LOUISIANA COASTAL WETLANDS RESTORATION PLAN

TERREBONNE BASIN
APPENDIX E

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APPENDIX E

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INTRODUCTION

STUDY AREA

The Terrebonne Basin (Figure 1) covers approximately 1,712,500 acres, including open water. There are about 728,700 acres of wetlands in the Terrebonne Basin. The basin is bordered by Bayou Lafourche on the east, the Atchafalaya Basin floodway levee on the west, the Gulf of Mexico on the south, and the Iberville/Assumption and Iberville/Ascension Parish boundaries between the Atchafalaya Basin and the Mississippi River on the north. The basin includes all of Terrebonne Parish, and parts of Lafourche, Assumption, St. Martin, St. Mary's, Iberville, and Ascension Parishes.

For the Restoration Plan, the basin is divided into four subbasins as shown on Figure 1. The Timbalier Subbasin (800,800 acres, including 278,800 acres of wetlands) is south of Bayous Terrebonne and Blue, between Bayou du Large on the west and Bayou Lafourche on the east. The Penchant Subbasin (503,700 acres, including 306,500 acres of wetlands) is south of Bayous Boeuf and Black, between the Atchafalaya River and Bay on the west, and Bayou du Large on the east; it includes Point au Fer Island The Verret Subbasin (279,300 acres, including 118,900 acres of wetlands) lies north of Bayous Boeuf and Black, and west of Bayou Terrebonne. The Fields Subbasin (128,700 acres, including 24,500 acres of wetlands) is north and east of Bayou Terrebonne and north of Bayou Blue.

Most of the wetlands (about 96 percent) in Terrebonne Basin are privately owned, with little interspersion of federally or state owned land. The Terrebonne Basin includes no federally owned wetlands. State owned land is represented by the Pointe au Chien Wildlife Management Area (WMA), managed by the Louisiana Department of Wildlife and Fisheries (LDWF) and covering 28,244 acres in the eastern portion of the Timbalier Subbasin. In addition, the LDWF leases Raccoon and Whiskey Islands in the Isles Demieres barrier chain, and manages them as WMAs.

EXISTING PROJECTS AND PROGRAMS

U.S. ARMY CORPS OF ENGINEERS

Navigation and flood control projects are major features of the Terrebonne Basin. The U.S. Army Corps of Engineers (USACE) maintains several navigation channels in the Terrebonne Basin, including the Gulf Intracoastal Waterway (GIWW) and the Houma Navigation Canal (HNC). The GIWW runs across the basin (east to west) for about 36 miles, from Larose, through Houma, to the Atchafalaya River at Morgan City. Its authorized size is a bottom width of 125 feet and depth of 12 feet; it is about 200 to 300 feet wide bank to bank, and up to 400 feet wide in some areas. Vessel traffic on the GIWW can be a major source of erosion of the typically fresh and intermediate marshes that the GIWW passes through. The HNC, constructed in 1962 by local interests, extends for about 27 miles south from Houma to Terrebonne Bay. It is about 300 feet wide bank to bank, and the channel is about 15 feet deep. As a north-south channel, the HNC serves as a major conduit for the movement of salt water up into the basin. The USACE uses spoil from its maintenance dredging programs to develop small amounts of marsh in several parts of the basin, with the greatest effort being along the HNC.

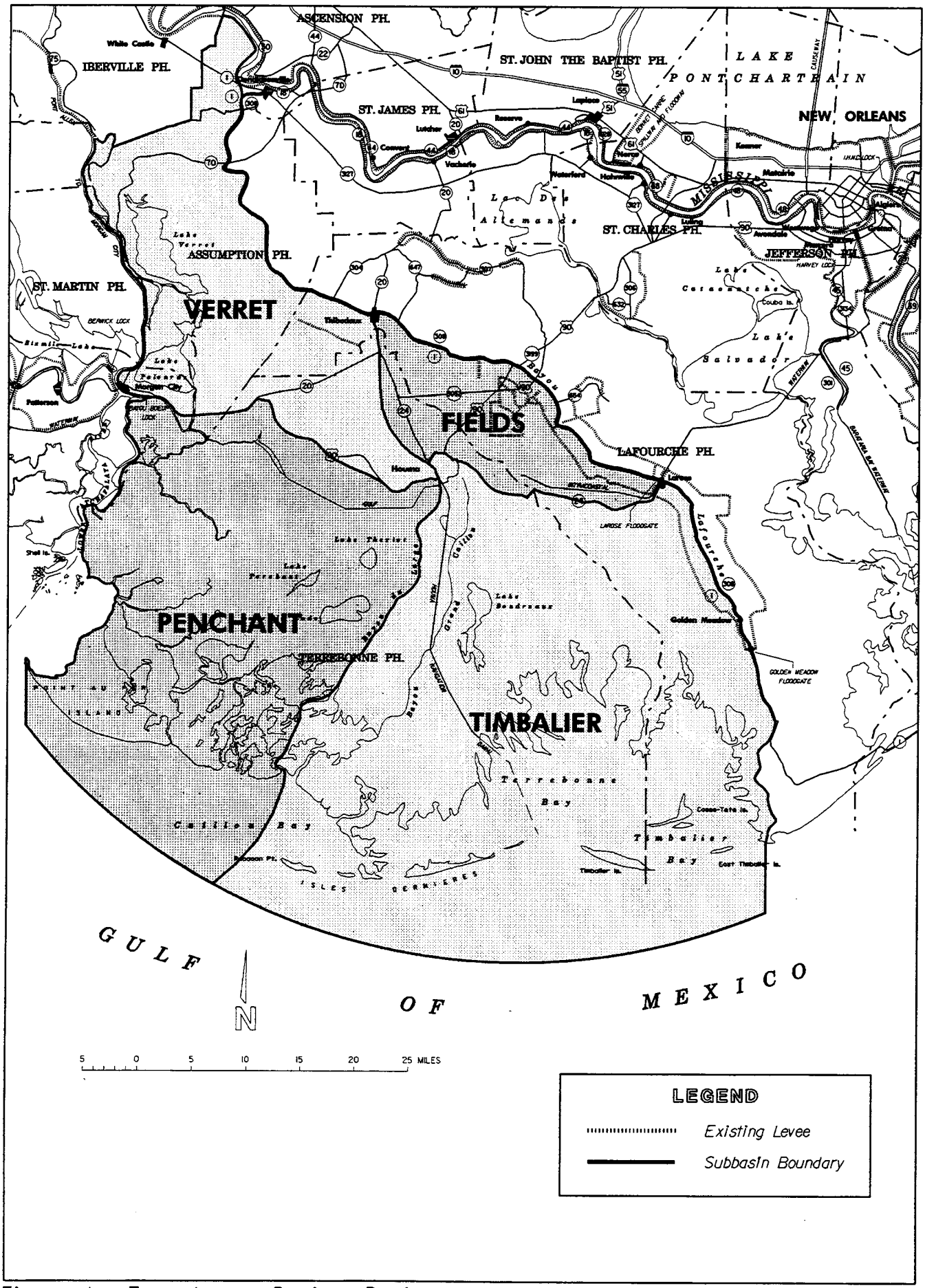


Figure 1. Terrebonne Basin, Basin and Subbasin Boundaries.

A major flood control project in the eastern part of the basin is the Larose to Golden Meadow Hurricane Protection Project. In the western part of the basin there is the East Atchafalaya Basin Protection levee.

U.S. ENVIRONMENTAL PROTECTION AGENCY

A Comprehensive Coastal Management Plan (CCMP) is being developed as part of the Barataria-Terrebonne National Estuary Program (BTNEP), a five-year, multi-agency planning effort administered by the U.S. Environmental Protection Agency (USEPA). Once the plan has been developed, projects carried out in the area must be consistent with that plan.

U.S. FISH AND WILDLIFE SERVICE

In 1991, the U.S. Fish and Wildlife Service (USFWS) constructed two small marsh management projects, covering approximately 175 acres, in the Jug Lake area to conduct research regarding the effects of active management.

U.S. SOIL CONSERVATJON SERVICE

The Soil Conservation Service (SCS) has an active marsh conservation planning program in the Terrebonne Basin, conducted in conjunction with landowners and the South Terrebonne Tidewater Management and Conservation District (STTMCD). Two of the larger projects are: 1) a 500,000 acre marsh conservation plan with the landowners in the Penchant Subbasin, and 2) an ongoing resource plan for a potential watershed project in the Lake Boudreaux area in the Timbalier Subbasin.

STATE OF LOUISIANA

Louisiana Department of Natural Resources.

The Louisiana Department of Natural Resources (LDNR), using the State Coastal Wetlands Conservation and Restoration Fund (State of Louisiana 1990, 1991, 1992, 1993), implemented several projects in the Terrebonne Basin. They include the 4,200 acre Montegut Wetland marsh management area (TE-1, Table 5), currently managed by the Louisiana Department of Wildlife and Fisheries as part of the Pointe au Chien WMA.

The LDNR and the Terrebonne Parish Consolidated Government (TPCG), as local sponsor, are constructing a 4,000 acre marsh management area north of Falgout Canal between Bayou DuLarge and the HNC (TE-2, Table 5); have developed a plan for a 4,250 acre marsh management area north of Bush Canal between Bayou Petit Caillou and Bayou Terrebonne (the LaCache Wetland, TE-3, Table 5); and sponsored a project on the Point Farm Wildlife Refuge to plant 100 acres of shrub/scrub in bottomland hardwood habitat (TE-14, Table 5).

The LDNR with the STTMCD, as local sponsor, completed a 3,000 acre hydrologic restoration effort south of Chauvin, Louisiana, between Lake Boudreaux and Highway 56. The project (TE-7b, Lower Petit Caillou Management, Table 5) is in an area of intermediate and brackish marsh, and includes shoreline stabilization along Lake Boudreaux, plugs and culverts, and revision of the outfall of a pumping station to divert fresh water into the marsh.

Louisiana Department of Wildlife and Fisheries.

The Pointe au Chien WMA, covering 28,244 acres in the eastern Timbalier Subbasin, is owned and managed by the Louisiana Department of Wildlife and Fisheries (LDWF). The LDWF also leases and manages the Raccoon and Whiskey Island WMAs on the Isles Dernieres barrier islands.

Louisiana Department of Transportation and Development.

The Louisiana Department of Transportation and Development (LDOTD) funded construction of levees, gravity drainage structures, and floodgates around the Morgan City and Franklin areas.

TERREBONNE PARISH

The TPCG and the STTMCD have a network of flood protection projects in various stages of development, such as the Bayou Petit Caillou floodgate, the Bayou Terrebonne floodgate (under construction), and forced drainage projects (levees, pumps, and other features along all inhabited bayous).

In the Isles Dernieres, Terrebonne Parish commissioned an experimental restoration project on East Island., including addition of sand, fencing, and vegetation. The restoration has survived over several years of difficult weather, including a major hurricane, and serves as a model for efforts to restore the remaining Terrebonne barrier islands.

Alternative actions and alignments for the Terrebonne Parish Comprehensive Hurricane Protection system are being considered and evaluated in an Environmental Impact Statement

PRIVATE

Locally, marsh management projects have been permitted or ate in the permitting process in Terrebonne Basin; most are only partially operational They range in size from 45 acres to almost 7,000 acres. Major land owners that are involved in this type of marsh protection activity include the Continental Land and Fur Company, Fina la Terre, Louisiana Land & Exploration, and Smyth Catholic Church.

PROBLEM IDENTIFICATION

EXISTING CONDITIONS

GEOMORPHOLOGY AND HYDROLOGY

The Terrebonne Basin is underlain by multiple abandoned deltaic complexes, characterized by a thick section of unconsolidated sediments which are &watering and compacting, and as a consequence are submerging at a rate of about 0.42 inches per year (Penland et al. 1988). The location of faults, depth to the Pleistocene, and related factors contribute to site-specific subsidence rates, and are important to consider in ongoing management and project design. A complex network of old natural finger ridges extends southward from the general area of Hourna. In the northern part of the basin, the ridges are 10 feet or more above sea level and 2 miles or more wide, and often have been developed for agriculture or urban land uses (Gagliano and Roberts 1990). These ridges become lower and narrower to the south, merging with the marsh near the coastline. The southern end of the basin is defmed by a chain of narrow, low-lying barrier islands which mark the retreating edge of the old delta and which give way, westwardly, to a marshy shore. The islands are separated from the main land body by a series of wide, shallow lakes and bays.

Inflow of fresh water, or lack of it, impacts all four subbasins in Terrebonne Basin. The Verret Subbasin and much of the Penchant Subbasin are dominated by fresh water (and., in the Penchant, some sediment influx) from the Atchafalaya River and Atchafalaya Bay. The inflow to Penchant through Avoca Cutoff alone is 5,000 to 10,000 cubic feet per second (cfs); additional inflow comes from the Verret Subbasin at Amelia. During periods of high Atchafalaya River stages, the GIWW carries a substantial eastward flow of fresh river water through Houma and as far east as Lake Salvador. However, during low river stages or drought, the GIWW is a conduit for salt water. In the Fields Subbasin, freshwater input is mostly from rainfall and the GIWW. Rainfall in the Terrebonne Basin averages 65 inches per year. On the average, precipitation exceeds evaporation; however, during the late summer, evaporation often exceeds precipitation. Freshwater input to the Timbalier Subbasin occurs in the form of rainfall and Atchafalaya River inflow from the GIWW via the HNC and Grand Bayou Canal. These inputs are small relative to the substantial influence of salt water from the gulf via Terrebonne and Timbalier Bays. Overall, the Timbalier Subbasin has the most limited freshwater resources in the entire Mississippi Deltaic Plain. The absence of overflows from river sources helps account for a significant accretion deficit (relative sea level rise, especially subsidence, not offset by sediment input and retention), roughly 0.2 inches per year (Templet and Meyer-Arendt 1988).

The Verret Subbasin drains to the Penchant Subbasin, this drainage is naturally blocked by the Bayou Black ridge, except for the natural outlet near Amelia. Drainage of fresh water through the Penchant Subbasin is in natural (sinuous) and artificial (linear) channels and is strongly controlled by river stage, winds, and tides, with an eastward gradient being dominant overall. The Mauvais Bois ridge acts as a natural barrier to strong marine influences in most of the Penchant Subbasin.

Natural and management levees (and the GIWW) strongly control hydrology in the Fields Subbasin, forced drainage exercises substantial control over freshwater distributions in this

area. In the Timbalier Subbasin, natural ridges tend to compartmentalize drainage into a series of sub-estuaries, designated the Blue, Barre, Boudreaux, and CailIou; in addition, there are two barrier island chains, Isles Demieres and Timbalier. The Boudreaux area is unique because it is surrounded by distributary ridges. In these drainage subbasins, marine processes (e.g., wave action, tidal currents, and saltwater inflow) become increasingly dominant toward Terrebonne and TimbaIier Bays and the gulf.

The hydrology of the basin has been influenced significantly by the construction of canals, levees, and other features. Navigation and pipeline canals breach the ridges and allow for lateral flows of salt water (and in some cases, rapid drainage of the limited fresh water supply). The HNC is a major inland artery for saltwater intrusion. Control of hydrology by management levees and pumps is important in the upper part of the Timbalier Subbasin.

Tides of the Terrebonne Basin are diurnal (one high and one low tide per day). Tidal height changes range from about 1.5 feet at the coast to 0.2 feet at Houma The passage of cold fronts is a dominant process, with wind-forced currents and tides driving saltwater flows and suspended sediment in the Timbalier Subbasin, as well as in the southern and western portions of the Penchant Subbasin.

Salinities vary substantially within the Terrebonne Basin. In the Timbalier Subbasin, freshwater resources are so limited that in the fall, bay salinities exceed 20 parts per thousand (ppt) and salinities below 5 ppt occur only in the extreme northern portions of the sub-estuaries (e.g., upper Bayou Blue and upper Lake Boudreaux). Springtime salinities are only moderately less. In contrast, in the Verret and Penchant Subbasins, the impact of the Atchafalaya River keeps conditions much fresher, even in the fa.ll, salinities inland of the Mauvais Bois ridge are typically less than 5 ppt and the entire upper Penchant Subbasin is fresh. The Fields Subbasin also typically contains fresh water.

