wildlife and Fisheries (LDWF) to beneficially use dredged material to create new wetlands. Beneficial uses to date include reinforcing the upstream end of delta lobes and creating bird islands.

The USACE long-term disposal program for the Chene, Boeuf, and Black navigation project optimizes beneficial use of dredged material within authorization and regulation constraints. The program goal is to develop a more environmentally acceptable plan for disposal of dredged material at a reduced, comparable, or justifiably increased cost while ensuring a maintained navigation channel for the next 20 years. USACE solicits input from agencies such as Environmental Protection Agency (EPA), LDWF, Louisiana Department of Natural Resources (LDNR), and U.S. Fish and Wildlife Service (USFWS) as to where dredged material can be utilized beneficially.

The Mississippi River and Tributaries project, the comprehensive flood control project for the lower Mississippi Valley below Cairo, Illinois, has had a significant impact on the water and land resources in the Atchafalaya Basin. Features of the

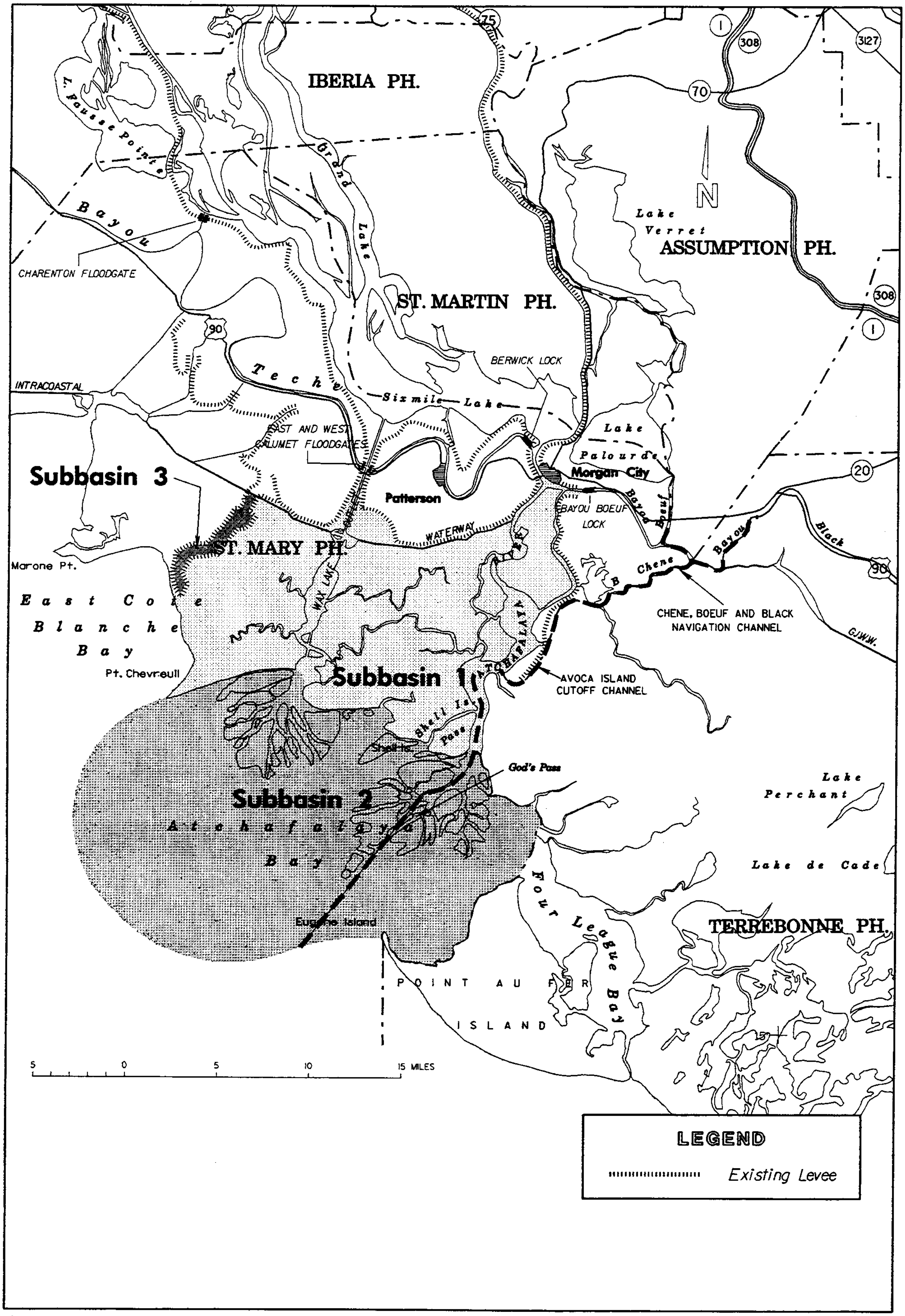

Figure 1. Atchafalaya Basin, Basin and Subbasin Boundaries.

project pertinent to the basin are:

- The Atchafalaya Basin Floodway system extends from Old River to the Atchafalaya Bay and includes the basin. The principal role of the floodway system is to safely convey one half of the project flood flow of 3,000,000 cubic feet per second to the Gulf of Mexico. The project consists of levees, floodwalls, locks, pumping stations, floodgates, flood control structures, drainage structures, and channels.
- The Old River Control project is located on the Mississippi River in Concordia Parish. When completed in 1963, the Old River Control project consisted of two control structures, a lock, and all necessary channels and closures. USACE added the Auxiliary. Control structure in 1986. In 1990, a private company completed construction of a hydroelectric powerplant adjacent to the Old River Control project under the authority of license granted by the Federal Energy Regulatory Commission.

The Old River Control project is operated to maintain the distribution of the total annual flow at the latitude of the Old River to approximately the same proportions as natural conditions existing in 1950. These conditions are 70 percent of the combined flow of the Mississippi and Red Rivers passing down the Mississippi River and 30 percent passing down the Atchafalaya River. The USACE water control plan for the Old River project includes provisions for minor deviations from the 70/30 distribution for wildlife or fisheries enhancement in the Atchafalaya Basin Floodway system.

- The Wax Lake Outlet, located in St. Mary Parish, is an artificial outlet for Atchafalaya floodwaters. When completed in 1941, the original design capacity of the Wax Lake Outlet was 20 percent of the project flood flow in the floodway, or 300,000 cubic feet per second. A weir and connecting levees were completed in 1989 to control the percent of low to normal flows in the Wax Lake Outlet to 30 percent of the floodway flow. After the 1991 high water season, USACE reduced the height of the connecting levees to accommodate local interests' concerns about increase in duration of high water in the Morgan City area.

STATE OF LOUISIANA

LDWF manages the Atchafalaya Delta Wildlife Management Area, encompassing 125,000 acres of the Atchafalaya Bay to: maximize recreational opportunity for the public; maximize short-term and long-term delta development through sediment fencing and working with the USACE on placement of dredged material; manage mineral exploration and development; and provide research support. In addition, LDWF improves wetland habitats to increase their productivity and creates sea bird nesting islands.

PROBLEM IDENTIFICATION

EXISTING CONDITIONS

GEOMORPHOLOGY AND HYDROLOGY

Previous Mississippi River delta complexes, including the Sale Cypremort and the Teche deltas, formed the land within the Mainland Subbasin. Today, the wetlands are low, with elevations of 2 to 3 feet National Geodetic Vertical Datum (NGVD). (NGVD is a reference datum of national scope for comparing land elevations.) Two channels, the Wax Lake Outlet and the Lower Atchafalaya River, convey flow and sediment through this subbasin to the Atchafalaya Bay.

The Atchafalaya Bay is the predominant feature of the Bay Subbasin. This is a very shallow bay, with an average open water depth of about 5 feet NGVD. On its western end, the bay blends into East Cote Blanche Bay via a five mile wide opening near Point Chevreuil. On the eastern end of the bay, a passage about 1.5 miles wide leads to Four League Bay. A natural shell reef barrier, Point Au Fer reef, once formed a natural barrier in the bay. Much of the reef is now absent. Two young, active deltas are forming in the Atchafalaya Bay at the mouth of the Wax Lake Outlet and the Lower Atchafalaya River.

The Bayou Sale MR&T levee system isolates the Bayou Sale Subbasin hydrologically from the rest of the Atchafalaya Basin. The levees encompass Bayou Sale and adjacent high ground. Pumps remove runoff in this subbasin from rainfall events.

The Atchafalaya Basin contains significant flow and sediment for delta and wetland growth. In the last 10 years, the Wax Lake Outlet has conveyed 38 percent of the 236,000 cubic feet per second average daily flow and the Lower Atchafalaya River 62 percent. The Wax Lake Outlet has conveyed 35 percent of the average daily suspended sediment load of 221,000 tons and the Lower Atchafalaya River 65 percent. Approximately 40 percent of the suspended sediment entering the bay deposits in the delta.

Delta growth in the Atchafalaya Basin is a recent occurrence. Prior to 1952, most sediment carried by the Lower Atchafalaya River to the Atchafalaya Bay did not deposit in the bay. Only prodelta clay deposition occurred as a result of contact with salt water. Subaqueous delta, or underwater land, began to form at the mouth of the Lower Atchafalaya River during the period 1952 to 1962 with the introduction of silts and fine sands to the bay. Before this period, these sediments were filling the lakes within the Atchafalaya Basin Floodway system to the north. Distributary and scour channels formed in the bay. By 1972, the underwater delta front advanced to the Point Au Fer shell reef. The spring flood of 1973 produced the first natural subaerial, or above water, growth of the Lower Atchafalaya River delta on both sides of the navigation channel. A smaller, subaerial delta also formed at the mouth of the Wax Lake Outlet.

Both the Lower Atchafalaya River and the Wax Lake Outlet deltas have grown since 1973 (Figure 2). About 16,000 acres of subaerial land exist in the Atchafalaya Bay.

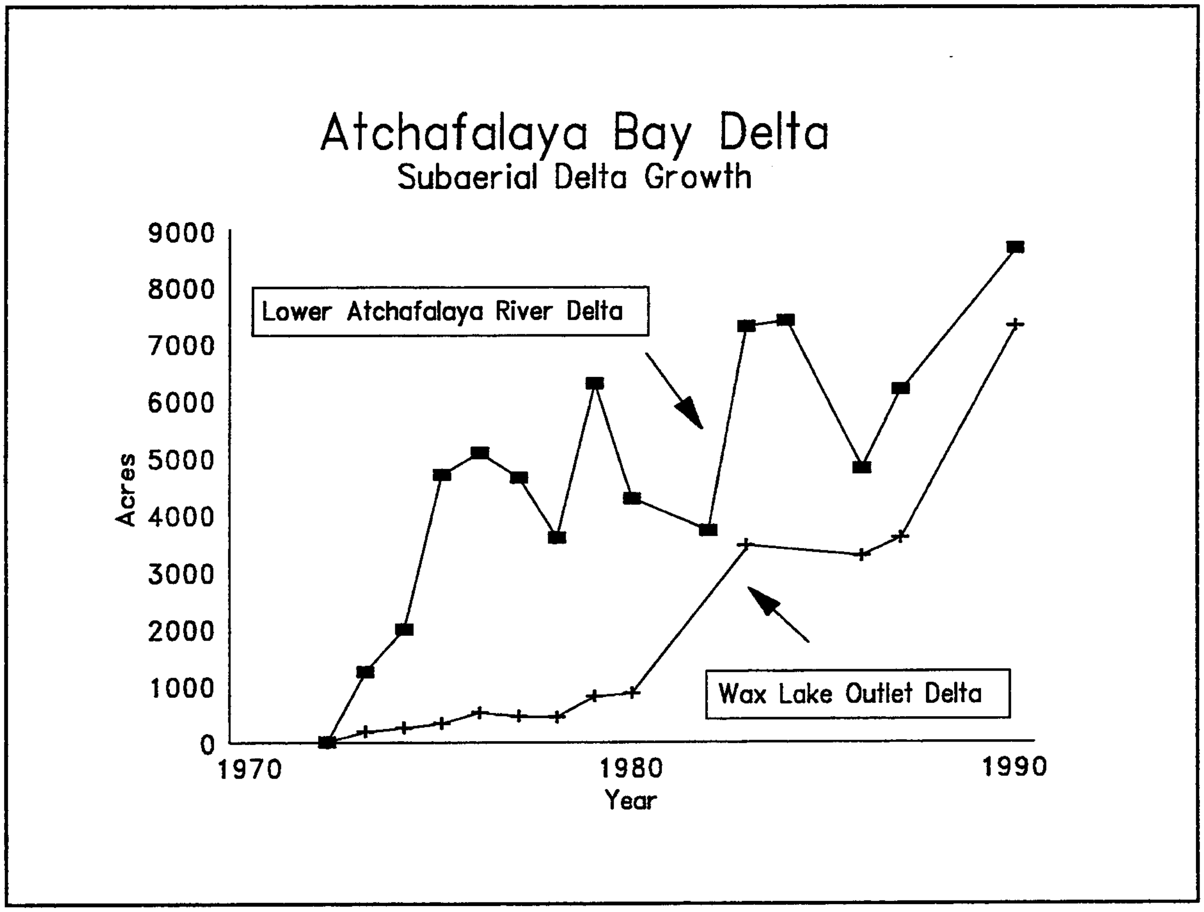

Figure 2

Relative sea level rise, the lowering of the land relative to the mean sea level, affects the Atchafalaya Basin. Relative sea level rise includes sea level rise and subsidence factors that lower the land such as basement sinking, or the sinking of the lower layers of sediment from the weight of more recent deposits, and sediment consolidation. Rates of relative sea level rise, developed for the Atchafalaya Bay by the Waterways Experiment Station (WES) for the 1980's study of the bay and Terrebonne marshes, vary from a low of 0.7 feet per century in the southwestern portion of the bay to 4.6 feet per century in the northeastern portion of the bay (Donnell et al, 1991).

The area experiences frequent storms, including three direct hits from hurricanes since 1956. Winter storm fronts are also prevalent. Typically, the fronts pass from the northwest to the southeast with winds shifting from a southwesterly direction to a northeasterly direction as the front passes. Tides two feet below normal are common after frontal passage (Van Heerden, 1980).

The Atchafalaya Bay experiences low wave and tide energy. The long east-west fetch length of Atchafalaya Bay frequently allows wind generated waves of 1 to 2 feet (Cratsley, 1975). The mean daily tidal range of 1.5 feet generates a tidal prism amounting to 25 percent of the volume of water within the bay. For a daily spring tide range of 2.7 feet, the tidal prism is 40 percent of the bay volume.

Riverine discharge and tidal patterns govern circulation patterns. During higher riverine flows, currents are generally to the south and to the west, although currents on the eastern side of the two deltas move somewhat toward the east through the delta before turning south and then west. During low river discharge and high tide, currents enter the eastern portion of the bay from the southeast. On the falling tide, currents in the eastern portion of the bay exit toward the southeast. The predominant net transport of water is to the west over the tidal cycle (Van Beek et al, 1977).

Saltwater intrusion in the basin is rare due to flow from the Lower Atchafalaya River and the Wax Lake Outlet. During the 1988 drought, a saltwater wedge in the navigation channel had little or no impact on adjacent wetlands.

VEGETATION AND SOILS

Coastal wetland types in the Atchafalaya Basin include early successional bottomland hardwood forests, cypress-tupelo swamps, and marshlands. Unlike other basins, species such as black willow and red maple form an integral part of the coastal wetlands systems in the Atchafalaya Bay and in the Mainland Subbasin. Table 1 shows the distribution of habitat types for existing conditions (1990). Plate 1 shows the distribution of vegetation types within the basin in 1988.

Table 1
Habitat Distribution in Atchafalaya Basin[1]

Category	Subbasins: Mainland (Acres)	Subbasins: Bay (Acres)	Subbasins: Bayou Sale (Acres)	Total (Acres)
Fresh Marsh	44,150	2,430	30	46,610
Early Successional BLH	0	1,310	0	1,310
Cypress Swamp	10,310	0	170	10,480
Total Wetlands	54,460	3,740	200	58,400
Bottomland Hardwood	41,160	0	620	41,780
Aquatic Vegetation[2]	4,260	4,270	10	8,540
Other Land	2,350	3,770	2,590	8,710
Water	18,610	237,710	40	256,360
Total Area	120,840	249,490	3,460	373,790

[1] USFWS GIS database, Feb 1993
[2] Includes floating and submerged beds

Early successional bottomland hardwood forests characterize recently accreted lands found along the Lower Atchafalaya River and in the delta area. Pure stands of black willow dominate the newly accreted lands with cottonwood and sycamore occurring on older sites. Other tree species typically found in association with these major species include red maple and bald cypress.

The basin contains the largest contiguous tract of fresh marsh in the state, a valuable national resource. The marshes located in the western basin and the deltas include maidencane, cattails, and bulltongue, with salinities ranging from 0.06 parts per thousand to two parts per thousand.

The general pattern of delta formation affects the variation in vegetation. Seasonal and willow vegetation occur on the upstream end of delta lobes and along the leading edge, where elevation is highest and sand content the greatest. Black willow is the only species that withstands the physical stress of the high sedimentation rates during spring high water. Cattails and bulltongue are found in areas having an intermediate percentage of sand and intermediate elevations. Duckpotato is the first emergent species that invades channel mouth bar islands. The species becomes established at elevations immediately above mean low water. Broadleaf cattail can withstand flood waters near the lobe heads, but apparently only when black willow stands protect the plants from upstream spring flood waters. Naiad vegetation occurs at the downstream ends of islands with the lowest elevations and lowest percentage of sands. Southern naiad, a submerged plant, dominates in areas too deeply flooded and possibly too cold for emergence of duckpotato plants.

The Wax Lake Outlet and Lower Atchafalaya River deltas together have a vegetated area about 10 percent of the total subaerial land, or about 1,600 acres.

The surface sediments in the basin are quite varied and typical of Gulf Coastal alluvial, deltaic, and marine environments. These deposits are predominately a thick segment of poorly consolidated peats and clays, silty clays, sands, and silts. The sediments are entirely of Holocene (recent) Age overlying Pleistocene Age deposits.

Marsh deposits cover most of the surface area between the Teche ridge and the Atchafalaya Bay. Sediments in these deposits consist primarily of clays, clays with organic matter, silts, some peats, and organic oozes overlain by a vegetative mat. The sediments are complexly interfingered both vertically and laterally.

Sediment types associated with the natural levees along the Lower Atchafalaya River and the Wax Lake Outlet are the result of overbank deposition during high river stages. The coarser materials, fine sand and silts, deposit near the channels edge, while the finer grained material, clays, deposit further from the channels.

Sediments in the Atchafalaya Bay are predominantly well sorted silty sand and sandy silt overlying prodelta clays. The delta front and distributary mouth bar deposits are primarily sands. The interior of the subaerial lobes consists of finer silts and **clays** deposited overbank as a result of an influx of finer sediments.

FISH AND WILDLIFE RESOURCES

Wildlife resources in the Atchafalaya Basin are extensive. The Atchafalaya Delta Wildlife Management Area and adjacent areas in the bay provide some of the highest quality habitat for wintering waterfowl in coastal Louisiana, including mallard, canvasback, blue-winged teal, gadwall, mottled duck, coot, and snow geese (Fur and Refuge, 1990).

The fresh marshes near Morgan City provide feeding habitat for the largest concentration of Southern bald eagles in the south-central United States. Many other species of birds occur: hawks; falcons; black skimmers; terns; gulls: white ibis; snowy egret; and several types of heron (Fur and Refuge, 1990). Another endangered species, the Louisiana black bear, is found in the basin. Alligator, snipe, rabbit, and nutria are also present.

The basin is very productive in terms of fisheries resources (Thompson and Deegan, 1983). Fisheries resources in the bay are typical of the north-central Gulf of Mexico with at least 108 species of finfish recorded. Finfish such as southern flounder, shad, garfish, blue catfish, freshwater drum, channel catfish, sunfish, black and red drum, and spotted seatrout frequent the area. Shrimp and crab are also abundant.

ECONOMIC RESOURCES

The economy of the area is based on mineral resources and agricultural production of soybeans, other grains, sugar cane and livestock Significant mineral deposits include crude petroleum, natural gas, and reef shells. Other important commercial activities center around fish and wildlife resources. Timber harvesting, trapping, shell dredging, and oil and gas related service industries are also predominant in the area.

Navigation is also an important part of the economy. The Chene, Boeuf, and Black navigation channel and the GIWW provide transportation routes for commercial and private traffic. The Morgan City and Berwick area is an active port.

Oil distribution, marine transportation, shipbuilding, and oil related businesses and industries operate along the Morgan City/Berwick riverfront. These businesses and industries have a substantial positive impact on the area's economy. The economies of the two communities are directly related to the economic health of these riverfront businesses.

COASTAL WETLAND PROBLEMS

The Atchafalaya Basin is unique among the other basins because it has a growing delta and nearly stable wetlands. Some land loss has occurred, however, in fresh marsh, floating marsh, cypress swamp, and bottomland hardwood swamp.

Coastal wetland loss occurring in the Mainland Subbasin is site-dependent due to shoreline erosion, human activities, and natural conversion to late successional bottomland hardwoods and uplands. Between 1932 and 1990, approximately 8,040 acres of land in the Mainland Subbasin have changed to open water. The average loss from 1974 through 1990 is 87 acres per year. Table 2 shows the loss of land between 1932 and 1990.

Eighty-three percent of the land loss in the Mainland Subbasin has taken place prior to 1974. Land loss has been centered around four areas. The construction of the Wax Lake Outlet has impacted land loss totals by the direct conversion of land to open water. Loss has also taken place along the banks of the GIWW and along the shoreline of the subbasin. In the Bateman Island area adjacent to the Lower

Table 2
Historic Land Loss in Mainland Subbasin[1]

Period	Acres	Percent/Year
1932-1958	3,440	0.15
1958-1974	3,200	0.20
1974-1983	880	0.11
1983-1990	520	0.09
Total	8,040	8.7

[1]USACE GIS Database, February 1993

Atchafalaya River south of Morgan City, land loss is approximately 1,440 acres or 13 percent of the 1932 land surface of the Bateman Island area. Thirty seven percent of the loss in this area is from the construction of canals for oil and gas exploration and production. The remaining loss can be attributed to the natural backwater lake development.

Land gains have also taken place since 1932 in the Bateman Island, Sweet Bay Lake, and Wax Lake areas of the subbasin. Approximately 4,280 acres of land have been gained in these areas. These gains are not accounted for in Table 2.

The landscape of the Atchafalaya Basin is constantly evolving. Several major processes are influencing the configuration of the basin and will continue to shape the basin in the future. Riverine processes are the building blocks; they create and maintain the wetlands. Other natural processes, such as subsidence, cold fronts, waves, and currents, refine and reshape the wetlands, frequently resulting in wetland loss. Human activity increasingly influences the development and shape of the wetlands.

The Lower Atchafalaya River delta growth is episodic and depends on flood flows for most of its growth. During nonflood years, the majority of sediments conveyed by the Lower Atchafalaya River deposit in the channel above the bay or remain in the Chene, Boeuf, and Black navigation channel, bypassing the delta. The average cross-sectional area of the Lower Atchafalaya River is decreasing as the morphology changes from a lake and bay environment to a riverine environment.

The deposition in the Lower Atchafalaya River affects the quantity of sediment delivered to the Atchafalaya Bay. Delta growth is limited during the nonflood years, and loss can occur. Channel deposition and closure, upstream accretion, and lobe fusion are prevalent in the growth patterns of the Lower Atchafalaya River delta, particularly during the nonflood periods of minimal growth. Delta bifurcations such as Natal Channel, Radcliffe Pass, Amerada Pass, and Log Island Pass are filling with sediment, reducing the transport of sediments to the delta lobes.

The Wax Lake Outlet delta has a higher and more uniform rate of growth than the Lower Atchafalaya River delta, even though the Wax Lake Outlet receives less sediment. Cross-section and sediment data of the two channels show the Wax Lake Outlet is more effective in conveying sediments to the bay. Channel extension and bifurcation dominate the growth patterns of the Wax Lake Outlet delta.

Sediments from the Atchafalaya Basin Floodway system- keep pace with subsidence in the Mainland Subbasin, enabling the wetlands in this area to remain relatively stable, healthy, and productive. Wetland loss resulting from subsidence takes place in areas of the Lower Atchafalaya River delta during nonflood years.

Winter storm fronts have a significant impact on the water surface elevations in the Atchafalaya Bay. The southwesterly winds preceding the frontal passage cause a setup of water surface elevations in the bay. As the front passes, the northeasterly winds and water surface gradient push the water out of the bay causing a set down of water levels that exposes much of the delta front to wave action Subaerial land in the Lower Atchafalaya River delta is primarily lost during the winter months as a result of these storm fronts (Van Heerden and Roberts 1980). The eroded sediment either remains in the subaqueous portion of the delta and provides a base for future subaerial propagation or leaves the basin because of waves, tides, and riverine currents.

During hurricanes, a drawdown of water levels also occurs; then as the storm comes into the bay, water levels increase from the storm surge. In this process, storms rework the delta sediments in the Atchafalaya Bay. A recent example is Hurricane Andrew that moved around 2 million cubic yards of sediment into the Chene, Boeuf, and Black navigation channel in August, 1992.

In the Atchafalaya Bay, tidal currents transport and flush sediments suspended by other mechanisms. Tidal currents and waves also contribute to shoreline erosion of the Atchafalaya Bay coastline from the Wax Lake Outlet to Point Chevreuil.

Human activity is shaping the evolution of the Atchafalaya Basin. The flood control features of the MR&T project define the quantity and entry location of flow and sediment into the bay. The Chene, Boeuf, and Black navigation channel conveys the majority of flow and sediment beyond the Lower Atchafalaya River delta, affecting delta growth, Oil and gas exploration creates channels through the wetlands and the delta, disrupting normal sediment transport. Canals and small navigation channels split delta lobes, disrupting natural delta-building processes. Shell dredging affects the prodelta and subaqueous delta through shell removal in the Atchafalaya Bay beyond the -3 foot NGVD contour.

In summary, human activity and natural processes are the primary causes of wetland loss in the Atchafalaya Basin. They are also limiting the effectiveness of the riverine processes in creating new wetlands in the Atchafalaya Bay and maintaining existing wetlands.

Figure 3 shows the areas of habitat change in the Atchafalaya Basin.

FUTURE WITHOUT-PROJECT CONDITIONS

WETLAND CHANGES

Wetlands in the Mainland Subbasin will continue to develop over the next 50 years through periodic overflow of water and sediments from the Atchafalaya system during the high water season. As the Lower Atchafalaya River and the Wax Lake Outlet develop into riverine systems, natural levees will progress along the channel

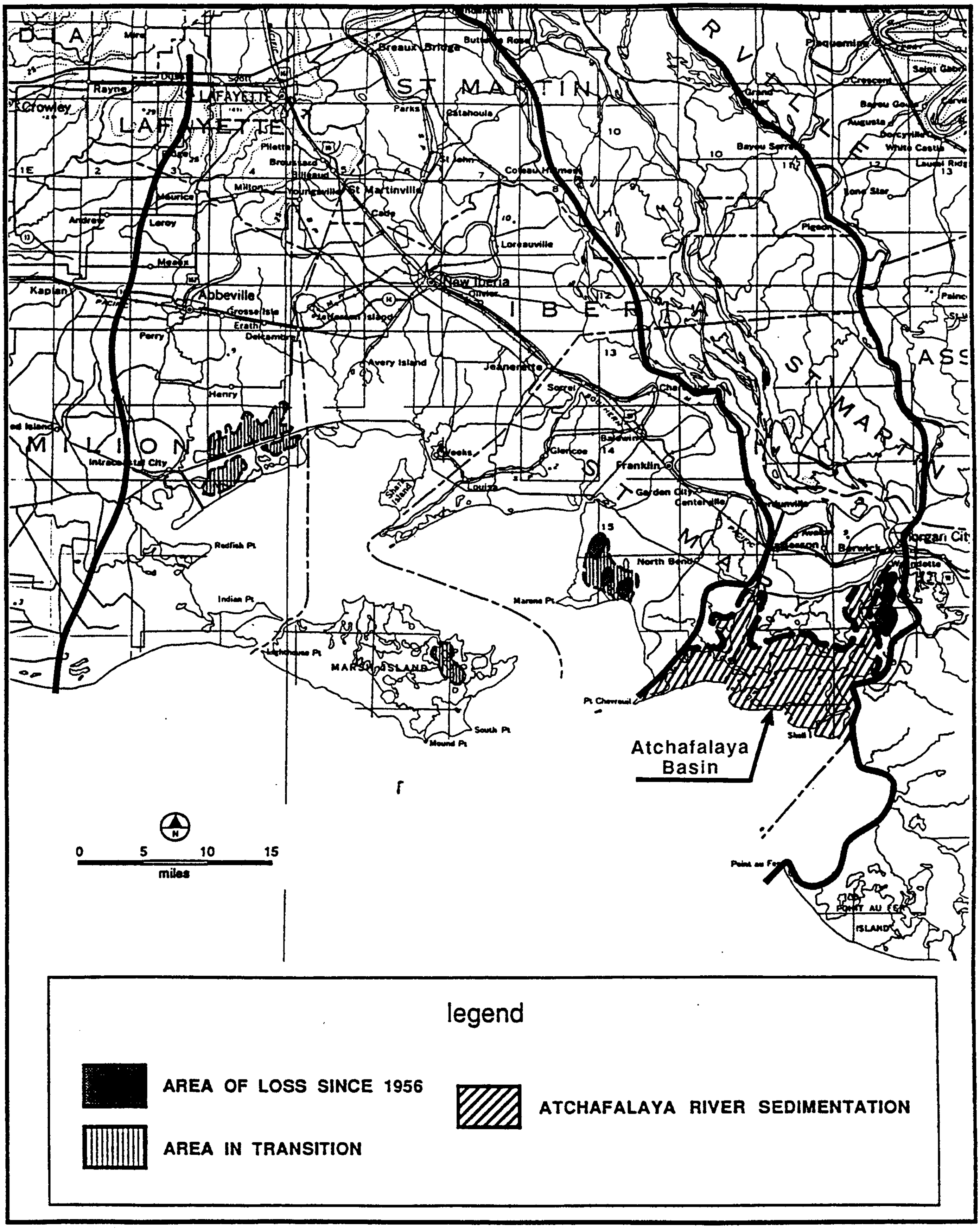

Figure 3. Primary areas of wetland habitat change in the Atchafalaya Basin.

and reduce the frequency of overflow. Wetland vegetation will continue to evolve to higher vegetation types. Loss of wetlands in the Mainland Subbasin due to shoreline erosion, human activities, and natural conversion of wetlands is expected to continue at a rate of 87 acres per year.

In the Atchafalaya Bay, delta growth will continue to take place by channel extension and bifurcation, channel deposition and closure, upstream accretion, and lobe fusion. During the 1980's, WES conducted extensive studies of the Atchafalaya Bay and deltas to predict the evolution of the two deltas and the effect of the delta growth on flood stages, maintenance dredging, salinity, sedimentation, and circulation in the bay system. The results from the WES studies compare favorably with the growth of the deltas today, as shown on Figure 4. In the year 2045, 67,000 acres of subaerial delta are projected in the Lower Atchafalaya River and the Wax Lake Outlet deltas.

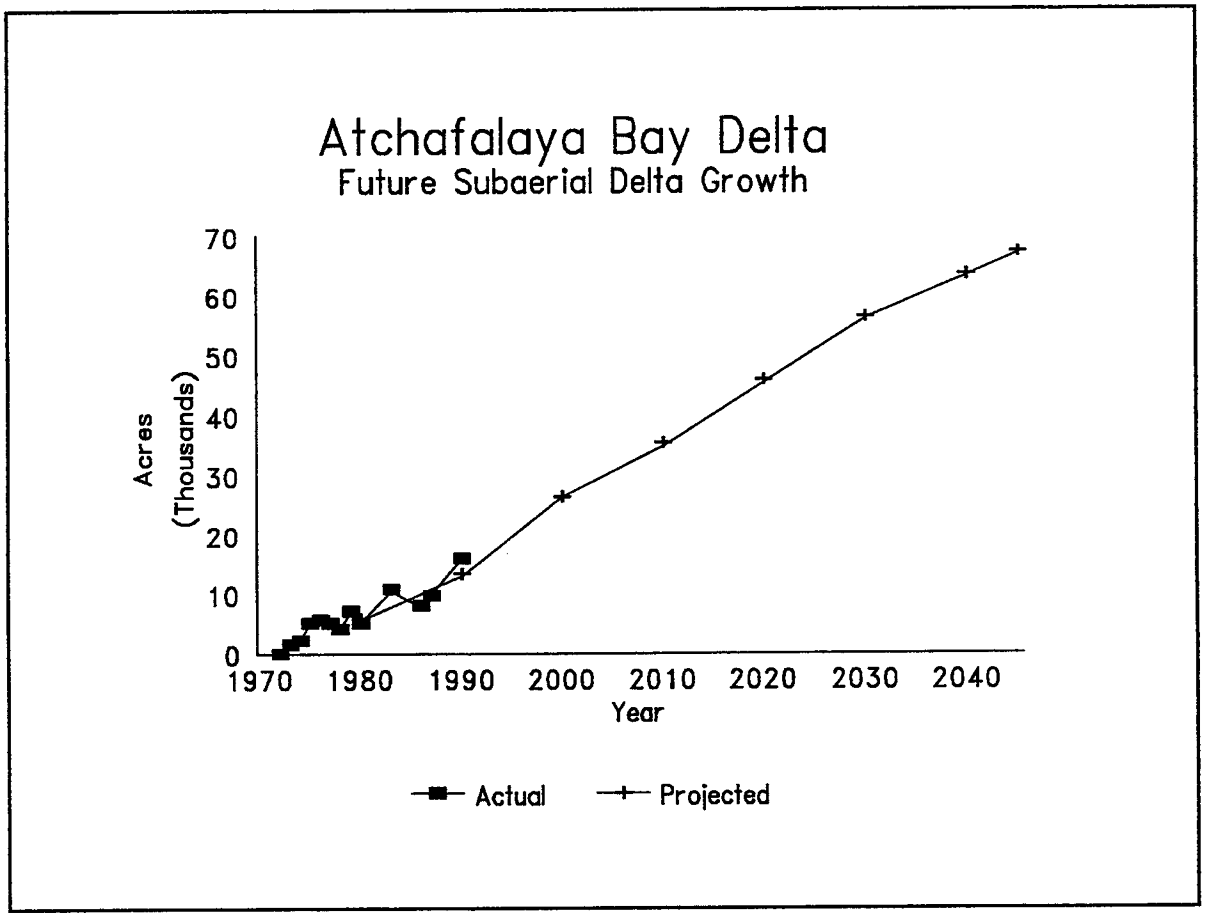

Figure 4

The WES studies show that a major scour channel between the entrance to Four League Bay and Point Au Fer will remain open or be one of the last areas in the bay to fill. A second scour channel between the two deltas will probably remain open.

As the eastern half of the Lower Atchafalaya River delta fills, the system for delivering sediment will become less efficient, and the smaller bifurcations will continue to close. Sediments will continue to be reworked by water exchange between the bay and the gulf from tidal currents, waves, and the passage of cold fronts. When the bay fills, delta growth beyond Point Au Fer will accelerate. Due to the navigation channel in the Lower Atchafalaya River delta, the growth rate of this delta will continue to be episodic. In contrast, the Wax Lake Outlet delta will naturally grow with more effective use of sediments.

Delta evolution will raise flood stages throughout the basin and in the Terrebonne Basin. The WES study identifies increases in stages as much as 6 feet near the mouth of the Lower Atchafalaya River and the Wax Lake Outlet for project flood conditions. Circulation will be altered to divert more flow through Four League Bay. Flow into the Terrebonne Basin will also increase. Salinities will decrease in the Terrebonne marshes adjacent to the Atchafalaya Basin and stay the same for the Atchafalaya Bay.