VEGETATION AND SOILS

Plate 1 and Table 1 show the distribution of wetland types in the Terrebonne Basin by subbasin. The Verret Subbasin is dominated by cypress swamps, characterized by bald cypress and tupelo gum trees. Limited amounts of swampland occur in the other subbasins. The northern Penchant Subbasin is mostly freshwater flotant marsh, which grades southward from intermediate to brackish marsh in the Lost Lake-Jug Lake area, and to saline marsh below that. Fresh marsh is dominant in the Fields Subbasin. Vegetation characteristic of Terrebonne fresh marshes include maiden cane, water hyacinth, pickerelweed, alligatorweed, bulltongue, and hydrocotyle. Brackish marsh (characterized by wiregrass, seashore saltgrass, three-cornered grass, coco and widgeongrass), saline marsh (characterized by smooth cordgrass, seashore saltgrass, and black rush), and open water are dominant in the Timbalier Subbasin. Soils in the basin grade from highly organic soils associated with fresh marsh in the upper portions of the basin to more mineral soils associated with saline marsh in the lower portions of the basin.

FISH AND WILDLIFE RESOURCES

The Terrebonne Basin provides extensive habitat for fish and wildlife, including several endangered species. Shellfish and finfish resources are abundant in Terrebonne Basin.

Table 1. Habitat Distribution in the Terrebonne Basin[1].

Habitat Type	Timbalier (acres)	Penchant (acres)	Verret (acres)	Fields (acres)	Total (acres)
Fresh marsh	21,617	165,672	937	23,410	211,636
Interm. marsh	23,035	36,412	0	0	59,447
Brackish marsh	70,773	61,422	0	0	132,195
Saline marsh	153,117	17,272	0	0	170,389
Total Marsh	268,542	280,778	937	23,410	573,667
Swamp	10,240	25,719	117,938	1,130	155,027
Aquatic vegetation[2]	3,091	32,291	2,045	2,367	39,794
Other land	94,199	56,931	127,941	96,481	375,552
Water	424,773	107,971	30,389	5,325	568,458
Total Area	800,845	503,690	279,250	128,713	1,712,498

[1] Data from the USFWS GIS data base, February 1993.
[2] Aquatic vegetation includes both floating and submerged beds.

Oysters, brown and white shrimp, blue crabs, and several finfish species including menhaden and spotted seatrout are harvested from the basin.

The Terrebonne Basin, together with the other inactive deltas (e.g., Breton Sound, Barataria), provides wintering habitat for approximately 400,000 waterfowl. Nutria, muskrat, mink, raccoon, river otter, and alligator are harvested from the marshes and swamps, although specific values of these harvests for the Terrebonne Basin alone are not readily available. Except for the muskrat, which is typically most abundant in the brackish marshes, the fresh and intermediate marshes are especially important in supporting these wildlife species (Palmisano 1972).

Threatened and endangered species occurring within the basin include the Louisiana black bear, bald eagle, arctic peregrine falcon, piping plover, brown pelican, and Kemp's ridley and loggerhead turtles. Louisiana black bears may utilize the swamps and fringing marshes in the extreme western portion of the Penchant Subbasin as year-round habitat. Bald eagles utilize basin wetlands during winter months as foraging and nesting habitat and typically nest in bald cypress trees located near open water areas. About 35 nests occur in the basin, most in the Verret and Penchant Subbasins. Wintering arctic peregrine falcons utilize area marshes as foraging habitat. The piping plover commonly winters along the Gulf of Mexico shoreline. The highest concentrations of this species are found on the barrier islands. Brown pelicans nest on Raccoon Island and feed in nearshore gulf waters and in shallow bays and ponds. Kemp's ridley and loggerhead sea turtles utilize nearshore gulf waters as foraging habitat and are observed in inshore waters.

ECONOMIC RESOURCES

Within the coastal zone, urban and agricultural development is concentrated on the natural levees of the bayous, especially those spreading southward from Houma, which is the largest city in the basin. The wetlands areas are dissected by the GIWW and the HNC, along with an extensive network of smaller canals used for access to oil and gas fields or pipelines, or for general navigation.

In Terrebonne and Lafourche Parishes, representing a large portion of the Terrebonne Basin, three quarters of the residents make their living from the marsh or from support services to those who work in the marsh (Gagliano and Roberts 1990). Trapping, hunting and fishing, oil and gas exploration and extraction, and extraction of other minerals are all important to the local economy.

The Barataria-Terrebonne estuarine complex is considered the premier estuary in the United States in supporting commercial fisheries (Roemer 1989). The fishing port of Chauvin-Dulac, in the western portion of the Timbalier Subbasin, ranked seventh in pounds landed and fifth in dollar value among fishing ports of the United States in 1991 (National Marine Fisheries Service 1992). The Terrebonne and Timbalier Bay areas are characterized by more open, saline adult shrimp habitat. The 1989 inshore landings totaled about 14.5 million pounds composed of about 63 percent brown shrimp and 34 percent white shrimp. Landings of brown shrimp in the area of Terrebonne and Timbalier Bays were valued at about $19.7 million in 1989; landings for white shrimp were valued at about $12.7 million. Blue crab landings in the Terrebonne and Timbalier Bay area amounted to about $4.8 million in 1989. Many finfish, including menhaden and spotted seatrout, are also landed in the Terrebonne Basin. Oyster harvests from the Terrebonne, Atchafalaya, and Teche-Vermilion Basins were valued at about $14.1 million in 1989. Harvestable oyster resources in Timbalier and Terrebonne Bays are constrained by seaward salinity and inland sources of pollution; in 1990, 12 percent of the harvest area was harvest limited due especially to impacts from direct discharge (about 21,000 acres) and septics (about 21,000 acres).

COASTAL WETLANDS PROBLEMS

Loss data over the last half century are summarized in Table 2. The Terrebonne Basin has experienced wetlands loss at rates equal to or greater than elsewhere in Louisiana. Over the last half century (1932-1990), more than 200,000 acres of marshland have been lost in the Terrebonne Basin, or about 25 percent of the marsh acreage that was present in 1932. Figure 2 shows the primary areas of wetland habitat change in the basin.

Losses for the Verret Subbasin are not estimated in the table because of lack of data, but the loss rates probably are not high. Wetland problems are summarized by subbasin, as follows.

TIMBALIER SUBBASIN

Until recent decades, there were large areas of fresh, intermediate and brackish marsh in the upper part of this subbasin; much of the marsh was flotant and thus very vulnerable to break-up. The high natural subsidence rate combined with the construction of navigation and oil and gas canals allowed large-scale increases in tidal exchange and inundation. The result

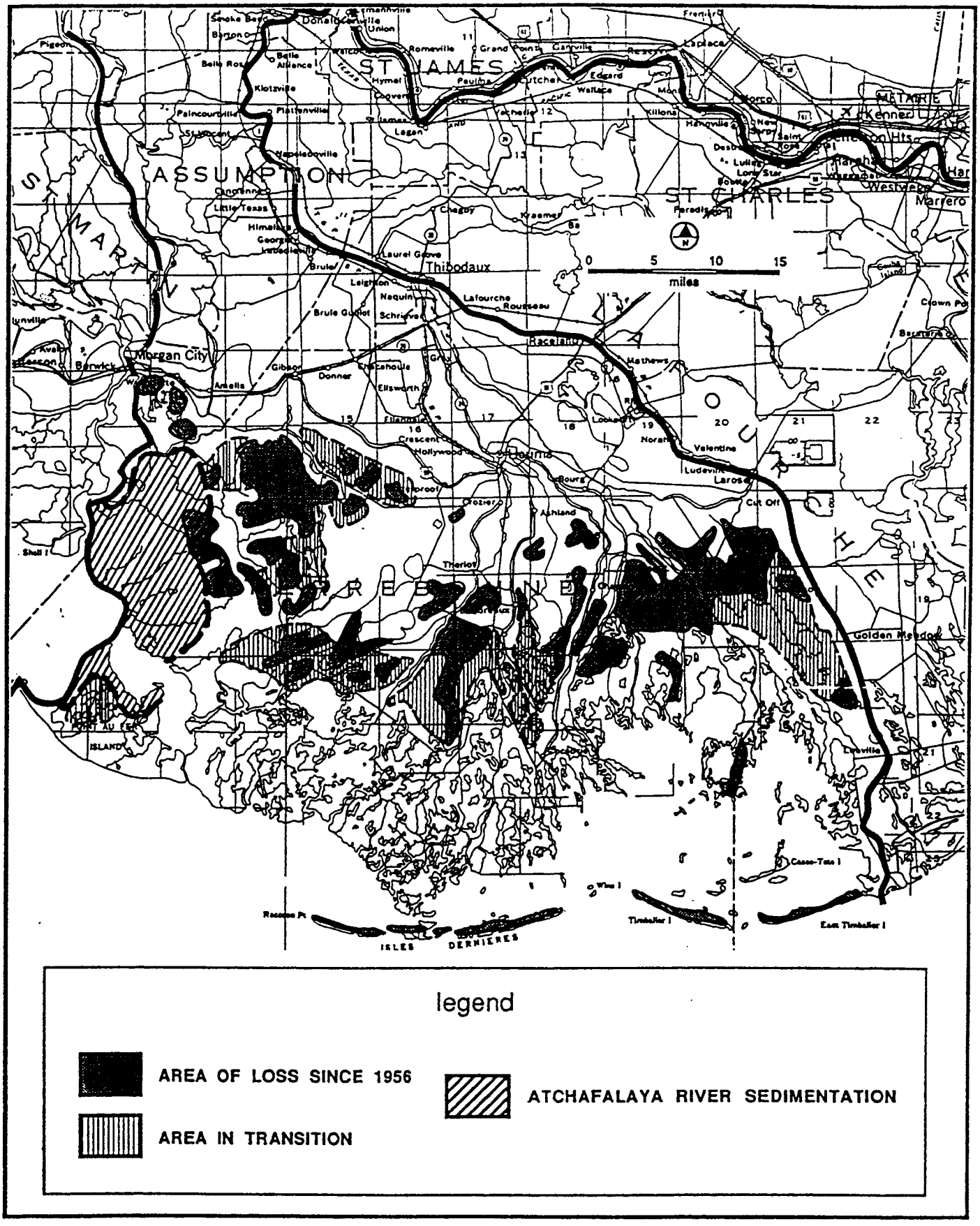


Figure 2. Areas of welands loss and stress in Terrebonne Basin.

Table 2. Historic Wetlands Losses in Terrebonne Basin'.

Period	Timbalier Acres	Timbalier Percent per Year	Penchant Acres	Penchant Percent per Year	Fields Acres	Fields Percent per Year	Total Acres
1932[2]-1958	21,655	.22	10,004	.09	1,529	.27	33,188
1958- 1974	38,451	.66	58,590	.95	1,342	.30	98,383
1974-1983	30,048	1.02	13,736	.47	741	.31	44,525
1983- 1990	18.027	.87	6.187	.28	1.491	.82	25.705
Total	108,181		88,517		5,103		201,801
Total Percent	27.96		22.28		17.21		24.86

[1] Data from the USACE GIS data base, February 1993.
[2] Data first collected in 1931 for the Penchant subbasin and in 1939 for Fields.

was rapid wetlands loss, especially in the 1960's and 1970's. Losses were concentrated in a wide east-west belt located in the Pointe au Chien area west to Lake DeCade (Figure 2), where there has been a concurrent shift toward more saline marsh habitat (Chabreck and Linscombe 1982).

Losses were at a maximum in the 1974-1983 period but remain high in the most recent period of record More than a quarter (28 percent) of the marshes present in this subbasin in 1932 were lost to open water by 1990 (Table 2).

The sand-starved barrier islands of the subbasin are being rapidly eroded, and the effects of Hurricane Andrew in August 1992 were particularly devastating; most or all of the islands will be submerged by early in the next century, leading to an increase in wetland losses. Much of the sand lost from the islands is washed into deeper water and does not drift along the shore to sustain land elsewhere. The shoreline behind and west of the islands also is retreating rapidly. Much of what presently is salt marsh in the basin is expected to be lost in the foreseeable future. In the northern part of the subbasin, most marshes are increasingly subjected to or are indirectly affected by management, e.g. behind flood control levees.

PENCHANT SUBBASIN

In the Penchant Subbasin, historic losses were concentrated in a central band (from Lake Decade to Jug Lake to Carencro Lake), where them was a shift toward fresher marsh habitats, and in the Turtle Bayou area in the northern part of the subbasin. Loss rates were highest during the period from 1958 to 1974, and appear to have decreased markedly in recent years (Table 2). Cumulative marsh losses from 1931 to 1990 total 88,517 acres, or about 22 percent of the marsh area present in 1931. Stresses that have impacted the central area over the last 40-50 years include high salinities resulting from &ought (1950's); saltwater intrusion from subsidence and aggravated by landscape modifications such as the Avoca Island Levee (1950's), the HNC (1960's), and oil and gas development; and flooding from the Atchafalaya River. Losses near Turtle Bayou may reflect impacts from oil and gas

activity and hydrologic stresses on flotant marsh; excessive riverine floods in the mid-1970's contributed substantially to that loss.

Regardless of what caused past losses, it is clear that at this time the Penchant Subbasin is characterized by natural hydrologic change related primarily to the Atchafalaya River, which supplies significant amounts of fresh water and sediment to portions of the subbasin, despite blockages imposed by the Avoca Island levee, spoil banks of the GIWW, and an extensive oil and gas canal network. While fresh water and sediment benefit the subbasin, they do not achieve maximum wetland gains due to man-made impediments to natural distribution and retention of sediments. High water levels can also cause wetlands stress due to flooding. The flooding problem could be increased by some projects in the Atchafalaya Basin that would raise water levels in the floodway. Other factors in the subbasin include: construction of the GIWW (a major contributor to losses of flotant marsh, especially where boat wakes and water surges accelerate erosion of adjacent flotant marsh); and herbivory, which is a problem here as it is in much of coastal Louisiana.

VERRET SUBBASIN

The Verret Subbasin has experienced problems from flooding and wetlands inundation, related to hydrologic changes in the Atchafalaya River floodway. This is also a problem in the northernmost part of the Penchant Subbasin, but elsewhere the impact of the Atchafalaya is generally beneficial, because of the freshwater and sediment inputs. Excessive water levels are partly the natural consequence of an accretion deficit. As a result, cypress swamps in this subbasin are not being regenerated. Herbivory contributes to the problem and stresses exist from causes such as urban and agricultural runoff.

FIELDS SUBBASIN

Land use changes and hydrologic isolation dominate this subbasin. Most remaining wetlands are managed in some way. Average rates of marsh loss have been fairly steady from 1939 through 1983 at about 0.3 percent per year (Table 2), but appear to have increased in the recent period. Cumulative losses over the last half century have been moderate (5,103 acres) in this subbasin, but still represent about 17 percent of the marsh acreage that was present in 1939. At this time, adverse impacts on the remaining wetlands are relatively minor and relate to matters such as inadequate management of forced drainage, impoundment, and shoreline erosion. However, there is the small possibility that saltwater intrusion impacts may occur if marshes to the south convert to open water, or if the GIWW becomes more saline (e.g. due to wetlands losses in the Barataria Basin or the Timbalier Subbasin, with subsequent intrusion of salt water).

FUTURE WITHOUT-PROJECT CONDITIONS

WETLANDS CHANGES

Table 3 shows marsh losses projected over the next 20 and 50 years by subbasin, using the 1974-1990 loss rates from Table 2. Without actions to correct the problems discussed previously, another third of the basin's wetlands would be lost to open water by 2040.

Table 3. Projected Marsh Loss in Terrebonne Basin.

Subbasin'	Projected Loss in 20 yrs Acres	Percent	Projected Loss in 50 yrs Acres	Percent
Timbalier	60,100	22	150,250	54
Penchant	24,900	8	62,250	20
Fields	2.800	11	7,000	29
TOTAL	87,800	14	219,500	36

'No data are available for Verret Subbasin.

Losses would be concentrated in the Timbalier Subbasin, where Timbalier Bay would become open to the gulf, and the existing shoreline could retreat as much as 10 miles north.

The estimate for the Timbalier Subbasin excludes recent (1992) effects of Hurricane Andrew and future effects when barrier islands disappear, and thus it probably underestimates the true dimensions of future problems. Even so, the projection is for a net loss over 50 years of about 150,000 acres, more than half the existing marsh. Much of the loss would occur in the central band of the subbasin, from the area of Falgout Canal and Lake Boudreaux east to the Pointe au Chien WMA, resulting in a substantial expanse of open water that could reach as far north as the suburbs of Houma.