Under the Sea Grant program, Louisiana State University (LSU) modeled vegetation dynamics in the Lower Atchafalaya River delta (Conner and Day, undated). The results are shown on Figure 5. Using Figure 5, 4,940 acres of

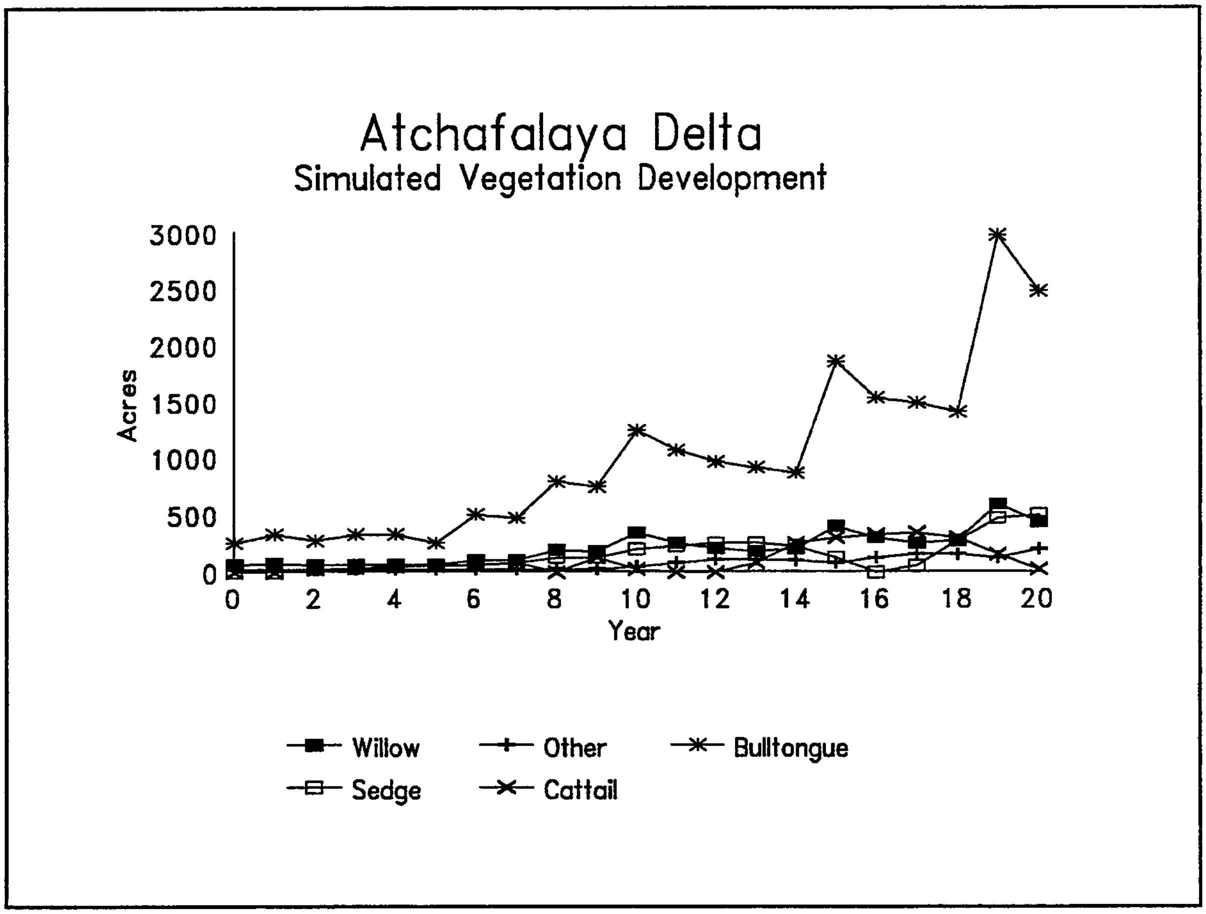

Figure 5

wetlands are projected in the Lower Atchafalaya River delta by the year 2015, and 9,760 acres by the year 2045. If the Wax Lake Outlet wetlands increase at twice the rate of the Lower Atchafalaya River delta, approximately 7,730 acres are expected to occur by the year 2045 and 17,790 acres by the year 2045. The total wetland acreage predicted for both deltas is about 40 percent of the projected subaerial delta growth predicted by the WES models.

Delta formation will affect the quantity and variation of vegetation in the deltas. Bulltongue, willows, and cattails will continue to dominate, with bulltongue increasing at a faster rate than any species. Sedge quantities may increase. Elevation and soil type will prescribe vegetation community. Diversity will continue to be low with one species dominating areas of the deltas.

The geomorphology and hydrology of the Bayou Sale Subbasin is not expected to change over the next 50 years. Future loss of wetlands is not anticipated. Wetland loss is possible if land use changes occur. These changes can occur if the existing pumps draw water levels in the wetlands lower. However, pumping rates can be changed only through the permit process.

The amount of wetlands estimated for future-without project conditions over the next 20 and 50 years are shown on Table 3.

Table 3
Projected Wetland Loss in Atchafalaya Basin

	Projected loss at 20 years		Projected loss at 50 years	
Subbasin	Acres	Percent	Acres	Percent
Mainland	1,740	3.2	4,350	8.0
Bay	(8,530)	(205.9)	(23,410)	(565.2)
Bayou Sale	0	0.0	0	0
Total	(6,790)	(6.8)	(19,060)	(19.0)

( ) = gain

FISH AND WILDLIFE RESOURCES

As the deltas continue to grow, the Atchafalaya Bay will change toward a riverine environment. Changes in water temperature, and turbidity and continued low salinities will reduce shrimp production and several saltwater fishes and increase freshwater species.

ECONOMIC RESOURCES

The economy based on fish and wildlife is expected to expand with delta growth and wetland development. Industry along the Lower Atchafalaya River will be affected by increased frequency and duration of high water resulting from increased delta growth.

PLAN FORMULATION

PLANNING OBJECTIVES FOR THE BASIN

Planning objectives for the Atchafalaya Basin are to:

1) enhance the natural growth of the deltas and their evolution to wetlands;
2) restore fluvial input in areas where flow and sediment have been disrupted; and
3) reduce shoreline erosion.

Enhancing the natural growth of the deltas is the key objective. It addresses the principal cause of the coastal wetlands problems in the basin, i.e. human activity reducing sediment input and decreasing the retention of sediments within the Atchafalaya Bay.

STRATEGIES CONSIDERED

Three strategies can enhance natural growth of the deltas by increasing the sediment input to the Atchafalaya Bay:

1) realign the entrance to the Wax Lake Outlet;
2) modify the Lower Atchafalaya River to increase channel efficiency; and
3) dredge sediments in the floodway above the basin

Three strategies can enhance natural delta growth by decreasing sediment output from the bay:

4) move the navigation channel;
5) relocate the flow and sediment to the Wax Lake Outlet; and
6) manage the growth of the Lower Atchafalaya River delta.

Fluvial inputs can be restored by closing pipelines and reopening closed distributaries. Shoreline erosion can be reduced through shoreline protection measures.

STRATEGY 1 - REALIGN THE ENTRANCE TO THE WAX LAKE OUTLET

Realigning the entrance to the Wax Lake Outlet increases the amount of sediment conveyed by the Wax Lake Outlet, the more efficient of the two outlets. Increasing the quantity of sediment down the Wax Lake Outlet is beneficial to the growth of wetlands as the Wax Lake Outlet delta is currently growing at a rate two to three times faster than the Lower Atchafalaya River delta with less flow. This strategy involves realigning the entrance to the Wax Lake Outlet and structural measures to divert additional sand into the outlet.

STRATEGY 2 - MODIFY THE LOWER ATCHAFALAYA RIVER

Modifying the Lower Atchafalaya River increases the transport of flow and sediment of the Lower Atchafalaya River to the Atchafalaya Bay. Sediment load available for delta growth is dependent on the efficiency of the channel delivering the sediment. The efficiency of the Lower Atchafalaya River channel is poor as evident by the deposition that has taken place over time. Sediments that deposit in the

Lower Atchafalaya River are not available for delta growth. Construction of dikes and channel realignment increases channel efficiency and reduces deposition, thereby increasing the amount of sediments entering the Atchafalaya Bay.

STRATEGY 3 - DREDGING SEDIMENTS IN THE FLOODWAY

Dredging channels within the Atchafalaya Basin Floodway system also increases the amount of sediment entering the bay. Dredging can be conducted on the Atchafalaya Basin Main Channel north of the basin and the Lower Atchafalaya River. Dredged material from the Atchafalaya Basin Main Channel can be disposed of in the Wax Lake Outlet. The Wax Lake Outlet is capable of conveying a larger portion of sediment than it presently does. Dredged material from the Lower Atchafalaya River can be piped or barged to the Atchafalaya Bay.

STRATEGY 4 - MOVE THE NAVIGATION CHANNEL

Strategy 4 separates delta growth and navigation. The navigation channel can be relocated to Shell Island Pass and into the Atchafalaya Bay between the two deltas to beyond Point Au Fer reef, or to Four League Bay from the mouth of the Lower Atchafalaya River, or to the Terrebonne Basin from the Avoca Island Cutoff Channel. By separating the fluvial inputs from the navigation channel, delta growth can increase threefold.

STRATEGY 5 - RELOCATE THE FLOW AND SEDIMENT

Relocating the flow and sediment to the Wax Lake Outlet is another way of separating delta growth from navigation This strategy consists of directing all flow and sediment down the Wax Lake Outlet; the navigation channel remains where it is. The strategy involves closing the Lower Atchafalaya River to either low to normal flows or all flows and enlarging the Wax Lake Outlet to accommodate the increase in flow. A lock is necessary on the Lower Atchafalaya River to maintain navigation.

STRATEGY 6 - MANAGE THE GROWTH OF THE DELTA

Management of the Lower Atchafalaya River delta is a strategy to maximize sediment deposition, reduce sediment output, and increase delta growth through management of existing resources of flow and sediment and enhancing natural processes affected by human activities. Delta management works to minimize the impact of the Chene, Boeuf, and Black navigation channel on delta growth and wetland development through an active fluvial resource management program. Management activities include use of booster pumps with maintenance dredging, reopening closed bifurcations, spray dredging, mining existing dredged material disposal islands, cutting V-notches in existing disposal mounds, realigning bifurcation entrances, and other activities to make delta growth and navigation complementary.

OTHER STRATEGIES

The two remaining strategies, restoring fluvial input and reducing shoreline erosion, are effective strategies in solving small, site-dependent problems of wetland loss and erosion and creating small areas of wetlands. Fluvial inputs can be restored by closing pipelines and reopening closed distributaries. This strategy is effective in areas such as the Bateman Island area adjacent to the Lower Atchafalaya River, the marsh area west of the Wax Lake Outlet, and the bifurcations of the Lower Atchafalaya River delta. Shoreline erosion can be reduced through shoreline protection measures. Shoreline erosion is a problem between Point Chevreuil and the Wax Lake Outlet.

RATIONALE FOR SELECTED STRATEGIES

RATIONALE FOR SELECTION OF STRATEGY TO INCREASE SEDIMENT INPUT

The first three strategies enhance delta growth by increasing sediment delivery. Strategy 1, realigning the entrance to the Wax Lake Outlet, takes advantage of the higher growth rate of the Wax Lake Outlet delta. The Wax Lake Outlet has sufficient transport capacity to convey additional sediment to the bay, and human activity in the Wax Lake Outlet delta is insufficient to impact the deposition of the sediment. The strategy reduces the impact of human activities by lessening the impact of the MR&T project. It has relatively small impact to flood control, navigation, and the environment. However, the strategy requires additional study to ensure that engineering issues are resolved. These issues are described in the Projects Considered sedtion of this appendix.

Strategy 2, increasing the efficiency of the Lower Atchafalaya River through channel training, increases the delivery of sediments to the Atchafalaya Bay. However, the suspended sediments transported during floods are responsible for the growth periods of the subaerial portions of the Lower Atchafalaya delta. The navigation channel significantly affects the hydraulics of the bifurcations in the delta. Bifurcations fill with sediments faster during normal high water seasons because the majority of the flow and energy is contained in the navigation channel. Flood flows are necessary to increase flow and conveyance in the bifurcations and push sediments further down the bifurcations, resulting in channel elongation and more bifurcations. An increase in delta growth may not occur with this strategy; the potential exists for a reduction in growth because of less storage of sediments in the interior channels during nonflood years to be transported during flood events when the majority of delta growth in the Lower Atchafalaya River delta occurs. In addition, channelization adversely affects the diversity of the river bottom habitat and reduces overbank flows providing nourishment to adjacent wetlands. In conclusion, this strategy may not meet the planning objectives and adversely affects the environment.

Dredging sediments, Strategy 3, creates wetlands and meets the planning objectives for the basin. However, dredging is an expensive method of sediment diversion when implemented continuously over a long period. In addition, dredging only increases the availability of sands for delta growth and wetland development. Sands, silts, and clays are necessary for effective, natural delta development.

Strategy 1, realigning the entrance to the Wax Lake Outlet, is the preferred strategy. It meets the basin objectives, is a long term solution to the impact of human activity, and is cheaper to implement than dredging alone. However, dredging can be implemented now and serve as an interim measure until the entrance to Wax Lake Outlet is realigned.

RATIONALE FOR SELECTION OF STRATEGY TO DECREASE SEDIMENT OUTPUT

Three strategies enhance delta growth by decreasing the output of sediments from the Atchafalaya Bay. Relocating the navigation channel, Strategy 4, separates navigation from delta growth. This strategy increases the rate of growth of the Lower Atchafalaya River delta to a more natural rate similar to the Wax Lake Outlet delta. It also reduces the impact of human activities by decreasing or eliminating the effects of the Chene, Boeuf, and Black navigation channel in the Lower Atchafalaya River delta.

Resolution of several engineering and environmental issues is necessary with this strategy. Construction of a new channel in areas other than Shell Island Pass directly destroys hundreds of acres of wetlands. A connection to the fresh water of the Atchafalaya River is necessary; otherwise, the new navigation channel creates saltwater intrusion problems. The engineering problem of keeping the majority of flow and sediment in the Lower Atchafalaya River for delta building and keeping the navigation channel open with minimal dredging needs to be solved. A structure on the channel to prevent saltwater intrusion is not feasible; clearance above the water surface necessary for passage of oil rigs is too great for a structure.

Strategy 5, diverting flow to Wax Lake Outlet involves constructing a navigation structure on the Lower Atchafalaya River and widening and deepening the Wax Lake Outlet. The increase in flow and sediment down the Wax Lake Outlet will positively impact the wetlands to the west of the Atchafalaya Basin. However, the additional flow and sediment create flood problems in the Teche-Vermilion Basin. The Lower Atchafalaya River delta will deteriorate without a source of sediment to offset natural processes. This strategy will also reduce the flow and sediment available to the Terrebonne Basin where these fluvial inputs are desperately needed for wetland creation and protection.

Delta management, Strategy 6, is an option to reduce the impact of the Chene, Boeuf, and Black navigation channel by making delta growth and navigation complementary. Wetland creation with this strategy is less than with Strategies 4 and 5; however, flood control and environmental impacts are less.

Relocating the navigation channel, Strategy 4, is the preferred strategy on the basis of solving human impacts and creating more wetlands than the other two strategies. The Shell Island Pass route is the favored location for the navigation channel because this route creates fewer environmental problems even though fewer wetlands are created than the other locations. However, additional environmental and engineering studies are necessary before implementation In the interim, delta management, implemented in a phased approach as a flexible system of small features, can be initiated and continue over the long term until relocation of the navigation channel is viable.

RATIONALE FOR SELECTION OF OTHER STRATEGIES

The remaining strategies are effective in solving small, site-dependent problems of wetland loss and erosion and creating small areas of wetlands. Some projects, such as reopening Natal Channel and Radcliffe Pass and reducing the height of Big Island are vital to the success of the restoration plan because they shape the direction of future work in the Lower Atchafalaya River delta. Projects that encompass these strategies have sufficient information and implementation potential to be started now.

Figure 6 shows the selected strategy features for the basin.

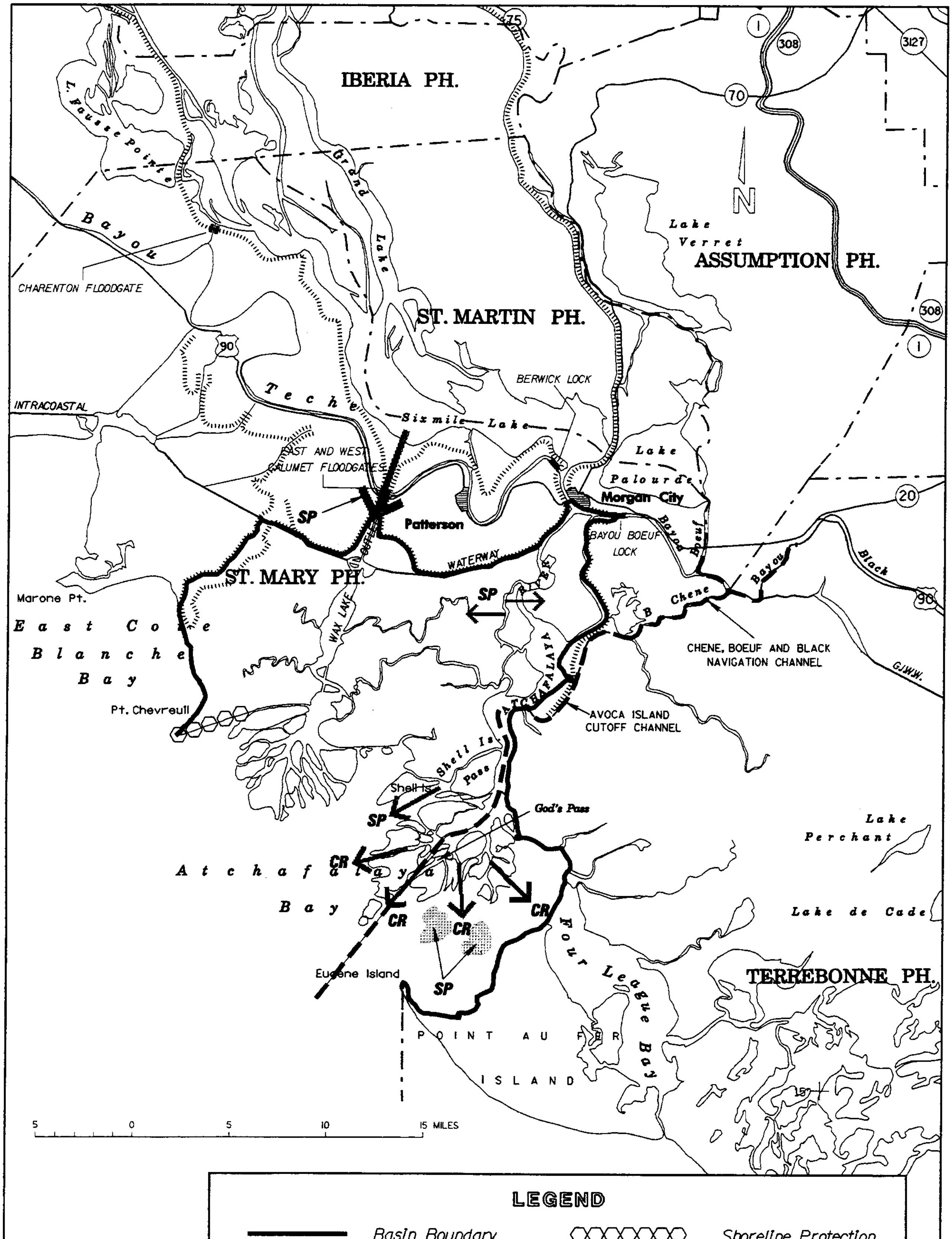

Figure 6. Atchafalaya Basin, Strategy Map.

IMPLEMENTATION OF THE SELECTED PLAN

COMPONENT PROTECTS

The selected plan consists of nine projects that achieve the basin objectives. Table 4 summarizes these projects, indicating project type, cost, acres created, whether a project is critical or supporting, and if it is to be implemented in the short term or long term. The projects are also shown on Figure 7.

Projects are included in the selected plan as critical or supporting projects. A critical project is one that meets the key objective and is vital to the success of the restoration plan. Supporting projects work with the critical projects in achieving the basin objectives. One strategy may be more effective than another at meeting the objectives but requires further study to resolve key issues. Projects that encompass the less effective strategy can be implemented first while studies are underway. Projects with sufficient information and implementation potential are short-term projects. Long-term projects require additional study, are best implemented in the future, depend on major studies of other basins, or require phased implementation.

DEVELOPMENT OF BENEFITS AND COSTS

The benefits for the short-term and critical projects have been estimated according to a modified rapid assessment Wetland Value Assessment (WVA) protocol based, in part, on project specific information that varies in quality and quantity between projects. Therefore, the estimates are rough approximations and are considered preliminary to a more in-depth assessment. The estimates should be interpreted and used as such. Projects that have been included on the first three Priority Lists have undergone a complete, in-depth WVA analysis.

Cost estimates for projects have been developed according to a generic CWPPRA cost formula that consists of the construction cost plus 12.5 percent for planning, engineering, and design; 11.5 percent for supervision and administration; and 25 percent for contingencies; plus monitoring and operation and maintenance costs for 20 years. Projects on the first three Priority lists have more detailed construction and operation and maintenance estimates. These estimates include the multipliers described above.

PRIORITY LIST PROJECTS

Two projects, PAT-2, Atchafalaya Sediment Delivery, and XAT-7, Big Island Mining, are on the CWPPRA second priority project list. They are sediment diversion and marsh creation projects in the Lower Atchafalaya River delta. The projects benefit 4,810 acres of wetlands.

CRITICAL SHORT-TERM PROJECTS

Two projects, PAT-2, Atchafalaya Sediment Delivery, and XAT-7, Big Island Mining, are critical short-term projects. Both projects are on the CWPPRA second priority project list.

Table 4
Summary of the Atchafalaya Basin Projects

Project No.	Project Name	Project Type	Priority List Projects	Acres Created, Protected, or Restored	Net Benefited Acres	Estimated Cost ($)	Cost per Benefited Acres ($/Ac)
Critical Projects, Short-Term							
PAT-2	Atchafalaya Sediment Delivery	SD, MC	PPL 2	2,230	2,790	810,000	300
XAT-7	Big Island Mining	SD, MC	PPL 2	1,560	2,020	3,821,000	1,900
Subtotal				3,790	4,810	4,631,000	
Critical Projects, Long-Term							
XAT-5	Delta Management	SD, MC		4,320	9,260	11,350,000	1,200
Supporting Projects, Short-Term							
XAT-3	Shoreline Erosion	SP		230	280	900,000	3,200
XAT-6	Booster Pump	MC		80	110	977,000	8,900
XAT-8	Dredge Sediments into Wax Lake Outlet	SD		40	2,070	1,530,000	700
Subtotal				350	2,460	3,407,000	
Supporting Projects, Long-Term							
XAT-4	Establish Wetland Management	SD, MC		800		300,000	
XAT-9	Relocate Navigation to Shell Island Pass	SD	*	9,040		90,000,000	
XAT-10	Realign Wax Lake Outlet	SD		1,840		20,290,000	
Total Atchafalaya Basin **				4,140	7,270	8,038,000	
Total Atchafalaya Basin ***				8,460	16,530	19,388,000	

MC Marsh Creation
SD Sediment Diversion
SP Shoreline Protection
* Denotes project to be implemented after 20 years. Acres shown are protected by year 50.
** Total include only Critical Short-Term Projects and Supporting Short-Term Projects.
*** Total includes Critical Short and Long-Term and Supporting Short-Term Projects.

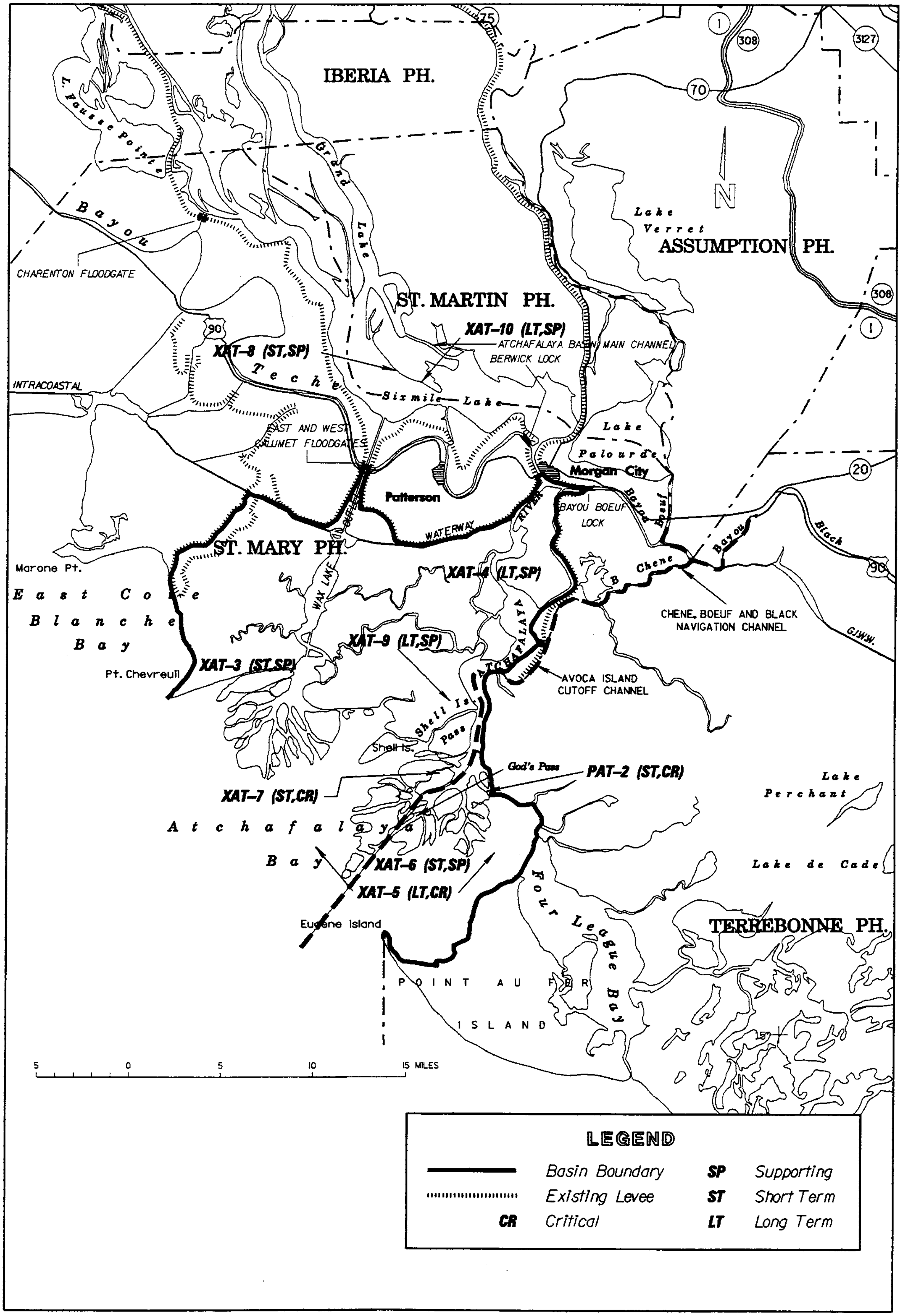

Figure 7. Atchafalaya Basin, Project Locations.

IMPLEMENTATION OF THE SELECTED PLAN

CRITICAL LONG-TERM PROJECTS

The critical long-term project for the Atchafalaya Basin is XAT-5, Delta Management. This is a sediment diversion and marsh creation project. This project is best suited for implementation under separate authorization.

SUPPORTING SHORT-TERM PROJECTS

Three projects are supporting short-term projects. They are: XAT-3, Shoreline Erosion, a shoreline protection project between Point Chevreuil and the Wax Lake Outlet; XAT-6, Booster Pumps, a marsh creation project in the Lower Atchafalaya River delta; and XAT-8, Dredge Sediments into the Wax Lake Outlet, a sediment diversion project dredging material from the Atchafalaya Basin Main Channel and disposing the material in the Wax Lake Outlet. All three projects are suited for implementation under CWPPRA.

SUPPORTING LONG-TERM PROJECTS

Three projects are supporting long-term projects. They are: XAT-4, Established Wetland Management, a sediment diversion and marsh creation project, involving the closure of pipeline canals and reopening distributaries where needed; XAT-9, Relocate Navigation to Shell Island Pass, a sediment diversion project separating navigation from delta growth by the relocation of the Chene, Boeuf, and Black navigation channel; and XAT-10, Realign the Wax Lake Outlet, a sediment diversion project consisting of realigning the entrance to the Wax Lake Outlet and constructing bendway weirs in the Atchafalaya Basin Main Channel to divert additional sediments into the outlet. Of the three, XAT-4 is best suited for implementation under CWPPRA. The other two projects require additional study and USACE approval.

BENEFITS AND COSTS OF THE SELECTED PLAN

The selected plan creates, protects, and restores approximately 11,090 acres of wetlands over 20 years and a total of 28,150 acres in 50 years. Table 5 shows the results of the short-term and critical projects in the plan over a 20 year period.

Table 5
Results of Short-Term and Critical Projects in Atchafalaya Basin

Subbasin	Net Acres Wetlands Created/ Preserved	Percent Wetland Loss Prevented	Estimated Cost (x $1,000)
Mainland	230	13	900
Bay	8,230	65[1]	18,488
Total	8,460	13[1]	19,388

[1] percent increase over conditions at year 20

The three critical projects create, protect, or restore 8,110 acres of wetlands over a 20 year period at a first cost of $15,981,000. In addition, these projects benefit an additional 5,960 acres. The critical long-term project, delta management, creates an additional 4,070 acres of vegetated wetlands in 50 years. Short-term supporting projects create, protect, or restore 350 acres of wetlands in 20 years at a first cost of $3,407,000 and benefit an additional 2,110 acres. Long-term supporting projects create 2,640 acres in 20 years and 15,630 acres in 50 years at a first cost of approximately $110,590,000.

KEY ISSUES IN PLANNING

The formulation of the selected plan for the Atchafalaya Basin to address the problems and opportunities of creating and restoring wetlands involves many planning issues. Foremost among the issues is that of flood control. The MR&T system, including the Atchafalaya Basin Floodway system, must retain its ability to safely pass the project flood to the Gulf of Mexico. Delta growth increases the frequency and duration of flooding in the area to the east of the Atchafalaya Basin Floodway system. Opposition exists in areas such as Assumption Parish and Morgan City to any plan that does not address the flood control problems it generates. Delta growth increases project flood stages in the Atchafalaya Basin Floodway system, necessitating levee raising and possibly structural modification, costs not included in this plan. Associated with the issue of flood control is the need to minimize sediment deposition in the floodway north of the Atchafalaya Basin that reduces the floodway's ability to pass the project flood and destroys bottomland hardwood and cypress tupelo swamps. Additionally, the people living and working adjacent to the floodway need to be protected against flooding induced by the selected plan.

The selected plan must, to the maximum extent practicable, retain and restore the environmental features of the area including the floodway, and maintain or enhance the long range productivity of the wetlands and woodlands.

Navigation is also an important aspect. The selected plan must accommodate navigation needs.

The distribution of flow and sediment between the Mississippi River and the Atchafalaya River plays an integral role in the restoration plan for the Atchafalaya Basin. Modification of the operation of existing navigation and flood control projects, including the Old River Control Complex, changes the amount of flow and sediment conveyed by the Atchafalaya Basin Floodway system. Under section 307, General Provisions, of the Act, a study is authorized on the "feasibility of modifying the operation of existing navigation and flood control projects to allow for an increase in the share of the Mississippi River flows and sediments sent down the Atchafalaya River for the purpose of land building and wetlands nourishment." The outcome of this study may have a tremendous impact on the growth of wetlands in the Atchafalaya Basin and adjacent basins.

The key to the selected plan is that two deltas are naturally building in the basin, the Wax Lake Outlet delta and the Lower Atchafalaya River delta. The first step in implementing the basin plan is optimizing the growth of the two deltas through implementation of XAT-5, Delta Management, and XAT-10, Realign Wax Lake Outlet.

Studies to implement these projects should commence.

Small scale projects such as reopening distributaries and reducing the height of disposal areas can be implemented concurrently with the delta building projects and within current CWPPRA funding.

Implementation of XAT-9, Relocate Navigation to Shell Island Pass, requires a major feasibility study to determine engineering feasibility and the impacts to flood control and navigation; however, the study can be initiated now. The attractiveness of the Atchafalaya Basin plan is that if the flow distribution at Old River is changed and navigation and delta growth separated, the projects previously implemented will be enhanced and the system's delta building capability maximized.

PROJECT DESCRIPTIONS

CRITICAL SHORT-TERM PROJECTS

PAT-2 ATCHAFALAYA SEDIMENT DELIVERY

Location.

The proposed project area is in the Atchafalaya Bay, in the lower southeast corner of St. Mary Parish. The project area is in the eastern side of the Lower Atchafalaya River delta, as shown on Figure 7 and Figure 8. Freshwater marsh comprises about 250 acres of the project area; the remaining 4,000 acres is open water or subaerial delta.

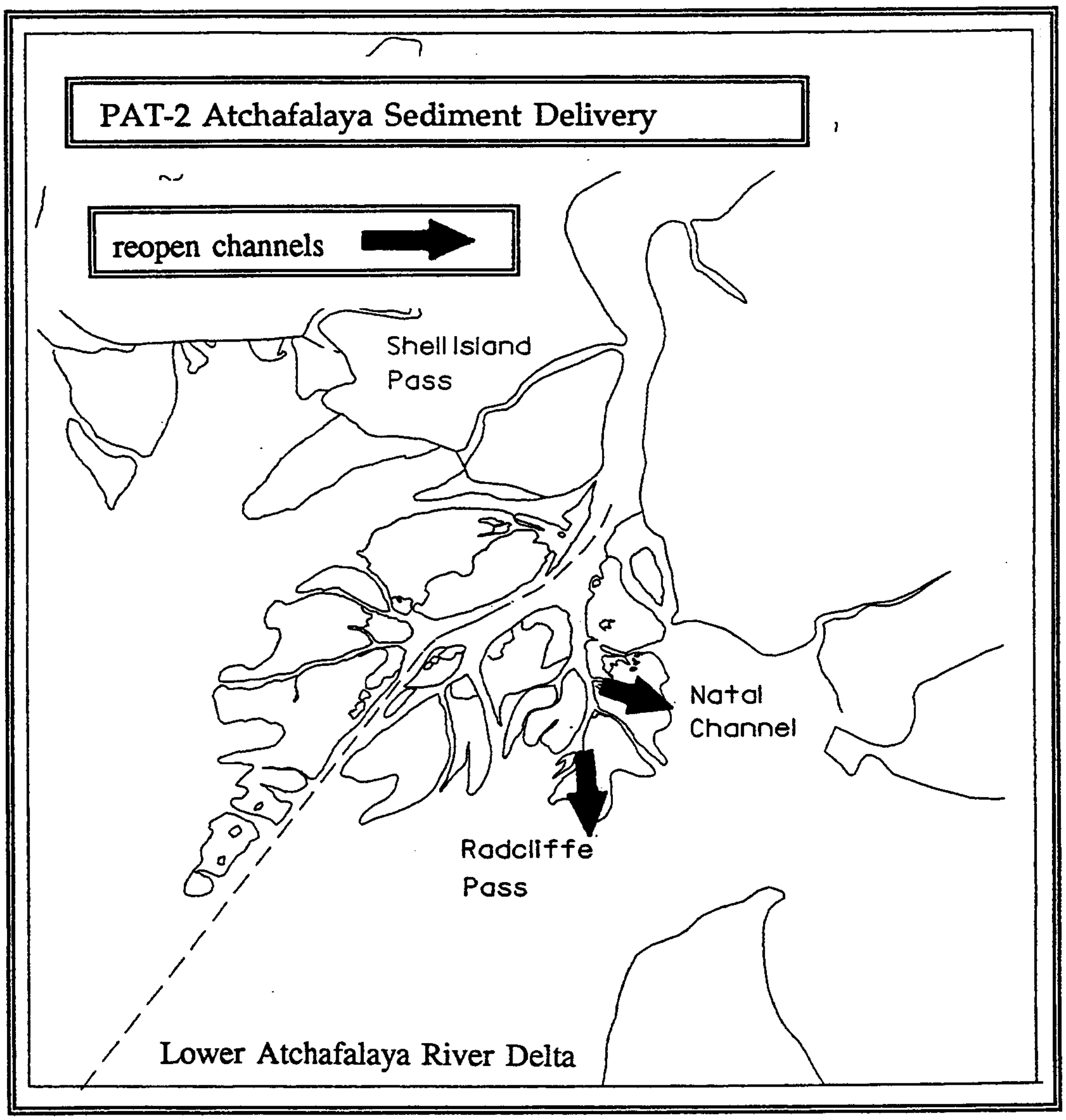

Figure 8

Problems and Opportunities.