The estimated loss for the Penchant Subbasin of 62,250 acres over 50 years represents about 20 percent of the existing marsh. The projection may be high, given increasing benefits of Atchafalaya sediment Losses would likely be concentrated in the central and northern sectors of the subbasin, following the historic pattern, and would further expose areas of open water and broken marsh. There would be continued inefficient use of Atchafalaya fresh water and sediments in the Penchant Subbasin.

In the Fields Subbasin, the 50-year loss is about 7,000 acres, or nearly 30 percent of the existing marsh. In the Verret Subbasin, no data are available from USACE to estimate recent loss rates. Based on application of a forested wetland simulation model (USFWS 1989), excessive flooding will continue to be a problem in this basin, and will result in wetter and more stressed swamps. While large-scale loss of the swamps to open water is not predicted to occur within a 50-year time frame, significant conversions to open water could begin within 100 years.

Excluding the Verret Subbasin, total marsh losses in the Terrebonne Basin if no restoration action is taken would be approximately 219,500 acres over 50 years. This equals about 36 percent of the marsh acres estimated to be present in 1990. Over 20 years, total loss would be 87,800 acres, equaling about 14.4 percent of the 1990 estimated acres.

FISH AND WILDLIFE RESOURCES

These wetland losses will result in the loss of critical breeding, nesting, nursery, foraging, and over-wintering habitat for commercial and recreational fish, shellfish, and furbearers; migratory waterfowl; alligators; and several endangered species. Loss of marsh

habitat and the accompanying trend toward higher salinities typically leads to lower biodiversity and declining long-term productivity. The deterioration of the Timbalier Subbasin causes an export of organic matter which in the near term sustains a very high biological productivity, shown by the importance of this subbasin to commercial fishing. Productivity will decline in Timbalier and Penchant as the subbasins increasingly become open water.

ECONOMIC RESOURCES

As the wetlands are lost, flooding problems will increasingly impact economic activities throughout the basin, including grave consequences to the oil and gas industry, where rigs are not designed for open water conditions. The marshes offer some protection to inland areas during hurricanes. There will be an increase in maintenance dredging and navigation costs as the lower HNC becomes exposed to open water. The eventual decrease in biological productivity will negatively impact economic sectors which are wildlife and fisheries based

PLAN FORMULATION

PLANNING OBJECTIVES FOR THE BASIN

Based on recognition of the major causes of wetlands problems in the Terrebonne Basin, the following key planning objectives were identified: 1) restoration of fluvial inputs of sediment and water to create and preserve wetlands and reduce salinities; 2) preservation of existing marsh in the Timbalier, Penchant, and Fields Subbasins; and 3) restoration of hydrologic conditions conducive to cypress regeneration in the Verret Subbasin.

Over the long term, it will not be sufficient just to "hold on to what we have" by reducing rates of wetlands loss. Rather, creation of new wetlands to offset regional losses, thus establishing a sustainable wetlands ecosystem, is a primary long-term objective. Because the Terrebonne Basin is relatively isolated from sediment resources, it will take significant planning, feasibility studies, and project development before this objective can be achieved. Thus, "holding on to what we have" (Objective 2) by addressing the proximal causes of wetlands loss in the basin becomes a key short-term objective.

STRATEGIES CONSIDERED

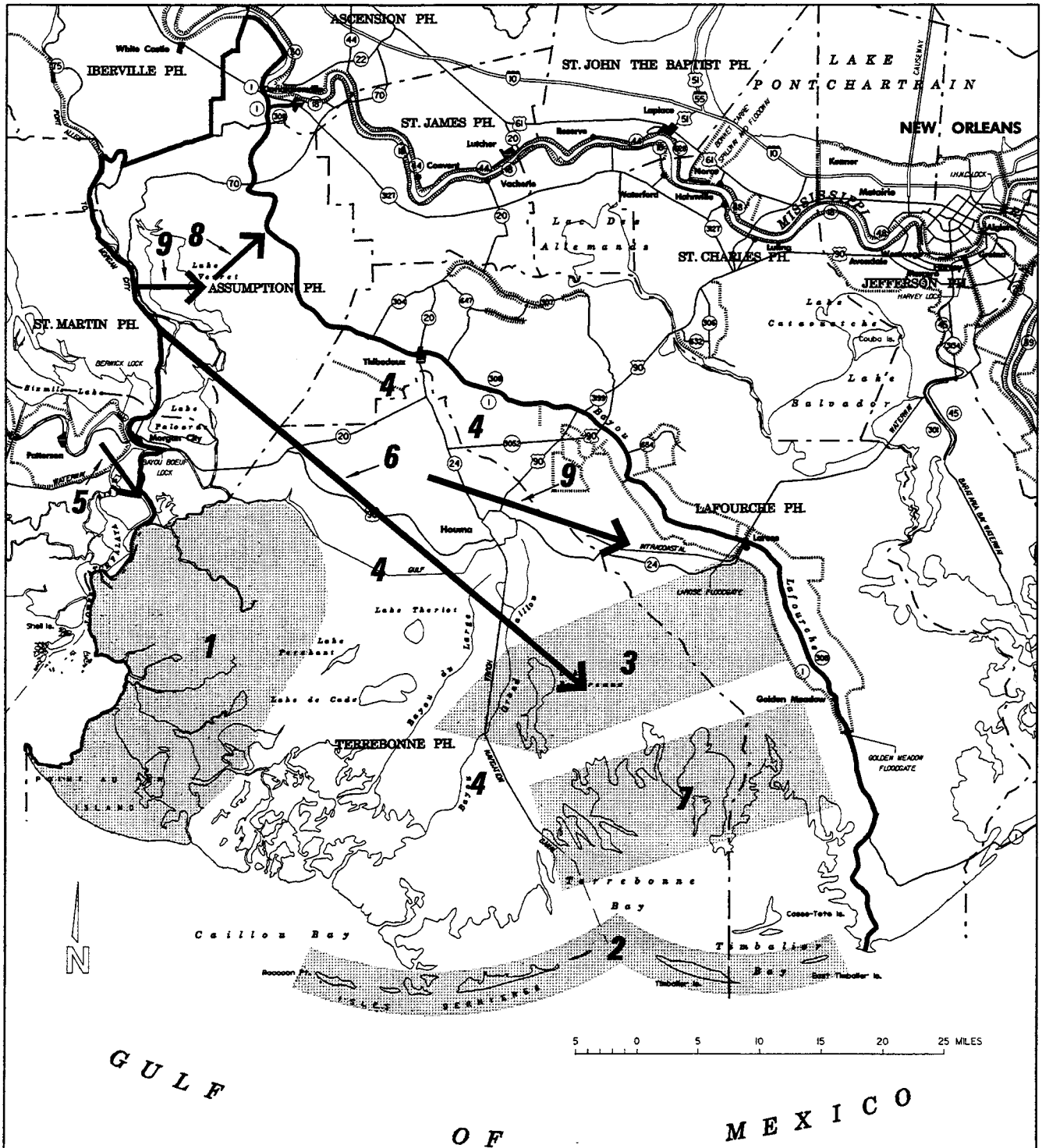
Several strategies were developed and evaluated to address the objectives for the Terrebonne Basin. General locations of these strategies arc illustrated in Figure 3. Objective 2 is addressed by several short-term strategies, as follows.

1) Management of Atchafalaya River sediments and water on a small scale to restore Penchant marshes.
2) Restoration of barrier islands (Isles Demieres and Timbalier Islands) to preserve Timbalier marshes.
3) Restoration of hydrology in Timbalier Subbasin to preserve marshes.
4) Utilization of small scale measures (e.g., shoreline protection, marsh creation, hydrologic restoration, etc.) to create, protect, restore, and/or enhance wetlands in all subbasins, in areas of critical need or significant opportunity.

Strategies 1,2, and 3 am key short-term strategies, and are considered essential to the Terrebonne Basin plan.

Implementing these short-term strategies will reduce loss rates and gain some new wetlands, but will not overcome the sediment deficit of the basin, make maximum use of the Atchafalaya resources, or address the problem of swamp deterioration in the Verret Subbasin. Consequently, the following long-term strategies also apply in the Terrebonne Basin.

5) Introduction of Atchafalaya River sediment on a regional scale into the Penchant Subbasin to create marsh as well as preserve existing marsh.
6) Introduction of Atchafalaya or Mississippi River sediment on a regional scale into the Timbalier Subbasin to create marsh and preserve existing marsh.
7) Importation of large amounts of sediment from the gulf or the rivers by dedicated dredging to create marsh in Timbalier Subbasin.
8) Reduction of water levels in the Verret Subbasin by pumping and hydrologic restoration.



LEGEND

.....	*Existing Levee*	*Strategy 5:*	*Perchant sediment import*
———	*Basin Boundary*	*Strategy 6:*	*Timbalier sediment import*
Strategy 1:	*Perchant hydrologic restoration*	*Strategy 7:*	*Timbalier dedicated dredging*
Strategy 2:	*Timbalier barrier island restoration*	*Strategy 8:*	*Verret hydrologic restoration*
Strategy 3:	*Timbalier hydrologic restoration*	*Strategy 9:*	*Verret sediment import*
Strategy 4:	*Mutiple small scale projects*		

Figure 3. Terrebonne Basin, Location of Basin Strategies.

9) Reduction of water levels in the Verret Subbasin by importing sediment.

Long-term Strategies 5, 6, 7, and 8 are considered key strategies in the Terrebonne Basin Plan.

STRATEGY 1: PENCHANT SUBBASIN HYDROLOGIC RESTORATION

The concept of this strategy is to create flow regimes which effectively use the sediments, fresh water, and nutrients that already reach the Penchant and Point au Fer marshes, particularly from the Atchafalaya River. Hydrologic restoration would focus on: 1) restoring historic water flow patterns through natural bayous; 2) allowing better distribution and retention of sediment laden waters; 3) increasing freshwater flow to intermediate and brackish marsh areas; 4) providing drainage outlets during high-water periods; and 5) controlling velocities at major outlets. As flooding from backwater influence from the Atchafalaya River is an increasing problem in this subbasin, these hydrologic restoration efforts would be attentive to flooding concerns.

To effectively enhance wetlands in the Penchant Subbasin, the area must be divided into units which are delineated by some type of hydrologic barrier. Prospective units for the Penchant Subbasin were identified by the SCS through a planning process that was coordinated with local landowners. Generally, these units are delineated based on the natural levee ridges of the Teche and Lafourche deltas.

The primary component of this strategy is, where feasible, to direct flow down distributary channels to mimic natural conditions and increase freshwater and sediment distribution to interior marshes. Specifically, this strategy would: 1) utilize Bayou Penchant as the primary distributary channel to transport sediments into the area; 2) provide additional outlets for drainage south of the Mauvais Bois Ridge; and 3) continue to allow freshwater introduction from Atchafalaya Bay through natural bayous. It will be important to protect flotant marshes from possible erosion associated with increased flows.

In order to properly utilize Bayou Penchant as the primary distributary channel for the project area, water control structures will be placed in canals and bayous branching off the bayou and an overflow bank will be created along Bayou Penchant where the natural levee ridge has subsided and the interior marsh is unprotected. However, water control structures in natural bayous will reduce access and production for estuarine-dependent fisheries. Fresh water and sediments will be transported farther south to enrich the intermediate and brackish marshes in the Mauvais Bois Ridge area.

Bayous leading inland from Atchafalaya Bay will also be utilized to carry fresh water and sediments to interior marshes. To establish the proposed water flow patterns and increase freshwater and sediment distribution, several major water control structures and numerous secondary structures will be needed to allow for freshwater and sediment movement while limiting saltwater inflow. These structures would be passive, accommodate navigation access, and be designed to allow sediment movement into marsh areas. It should be noted, however, that numerous structures exist in waterways east of Four League Bay, that may be removed or altered to enhance flows of fresh water and sediment into interior marshes.

STRATEGY 2: TIMBALIER SUBBASIN BARRIER ISLAND RESTORATION

This strategy involves the protection and restoration of the barrier islands which provide the southern-most line of defense for the marshes of the Timbalier Subbasin. This strategy is vital because destruction of the islands is imminent, and because the islands provide essential and irreplaceable protection for mainland marshes. Restoration would be provided to both the Isles Demieres (East, Trinity, Whiskey and Raccoon Islands) and the Timbalier Islands, primarily through: 1) pumping of sand to elevate dunes and provide greater island width, 2) creation of back-island salt marshes to provide habitat and added width, and 3) filling of oil and gas canals (especially in the Timbalier chain). Sediment sources may include bay or off-shore areas. The use of structures for sediment trapping or wave attenuation is also proposed, recognizing that careful analysis of effects must be weighed when considering the use of structures, especially segmented breakwaters. Given the magnitude and controversial nature of barrier island restoration projects, project design may be reviewed by an independent engineer.

Barrier islands are an essential element in maintenance of the estuaries characteristic of the Louisiana coast. Barrier islands limit the transmission of tides and the volume of salt water that is passed to the estuary. Without the islands, the bays would have free exchange with the gulf and would take on the salinity and energy characteristics of the gulf. The transition from salt to fresh water (i.e., the extent of "saltwater intrusion") would occur much farther inland Barrier islands also protect coastal Louisiana wetlands from wave erosion and the direct effects of storms by various processes, including reduction of ovenvash erosion, reduction of fetch for wind-induced waves, and energy dissipation of storm surges. The amount of protection provided is related to the distance between the islands and the mainland, the depth of the water, and the strength of the destructive forces (List and Hansen 1993). The Isles Demieres barrier islands in front of Lake Pelto and Caillou Bay protect the marshes behind them from wind-induced wave erosion associated with more than 95 percent of coastal Louisiana weather conditions (Penland 1993).

Studies of barrier island erosion and land loss by the USGS and the LGS in coordination with the Louisiana State University (LSU), the USFWS, and others have shown that the Isles Dernieres and Timbalier Island are being rapidly lost by a process of in-place breakup, while East Timbalier Island is characterized by landward roll-over, where land area has been lost at a slower rate (e.g., McBride et al. 1991; Williams et al. 1991; Sallenger et al. 1987). These studies estimate that Isles Demieres will disappear by the early 21" century if no restoration efforts are undertaken. Based on the above studies, this will have significant detrimental effects, reducing estuarine area and productivity and increasing rates of wetland loss. Results of recent modeling studies have shown that by moderating the tidal prism, the Isles Demieres and Timbalier barrier islands significantly reduce the acreage of marsh inundated (beyond the optimum) by tides, as well as the length of the inundation period (Van Heerden, Kemp, and Suhayda 1993). Model results suggest that a significant acreage of marsh would be lost with total loss of the islands.

An important element of the barrier island alternative is the continuation of projects by which the protective effects of barrier islands can be measured, modeled, or otherwise evaluated, with the objectives of documenting benefits and improving future designs.

STRATEGY 3: TIMBALIER SUBBASIN HYDROLOGIC RESTORATION

This strategy is to promote overland flow, sinuous channel flow, and sediment deposition in the central band of Timbalier marshes (in the vicinity of the proposed Terrebonne Parish Comprehensive Hurricane Protection System), where rapid and regional deterioration now occurs (Figure 2). Marshes in the southern portion of this zone are a special priority, because they help protect fresher marshes in the upper part of the subbasin against the invasion of marine processes. This strategy would provide a series of projects across the entire subbasin which would, depending on the site-specific problems, create marshes in open water, protect existing marshes, increase and manage freshwater and sediment resources, and restrict tidal scour and saltwater access, while allowing at least some ingress and egress of estuarine organisms.

To the extent practical, the objective of each project would be to restore more natural hydrologic conditions within this zone, primarily through passive management techniques to restore hydrologic conditions favorable to marsh function, including plugs in canals (notably oil canals), and construction of low levees with water management structures (such as weirs) to reduce tidal velocities and increase the retention time of fresh water. It is noted that the value of marsh management projects (benefits versus environmental impacts) is under review by the USFWS as well as other researchers. The results will be incorporated in implementation of this strategy. Other typical project components would include some of the following: introduction of fresh water and sediment (e.g., from the GIWW), management of stormwater outfalls, removal of obstacles to freshwater and sediment flow (e.g. gapping of spoil banks), and wetlands creation through maintenance or dedicated dredging. Many of the projects which make up this alternative are already included in the State plan, and some are already being implemented.