Closure of Natal Channel, a bifurcation in the eastern half of the Lower Atchafalaya River delta, has cut off the sediment supply to approximately 1,000 acres of wetlands and 1,000 acres of shallow delta platform. The closure is a result of the concentration of flow in the Chene, Boeuf, and Black navigation channel bypassing the delta. As a result, delta development in this area has decreased, and wetland loss is occurring. Disruption of the sediment delivery network results in sediment delivery during floods not being in balance with winter erosion and subsidence. Radcliffe Pass, south of Natal Channel, experiences similar loss of sediment delivery. This project reestablishes the natural sediment delivery system in this portion of the Lower Atchafalaya River delta and enhances the system's natural delta building potential. This project addresses the strategy restoring fluvial inputs and the strategy of managing the growth of the Lower Atchafalaya River delta to decrease the output of sediments from the Atchafalaya Bay.

Description of Features.

This project is a sediment diversion and marsh creation project. Approximately 125,000 cubic yards. of material will be dredged from a 90 feet wide, 6 feet deep, 6,300 feet long cut through Natal Channel. A similar cut will be made in Radcliffe Pass. Spray dredging will be used to deposit a thin veneer of dredged material over a large area. The spray dredging technique will be a hydraulic cutter/suction dredge connected to a barge fitted with a spray nozzle by a section of hose. The barge will be able to move independently of the dredge ensuring that the spray disposal leads to minimal buildup.

Benefits and Costs.

From the WVA, the project creates or restores 2,200 acres of wetlands, protects 30 acres, and enhances 240 acres. An additional 320 acres of aquatic vegetation also benefit for a total of 2,790 benefitted acres over a 20 year life.

First cost for this project is $810,000. The average annual cost per average annual habitat unit is $113.

Effects and Issues.

The Lower Atchafalaya River delta is one of Louisiana's prime waterfowl wintering areas. Additionally, it has a large indigenous duck breeding population as well as numerous ibis and heron breeding colonies. Development of new delta lobes greatly increases the habitat on which these birds are dependent.

The shallow delta lobe interiors, channel flanks, and mud flats are utilized by numerous species of fish. Increasing the area of these environments greatly enhances fisheries habitat and productivity.

Reopening the two channels will have no adverse effects on adjacent environment and no direct impacts to flood control or navigation. The project will have no impact to endangered or threatened species. Projects that increase delta growth cumulatively raise project flood stages and increase the frequency and duration of high water the in Terrebonne and Morgan City areas.

Some question exists as to how long the channels will remain open.

Status.

Atchafalaya Sediment Delivery, a critical short-term project, is on the CWPPRA second priority project list. NMFS sponsors the project.

XAT-7 BIG ISLAND MINING

Location.

The project is in the Atchafalaya Bay, in the lower southeast corner of St. Mary Parish. The project area is in the western half of the Lower Atchafalaya River delta. The project area consists of Big Island, a high, tree covered dredged material disposal area and adjacent open water. Approximately 300 acres of wetlands are in the project area. Figure 7 shows the location of the project. Figure 9 shows the project features.

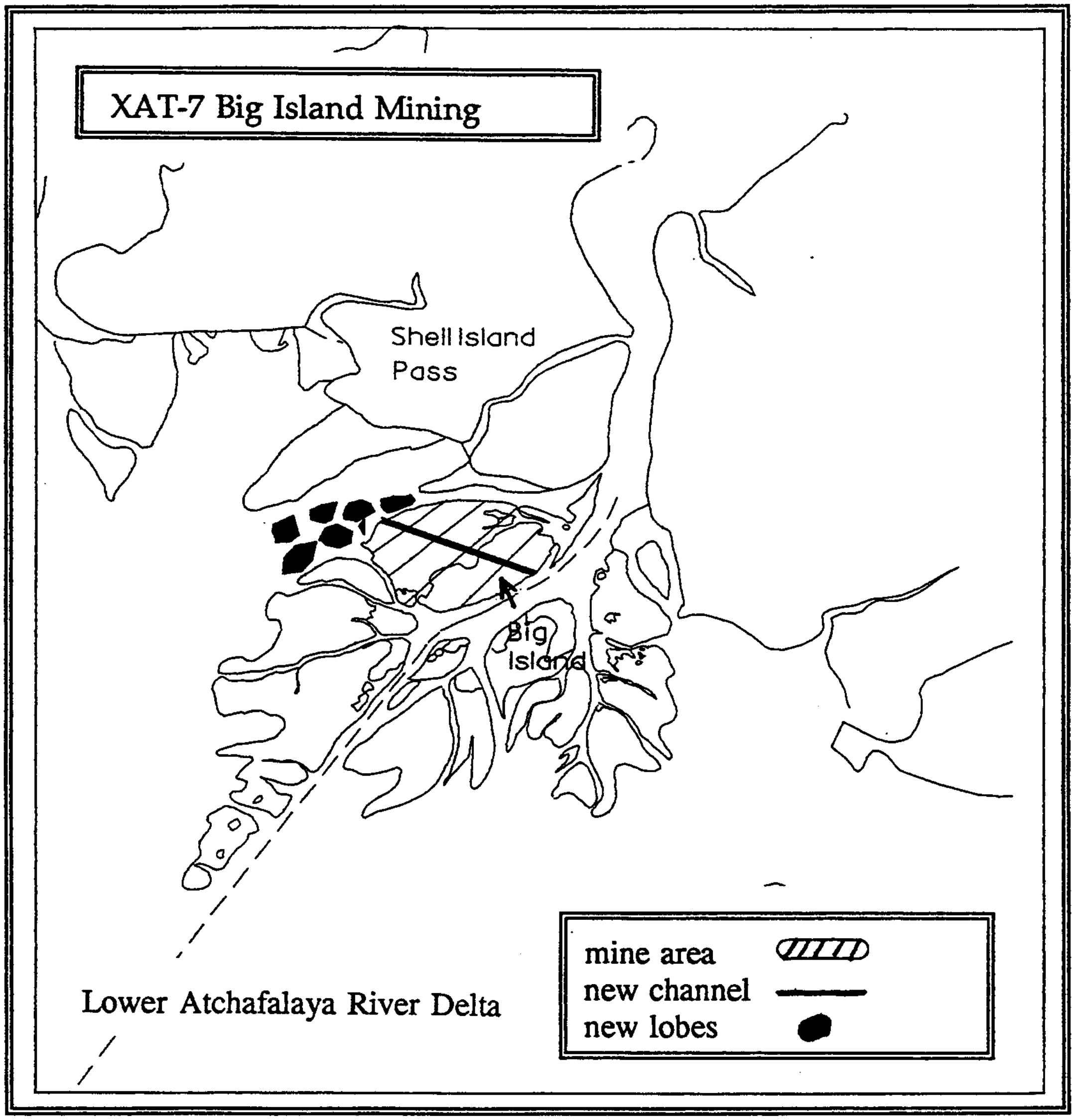

Figure 9

Problems and Opportunities.

Very little flow and sediment reach the area to the west of Big Island from the

Lower Atchafalaya River channel. The Big Island is comprised of dredged material from the Chene, Boeuf, and Black navigation channel. Flow and sediment bypass the area because of the lack of a bifurcation channel and because most of the flow and sediment remains in the navigation channel bypassing the delta. The project creates new wetlands with an associated distributary channel network and subaqueous delta platform by removing material from Big Island and placing it in adjacent open water. This project addresses the strategy of restoring fluvial inputs and the strategy of managing the growth of the Lower Atchafalaya River delta to decrease the output of sediments from the Atchafalaya Bay.

Description of Features.

This sediment diversion and marsh creation project consists of a distributary channel, with a bottom width of 500 feet and minimum depth of 6 feet, cut through Big Island. Dredging will commence from the western side of the island. Approximately 1,920,000 cubic yards. of dredged material will be placed in the form of delta lobes, with maximum elevations at the upstream, midsection of the lobe. Elevations will decrease toward the tip of the lobe. The lobes will be spaced on a pattern similar to that of natural delta lobes so that bifurcation channels would become active between the lobes. The distributary channel will convey flow and sediment to the west of Big Island.

Benefits and Costs.

From the WVA, this project creates or restores 1,200 acres of wetlands, protects 360 acres, and enhances 230 acres. In addition, 230 acres of aquatic vegetation benefit for at total of 2,020 benefitted acres over a 20 year period.

First cost for this project is $3,821,000. The average annual cost per average annual habitat unit is $696.

Effects and Issues.

Increased sediment and fresh water in western Atchafalaya Bay benefit fringe wetlands in numerous areas.

The Lower Atchafalaya River delta winters up to 250,000 waterfowl. This project immediately increases the marsh area with associated benefits to the waterfowl. Additionally, ducks, ibises, herons, skimmers, and other birds have breeding colonies in the delta. The new delta lobes provides suitable habitat for additional breeding colonies.

Fish populations benefit from the shallow protected environments associated with the delta lobe creation. These areas provide forage and nursery habitats and an additional source of plant detritus. Detrital material contributes to increase inshore and nearshore fish productivity.

The project enhances recreational access and establishes new fishing and hunting grounds.

Mining sediment from Big Island and creating new delta lobes and channels will have no adverse effects on adjacent environment and no direct impacts to flood control or navigation. The project will have no impact to endangered or threatened species. Projects that increase delta growth cumulatively raise project flood stages and increase the frequency and duration of high water the in Terrebonne and Morgan City areas.

Status.

Big Island Mining is a critical short-term project sponsored by NMFS. The project is on the CWPPRA second priority project list.

CRITICAL LONG-TERM PROJECTS

XAT-5 DELTA MANAGEMENT

Location.

The delta management project is located in the Lower Atchafalaya River delta in the Atchafalaya Bay in the lower southeast corner of St. Mary Parish. Fresh marsh comprises 10 percent of the 8,670 acres of subaerial delta. Figure 7 shows the location of the project; Figure 10 shows the project features.

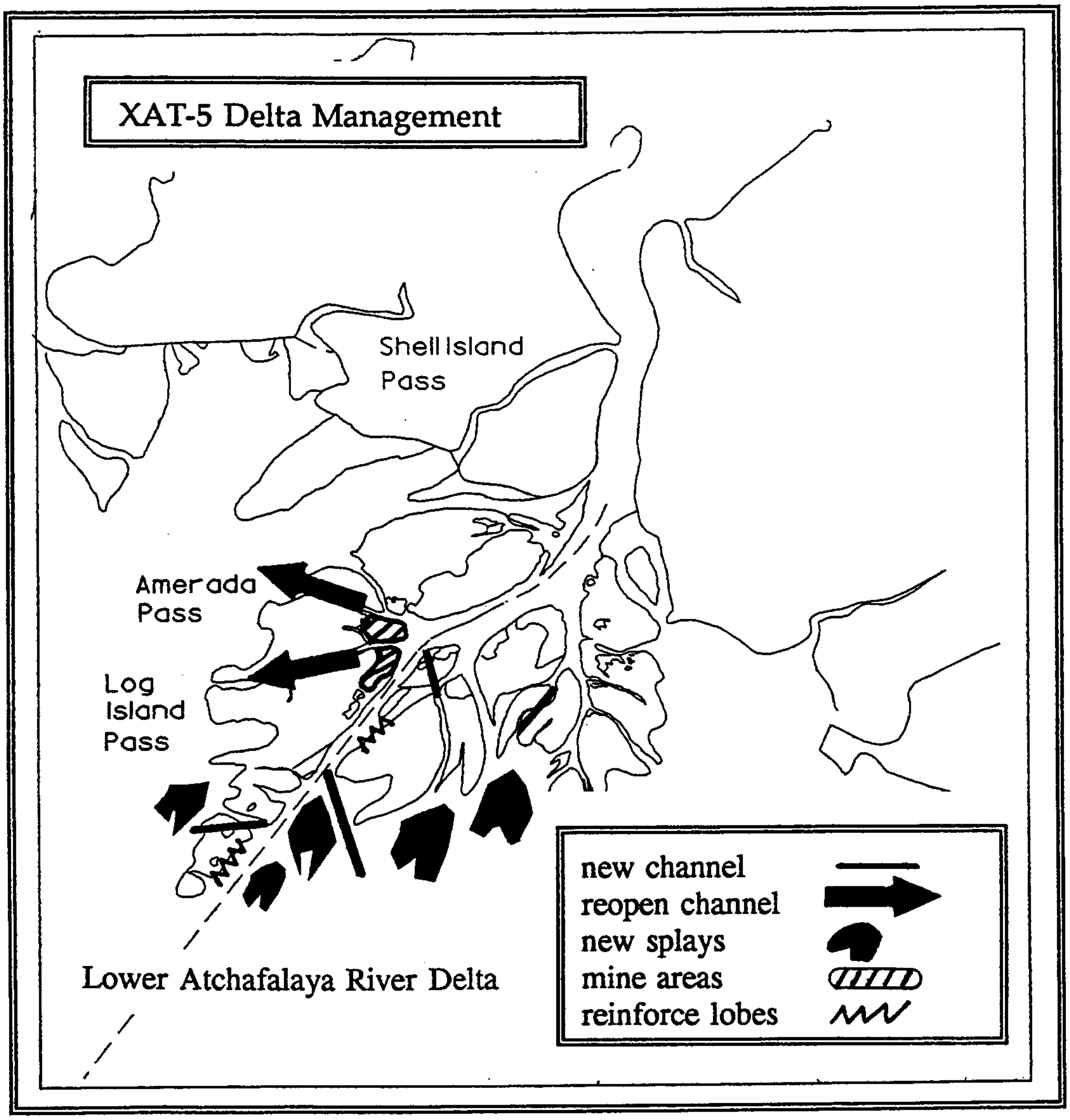

Figure 10

Problems and Opportunities.

The Chene, Boeuf, and Black navigation channel has a significant impact on delta growth in the Lower Atchafalaya River delta, conveying the majority of flow and sediment through the delta. Delta management presents the opportunity to make delta growth and navigation complementary while effectively utilizing the available resources of flow and sediment. This project encompasses the strategy of managing the growth of the Lower Atchafalaya River delta to enhance natural delta growth by decreasing sediment output from the bay.

Description of Features.

This project is a sediment diversion and marsh creation project. Delta management will integrate other projects in the Atchafalaya Bay such as the USACE long-term dredge disposal program for the Chene, Boeuf, and Black navigation channel and the LDWF management area. The planning and implementation processes of delta management will be structured to increase effectiveness. Because of the inability to predict the major processes that will affect delta growth, floods and hurricanes, the delta management plan will be flexible to meet ever changing conditions in the delta. Delta management will be implemented in phases, each preceded by a short term planning period. Short-term planning throughout the implementation phase will provide adaptability that a fixed plan after years of study cannot have. A decision team will make policy and select projects for implementation. The decision team will include agencies with an active interest in the delta and could include LDWF, Soil Conservation Service (SCS), EPA, USFWS, National Marine Fisheries Service (NMFS), the USACE, and LDNR. A technical support team will evaluate data collected in the basin and bay and make recommendations to the decision team. The technical support team will include specialists in hydraulics, geology, vegetation, physical processes of delta growth, dredging, and hydroclimatology. At minimum, representatives from LSU and the USACE will be included. The technical support team will work to develop a decision support system and a data clearinghouse to improve the decision making process in regard to effective use of flow, sediment, and dredged material to maximize wetlands. Based on recommendations from the technical team, the decision team will decide on when and where to implement projects such as those described in the following paragraphs.

Different areas of the Lower Atchafalaya River delta have different needs. Currently, the northern portion of the delta exhibits evidence of slow growth, indicating a lack of flow and sediments. Channels are closing; growth is occurring on upstream portions of delta lobes and not further downstream. The emphasis of a management plan in this area will be natural process reestablishment to promote growth, sediment delivery systems, island geometry restoration, and bifurcation enhancement. In areas where growth is not occurring, dredged material will be used to create new lobes and bifurcation systems. The height of disposal mounds will be varied to encourage diversity in vegetation growth. Several short-term projects include:

1) reopening bifurcations. Natal Channel and Radcliffe Pass are to be reopened under project PAT-2, Atchafalaya Sediment Delivery. Other bifurcations will be reopened when needed. The objective of projects of this type is to reestablish the

natural sediment delivery system in the Lower Atchafalaya River delta and to enhance the system's natural delta building potential.

2) the use of booster pumps. Project XAT-6 Booster Pumps was a candidate for the CWPPRA third priority project list but was not included on the list. Other projects involving the use of booster pumps to dispose dredged material will increase the distance from the navigation channel material can be disposed. Restoration of delta lobes will be accomplished when a source of sediments nearby is absent.

3) spray dredging. Spray dredging, spreading a thin veneer of dredged material over a large area, will be implemented to augment areas that are now predominantly sand with silt to encourage increased vegetation growth and diversity.

4) placement of material on the upstream face of the lobes to strengthen them and create more pronounced lobes and bifurcations. Placement of material in this manner is successful in the USACE long-term dredge disposal program.

5) mining existing islands and dredge disposal areas. The Big Island is to be mined to reduce its height under project XAT-7, Big Island Mining. Other disposal areas will be mined to ensure that sediments are be available for wetland creation while at the same time keeping the disposal areas open for maintenance dredging.

6) cut V-notched breeches in existing disposal mounds to open small bifurcations. The breeches will open the areas behind the disposal mounds to flow and sediment, restoring natural processes.

7) realign bifurcation entrances to increase amount of flow and sediment entering a bifurcation. Bifurcation entrances can be modified to direct more flow and sediment into the bifurcation.

8) create new bifurcations. New bifurcations, either primary, secondary, or tertiary may be necessary to distribute flow and sediment into areas with minimal sedimentation.

9) increase the limitation of human activities such as shell dredging and the creation and maintenance of small navigation channels. Such activities can be reduced or eliminated in areas where insufficient flow and sediment exists to minimize impacts.

In the middle portion of the Lower Atchafalaya River delta, growth occurs in most areas. Management in these areas will be minimal; there is only a need to ensure that other projects and dredging have minimal impact on growth. In the middle section, dredged material will be used to minimize the size of pass in which the navigation channel is located. A project proposed during the scoping process, PAT-1 Channel Modification, will be part of delta management. By minimizing the size to only what is necessary for navigation, an increase in head upstream will divert more flow into the bifurcations on the east and west side, restoring some of the natural delta process. Other short-term projects include: reopening bifurcations, including Amerada Hess and Log Island, if necessary; using booster pumps; and spray dredging.

In the southern section, projects can be used to initiate development of the skeleton framework for growth of the delta lobes. A map of subaqueous lobes and channels will be used to determine where dredged material should be placed. Dredge disposal lobes will be aligned along lines indicated by subaqueous map of delta as well as aerial photography of sediment plumes. Dredge disposal areas will be used to: increase trapping of the finer sediments; reduce wave energy; protect emergent lobes from storms; reinforce bird islands; and create new bird islands. Dredged material will also be placed for redistribution by frontal passages. Other projects include using booster pumps and spray dredging.