The proposed hurricane protection system is not essential to wetlands protection; however, in areas where segments of the hurricane protection levee are already constructed, or if additional segments are approved and placed in the future, marshes behind the levee may need protection, including active water level management, with modifications to the levee system to provide estuarine access. Levee alignments not yet finalized (e.g. near Lake Boudreaux) should be defined to minimize wetlands conflicts. To the extent possible, these could be placed in non-wetland areas, such as at the upland border. Concerns about potential adverse environmental impacts of the proposed hurricane protection project have prompted development of an EIS by the USACE, results of which may affect decisions on proposed projects.

Canals and bayous are significant avenues of saltwater intrusion into fresher areas of marsh that may not be addressed by the hydrologic restoration of the marshes surrounding the hurricane protection project, especially for larger waterways such as the HNC. To address this, a saltwater barrier on the HNC (i.e., a lock, gate, or sill if feasible), as well as restoration of the integrity of the banks of the HNC, are also included in this strategy. The need for similar locks or gates in other large canals or bayous not otherwise considered in proposed hydrologic restoration projects may need to be reviewed.

STRATEGY 4: TERREBONNE BASIN SMALL-SCALE MEASURES

Large-scale alternatives are unlikely to address each area in the Terrebonne Basin where there is a critical need for wetlands protection or restoration, or a significant opportunity for wetlands creation. Strategy 4 responds to Objective 2 by considering projects that focus on a relatively limited area and problem, as the following examples indicate. The approach is to address each site on a case-specific basis and choose cost-effective projects.

In the Fields Subbasin, at least three locations exist along the GIWW where breaches of the canal bank adversely impact adjacent marsh and bank restoration is needed. An open water area exists along the St. Louis Canal where marsh creation is feasible, and some projects would freshen the supply in the GIWW to benefit the Timbalier Subbasin, with probable benefits to the Fields Subbasin.

In the Penchant Subbasin, areas exist on Point au Fer where sediment input and/or hydrologic restoration could accomplish significant wetlands benefits. Areas of flotant marsh may need management beyond hydrologic restoration, and areas exist which could benefit from deposition of dredged material along the GIWW and Bayous Chene, Boeuf, and Black. The banks of the GIWW contain sites where restoration could protect adjacent marshes, and the Avoca Island area could benefit from a small-scale sediment diversion to create and restore marsh.

In the Timbalier Subbasin, the lower reach of Bayou Lafourche is an area where sediment input and hydrologic restoration could accomplish significant wetlands benefits. Areas of flotant marsh exist where management beyond hydrologic restoration may be needed, and there are areas which could benefit from placement of dredged material along the GIWW, the HNC, and various bayous.

In the Verret Subbasin, the area known as Savanne Basin is a candidate for a small-scale project.

Strategy 4 encompasses many of the projects previously proposed for the Terrebonne Basin. In addition to projects already proposed, development of additional small-scale projects, as needed, would be consistent with this aspect of the plan.

STRATEGY 5: PENCHANT SUBBASIN SEDIMENT DIVERSION

This strategy addresses Objective 1, re-introduction of fluvial processes, with the goal of promoting sustainability. This strategy calls for construction of at least one major diversion from the Atchafalaya River to bring fresh water and sediment into the Penchant Subbasin. A diversion structure would be located in the Avoca Island levee bordering Bayou Shaffer to allow controlled flows (about 3,700 cfs) into Avoca Island Lake. Bayou Penchant would be the primary conveyance channel for flows, with the GIWW acting as a secondary conveyance channel. Some fresh water and sediment would reach the Timbalier Subbasin through the GIWW.

Excessive water levels are already a problem in the area which would be impacted by this project. Thus, while the introduction of sediment may be key to the long-term resolution of the problem in Penchant and this strategy is positive, a wetland/water management plan that also addresses flooding concerns for the Penchant Subbasin (Strategy 1) must be developed and implemented, and flooding concerns in the Verret Subbasin (Strategy 9) must be addressed before a sediment diversion in Penchant could be undertaken.

STRATEGY 6: TIMBALIER SUBBASIN SEDIMENT IMPORT FROM THE MISSISSIPPI OR ATCHAFALAYA RIVERS

This strategy also addresses the objective of restoring fluvial processes in the Terrebonne Basin, if possible, to achieve a sustainable ecosystem (Objective 1). This strategy is long term, because importation of sediments from long distances would be necessary, making this strategy dependent on evaluation of the Mississippi and Atchafalaya Rivers sediment budgets, decisions on the most efficacious distribution of those sediments, and development of approaches for distribution. This makes a sediment budget study, as well as appropriate demonstration and pilot projects a high, short-term priority for this basin.

In this strategy, sediment would be obtained from the Mississippi River via Bayou Lafourche or from the AtchafaIaya River via a specially constructed channel. An option for bringing sediment in from the Atchafalaya River via an existing 30-inch pipeline is also being considered. The sediment would be delivered to areas of fresh and intermediate marsh in the band of intensive wetlands loss (Falgout-Golden Meadow). A major element of this strategy would be to develop optimum technologies for distribution and placement of sediment, using natural processes (with or without containment) or technologies such as spray dredging.

Quantities of sediment required can be roughly estimated using data in Dunbar, Britsch, and Kemp (1992). Maintenance of existing marshes requires roughly 1.5 million tons per year, and creation of new marsh at a rate equal to historic loss rates (about 2,500 acres per year) requires on the or&r of 9.3 million tons per year. To meet the total demand for nearly 11 million tons per year would require about 16 percent of the sediment load of the Atchafalaya River or 6 percent of the Mississippi below the Old River Control Structure. In either case, this would require ***a*** diversion of more than 25,000 cfs to meet the total A project to provide sediment to existing marshes would need to be less than 5,000 cfs.

One specific proposal is to divert about 12 percent (about 55,000 cfs) of Mississippi River flows down Bayou Lafourche, mimicking the historic flow in that bayou, and to make half of this resource (about 27,500 cfs) available to Terrebonne Basin (with the other half diverted into Barataria Basin). Small, controllable diversions could be constructed along the western bank of the bayou into the eastern portions of Timbalier Subbasin.

Assuming that a sediment diversion of this magnitude were feasible, it would be necessary to deliver the sediment to points of need_ Because the area being impacted is not an active delta, but instead is an abandoned delta that is highly compartmentalized by old distributary ridges and canal spoil banks, a network of channels and overland-flow control systems must be developed in or&r to bring sediment back into the original natural distributary network to nourish the marshes. Placement of sediment in open water to offset losses would be another option and might be done at a single location for some period of time, simulating natural crevasse splay development. New wetlands in a subdelta at that single location would result, offsetting losses, and having some limited benefits to the adjacent emergent marshes.

STRATEGY 7: TIMBALIER SUBBASIN SEDIMENT IMPORT BY DEDICATED DREDGING

To address Objective 1, and to some extent Objective 2, this strategy would provide for large-scale dedicated dredging to counteract subsidence and create salt marsh in the upper parts of Terrebonne and Tiibalier Bays (Figure 3). The new marsh would help offset wetlands losses in the subbasin and help protect wetlands to the north from the effects of detrimental marine processes.

No action of this type has been considered in detail in Louisiana before, and the mechanics are not fully determined Because creation of 2,500 acres per year would be necessary to offset historic loss rates, full implementation of this feature would require very large dredging and transportation capacity and, consequently, potential for economies of size if operated over a prolonged period (e.g., 40 years, for a total creation of 100,000 acres). Partial implementation of dedicated dredging for large scale marsh creation could be considered.

Sediment sources could be offshore sands, since salinity of the water is not a concern. More than 2.61 billion cubic yards of sand are available offshore in the Cat Island Pass area and Ship Shoal. Selection of the better source would require consideration of transportation costs (Cat Island Pass is closer) and the effects of sediment mining on erosion of the barrier islands. Sand also might be obtained from the bays behind the barrier islands; resources in this area are currently being investigated by LSU. Finally, sand might be imported from the Atchafalaya or Mississippi Rivers, with transport in an abandoned oil and gas or dedicated pipeline.

A representative concept for this strategy would be to use a dedicated highcapacity dredge (e.g. at Ship Shoal) supplying a permanent submerged pipeline; the pipeline would be extended incrementally as needed to create new areas of salt marsh. Provisions could be made to bifurcate the pipeline so that it could also provide sediment to the barrier islands, or to off-load sediment to barges to satisfy needs of specific, small-scale projects. A different concept would use small-capacity very shallow-draft hopper dredges that could dredge the sediment, transport it, and place it, either by dumping or pumping out.

Other concepts also could be considered, but all need significant modification to existing technologies and have large capital costs. Implementation of this strategy will require development of realistic cost estimates for a long-term project. This also will rely extensively on demonstration projects, including projects at a scale substantially larger than were previously funded under the CWPPRA.

STRATEGY 8: VERRET SUBBASIN HYDROLOGIC RESTORATION

This strategy addresses Objective 3, restoring hydrologic conditions conducive to cypress regeneration. It would manage water levels through one or more pump stations at the edge of the Verret Subbasin. A representative concept for the strategy is as follows: construct a flood control levee in the Morgan City-Gibson area, with flood gates along the major drainage outlets of the Verret Subbasin; operate the pump stations to achieve the desired water level regime. The regime would be based on flood control and wetlands needs. Effecting changes to existing water levels will require extensive study to define existing problems, develop solutions, and assess related issues such as flood control, making this a

long-term strategy. This strategy will be investigated in the ongoing USACE Morganza to the Gulf Reconnaissance Study.

STRATEGY 9: VERRET SUBBASIN SEDIMENT IMPORT

This strategy also addresses Objective 3. Although it is not mutually exclusive with Strategy 8, any methods of bringing in and distributing sediment that require large volumes of water as a transport medium (e.g., sediment diversions) will require that water level and flooding issues in Verret be addressed first. Thus Strategy 8 must precede Strategy 9. This strategy would develop major transportation and distribution systems from the Atchafalaya River (or Bayou Lafourche) to bring sediment into the Verret Subbasin. If this were done on a large enough scale to offset subsidence, the existing problem of inundation of cypress swamps could be corrected. Material would be obtained by dedicated (or maintenance) dredging of high deposition areas in the Atchafalaya Floodway. Material would be routed to areas of sediment need by specially constructed pipelines. A variation on this approach, utilizing an uncontrolled sediment diversion, was rejected because of its potential to cause substantial flooding in the basin.

RATIONALE FOR SELECTED PLAN

As shown in Table 4, each strategy analyzed for the Terrebonne Basin Plan would implement an aspect of one of the the planning objectives for the basin, providing more than one approach to achieve each objective. The four short-term and five long-term strategies are complementary, and can all be considered part of the Terrebonne Basin Plan.

The strategies that involve bringing sediment into the Timbalier and Penchant Subbasins (Strategies 5, 6, and 7) would most directly address one of the fundamental causes of wetlands loss in these areas--subsidence that is no longer offset by sediment input and retention. Thus these strategies are critical components of the Terrebonne Restoration Plan, and are viewed as the approaches that would most likely support long-term, sustainable wetlands systems. However, as previously indicated, much additional knowledge (&termination of the extent and best distribution of riverine sediment resources, and development of methods of sediment delivery and distribution) must be amassed before these large scale actions can reasonably be planned and implemented. In Penchant, problems of excessive water levels and flooding concerns must also be addressed before large scale sediment introductions could be initiated_ These constraints place the critical strategies related to large scale sediment introduction into a long-term time frame. In the Verret Subbasin, hydrologic restoration (Strategy 8) is the priority because it will address the primary cause of wetlands stress (excessive water levels) without unacceptable impacts on existing non-wetlands conditions. The extensive planning required to develop this strategy also makes it long-term. The option of bringing sediment into Verret (Strategy 9) is classified as supportive of the plan in the long term, because significant additional study will be required after water levels are successfully managed in this region of cypress swamp to determine the possible benefits and detriments of sediment addition.

Table 4. Relationship Among Basin Objectives, Strategies, and Status in Terrebonne Basin.

Planning Objectives	Strategies	status	Example Projects
Preserve marshes in Timbalier, Penchant, and Fields (#2)	Manage existing sediment and water in Penchant	Short-term priority	PTE-26,26a, 26b
	Restore barrier islands	Short-term priority	PTE-15 XTE-45
	Restore hydrology of loss zone	Short-term priority	TE-5 to 10, XTE-55 to 60, XTE-42 and others
	Small scale measures	Short-term (as needed)	
Restore fluvial inputs	Sediment into Penchant	Long-term priority	
	Sediment into Timbalier	Long-term priority	
	Dedicated dredging into Timbalier	Long-term priority	
Regenerate cypress in Verret	Manage water levels	Long-term priority	XTE-32, 50, 51
	Sediment import	Long-term	

In the interim, it is deemed critical to take immediate actions to preserve existing wetlands to the extent possible. Short-term critical components of the Terrebonne Plan thus focus on protection of barrier islands and restoration of key marshes (Strategies 1,2, and 3). Protection of the Isles Demieres and Timbalier barrier islands requires immediate and extensive action because these landforms provide substantial protection for mainland marshes and because destruction of many islands is imminent. Interior marshes of the Tiibalier

Subbasin will also be protected through hydrologic restoration of marshes in a zone of high loss in the vicinity of the proposed Terrebonne Parish Comprehensive Hurricane Protection System. In this zone, fresh water and sediment will be used along with marsh protection and passive hydrologic restoration structures to enhance and restore overland and sinuous channel flow. In the Penchant Subbasin, Atchafalaya River fresh water, sediment, and nutrients will be better utilized through hydrologic restoration to protect marshes and reduce loss rates. To the extent possible, actions will restore historic flow patterns and conveyance channels and improve the distribution of sediment-laden water. Because the successful planning and implementation of the critical long-term strategies of the Terrebonne Plan depend on development of new information, studies which the Task Force hopes to initiate in the near future to evaluate the Mississippi and Atchafalaya River sediment budget and determine priorities for distribution of that resource, and demonstration and pilot projects to develop approaches for sediment transport and distribution, are also short-term priorities in the Terrebonne Basin Plan.

In all subbasins, site-specific, small-scale projects will be considered where there is a critical need for wetlands protection or restoration, or a significant opportunity for wetlands creation. These site-specific actions (Strategy 4) are considered supportive of the critical components of the Terrebonne plan.

Figure 4 illustrates the net strategy that will be implemented by this plan.