Demonstration projects will be developed to evaluate the effectiveness of untried or unstudied ideas. A need exists to develop technology to place dredged material in shallow open water area to low elevations. Frequently, shallow open water areas are only 1 to 2 feet deep, and dredged material needs to be placed to elevations of 1 to **1.5** feet NGVD. Spray dredging results in elevations too low, conventional techniques too high. Ways to effectively fill areas with one to two feet of fill will be studied. Different techniques such as the use of marsh buggies and hovercraft will be evaluated as well at mounting a crane with a nozzle on a marsh buggy.

Another demonstration project is the use of marsh buggies or barge mounted draglines to cut V-notches in the heads of dredge disposal areas. Islands on the east side of the navigation channel have rims of dredged material that start at the head and continue down each flank. Gaps mimicking the natural island geometry were intended to be left at the heads and on each flank during maintenance dredging to allow natural crevasses to fill in the lower central part of the delta lobe. These gaps were not created in most cases due to the inability to write this type of design into bid specifications for dredge disposal. Marsh buggy or barge mounted draglines will be utilized to cut these gaps in the existing deposits. Subsequent floods will scour these incipient crevasses and deposit sediment in the lobe interiors.

A third demonstration project will involve bifurcation enhancement. The normal bifurcation process has been altered by the maintenance of the navigation channel. Much of the coarse sediment usually routed through primary channels to form secondary and tertiary bifurcations is instead deposited in the navigation channel. Instead of disposing the material adjacent to the navigation channel, booster pumps will be used to bring the coarse material to the site of secondary and tertiary bifurcations that have until now been robbed of the necessary coarse sediments. A low triangular apron of sediment at these sites will be spread at the next flood to form the head and flanks of the next subaerial island. Material will be taken from existing disposal areas adjacent to the navigation channel. These existing disposal areas can be intermediate holding areas for sediments to be redistributed to the most beneficial site depending on the type of material. This will reduce the need to look for additional disposal areas for the dredging of the navigation channel as the areas can be reused.

A major concern in the success of any project to create or enhance wetlands in the Atchafalaya Bay is herbivory. Herbivore management must be a part of any delta management plan. Herbivory reduces bulltongue association vegetated areas by almost 50 percent and other associations by lesser amounts. Demonstration projects involving trapping, exclusion, predators, and biological controls such as sterilization or pathogen introduction will be conducted to ensure an effective delta management plan.

The delta management plan will also review the processes involved in the

USACE long-term dredge disposal program. The goals of the disposal program will be incorporated into a viable management plan, making navigation and delta growth complementary. Several procedures that can be implemented now to increase the effectiveness of dredge disposal to create wetlands are:

1. Take four cores prior to dredging, two in the bay channel and two in the bar channel. Do visual classification on one set and take other set to a soils lab for complete classification. Based on type material determined from visual classification, the dredging contractor will follow different disposal plans for different material types. A mixture of sands and silts will be used in critical areas where silt is unlikely to be present. Material that is mostly sands will be used to reinforce delta lobes and create the skeleton framework for future lobes. The cores will be used to assist in development of future plans.

2. Fly annual aerial photography of dredge disposal sites. USACE will take aerial photography after dredging to document and monitor dredge disposal sites.

3. Perform post construction surveys of dredge disposal sites. Surveys will be taken of disposal sites one year after work has been performed to document and monitor physical characteristics of site. From the surveys, an assessment of effectiveness of disposal plans will be made to improve future plans.

4. Conduct site visits one year after dredge disposal to identify presence and generic type of vegetation growing in dredge disposal areas. Vegetation is extremely sensitive to height of disposal mounds, type of material disposed, location of mounds within the bay, and frequency and duration of overflow. Site visits provide valuable information on effectiveness of disposal plans as well as influence decisions on the current and future disposal plans.

5. Use Global Positioning System (GPS) in bay to identify the location for all work, including surveys, dredging, and CWPPRA work. Work then can be included in a Geographic Information System (GIS) database of the Atchafalaya Bay and can be compared to other data collected from other sources.

6. Use GIS as clearinghouse for all information including information on dredge disposal.

7. Use sediment plumes and bathymetry to identify trends in distribution of sand concentrations. The plumes are good indicators of areas of future subaerial growth. During the subaqueous phase of delta growth, underwater lobes and channels develop. These lobes and channels are the framework for subaerial growth. Mapping the subaqueous portions of the delta will assist in identifying areas of future subaerial growth. Dredge disposal plans can rely on this information in selecting locations for disposal sites.

8. Install staff gages or benchmarks within the Atchafalaya Bay tied into the Amerada Hess gage. A critical need exists to establish a benchmark system throughout the delta. Currently, contractors have a difficult time complying with dredging specifications because it is not known what 2 feet NGVD or 4 feet NGVD is in most areas of the bay. Being half a foot off can mean the difference in the type of vegetation present and even the presence of vegetation. Gages will also benefit navigation channel dredging to the desired depth.

Estimate of Costs and Benefits.

Delta management is estimated to increase delta growth in the-Lower Atchafalaya River delta by 15 percent, or 4,730 acres of subaerial land, to a total of 36,300 acres of subaerial land by the year 2045. With management, the ratio of wetlands to subaerial growth increases from 31 percent to 50 percent, the ratio for the Wax Lake Outlet. This translates to a total acreage of 18,150 acres by the year 2045 or an increase of 8,390 acres over future-without project. Delta management enhances all the subaerial land in the Lower Atchafalaya River delta and expands the subaqueous platform for future growth.

Estimated cost for each phase varies depending on location and scope. Reopening two channels such as project PAT-2 has a first cost of $810,000 for a 20 year project life. Adding a new channel in the southern section by spray dredging and making V-notches has a cost around $1,4000,000. Booster pump dredging has a cost around $600,000. Other projects, such as realigning bifurcations, cutting notches, and placing material on upstream face of the delta lobe, cost in the $300,000 to $700,000 range. Total cost, including demonstration projects, planning, and evaluation is approximately $11,350,000 over 20 years and $22,000,000 over 50 years.

Effects and Issues.

With delta management, some natural processes are restored to the Lower Atchafalaya River delta. Growth is less episodic, more similar to the Wax Lake Outlet delta.

Wetlands increase in quantity and diversity as the Lower Atchafalaya River delta no longer depends on floods for growth. An overall increase in bulltongue, willows, cattails, and seasonal vegetation types occurs. Sedge, present now only after high river flows, increases.

The increase in wetlands benefits waterfowl wintering in the area and provides suitable habitat for breeding colonies. The fish population benefits from shallow protected environments associated with delta lobe creation. These areas provide forage and nursery habitats and an additional source of plant detritus. Detrital material continues to increase inshore and nearshore fish production.

With delta management, delta growth raises project flood stages, necessitating modification of the flood control system. Delta growth increases the frequency and duration of high water in the Terrebonne and Morgan City areas. Delta management does not adversely impact navigation.

Herbivore management must be a part of the delta management plan. Herbivory can reduce bulltongue associations by almost 50 percent.

Demonstration projects are needed to develop new dredged material placement techniques that achieve greater control over the elevation material is placed and reduce damage to the wetlands with equipment.

Impacts to flood control need to be addressed and solved. Parishes such as Assumption Parish oppose any plan that does not address the increase in frequency and duration of flooding in the area to the east of the Atchafalaya Basin Floodway system.

Status.

Delta Management is a critical long-term project. Although the goals of the project incorporate the goals and objectives of CWPPRA, implementation goes beyond the scope of CWPPRA. As such, this project requires authorization and separate funding; therefore, it is in the conceptual stage. The first step is for USACE to renew its delta management feasibility study.

SUPPORTING SHORT-TERM PROJECTS

XAT-3 SHORELINE EROSION

Location.

Point Chevreuil is located west of the Wax Lake Outlet in the southern part of St. Mary Parish. The project area includes a five mile stretch of shoreline from the westernmost point of Point Chevreuil to Hammock Canal. The project area is 600 acres, including 540 acres of wetlands. Figure 7 shows the location of the project. Figure 11 shows the project features.

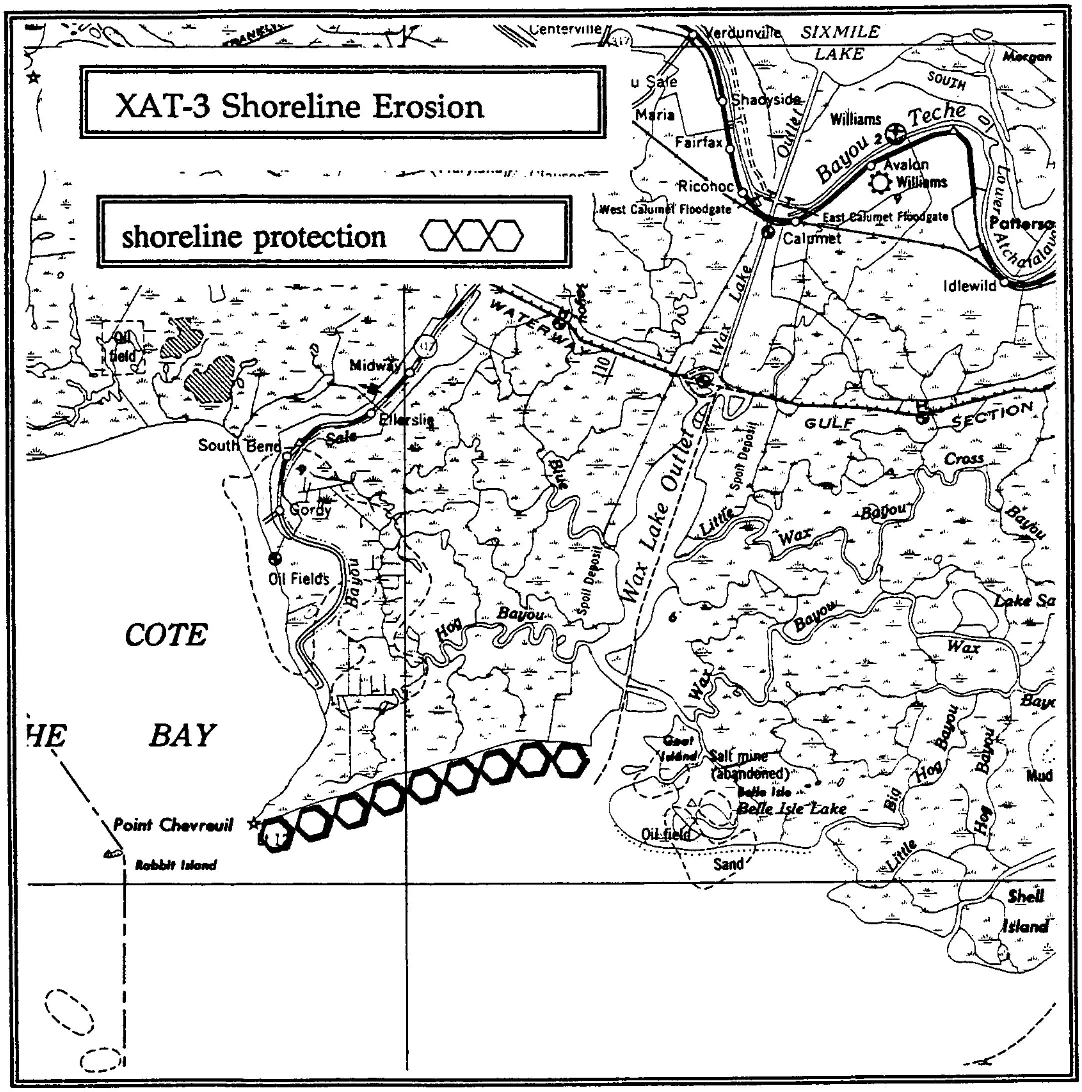

Figure 11

Problems and Opportunities.

Shoreline erosion has taken place on the stretch of shoreline between the Wax

Lake Outlet and Point Chevreuil. Calculated shoreline loss rate in this area is 15.5 feet per year. Approximately 1,060 acres of wetlands have been lost since 1932. This project will reduce the rate of shoreline erosion through shoreline protection measures. These measures reduce shoreline erosion rates by about 75 percent. This project addresses the strategy of reducing erosion through shoreline protection measures.

Description of Features.

This project is a shoreline protection with structures project. Structural devices will be utilized to reduce wave energy, thereby reducing shoreline erosion and subsequent loss of wetlands.

Benefits and Costs.

The WVA group estimates that this project creates or restores 40 acres of wetlands, protects 190 acres, and enhances 30 acres over a 20 year project life. An additional 20 acres of aquatic vegetation also benefit for a total of 280 acres.

Estimated first cost for this project is $900,000.

Effects and Issues.

This project will have no adverse effects on flood control, navigation, or adjacent environment. The project will have no impact to endangered or threatened species.

This project is a lower priority than other shoreline erosion projects in the overall restoration plan; the growth of the Wax Lake Outlet will have a greater influence on this area in the future.

Status.

This short-term supporting project is in the conceptual phase.

XAT-6 BOOSTER PUMPS

Location.

The project area is shallow open water to the east of the Chene, Boeuf, and Black navigation channel in the Lower Atchafalaya River delta in the Atchafalaya Bay, in the lower southeast corner of St. Mary Parish. The project area is just south of the eastern half of the Lower Atchafalaya River delta. Figure 7 shows the location of the project; Figure 12 shows the project features.

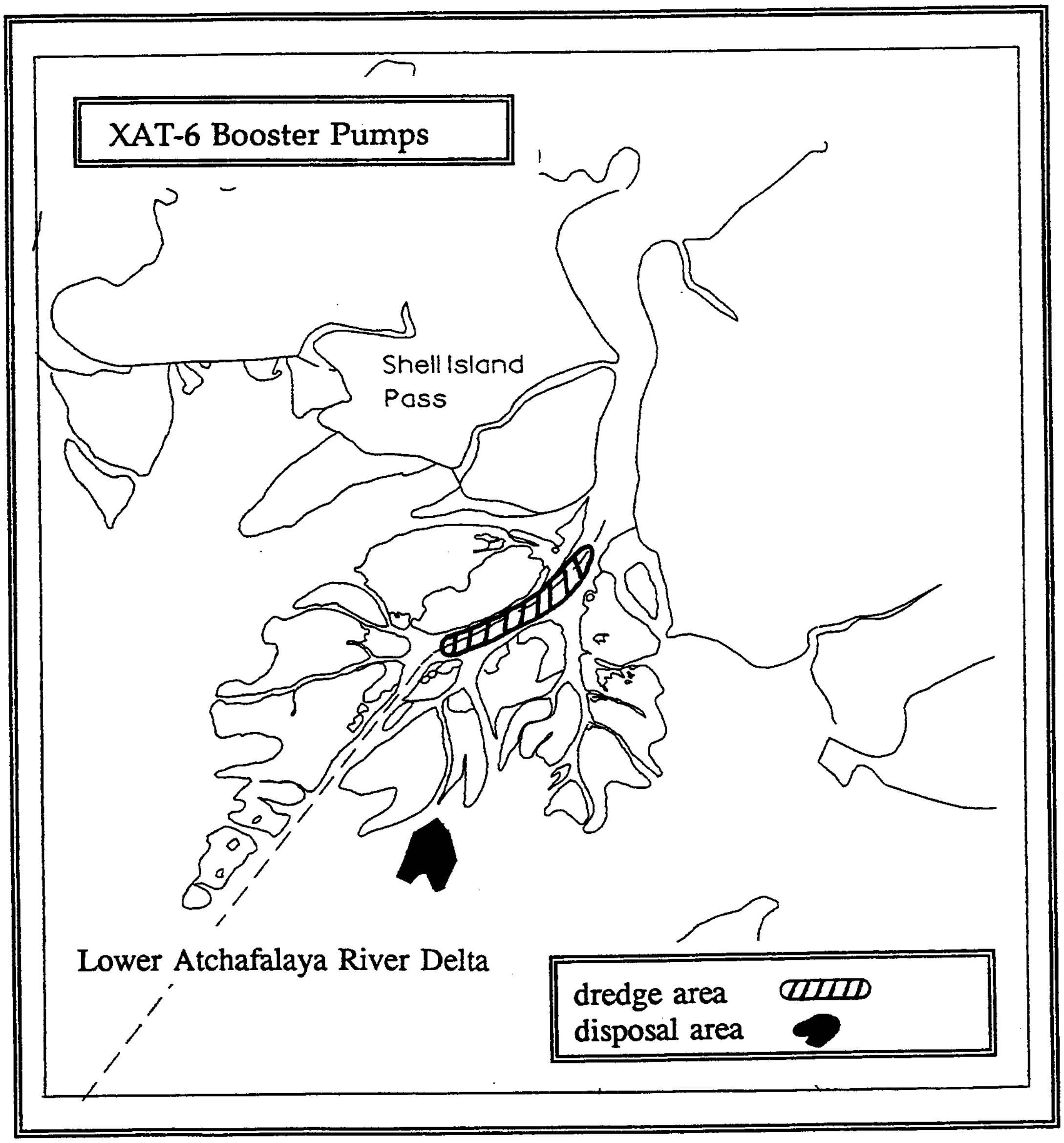

Figure 12

Problems and Opportunities.

Annually, USACE dredges an average of 2,000,000 cubic yards of sediment from the Chene, Boeuf, and Black navigation channel and disposes the material in designated disposal areas adjacent to the channel. Dredging-is necessary to maintain the navigation channel. Flow and sediment concentrate in the navigation channel, bypassing the delta. This material could be beneficially used in other areas of the Lower Atchafalaya River delta to create new delta lobes, create the foundation for additional deposition of finer grained sediments and new bifurcations, and reduce losses from natural processes such as waves, currents, and passage of cold fronts. This project addresses the strategy of managing the growth of the Lower Atchafalaya River delta to decrease the output of sediments from the Atchafalaya Bay.

Description of Features.

Material will be dredged from the Chene, Boeuf, and Black navigation channel by hydraulic cutterhead pipeline dredge, transported through dredge pipe using booster pumps to an area just south of a delta lobe between God's Pass and South Pass, and disposed unconfined in shallow open water.

Benefits and Costs.

The WVA group estimates that over a 20 year project life this project creates or restores 80 acres of wetlands, protects no acres, and enhances 10 acres. An additional 20 acres of aquatic vegetation also benefit for a total of 110 acres.

First cost for this alternative is $977,000. Costs can be reduced by decreasing the distance from the dredging site and the disposal site.

Effects and Issues.

The dredged material protects existing delta from the passage of winter cold fronts that result in land loss within the delta. The material enhances the existing delta by increasing the ability of the delta lobes to trap finer grained sediments. With increased sediment deposition, existing delta converts to wetlands at a faster rate. The dredged material also facilitates the creation of bifurcations increasing the transport of sediments within the delta system.

This project will have no adverse effects on adjacent environment and no direct impacts to flood control or navigation. The project should have no impact to endangered or threatened species. Projects that increase delta growth cumulatively raise project flood stages and increase the frequency and duration of high water the in Terrebonne and Morgan City areas.

LDNR feels that all projects to beneficially use material associated with maintenance dredging, should be borne by USACE regardless of cost.

Status.

This short-term supporting project was a candidate for the Act's third priority project list, but was not selected. The project is in the conceptual phase.

XAT-8 DREDGE SEDIMENTS INTO WAX LAKE OUTLET

Location.

The project area is the Atchafalaya Basin Main Channel near mile 104 and the Wax Lake Outlet in St. Martin and St. Mary Parishes. The project area benefitted consists of 7,320 acres of subaerial delta, 730 acres considered wetlands. Figure 7 shows the location of the project; Figure 13 shows the project features.

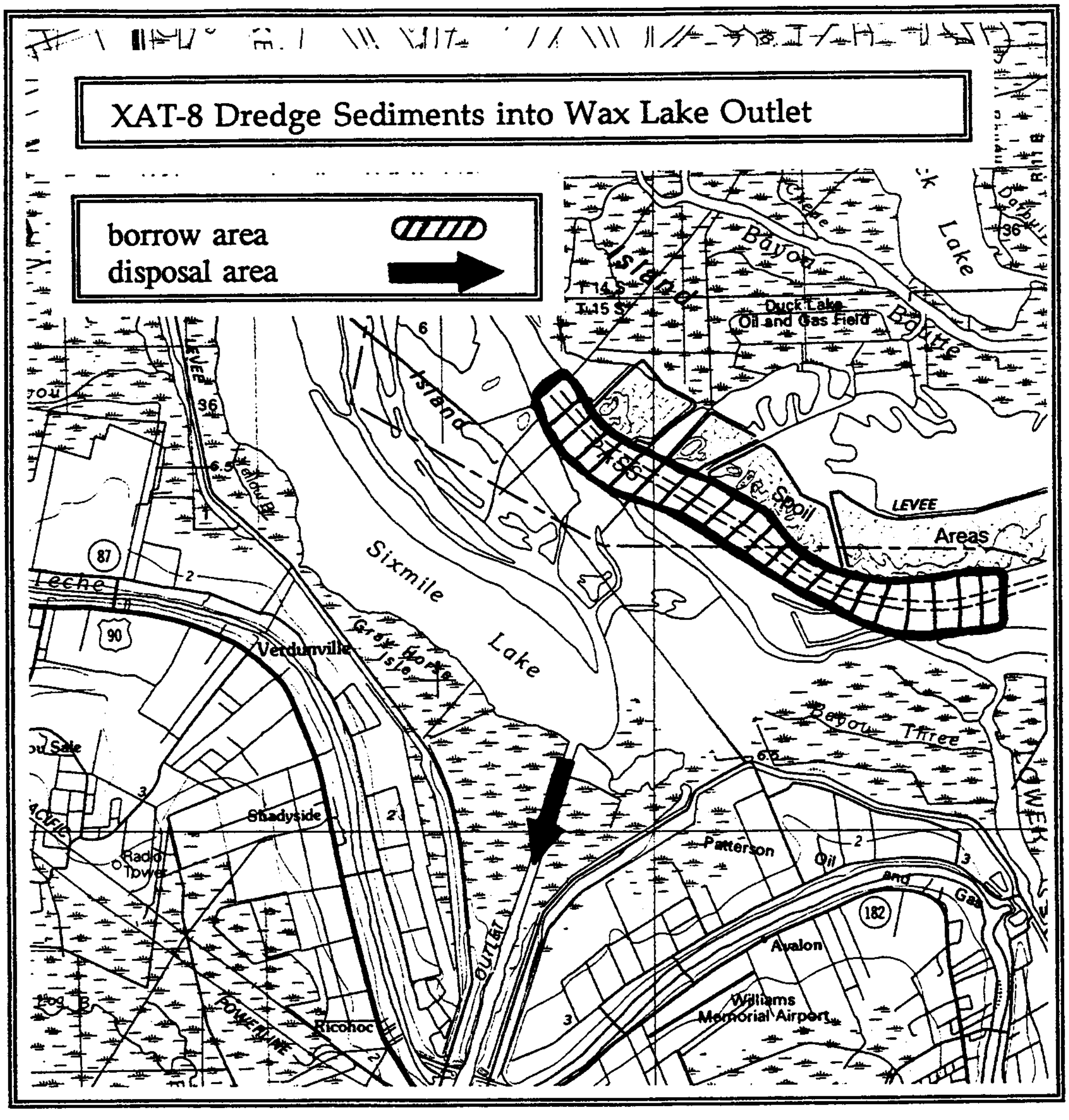

Figure 13

Problems and Opportunities.

The Wax Lake Outlet delta grows two to three times faster than the Lower Atchafalaya River delta with less flow, primarily due to the presence of the Chene, Boeuf, and Black navigation channel affecting the distribution of flow and sediments within the Lower Atchafalaya River delta. Increasing sediments down the Wax Lake Outlet is a more effective use of the sediments in the Atchafalaya Basin as more growth occurs with less sediment. This project encompasses the strategy of increasing sediment input to the Atchafalaya Bay by dredging and serves as an interim plan until the Wax Lake Outlet is realigned.

Description of Features.

For this sediment diversion project, approximately 600,000 to 700,000 cubic yards of sand will be dredged from the Atchafalaya Basin Main Channel and disposed into the Wax Lake Outlet, a distance of approximately 14,000 feet. Dredging will take place over a two month period just before the high water season to take advantage of the sediment transport capacity of the Wax Lake Outlet. Material will be disposed into the Wax Lake Outlet instead of Six Mile Lake because Six Mile Lake does not have the transport capacity to convey the additional sediment load. Dredging is recommended a site on the inside of the bend of the Atchafalaya River Main Channel where the river can replenish material. By selecting this site, routine dredging is possible.

Benefits and Costs.

Currently, the Wax Lake Outlet conveys about 15 percent of the sands of the Atchafalaya River with 30 percent of the flow, or about 4,1000,000 cubic yards per year. The material dredged is a 15 percent increase in the amount of sands conveyed by the Wax Lake Outlet. The rate of growth of subaerial land of the Wax Lake Outlet delta is estimated to increase from 520 acres per year to 600 acres per year from the increase in sands. An estimated 51 percent of the new subaerial land becomes vegetated. Therefore, the project is expected to create 40 acres of wetlands. The WVA group estimates that the project enhances 850 acres of wetlands and benefits 1,180 acres of aquatic vegetation over a 20 year project life for a total of 2,070 acres.

The estimated cost of the dredging, including contingencies, engineering and design, and supervision and administration of the project implemented once is $1,530,000.

Effects and Issues.

With the project, the dredged material deposits on the upstream ends and along the leading edges of the delta lobes in the Wax Lake Outlet delta. Seasonal and willow vegetation increase. The increase in willows results in an increase in cattails as willows provide protection from direct river flows. Willows also increase sediment trapping.

The increase in wetlands benefits waterfowl wintering in the area and provides suitable habitat for breeding colonies. The fish population benefits from shallow protected environments associated with delta lobe creation. These areas provide forage and nursery habitats and an additional source of plant detritus. Detrital material continues to increase inshore and nearshore fish production.

The channel capacity of the Atchafalaya Basin Main Channel in the vicinity of the Wax Lake Outlet may enlarge, resulting in a reduction in the frequency and duration of high water in the Morgan City area. Increased flood elevations resulting from the delta growth may offset these flood control benefits.

The project may impact growth in the Lower Atchafalaya River delta by reducing sediment storage in the Lower Atchafalaya River. Therefore, less sediment is available for transport during flood flows unless another source of sediment is available, i.e. bank and bar material.

Key issues include environmental, flood control, navigation, and engineering concerns. The environmental impacts of dredging in the Atchafalaya Basin Main Channel need to be addressed. The impact on flood control needs to be addressed. The change in distribution of sediments in the two outlets should be studied using models such as HEC-6 to identify the impacts on flood control. The sediment transport rate of the entire length of the Wax Lake Outlet needs to be evaluated to ensure that the dredged material reaches the bay, does not deposit in the channel, or is not diverted into the GIWW.

Evaluation of the potential for repeating the dredging on a routine basis is necessary. Repetition depends on the how quickly sands replenish the dredge site.

Status.

This short-term supporting project is in the conceptual phase. Engineering and environmental studies are needed to complete a detailed design.

SUPPORTING LONG-TERM PROJECTS

XAT-4 ESTABLISHED WETLAND MANAGEMENT

Location.

The project area is the wetlands adjacent to the Lower Atchafalaya River channel, from Morgan City to the Atchafalaya Bay, located in St. Mary Parish as shown on Figure 7 and Figure 14.

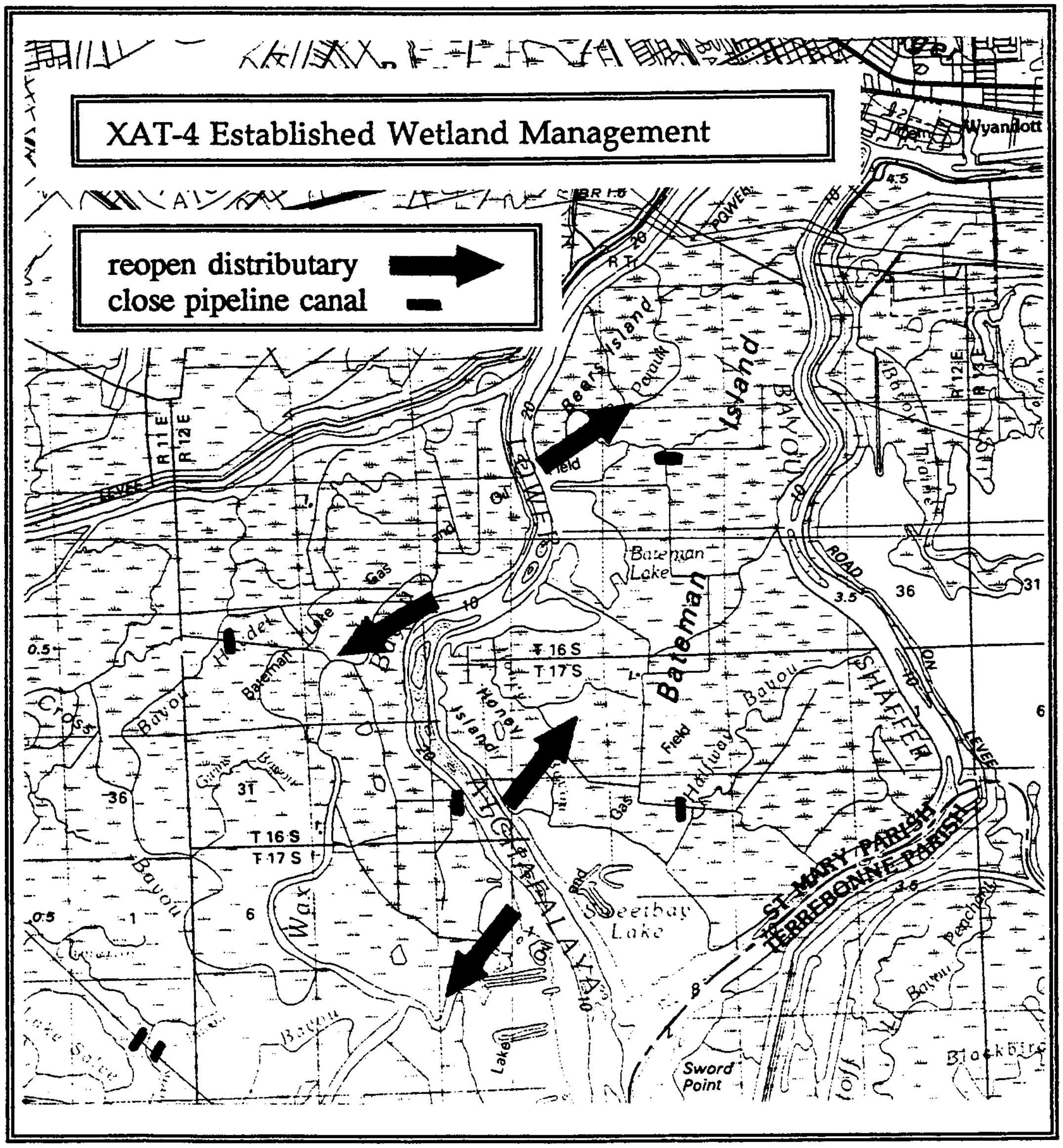

Figure 14

Problems and Opportunities.

Human activities have an impact on the natural evolution of the wetlands in the

Mainland Subbasin. Although the wetlands in this subbasin are healthy now, the potential exists in the future for problems to arise as a result of human activities such as construction of pipeline canals. If these problems arise, the opportunity exists to manage the evolution of these established wetlands to reduce the impacts. This project encompasses the strategies of restoring fluvial inputs by closing pipelines and reopening distributaries.

Description of Project Features.

This project is a sediment diversion and marsh creation project. Pipeline canals will be closed where necessary. Channels and V-notches will be constructed off the Lower Atchafalaya River to convey flow and sediments to the adjacent wetlands. Dredged material will be used to restore wetlands lost through human activities and from the natural evolution of the Lower Atchafalaya River from an estuarine environment to a riverine environment.

Benefits and Costs.

WVA information was not determined for this project.

Implementation offsets an estimated half of the 87 acres per year land loss currently experienced in the Mainland Subbasin. The project restores about approximately 800 acres of wetlands over a 20 year project life and approximately 2,000 acres over a 50 year project life.

Gross estimated construction cost for this project is $300,000, including contingencies, engineering and design, and supervision and administration. This cost does not include monitoring, operation and maintenance, relocations, real estate, or mitigation for environmental damages or costs for flood control from increased delta growth.

Effects and Issues.

Restoration of wetlands has a positive effect on wildlife habitats in the Lower Atchafalaya River area, particularly birds. The project also has no direct effect on flood control or navigation.

This project is best suited for a phased implementation approach, where phases of the project are executed when and where the need exists to restore wetlands lost through human activity and the natural evolution of the Lower Atchafalaya River area from an estuarine environment to a riverine environment.

Status.

This project is a long-term supporting project in the conceptual phase.

XAT-9 RELOCATE NAVIGATION TO SHELL ISLAND PASS

Location.

Shell Island Pass is located around mile 130 of the Lower Atchafalaya River in St. Mary Parish as shown on Figures 7 and 15.

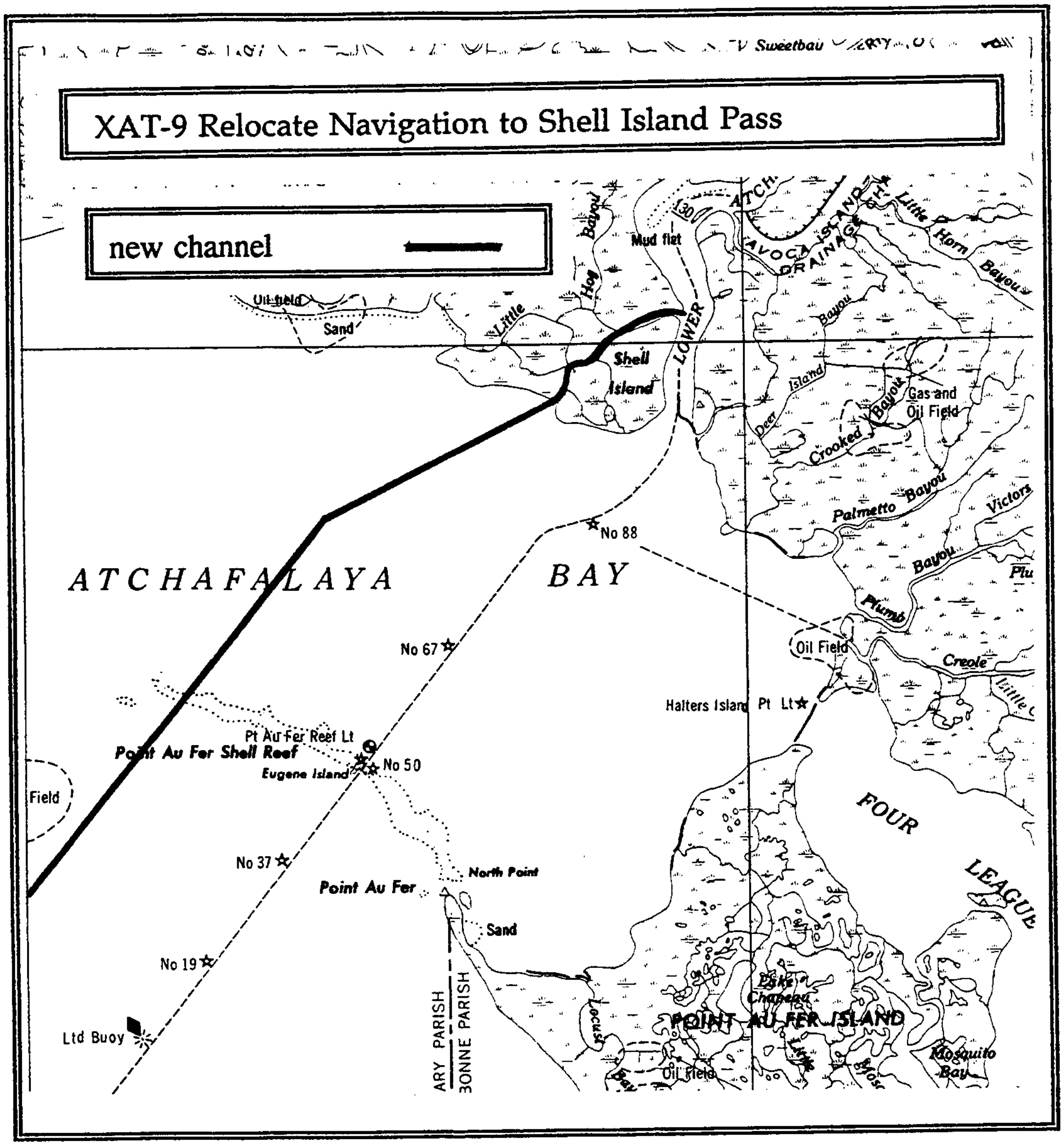

Figure 15

Problems and Opportunities.