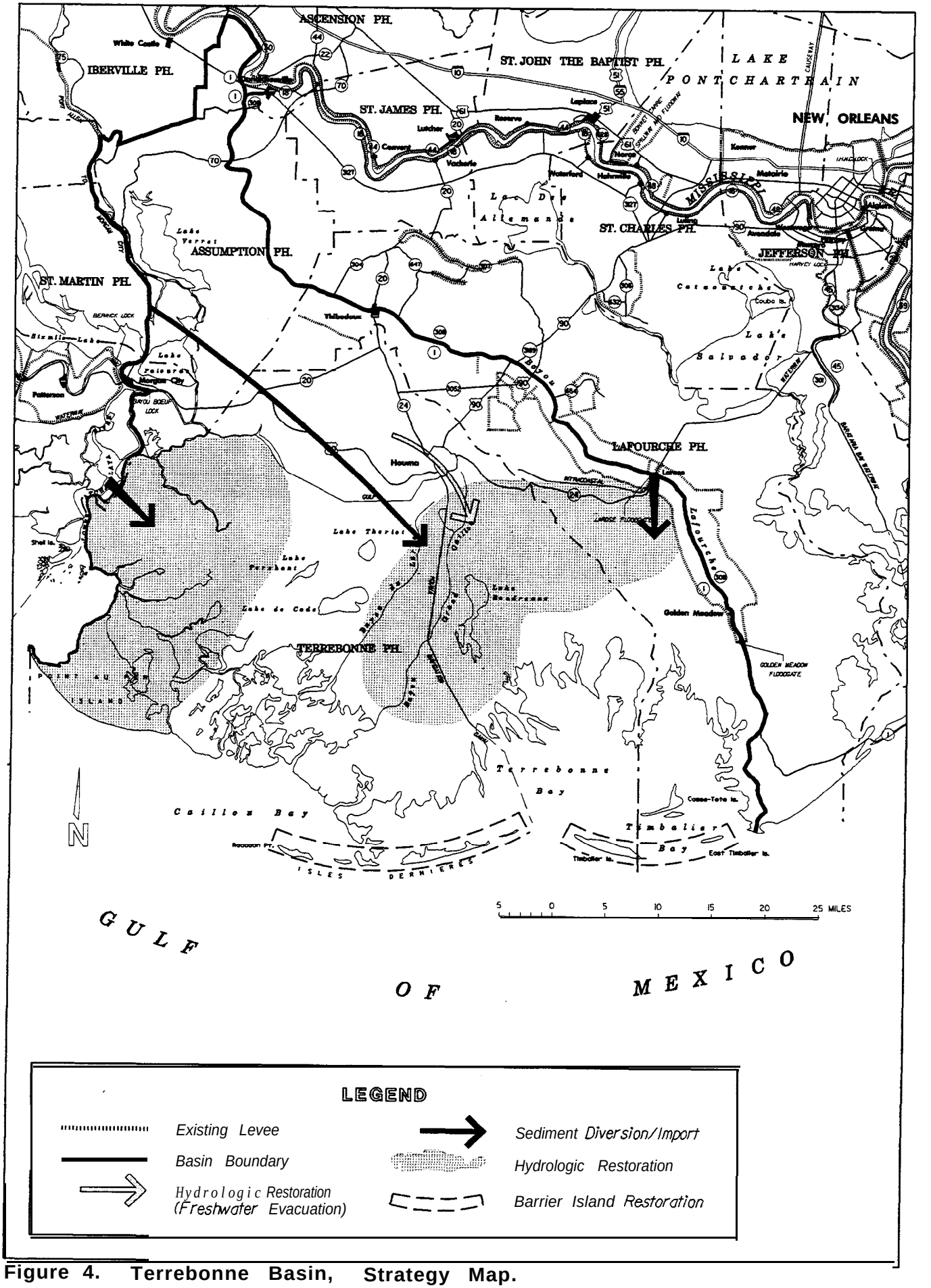


Figure 4. Terrebonne Basin, Strategy Map.

IMPLEMENTATION OF THE SELECTED PLAN

COMPONENT PROJECTS

All projects that have been proposed for the Terrebonne Basin are listed in Table 5. Those projects which were either combined with other projects, were found to be the same as or a subset of another proposed project, which were not included in the final plan for reasons summarized in Table 5, or which are active or completed and are described under Existing Projects, are indicated in Table 5. All remaining projects are components of the Terrebonne Basin Plan; their locations are shown in Figure 5, and each project in the plan is described in the following chapter.

Projects listed as part of the selected plan have been recommended by the public and participating agencies based on current knowledge of existing conditions, within time constraints of the planning process. Additional projects can be recommended in the future for incorporation in the Terrebonne Basin Plan as problems and needs change (see the Implementation section of the Main Report).

Projects in the Terrebonne Basin Plan are presented below by criticality and time frame for implementation (short-term and long-term). Within each classification (e.g., critical short-term), projects have been grouped by the strategy which they implement or contribute to. Projects already included on one of the three priority project lists (PPLs) selected each year under the CWPPRA are presented seperately.

DEVELOPMENT OF BENEFITS AND COSTS

The benefits for most of the projects in the plan were estimated according to a rapid-assessment modification of the Wetland Value Assessment (WVA) protocol. The estimates are based in part on project-specific information which varied in quality and quantity among projects. The estimates are therefore rough approximations considered proliminary to a more in-depth assessment, and should be interpreted and used as such. Information for shoreline erosion and marsh creation projects tends to be site-specific, and are more likely to be accurate. Benefits for hydrologic restoration and marsh management projects are often more generic and thus less accurate. Projects that have been included on the first three Priority Project Lists have had complete WVA analyses.

Cost estimates for all projects were done according to a generic CWPPRA cost formula which includes 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 for20 years.

Projects on the first three Priority Project Lists received more rigorous and detailed construction and operation and maintenance cost estimates. In some cases, projects that are still largely conceptual or only preliminarily designed received ball-park cost estimates with no multipliers applied; these are noted as such in tables and project descriptions.

PRIORITY LIST PROJECTS

On the first priority project list, four projects were selected for funding in the Terrebonne Basin, a fifth was deferred due to funding limits. These are: two vegetative planting/wetland protection projects (at Falgout Canal and on Timbalier Island); a barrier

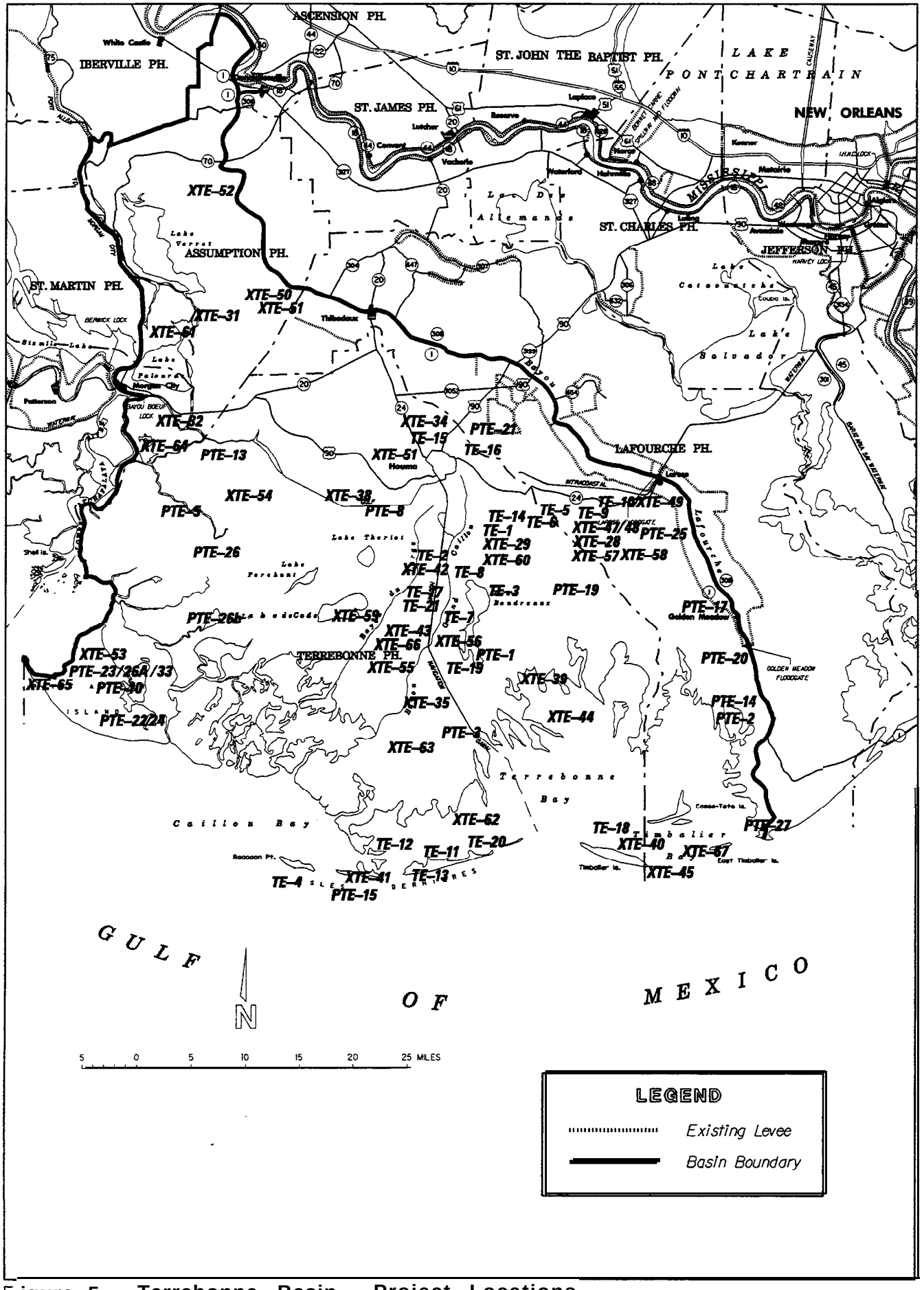


Figure 5. Terrebonne Basin, Project Locations.

Table 5. Summary of the Terrebonne Basin Projects

Project NO.	Project Name	project Type	Priority List Project	Acres Created, Restored, or Protected	Net Benefited Acre8	Estimated cost ($)	Cost per Benefited Acre ($/Ac)	Comments
Critical Projects. Short-Term								
Penchant Subbasin								
PTE-26	Upper Bayou Penchant	HR		[10,600]	[49,153]	50,000,000	1,000	
PTE-26b	Brady Canal Hydrologic Rest	HR	PPL 3	297	1,968	3,609,000	1,900	
PTE-23 /XTE-33	Lake Chapeau Hydr Rest/Sed	HR/MC	PPL 3	509	2,136	3,663,000	1,700	Includes X-l-B-33.
Subtotal				11,406	53,257	57,272,000		
Timbalier Subbasin. Barrier Island Restoration								
TE-lla	Is Demeriers New Cut Closures	BI		3	73	6,400,000	81,000	Complements PIE-15.
TE20	Eastern Isles Demieres	BI	PPL 1	9	79	5,714,000	72,300	
PTE-15	Restore Isles Demieres	BI		1,050	1,864	33,188,000	17,800	Interacts w/ TE-20, XTE-41, XTE-45, XTE-40, XTE-67.
PTE-15b	Restore Is Demieres Phase 2	BI						Interacts w/ TE-20,XTE-41, Xl'E-45, XTE-40, XTE-67.
PTE-15bi	Whiskey Island Restroratton	BI	PPL 3	1,239	1,386	4,524,000	3,300	
PTE-15bii	Raccoon Island Restoration	BI						
xTG41	Isles Dernieres phase 1	BI	PPL 2	109	276	6426,000	23,300	Cost & acreage included in PTE-15 for totals, active.
XTE-45	Timbalier Restoration	BI						
XTE-67	Creation/East Timbalier Island	BI	PPL 3	1,013	2,745	1,870,000	700	
Subtotal				3,423	6,423	58,122,000		
Timbalier Subbasin. Hydrologic Restoration								
TE-7a	Lake Boudreaux Watershed	MM/HR		63	796	2,665,000	3,300	2/
TE-7d	Lake Boudreaux Watershed	MM/HR		[1,492]	[5,888]	9,364,000	6,400	2/
TE-9	Bully Camp Marsh	MM		43	235	638,000	2,700	2/
TE-10/ xTE-49	Grand Bayou-GIWW Diversion Cutoff Canal Plug	FD/HR		[1,825]	[4,929]	5,515,000	1,100	2/, Interacts w/ XTE-47/48, XTE-49,51, See XTE-49.
TE-19	Lower B LaCache Wetlands	HR	PPL 1	86	292	1,388,000	4,800	2/, Active.
TE-21	Falgout Canal South	MC		104	118	5,792,000	49,000	3/, Interacts w/ XTE-43, XTE-55.
ME-3	HNC Bank Stabilization	SP		311	1,059	1,600,000	1,500	
PTE19	Stromwater Runoff Management	HR						2/
PTE-25	Bayou Blue water Management	HR		1,089	2,431	[4,400,000]	1,800	2/, Interacts w/ TE-10/XTE-49, TE-9, XTE-47/48.
XTE-29	Wonder Lake Restoration	MM		613	1,196	[2,200,000]	1,800	
XTE-35	HNC Sffl							
XTE-42	HNC Lock	HR		2,891	2,891	122~45,000	42,400	Interacts w/ XTE-35.
XTE-47/48	Grand B Blue/Bully Camp Rest	MM/HR		247	1,829	[3,300,000]	1,800	2/
XTE-55	South Falgout Hydrologic Rest	HR		472	1,948	2,128,000	1,100	2/
XTE-56	South Bay Pelton Hydrologic Rest	HR		26	328	833,000	2,500	2/
XTE-57	South Pt au Chten Hydr Rest	HR		610	1,285	805,000	600	2/
XTE-58	South Bully Camp Hydr Rest	HR		1,401	3,109	1,879,000	600	2/
XTE-59	South Fina LaTerre Hydr Rest	HR		18	307	499,000	1,300	2/
XTE-60	South Wonder Lake Hydr Rest	HR		1.635	3,088	2,060,000	700	2/
Subtotal				12,926	31,809	167,611,000		
Subtotal Critical Projects, Short-Term				27,760	91,490	283,005,000		

Table 5. Summary of the Terrebonne Basin Projects (continued)

Project No.	Project Name	Project Type	Priority List Project	Acres Created, Restored, or Protected	Net Benefited Acres	Estimated cost ($)	Cost per Benefited Acre ($/Ac)	Comments
Critical Projects, Long-Term								
Penchant Subbasin, Sediment Diversion								
PIE-5	Atchafalaya River Diversion	SD		[6,000]	[6000]			Interacts w/ PTB-13, PIE-26.
Timbalier Subbasin, Sediment Import from the Mississippi or Atchafalaya Rivers								
XTE-52	Miss R/B Lafouche Diversion	PD		[14,000]	[14,000]	[1,500,000,000]	107,100	Interacts w/ ME-17.
XTE-63	Sediment Distribution/30" Pipe	SD						
Timbalier Subbasin, Sediment Import Dedicated Dredging								
XTE44	Large Creat/Line of Defense (LOD)	MC		[86,311]	[86,311]			
Verret Subbasin, Hydrologic Restoration								
XTE-32	B Boeuf Pump Station/Barrier	HR						Interacts w/ XTE-50/51.
XI-E.50	Verret Drainage of B Lafouche	HR/FD						4/, Interacts w/ XTE-32, XTE-51.
XTE-51	Disch Channel Vet-ret-Houma	HR						4/, Interacts w/ XTE-32, XTE-50.
Supporting Projects, Short-Term								
Timbalier Subbasin								
TE-5	Grand Bayou Wetland	MM		823	7,043	2500,000	400	1/, TE-5a mostly constructed.
TE-6	Point au Chien Wetland	MM		589	1,696	3800,000	2,200	1/
TB8	Bayou Pelton Wetland	MM		137	795	1,720,000	2,200	1/
TE12	Bird Island Restoration	MC		10	15	2,117,000	141,100	
TE-17	Falgout Canal Vegetative Planting	VP	PPL 1	49	53	161,000	3,000	
TE-18	Timbalier Island Planting	VP	PPL 1	178	497	390,000	800	
PTE-27	W Belle Pass Headland Rest	MC/SP	PPL 2	474	639	4424,000	6,900	
XTE-40	Timbalier Sediment Trapping	ST		4	93	1,359,000	14,600	Interacts w/ XTE-45.
XTE-62	Creation at Wine Island Shoals	BI		5	13	[500,000]	38,500	
Subtotal				2,269	10,844	16,971,000		
Penchant Subbasin								
PTE-22/24	Pt au Fer Canal closure	HR	PPL2	375	804	978,000	1,200	
XTE-38(d-i)	GIWW Bank Restoration	SP		130	684	3,800,000	5,600	
XTE-64	Avoca Island Sediment Div	SD		413	1,030	922,000	900	
XTE-65	Spray Dredging W Locust Bayou	MC		[1,300]	[1,300]	3318,000	2,600	
Subtotal				2,248	3,978	9,018,000		
Fields Subbasin								
TB-16	St. Louis Wetlands Rest	MC		31	82	500,000	6,100	
XTE-38(a-c)	GIWW Bank Restoration	SP		30	160	315,000	2,000	
Subtotal				61	242	815,000		
Subtotal Supporting Projects, Short-Term				4,550	14,900	26804,000		
Total Terrebonne Basin				32,310	106,390	309,809,000		5/

Table 5. Summary of the Terrebonne Basin Projects (continued)

Project No.	Project Name	Project Type	Priority List Project	Acres Created, Restored, or Protected	Net Benefited Acres	Estimated cost ($)	Cost per Benefited Acre ($/Ac)	Comments
Supporting Projects, Long-Term								
Timbalier Subbasin								
PTE-1	Bayou Terrebonne Dredgtng	MC		[291]	[291]	1500,000	5,200	
PTE-14	Creation W Bayou Lafouche	MC						Interacts w/PTE-27, XTE-52.
PTE-17	Bayou Lafourche Dredgtng	MC						Interacts w/PTE-2, PTE-27, XTE-52.
PTE-21	B Terrebonne/Lafouche Channel	HR						
XTE-28	Parish Line of Defense	MM						2/
P_hant_Subbasin								
PTE-8	MC W Houma N GIWW	MC		[115]	[115]	6,000,000	52,200	
PTE-13	B Chene, Boeuf, & Black WL	MC						Interacts w/PTE-5, PTE-26.
Verret Subbasin								
XTE-31	Sediment Diversion, Verret	SD						Interacts w/ XTE-32
XTE-34	Savanne Basin Restoration	HR				375,000		
Fields Subbasin								
TE-15	GIWW Levee Planting	VP		[24]	[24]	194,000	8,000	Interacts w/XTE-38c.
Demonstration Projects								
PTE-10	Pt au Fer Restoration	HR		6	75	78,000	1,000	
PIE-20	Bayou Lafouche Salinity Barrier	HR						Interacts w/ XTE-52
XTE-39	Lake Barre Oyster Reef	SP			41	301,000	7,300	
XTE-43	Red Mud Coastal Rest Demo	MC	PPL 3	3	3	529,000	58,800	
XTE-53	Pt au Fer Rest w/ Spray Dredge	MC					674,000	Abandoned canals.
XTE-54a	Flotant Creation/Enhancement	ST					813,000	Fendng levee breaks.
XTE-54b	Flotant Creation/Enhancement	ST						
XTE61	Sediment Cypress Swamp	SD						
XTE-66	Sediment Conveyance Demo	MC		[550]	[1,080]	1,228,000	1,100	
TOTAL	TERREBONNB BASIN			32,300	106,393	309,809,000		5/

Table 5. Summary of the Terrebonne Basin Projects (continued1

Project No.	Project Name	Project Type	Priority List Project	Acres Created, Restored, or Protected	Net Benefited Acres	Estimated cost ($)	Cost per Benefited Acre ($/Ac)	Comments
Projects Not In Restoration Plan								
TE-1	**Montegut** Wetalands							1/, Completed.
TE-2	**Falgout** Canal Wetland							1/, Completed.
TE-3	Bayou **LaCache** Wetaland							1/, Active.
TE-4b	Barrler Island Sand Retention							Same as **TE-18.**
TE-7b	Lake **Boudreaux** Watershed							**TE-7b** complete.
TE-7c	Lake Boudreaux Watershed							**TE-7c** schedule **const. '93.**
TE-11	Is **Derneires** Cut Closures							Covered under **FTE-20/XTE-41.**
TE-13	**Trinity** Bayou **Pilot** Project							Covered under **FTE-2/XTE-41.**
TE-14	**Point** Farm **Planting**							Active, acres are bottom land hardwood.
PTE-2	Bank Stab, Bayou Lafourche							A phase of **PTE-17.**
PTE-4	**GIWW/Bayou** Lafourche Closure							Same as **XTE-38a.**
PTE6	Lake Houma Cypress Restoration							landowner **conflict, minimum benefits.**
PTE-7	HNC **Salinity** Cells							technology not appropriate for site.
ME-9	Reroute GIWW							primary objectives not wetlands.
PTE-11	Avoca Island Cutoff							Covered under **PTE-13.**
PTE-12	Close Off Northern B Chene							better done by **XTE-32.**
PTE-15a	Restore Is Dernleres Phase 1							Same as **XTE-41.**
PTE-16	**Artificial** Reef, Timballer							not viable.
PTE-18	**Diversion** from Bayou Lafourche							no suitable site, achieved by **TE-10.**
ME24	Pt au Fer Canal **Closure**							Combined with **PTE-22.**
XTE-30	**Montegut** Wetland							Same as TE-1.
XTE-33	Pt au **Fer Sediment** Input							Combined with **PTE-23.**
XTE-36	Creation from Cat Island Pass							Covered under **XTE-44,** Demonstration Project.
XTE-37	Pt au Fer Island Restoration							Same as **PTE-10.**
XTE-46	Atchafalaya River Dlversion							**irreconciiabie human conflicts.**
XTE-48	LOD East/Grand Bayou Canal							Combined **with** XTE-47.
xTE-49	Plug **in** cutoff canal							Combined **with** TE-10.

BI Barrler Island Restoration
FD Freshwater **Diversion**
HR Hydrologic Restoration
MC Marsh Creation **with** Dredged Material
MM Marsh Management
SD Sedlment **Diversion**
SP Shorellne **Protection with** Structures
ST **Sediment/Nutrient** Trapping
VP Vegetative **Plantings**

1/ The project is part of Alternative G, northern portion of the zone **in** the **vicinity** of the proposed hurricane protection system.
2/ The project is part of Alternative G, southern portion of the zone in the **vicinity** of the proposed **hurricane** protection system.
3/ Deferred from **PPL1**
4/ Projects also serve as **diversion** to Tlmbalier **subbasin**
5/ Total cost and **benefits** for the basin plan include only those for **Critical** Short-Term and **Supporting** Short-Term Projects.
[ ] Denotes acreage not reviewed by Wetlands Value Assessment Workgroup or cost estimate **order** of magnitude only.

island restoration project (Eastern Isles Dernieres); a hydrologic restoration project (lower Bayou LaCache); and a wetland creation project using dedicated dredged materials which was deferred (south of Falgout Canal). The four active projects are in various stages of development.

On the 2nd Priority Project List, three Terrebonne Basin projects were selected for funding: a hydrologic restoration project (Point au Fer canal closure); a marsh creation and hydrologic restoration project (West Belle Pass Headland); and a barrier island restoration project (west end of Trinity Island of Isles Demieres). The island restoration will be constructed in conjunction with the similar project from the lst Priority Project List.

On the 3rd Priority Project List, five projects were selected for funding in the Terrebonne Basin: two barrier island restoration projects (Whiskey Island in the Isles Demieres, and East Tiibalier Island); a marsh creation and hydrologic restoration project on Point au Fer near Lake Chapeau; a hydrologic restoration project in Penchant near Brady Canal; and a demonstration project of marsh creation using processed bauxite soil (red mud).

CRITICAL SHORT-TERM PROJECTS

Critical projects are those which implement key strategies of the plan and which are vital to basin protection and restoration, regardless of whether they can be implemented immediately or only in the long term. Critical short-term projects are those which need immediate action, and for which sufficient information exists to support implementation. They are identified below, by strategy, and are described in the subsequent section. (An "*" indicates priority list projects.)

Strategy 1. Penchant Subbasin Hydrologic Restoration.

	PTE-26	Upper Bayou Penchant Watershed Management
*	PTE-26b	Brady Canal Hydrologic Restoration
*	PTE-23/XTE-33	L. Chapeau Hydrologic Restoration/Sediment Input

Strategy 2. Timbalier Subbasin Barrier Island Restoration.

	TE-lla	Isles Demieres New Cut Closure
*	TE-20	Eastern Isles Dernieres (Phase 0)
	PTE-15	Restoration of the Isles Demieres Barrier Islands
*	XTE-41	Isles Demieres Restoration Phase I (same as PTE-15a)
*	PTE-15bi	Isles Demieres Restoration Phase II (Whiskey Island)
	PTE-15bii	Isles Dermieres Restoration Phase II (Raccoon Island)
	XTE-45	Restoration of the Timbalier Barrier Islands
*	XTE-67	East Timbalier Island Restoration

Strategy 3. Timbalier Subbasin Hydrologic Restoration.

	TE-7	Lake Boudreaux Wetland
	TE-9	Bully Camp Marsh Management
	TE-l0/XTE-49	Grand Bayou-GIWW Diversion/Cutoff Canal Plug
*	TE-19	Lower Bayou La Cache Wetland Restoration
	TE-21	Falgout Canal South Wetland Creation

PTE-3	HNC Bank Stabilization
PTE-19	S tormwater Management
m-25	Bayou Blue Water Management
XTE-29	Wonder Lake Marsh Restoration
XTE-35	HNC Sill (if determined to be feasible)
Xl-E-42	HNC Lock
XTE-47/48	Grand Bayou Blue/Bully Camp Restoration
XTE-55	South Falgout Canal Hydrologic Restoration
XTE-56	South Bayou Pelton Hydrologic Restoration
XTE-57	South Point au Chien Hydrologic Restoration
XTE-58	South Bully Camp Hydrologic Restoration
XTE-59	South Fina LaTerre Hydrologic Restoration
XTE-60	South Won&r Lake Hydrologic Restoration

CRITICAL LONG-TERM PROJECTS

Critical long-term projects are those which must be deferred until other projects are successfully implementated, or which require significant additional information or research and development before they can be implemented. Some of these long-term critical projects are only conceptual at this time, and, using currently available technologies, would be very expensive to implement. Their future feasibility will be in part determined by the outcome of feasibility studies and demonstrations which will be conducted in the short term to develop alternate methodologies and evaluate resource availability and distribution.

Strategy 5: Penchant Subbasin Sediment Diversion.

PTE-5	Atchafalaya R. Diversion

Strategy 6: Timbalier Subbasin Sediment Import from the Mississippi or Atchafalava Rivers.

Xl-E-52	Miss. R./B. Lafourche Diversion
XIE-63	Sediment Distribution, 30-inch Pipeline

Strategy 7: Timbalier Subbasin Sediment Import by Dedicated Dredging.

XTE-44	Large Scale Creation/Lline of Ddefense

Strategy 8: Verret Subbasin Hydrologic Restoration.

XTE-32	Bayou Boeuf Pump Station/Barrier
XTE-50	Partial Diversion of Verret Subbasin Drainage into Bayou Lafourche and the GIWW
XTE-5 1	Dredge a Discharge Channel from the Southeast Comer of the Verret Subbasin to Near Houma

SUPPORTING SHORT-TERM PROJECTS

Supporting projects are those that would contribute to wetland protection, but do not address key strategies. They usually address local situations, and are reviewed to assure that they are consistent with the overall strategies of the subbasin and do not conflict with critical

projects. Short-term supporting projects have sufficient information and implementation potential to fulfill needs for immediate action; they could be proposed for consideration on upcoming CWPPRA priority lists (e.g., the 1994 or the 1995 lists). Most short-term supporting projects are associated with Strategy 4 (small scale measures), and are listed below by subbasin.

Timbalier Subbasin.

	TE-5	Grand Bayou Wetland
	TE-6	Pointe au Chien Wetland
	TE-8	Bayou Pelton Wetland
	TE-12	Bird Island Restoration
*	TE-17	Falgout Canal Planting
*	TE-18	Timbalier Island Planting
*	PTE-27	West Belle Pass Headland
	XTE-40	Timbalier Island Sediment Trapping
	XTE-62	Creation at Wine Island with Dredged Material from Cat Island Pass

Penchant Subbasin.

*	**PTE-22/24**	Pt. au Fer Canal Closure
	XTE-38(d-i)	GIWW Bank Restoration
	XTE-64	Avoca Island Sediment Diversion
	XTE-65	Spray Dredging West of Locust Bayou

Fields Subbasin.

	TE-16	St. Louis Wetland
	XTE-38(a-c)	GIWW Bank Restoration (includes PTE-4)

SUPPORTING LONG-TERM PROJECTS

Long-term supporting projects are those which are not ready to be proposed for CWPPRA evaluation and possible funding at this time. Some projects require additional study and development and will not be ready for detailed evaluation for funding for several years. Others could not be considered in detail until decisions are made regarding other projects, or until substantial additional information is available from major studies or demonstration projects. Projects in this category are listed below.

Timbalier Subbasin.

	PTE-1	Bayou Terrebonne Dredging
	PTE-14	Belle Pass Marsh Creation West (creation feature same as PTE-27)
	PTE-17	B. Lafourche Dredging
	PTE-21	B. Terrebonne/Lafourche Channel (depends on XTE-52)
	XI-E-28	Parish Line of Defense (Strategy 9)

Penchant Subbasin.

PTE-8	Creation WHouma/ NGIWW
PTE-13	B. Chene, Boeuf, and Black Wetland

Verret Subbasin.

XTE-31	Sediment Diversion, Verret (Strategy 9)
XTE-34	Savanne Basin Restoration

Fields Subbasin.

TE-15	GlWW Levee Planting

DEMONSTRATIONS

Supporting research projects needed for the Terrebonne Basin to support implementation of various basin strategies are listed below. Additional demonstration and pilot projects will have to be develope in the future, especially to support development o sedfment diversion and importation strategies.

Pm-nose	Proiect
Remediation of oi & gas canals	PTE-10, Pt. au Fer Spoil Bank Management XTE-53, Pt. au Fer Spoil Bank Management and Spray Dredging
Barrier island protection	XTE-39 Oyster Reef
Reduce saline intrusion	PTE-20 B. Lafourche Salinity Sill
Improve special wetlands	XTE-54 Flotant Marsh Creation and Enhancement XTE-61 Sedimen t. . . Cypress swamp
Sediment import	XTE-43 Red mud coastal restoration XTE-66 Sediment conveyance

XTE-54 is considered a high priority, as it is essential to the development of effective management techniques for a key wetland type (flotant marsh). XTE-66 is also considered a high priority, as it would increase knowledge of sediment distribution alternatives, and would interface with the State 's investigation of using existing (abandoned) pipelines for sediment distribution.

Either PTE-10 or XTE-53 would be considered a high priority, because either would address a coast-wide problem of oil and gas canal remediation. XTE-53 is preferred over PTE-10 because it represents a more complete and appropriate restoration effort for the area of Point au Fer and combines multiple techniques. Project PTE-20 would help address the problem of saltwater intrusion, but has a relatively large and poorl focussed scope . The feasibility of using a sill to address the problem of saltwater intrusion in the HNC will be evaluated separately, to determine whether this less expensive alternative to a lock could be

implemented, reevaluation of PTE-20 would be appropriate when the results of the feasibility analysis of XTE-35 are known.

XTE-61 is considered a valuable demonstration project, as it is essential to the development of effective management techniques for a key wetland type (cypress swamp). However, until key hydrologic restorations are implemented i Vermt, there remains the concern that this project would cause local flooding problems. XTE-43 would provide valuable information to advance our understanding of sediment import components such as Strategy 3 and alternate sediment sources. Further, the project represents a partnership in wetlands restoration among Federal, State, and local agencies and industry. XTE-39 is not considered essential, because other approaches to barrier island protection are proposed.

COSTS AND BENEFITS OF THE SELECTED PLAN

Table 6 summarizes the estimated wetland acres which will benefit from the selected plan, and the costs of this plan; benefits and costs are based on specific projects which are summarized in Table 5. Prospective benefits should be compared to th 20-yeare projection of losses (under a no action alternative, see Table 3).

Table 6 . Estimated Benefits and Costs of Terrebonne Basin Selected Plan Projects ".

	Acres Created, Protected, or Restored	Percent Loss Prevented	cos t ($)
Critical Short-Term			
Timbalie r Subbasin	16,349	27	225733,000
Penchan Subbasin	11,406	46	57,272,000
Field s Subbasin	N/A[3]	N/A	N/A
SUBTOTAL,	27,755	32	283,005,OOO
Supportinn Short-Term			
Timbalie r Subbasin	2,269	4	16,971,OOO
Penchan Subbasin	2,218	9	9,018,OOO
Field s Subbasin	61	2	815,000
SUBTOTAL	4,548	5	26,804,OOO
TOTAL,	32,303	37	309,809,OOO

[1] Only projects with estimates of both benefitted acres and cost were included in the summary.
[2] Neither costs nor benefits are now known for the key strategies in the Verret Subasin.
[3] N/A - not applicable (no critical projects in the Fields Subbasin).

In the Timbalier Subbasin, implementation of critical and supporting projects comprising the short term phase of the selected plan will offset almost one third (31 percent) of the predicted marsh losses by direct protection against loss, by restoration, or by marsh creation.

Additional benefits from enhancement of marsh and shallow water habitat would also be gained. These gains as a result of restoring altered hydrologic conditions, creating marsh in key areas on a small scale, and restoring barrier islands would cost approximately $243 million. Clearly, additional efforts will be needed in order to achieve a sustainable wetlands environment in the Timbalier Subbasin. Thus, sediment-import projects are necessary if the basin is to receive optimum protection and restoration Restoration of the basin requires investigation into alternatives such as diversions from Bayou Lafourche and demonstration of sediment importation technologies.