The presence of the Chene, Boeuf, and Black navigation channel has significantly impacted the growth of the Lower Atchafalaya River delta. Relocating the channel outside the delta reduces the effects of human activity on delta growth and wetland development. This project achieves the strategy of moving the navigation channel to increase the retention of sediments within the delta and therefore reduce the output of sediments from the Atchafalaya Bay.

Description of Project Features.

This project is a sediment diversion project. The 20 foot x 400 foot navigation channel will be relocated to Shell Island Pass from the Lower Atchafalaya River to the Atchafalaya Bay and then through the area between the two deltas out into the Gulf of Mexico following a tidal channel that is expected to develop in the future. Bendway weirs will be constructed to keep the majority of flow and sediments going down the Lower Atchafalaya River. Sufficient flow will go down Shell Island Pass to maintain the navigation channel and prevent saltwater intrusion as much as possible. A structure on Shell Island Pass is not engineeringly feasible because of the needed clearance above the water surface for passage of oil rigs out to sea.

The project will be constructed after the Lower Atchafalaya River has developed into a stable channel and the two deltas have grown such that a tidal channel has developed between them. The delay will ensure that the structural measures will be effective and the project will not have to be continually modified.

Benefits and Costs.

WVA information was not determined for this project.

With the navigation channel relocated, the Lower Atchafalaya River delta grows at a rate similar to the Wax Lake Outlet delta. If the project was constructed after 20 years, then an increase in subaerial land of 6,300 acres is expected by the year 2045. The rate of wetland development increases to the rate for the Wax Lake Outlet delta. The project creates an additional 9,040 acres of wetlands over the without project scenario by the year 2045.

Estimated construction cost for this project is $90,000,000, including contingencies, engineering and design, and supervision and administration. This cost does not include monitoring, operation and maintenance, relocations, real estate, mitigation for environmental damages, or costs for flood control from increased delta growth.

Effects and Issues.

The project restores natural process to the Lower Atchafalaya River delta. Growth is less episodic, more similar to the Wax Lake Outlet delta. Wetlands increase in quantity and diversity as delta growth in the Lower Atchafalaya River delta is not solely dependent on floods. An overall increase in bulltongue, willow, and cattail, and seasonal associations occurs as well as sedge, present now only after high river flows.

The increase in wetlands benefits waterfowl wintering in the area and provides suitable habitat for breeding colonies. The fish population benefits from shallow protected environments associated with delta lobe creation. These areas provide forage and nursery habitats and an additional source of plant detritus. Detrital material continues to increase inshore and nearshore fish production.

The project has a positive impact on navigation. Maintenance costs are lower because the majority of the sands continue down the Lower Atchafalaya River and bypass the navigation channel.

Delta growth raises flood stages in the middle and lower portions of the Atchafalaya Basin Floodway system. Increased delta growth increases the frequency and duration of high water in the Terrebonne Basin and in the Morgan City area. The impacts of increased delta growth on flood control need to be identified and addressed. If the flood control impacts are significant, they need to be resolved before implementation of this project.

A second issue is the engineering feasibility of bendway weirs to reduce sediment diversion Bendway weirs have an effect on current patterns on river bottoms. However, bendway weirs have never been used for diversion purposes. Model studies are currently underway to determine if bendway weirs can be used to increase sediment diversion at the Old River project. Numerical or physical model studies are necessary to determine the engineering feasibility. The potential exists for scour to develop at the ends of some of the weirs, requiring weir extension after the channel develops, increasing the cost.

A third issue is the timing of the implementation of this project. Monitoring of the Lower Atchafalaya River and the Atchafalaya Bay is necessary to determine when this project can be implemented.

Status.

This long-term supporting project is in the conceptual phase. The project is more effective when implemented in the future when the Lower Atchafalaya River channel is more stable. Engineering studies are needed to complete a detailed design. A model study is recommended to evaluate the bendway weirs.

XAT-10 REALIGN WAX LAKE OUTLET

Location.

The project is located near mile 104 of the Atchafalaya Basin Main Channel in St. Martin and St. Mary Parishes as shown on Figures 7 and 16.

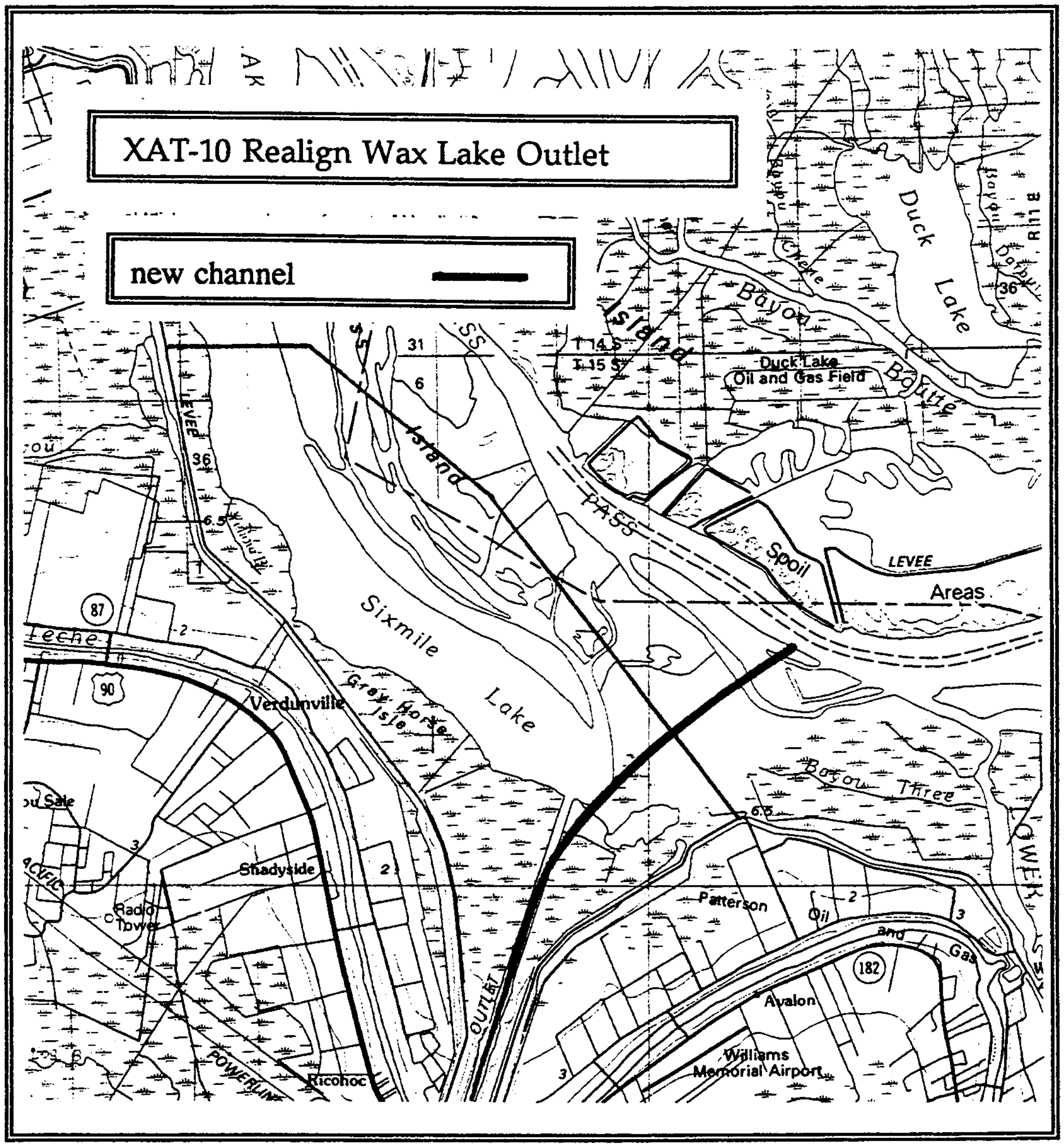

Figure 16

Problems and Opportunities.

The Wax Lake Outlet delta grows two to three times faster than the Lower Atchafalaya River delta with less flow, primarily due to the presence of the Chene, Boeuf, and Black navigation channel affecting the distribution of flow and sediments within the Lower Atchafalaya River delta. This project increases sediments down the

Wax Lake Outlet, a more effective use of the sediments in the Atchafalaya Basin as more growth occurs with less sediment. This project encompasses the strategy of realigning the entrance to the Wax Lake Outlet to increase sediment input to the Atchafalaya Bay.

Description of Project Features.

For this sediment diversion project, the entrance to the Wax Lake Cutlet will be realigned, and bendway weirs will be constructed to increase the amount of bed sediments entering the outlet. The channel entrance will be located downstream of numerous pipelines traversing the Atchafalaya Basin Main Channel. The angle of the channel entrance will be aligned to increase the amount of bed sediments entering the outlet. The new channel will bypass Six Mile Lake as the lake's channel is not efficient enough to convey the additional sediments. The new channel will be the original size of the Wax Lake Outlet. The material dredged from the new channel will be placed in the deep areas of the Wax Lake Outlet in the vicinity of Calumet. The Wax Lake Outlet weir will be closed up to the elevation of the connecting levees. The Wax Lake Outlet will still be available to convey flood flows by overtopping the weir and connecting levees.

Benefits and Costs.

WVA information was not determined for this project.

Currently, the Wax Lake Outlet conveys about 15 percent of the sands of the Atchafalaya River with 30 percent of the flow, or about 4,100,000 cubic yards per year. Based on model tests of bendway weirs for the Old River project, WES estimates that bendway weirs in the Atchafalaya Basin Main Channel would divert about 20 percent of the Atchafalaya River sediments. The rate of growth of subaerial land of the Wax Lake Outlet delta is estimated to increase from 520 acres per year to 700 acres per year from the increase in sediments. It is estimated that 51 percent of the new subaerial land would become vegetated. Therefore, the project creates 4,590 acres of wetlands over a 50 year project life and 1,840 acres over a 20 year project life.

The estimated cost of the project, including contingencies, engineering and design, and supervision and administration is $20,295,000.

Effects and Issues.

The greater sand load reaching the Wax Lake Cutlet delta increases vegetation associations such as seasonal, willows, cattails, and bulltongue.

The increase in wetlands benefits waterfowl wintering in the area and provides suitable habitat for breeding colonies. The fish population further benefits from shallow protected environments associated with delta lobe creation. These areas provide forage and nursery habitats and an additional source of plant detritus. Detrital material continues to increase inshore and nearshore fish production.

If the distribution of flow remains at 70/30, then the proportion of sediments down the Lower Atchafalaya River to flow become balanced; deposition in the Lower Atchafalaya River channel decreases. The project may impact growth in the Lower

Atchafalaya River delta but of lesser magnitude than increasing the flow down the Wax Lake Outlet. If the distribution of flow is unaffected, sediment storage in the Lower Atchafalaya River decreases. Therefore, less sediment is available for transport during flood flows unless another source of sediment is available, i.e. bank and bar material.

This project will have no adverse effects on adjacent environment and positive short-term impacts to flood control and navigation. The project will have no impact to endangered or threatened species. Projects that increase delta growth cumulatively raise flood stages in the basin and floodway system.

With the realigned entrance to the Wax Lake Outlet, the distribution of flow between the two outlets may be affected. Engineering design is necessary to ensure that the distribution does not increase significantly. If the flow down the Wax Lake Outlet increases significantly, then the effects increase.

A second issue is the engineering feasibility of bendway weirs to increase sediment diversion. Bendway weirs have an effect on current patterns on river bottoms. However, bendway weirs have never been used for diversion purposes. Model studies are currently underway to determine if bendway weirs can be used to increase sediment diversion at the Old River project. Due to the area of concern, the amount of flow required and its effects on the Wax Lake Outlet channel transport capacity, and the need to quantify flood control impacts, this project needs to be studied with numerical or physical models. The potential exists for scour to develop at the right ends of some of the weirs, requiring extension of the weirs after the channel develops, increasing the cost.

A third issue is the impact on flood control and navigation. The change in distribution of flow and sediments in the two outlets should be studied using models such as HEC-6 to identify the impacts on flood control and navigation.

A fourth issue is the estimate of wetlands resulting from the increase in sediment load. The estimate used is based on simple relationships between sediment load, subaerial growth, and percent vegetation, simple relationships describing a complex process. It is recommended that the estimate of wetlands be revisited using more sophisticated methods.

Status.

This long-term supporting project is in the conceptual phase. Engineering and environmental studies are necessary to develop the design of the project and determine all the environmental impacts. A model study is recommended to evaluate the channel realignment and bendway weirs.

SUPPORTING RESEARCH

Demonstration projects developed for project XAT-12 Delta Management are discussed in the project descriptions section for this project. These demonstration projects support other wetland creation efforts along the coast.

A significant need exists for additional information in the Atchafalaya Basin. The following inventories and studies are needed in the Atchafalaya Basin to properly assess the effects of projects and evaluate prospective benefits:

1) Development of a GIS for the Atchafalaya Bay to serve as clearinghouse for information on activities in the bay, including: permits; dredging, dredge disposal areas, and dredge as-built information; active and inactive oil well locations; pipelines; gages; flow and current patterns; sediment deposition; and vegetation.

2) Compilation of baseline information, including aerial photos, bathymetry, topography, bifurcation flows, sediment, centerline profiles of bifurcations, particle size, and vegetation.

3) Vegetative remapping of Atchafalaya Bay. The last complete mapping was completed by LSU in early 1980's.

4) Study on the relationship between vegetation type, elevation, particle size, compaction rates, and location in the Atchafalaya Bay to identify key factors in the design of disposal plans.

5) Engineering study on flow and sediment distribution in the bifurcations to identify hydraulic aspects of the Lower Atchafalaya River delta. The study serves as a preliminary assessment of what bifurcations on both sides of delta need reopening. The study includes replication of discharge and sediment measurements made in the 1970's and 1980's.

6) Engineering study on hydraulic gradients in Lower Atchafalaya River delta to evaluate energy grade slopes in the bay and identify areas where riverine processes are absent or insufficient to offset tidal processes that result in wetland loss. The areas identified are candidates for beneficial use of dredged material. The study includes the installation of staff gages throughout bay area to determine hydraulic slopes and assist in the dredged material disposal program.

7) Survey of area beyond Eugene Island, last surveyed in 1981, to give evidence of prodelta and subaqueous delta development. From comparison of the two surveys, an assessment of the need for seeding growth in this area can be determined.

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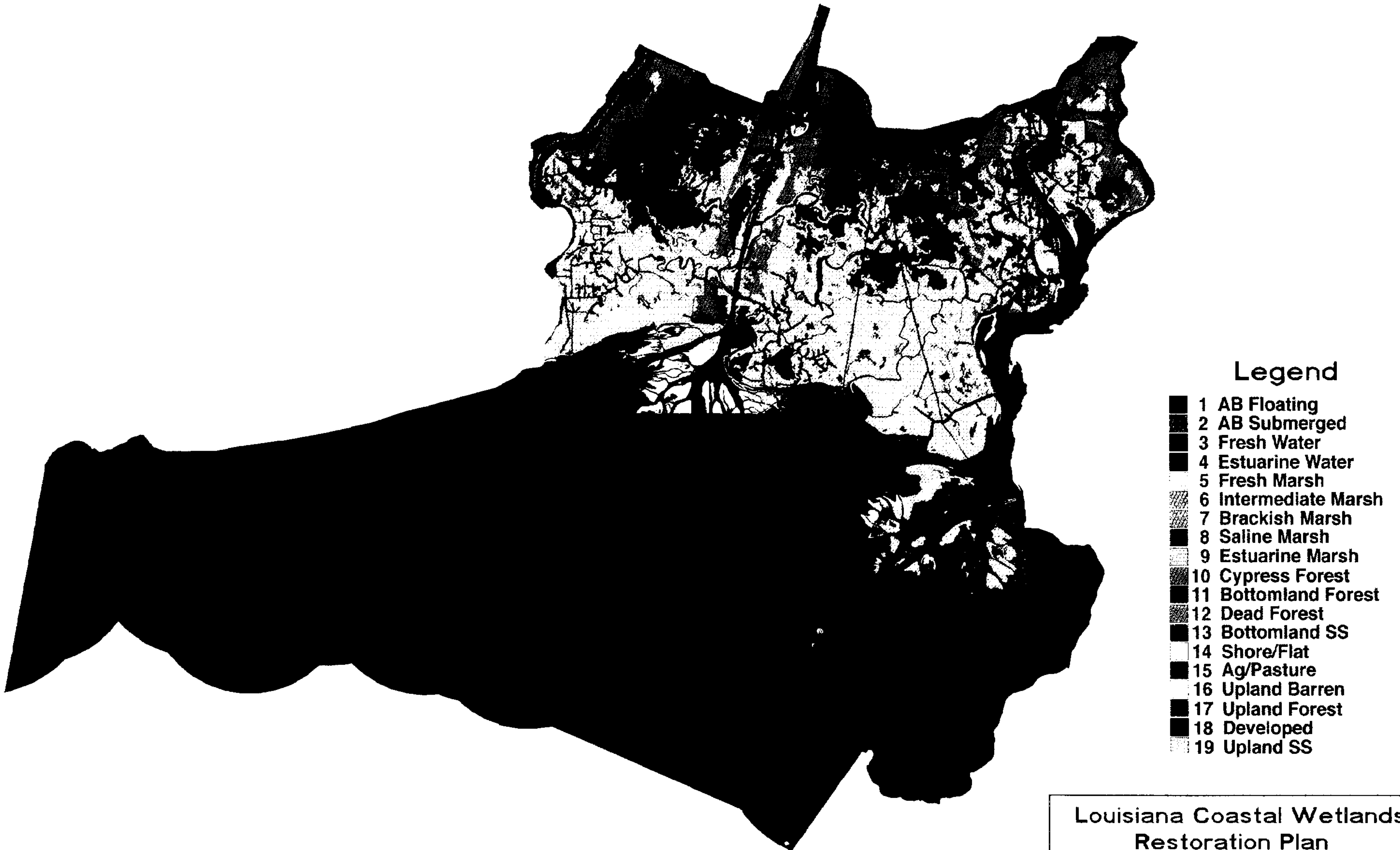

Louisiana Coastal Wetlands
Restoration Plan
Atchafalaya Basin

1988 HABITAT DATA

date: April 1993

PLATE 1