In the Penchant Subbasin, implementation of the short-term phase of the selected plan, including both critical and supporting projects, will avert or offset aproximately 55 percent of the predicted losses, at a cost of about $66 million After hydrologic restoration is in place and flood-control problems are addressed, the long-term strategy of diverting substantial amounts of Atchafalaya River sediment into th subbasin can be implemented, such an approach conceivably would lead to a condition of no net loss of wetlands.

Neither costs nor benefits are currently known for the key strategy in the Verret Subbasin. However, the strategy in Verret is scaled to the magnitude of the problem in the swamps, and thus will address the major portion of the problem. Options such as introducing sediments to specific areas would then be available for remaining problems.

Only site-specific, small scale projects are currently planned for the Fields Subbasin. The acreage estimated to benefit from projects in the Field Subbasin is substantially less than the projected acres of marsh loss, which suggests that many of the local problems in the subbasin are not yet addressed by proposed projects That is not considered a major issue, because of the relatively low rate of marsh loss (11 percent in the next 20 years) and because the ongoing planning process allows for currently unaddressed local problems to be considered in the future.

KEY ISSUES IN PLANNING

Traditional marsh-management projects which involve active water level management are likely to restrict access for estuarine organisms and interfere with re-establishment of natural pathways of water and sediment distribution. Habitat composition and functional characteristics may be different in managed marshes, and there is uncertainty as to their success in increasing marsh acreage. Some opposition to these projects exists on the grounds that they do not promote long-term sustainable marsh ecosystems as opposed to projects which achieve a more natural hydrologic environment. Others believe such projects are the only practical choice in many severely damaged areas; and that with proper design and implementation, marsh management can reduce saltwater intrusion and tidal scour, and partially restore natural hydrology and promote freshwater retention and sediment deposition. The USFWS is conducting an ongoing study of marsh management intended to address some of the issues identified above. In addition, th USACE is preparing a programmatic EIS on marsh management to evaluate the existing evidence on these issues.

A successful plan must be consistent with the need to protect human settlements (e.g. through flood control, as notably in Verret and Penchant Subbasins) and to support economic activity (e.g., through maintenance of navigation channels, consideration of impacts on fisheries, including oysters, and consideration of oil and gas activities). Impacts to oyster

leases are of particular concern for any proposals to introduce large quantities of fresh water and sediment into brackish or saline areas. These are the principal concerns with diverting Mississippi River water into a re-opened Bayou Lafourche, with subsidiary diversions along the lower west bank of the bayou into the Timbalier Subbasin Impacts to drinking-water quality are an issue to communities whose supply intakes are impacted by saltwater intrusion.

Pilot projects to develop effective management of floating marsh, herbivore control, and hydroperiod restoration in cypress swamp will be developed in the near future. Information gained from demonstration projects in other basins that test alternative designs and materials for erosion protection on soft shorelines will be incorporated into project design in this basin.

IMPLEMENTATION

PROJECT DESCRIPTIONS

CRITICAL SHORT-TERM PROJECTS

STRATEGY 1: PENCHANT SUBBASIN HYDROLOGIC RESTORATION

PTE-26 UPPER BAYOU PENCHANT WATERSHED MANAGEMENT

Location.

The entire Penchant Subbasin would be divided into twelve conservation treatment units (CTUs) delineated by hydrologic barriers, especially the natural levee ridges of the Teche and Lafourche distributary channels (Figure 6). Units will be divided into subunits for individual management by landowners.

Problems and Opportunities.

Sediments and water are introduced to the Penchant area via the GIWW and the Atchafalaya River. At present, a large percentage of these sediments are not retained within interior marshes because of rapid water exchange rates. The concept of Project PTE-26 is to better utilize the sediments and nutrients in the Penchant Subbasin by means of hydrologic restoration (i.e., primarily passive management).

Description of Features.

Project PTE-26 is a management plan that will include a wide array of measures which collectively achieve the objectives of Strategy 1, hydrologic management in the Penchant Subbasin. At present, none of the measures have been fully defined; however, the planning process is well advanced, and specific measures within this plan are expected to be finalized within the remaining 3-year period of CWPPRA funding. Consequently Project PTE-26 is considered short-term. This plan proposes to:

1) restore some historic water flow patterns through natural bayous (distributary channels);
2) allow better distribution and retention of sediment-laden waters;
3) increase freshwater flow to intermediate and brackish marshes by utilizing oilfield and pipeline canals;
4) provide outlets to reduce flooding during high-water periods; and
5) control outflow velocities at major outlets.

Benefits and Costs.

Because specific components of this overall project have not been fully designed, specific project areas can not be delineated, and therefore benefits can not be estimated. Similarly, costs have been only grossly estimated at about $50,000,000. If the entire Penchant Subbasin is used as the project area, and assuming that hydrologic restoration of the subbasin would reduce the current land loss rate by about 60%, as defined for "protected acres" benefits estimates by the WVA subcommittee, then an anticipated benefit of the protection of 10,600 acres could be estimated. Following this approach of using the entire subbasin as the project area and applying estimation protocols adopted by the WVA work group, a further benefit of

the enhancement of an additional 38,553 acres could be anticipated These are likely overestimates of benefits, as no rdltof the subbasins ' land area would be included in specific project areas.

Effects and Issues.

Specific effects can not be anticipated until project components are defined It can.be expected that some freshening of intermediate and brackish marshes will occur Other effects will include local disturbances due to construction of project features (e.g., installation of wiers, plugs, sediment fences, etc.).

This watershed plan is largely based on engineering and design principles used by the Soil Conservation Service (SCS) in similar watershed plans. Interaction of the plan with possible water and/or sediment introductions to this subbasin must be considered. Although intended as a passive management project, there remain concerns that fisheries access as well as sedimentation may be restricted. This project was developed under PL 83-566 (the Small Watersheds Planning Act), and could also be appropriately funded under that program.

status.

Some preliminary aspects of the management plan were presented to the Bayou Penchant Landowners meeting in November 1992. The plan will be modified and expanded based on input from landowners or other interested parties and by further studies by SCS. A final comprehensive plan will be developed within a relatively short tim frame.

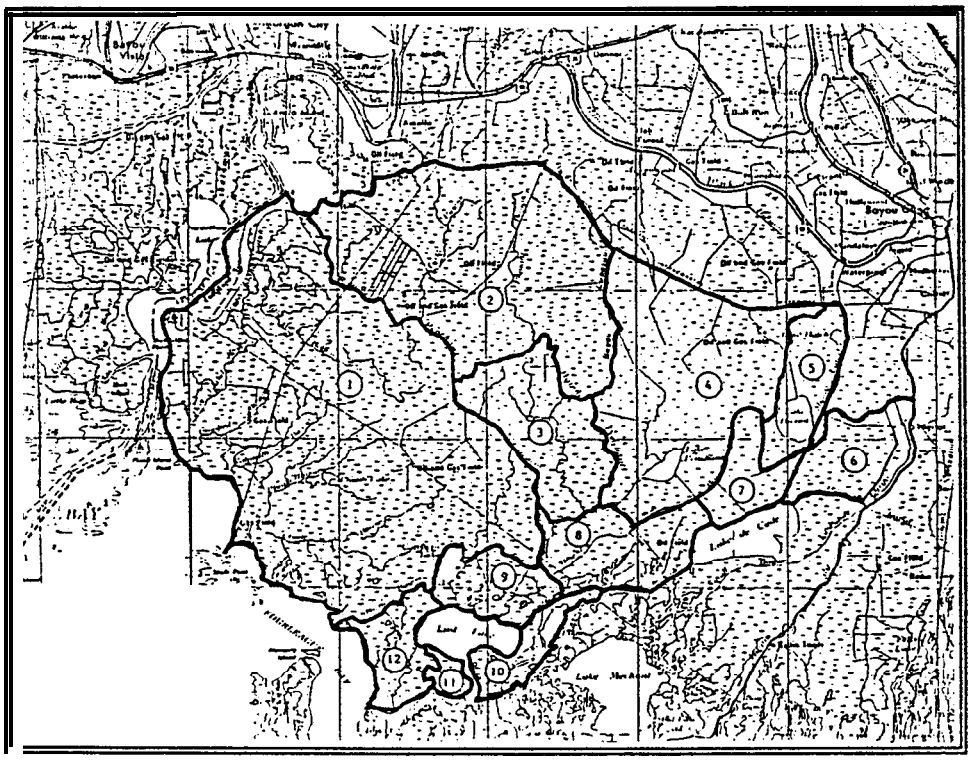


Figure 6. PTE-26 Upper Bayou Penchant Watershed Management

PTE-26B BRADY CANAL HYDROLOGIC RESTORATION

Location.

Approximately 7,200 acres of fresh/intermediate/brackish marsh, bounded by Bayou Penchant, Brady Canal, and Bayou Little Carenco to the north; Bayou Decad eand Turtle Bayou to the south; Superior Canal to the east; and Bayou Little Carenco and Voss Canal to the west (Figure 7).

Problems and Opportunities.

The objective of this project is to maintain marshes by enhancing freshwater, sediment, and nutrient delivery into a fragile, highly fragmented transitional area between the fresh and estuarine zones. The project will channel increased flows from Bayou Penchant to a fresh-intermediate marsh (outfall management area) that encompasses the western-most segment of the Mauvais Bois ridge. The project contains measures to reduce the likelihood of over-freshening oyster producing areas downstream of the project area. Those measures will also reduce saltwater intrusion during low flow conditions by limiting the size of natural and man-made outlets and by maintaining the banks along Bayou Decade, Turtle Bayou, and Superior Canal.

Description of Features.

Project features include installation of three 60-in chdiameter, one-way flap-gated structures at the existing Brady Canal structure at the confluence with Bayou Penchant. A portion (to be determined) of the bank along Brady Canal, Bayou Little Carenco, and Voss Canal will be modified to allow overbank flow into the outfall management area. Rock weirs will be installed at four locations along the banks of the above-noted watercourses to increase freshwater introduction into the project area. A one-way flap-gated structure will be installed at the end of an oil field access canal originating from Bayou Penchant and terminating in the center of the area Along the downstream boundary of the area, a portion (to be determined) of the banks along Superior Canal, Bayou Decade, and Turtle Bayou will be maintained and four existing outlets will be sized and armored with rock to accommodate oil field navigation and/or tidal exchange. Operation will be primarily passive.

Benefits and Costs.

Benefits resulting from this project would be approximately 297 acres of marsh protected; 360 acres of submerged aquatic vegetation restored, plus 180 acres of marsh enhanced, for a total of 837 acres of benefit. Estimated costs for this project are $3,609,000.

Effects and Issues.

As one of the major objectives of this hydrologic restoration is to increase freshwater delivery to intermediate and brackish marsh areas, it can be expected that some freshening of intermediate and brackish marshes will occur. Other effects will include local disturbances due to construction of project features (e.g., installation of weirs, plugs, sediment fences, etc.).

Status.

Status.

This project is on the third priority project list.

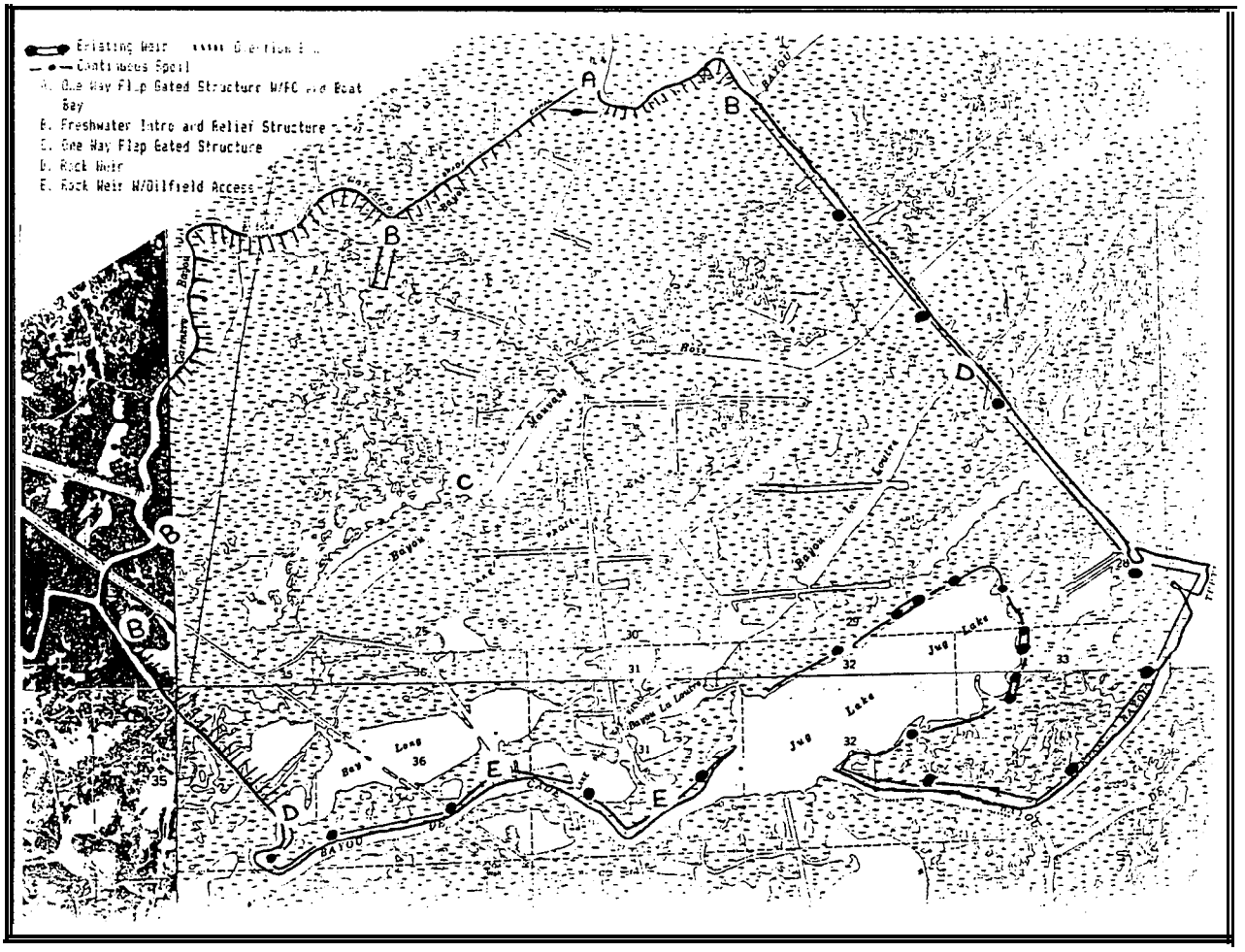


Figure 7. PTE-26b Brady Canal Freshwater-Sediment Diversion/Outfall Management

PTE-23/XTE-33 LAKE CHAPEAU HYDROLOGIC RESTORATION/SEDIMENT INPUT

Location.

Approximately 14,587 acres on Point au Fer island, including the vicinity of Lake Chapeau, bounded by Four League Bay to the north, Atchafalaya Bay to the west, Locust Bayou and a network of canals to the south, and Wildcat Bayou and an oil field canal to the east (Figure 8).

Problems and Opportunities.

Existing canal networks which extend into the center of the island have altered the hydrology of the island considerably. Atchafalaya River stages and tidal influences have more profound effects due to direct routes into the interior marshes. The primary objectives of this project are to re-establish hydrologic control points which will reduce tidal energies and the resulting scouring of the interior marsh. The project will reduce extreme tidal fluctuations in the project area. Reduced tidal energies may.promote conditions which will sustain viable communities of aquatic vegetation. Sediment and nutrient influx from the Atchafalaya River would allow some deteriorated areas to accrete and allow establishment of emergent vegetation.

Description of Features.

Hydrologic restoration project features will include rock weirs across the westernmost oilfield canal which is north of Locust Bayou and at the juncture of an oilfield canal and the west fork of Little Mosquito Bayou; rock plug/spillway structures where an oil field canal intersects with Locust Bayou and across an oil field canal to the west of Wildcat Bayou; a very low sill tidal dampening structure across the natural bayou which leads into the large open water area north of Lake Chapeau; and repair of an existing plug and bulkhead In addition, approximately 500,000 cubic yards of sediment would be dredged from Atchafalaya Bay just west of the project area and pumped to the shallow open water area west/northwest of and adjacent to Lake Chapeau to re-establish a land bridge (approximately 250 acres) separating watersheds. Operation will be primarily passive.

Benefits and Costs.

Total benefits resulting from this project would be approximately 509 acres of marsh created or protected; 725 acres of submerge aquatic vegetation restored, plus 880 acres of marsh enhanced, for a total of 2,114 acres of benefit. Estimates costs for this project are $4,362,000.

Effects and Issues.

It can be expected that some freshening of intermediate and brackish marshes wilI occur. Other effects will include local disturbances due to construction of project features (e.g., installation of wiers, plugs, sediment fences, etc.). Examination of potential impacts on natural sedimentation processes will be necessary.

Committing a high proportion of construction funds to projects such as this with high operation and maintenance costs over the life of the project is controversial. Extensive areas

of levees (such as the proposed 4,400 ft of levee along the southwestern project boundary) would also be controversial.

status.

This project is on the third priority project list.

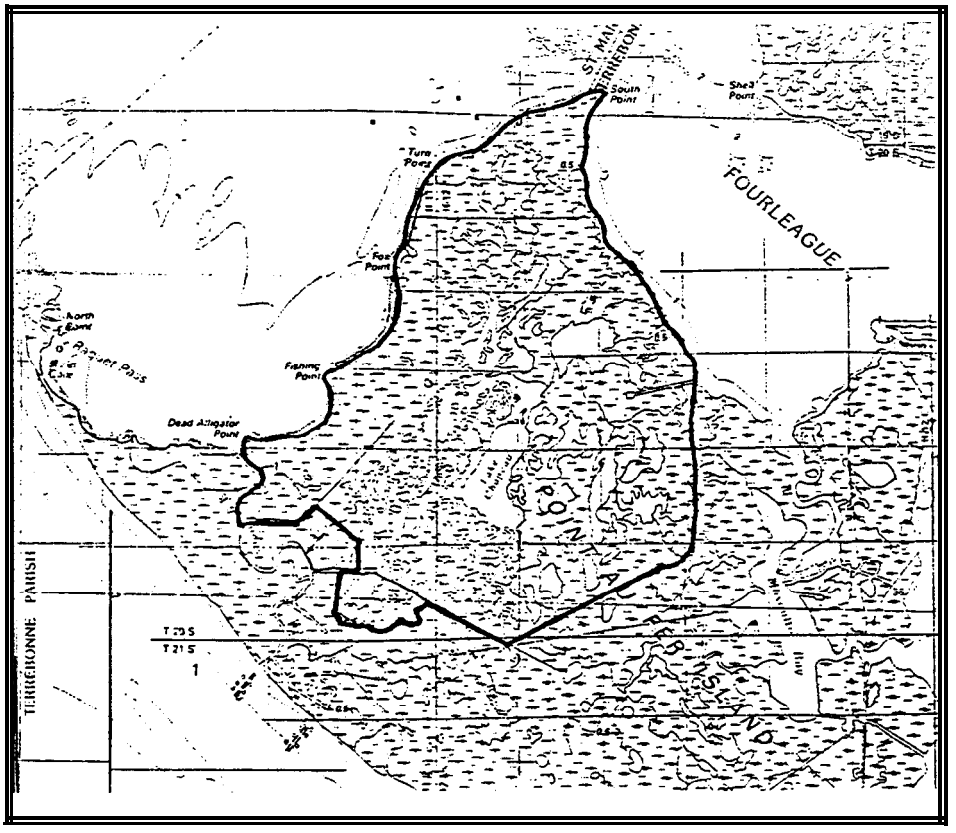


Figure 8. PTE-23/XTE-33 Lake Chapeau Hydrologic Restoration/Sediment Input

STRATEGY 2. TIMBALIER SUBBASIN BARRIER ISLAND RESTORATION

TE-11A ISLES DERNIERES NEW CUT CLOSURE

Location.

The cut between East and Trinity Islands of the Isles Dernieres chain, centered at longitude 90°48' and latitude 29°03' (Figure 9).

Problems and Opportunities.

The objective of this project is to seal New Cut, between East Island and Trinity Island, preventing loss of island beach face material into the cut and increasing the integrity of the barrier islands.

Description of Features.

The project would close New Cut with material dredged from the Ship Shoal area. Front dunes would be created at a nominal +300 ft. wide at a final MSL elevation of +8 ft., and back marsh would be created at a nominal +500 ft. at a final MSL elevation of +3.5 ft. Approximately 1,100,000 cubic yards of material would have to be dredged from Ship Shoal to create this section. Approximately 73 acres of dunes and 73 acres of marsh would be created Once construction of restoration features is completed, there are no operational features of this project.

Benefits and Costs.

Benefits for this project would be the creation of 73 acres of marsh (as well as the creation of 73 acres of dunes). Other benefits due to protection of mainland marsh and other marsh enhancement have not been estimated. Project costs have been estimated at $6,400,000.

Effects and Issues.

Dredging at Ship Shoal would temporarily disturb bottom habitat; deposition of the material in New Cut would replace bottom habitat with dune and marsh habitat. No other adverse effects are anticipated.

status.

This project could be considered on any of the future priority project lists.

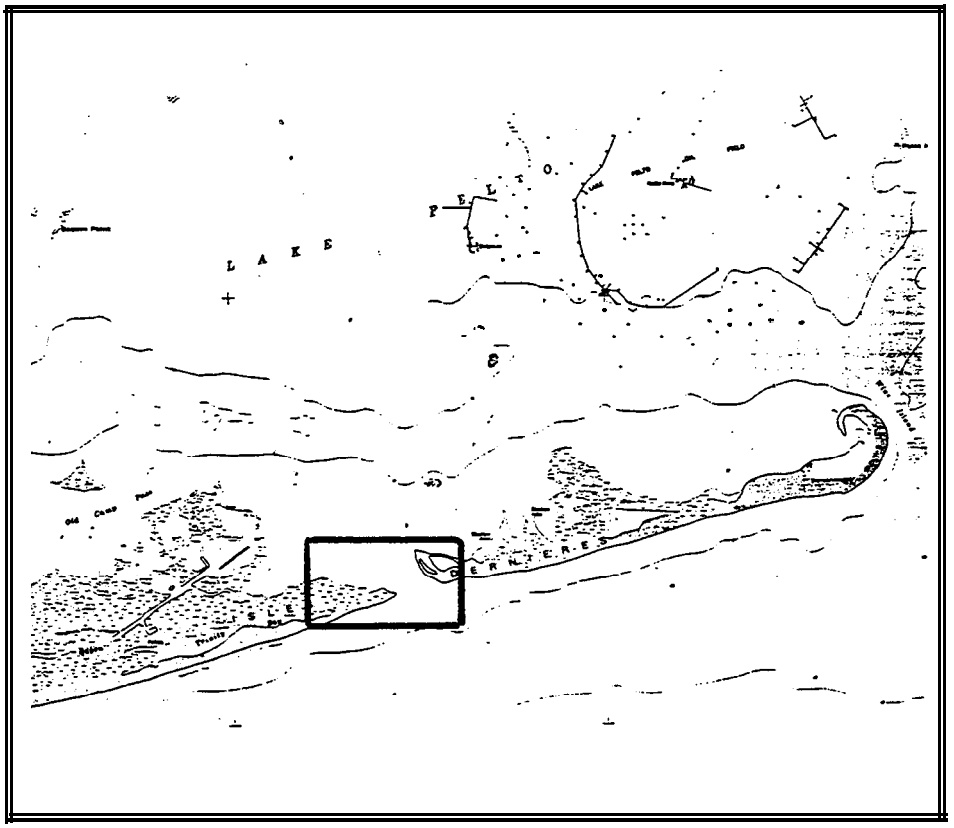


Figure 9. TE-11A Isles Demieres New Cut Closure

TE-20 EASTERN ISLES DERNIERES (PHASE 0)

Location.

East Island of the Isles Demieres chain, centered at longitude 90°42' and latitude 29°03' (Figure 10).

Problems and Opportunities.

The barrier islands in the Timbalier Subbasin offer significant protection to mainland marshes; however, the Isles Demieres chain is expected to disappear within the next decade if no restoration efforts are undertaken. Specific objectives of this project are to restore and elevate the coastal dunes and construct and enhance the wetlands of the East Island, enhance the physical integrity of the islands, and protect the lower Terrebonne estuary and associated vegetated wetlands against direct exposure to the Gulf of Mexico.

Description of Features.

Project features include building retaining dikes with overwash material, filling these with back bay dredged material to +8 ft MSL and 300 ft wide for dunes, and to +3.5 ft and 500 ft wide for marsh. Sand will also be used to fill breaches. Approximately 2 miles of island will be restored. Once construction of restoration features is completed, there are no operational features of this project, although monitoring would represent an ongoing activity.

Benefits and Costs.

The WVA subcommittee estimated (in 1991) benefits for this project to be 9 acres created, restored, and protected, and an additional 70 acres enhanced, for a total benefit of 79 acres.

Effects and Issues.

Dredging behind the islands could lead to increased wave action and erosion along the back bay marshes. Existing habitats on the dunes, back marshes, and overwash areas would be disturbed during construction. Some bay bottom habitat which will be filled with dredged material would be lost. Disturbed bay habitat may include some oyster leases. Bird usage of the islands would also be disrupted during construction. All of these effects except the dredging impacts will also occur without the project. Positive effects will include restoration of the land forms, creation of additional habitat, and protection of land forms behind the islands.

Modeling and monitoring studies may be needed to fully evaluate the level of protection to marshes which result from barrier islands. A potential engineering/design issue relates to the possibility that there may be insufficient quantities of overwash material of appropriate quality for construction of dune dikes (some information available in Penland and Suter 1988); if so, then an alternate source of material with concomitant changes in method of dune construction would have to be used. The feasibility of using Ship Shoals material was evaluated by the Louisiana Geological Survey (LGS 1991) and represents a potential alternative source. There is concern that using the back bay as a borrow area may be innapropriate, as it deepens the platform for natural island transqression. This will be

evaluated, although studies show the Isles Demieres are not transgressing, but breaking up in place.

status.

This project (TE-20) is on the first priority project list (PPLl).

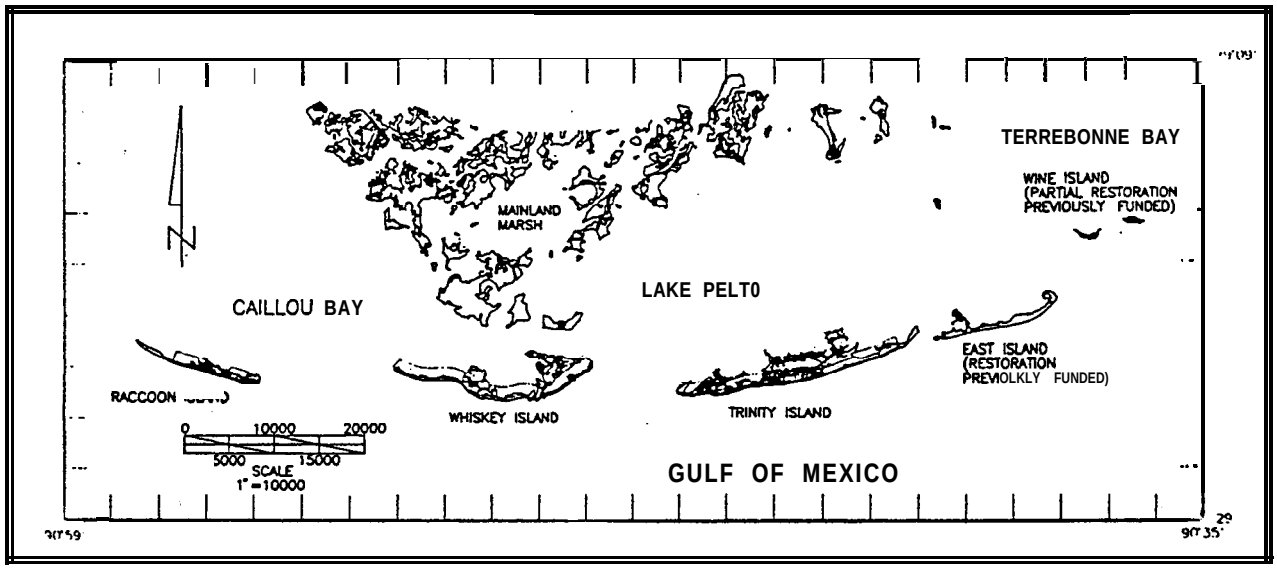


Figure 10. TE-20 Eastern Isles Demieres

PTE-15 RESTORATION OF THE ISLES DERNIERES BARRIER ISLANDS

Location.

East, Trinity, Whiskey, and Raccoon Islands of the Isles Demieres chain, centered at longitude 90°48' and latitude 29°03' (Figure 11).

Problems and Onnortunities.

The barrier islands in the Timbalier Subbasin offer significant protection to mainland marshes; however, the Isles Demieres chain is expected to disappear within the next decade if no restoration efforts are undertaken. Specific objectives of this project are to restore and elevate the coastal dunes and construct and enhance the wetlands of the Isles Dernieres, enhance the physical integrity of the islands, and protect the lower Terrebonne estuary and associated vegetated wetlands against direct exposure to the Gulf of *Mexico.

Description of Features.

Project features include building retaining dikes with overwash material; filling these with back bay dredged material to +8 ft MSL and 300 ft wide for dunes, and to +3.5 ft and 500 ft wide for marsh. Additional or alternative features are being considered which may include segmented breakwaters to protect the Gulf side of some of the islands, and increasing the depth of the marsh created behind the dunes. The project would be constructed in phases. Phase 0 (TE-20) will restore East Island of the Isles Demieres chain, and is on the first priority project list. Phase I (PTE-15a, =XTE-41) will restore the west end of Trinity Island, and is on the second priority project list. Both Phases 0 and 1 use the restoration methodology described above. PTE-15bi will restore Whiskey Island, and is on the third priority project list. PTE-15bii will restore Raccoon Island, and was evaluated as a candidate to PPL3, though not selected. Restoration of remaining island segments will be proposed as phases for future priority project lists. Once construction of restoration features is completed, there are no operational features of this project, although monitoring would represent an ongoing activity.

Benefits and Costs.

The WVA subcommittee estimated, in 1991, total benefits for this project to be 531 acres created and 521 acres protected. In 1993 an estimate of 812 acres enhanced was added, for a total of 1,864 acres of benefit. When proposed modifications to project design are finalized, revision of estimated benefits will be necessary, as, for instance, in 1993, the benefits estimated for a revised Phase II were 1236 acres created and protected, and 147 acres enhanced for a total benefit of 1386 acres. In addition, results of recent modeling efforts indicate substantial and quantifiable protection of mainland marshes by barrier islands, and this information may lead to modification of the estimate of benefits derived from barrier island restoration projects. The fully funded cost was estimated at $33,188,000 (Louisiana Coastal Wetlands Conservation and Restoration Task Force 1992). Clearly, the cost estimate will also change with proposed project modifications.

Effects and Issues.

Dredging behind the islands could lead to increased wave action and erosion along the back bay marshes. Existing habitats on the dunes, back marshes, and overwash areas would be disturbed during construction. Some bay bottom habitat which will be filled with dredged material would be lost. Disturbed bay habitat may include some oyster leases. Bird usage of the islands would also be disrupted during construction. All of these effects except the dredging impacts will also occur without the project Positive effects will include restoration of the land forms,- creation of additional habitat, and protection of land forms behind the islands.

Modeling and monitoring studies may be needed to fully evaluate the level of protection to marshes which result from barrier islands. A potential engineering/design issue relates to the possibility that there may be insufficient quantities of over-wash material of appropriate quality for construction of dune dikes (some information available in Penland and Suter 1988); if so, then an alternate source of material with concomitant changes in method of dune construction would have to be used. The feasibility of using Ship Shoals material was evaluated by the Louisiana Geological Survey (LGS 1991) and represents a potential alternative source. The proposed use of segmented breakwaters is controversial with regard to its appropriateness and benefit in a highly dynamic but sediment-starved system. There is concern that using the back bay as a borrow area may be innapropriate, as it deepens the platform for natural island transqression. This will be evaluated, although studies show the Isles Demieres are not transgressing, but breaking up in place.

Status.

Phase 0 of this project (TE-20) is on the first priority project list (PPLl), Phase I (XTE-41) is on the second priority project list (PPL2), and Phase II (PTE-15bi) is on the third priority project list. Substantial engineering and design effort has already been expended on the restoration of Isles Dernieres.

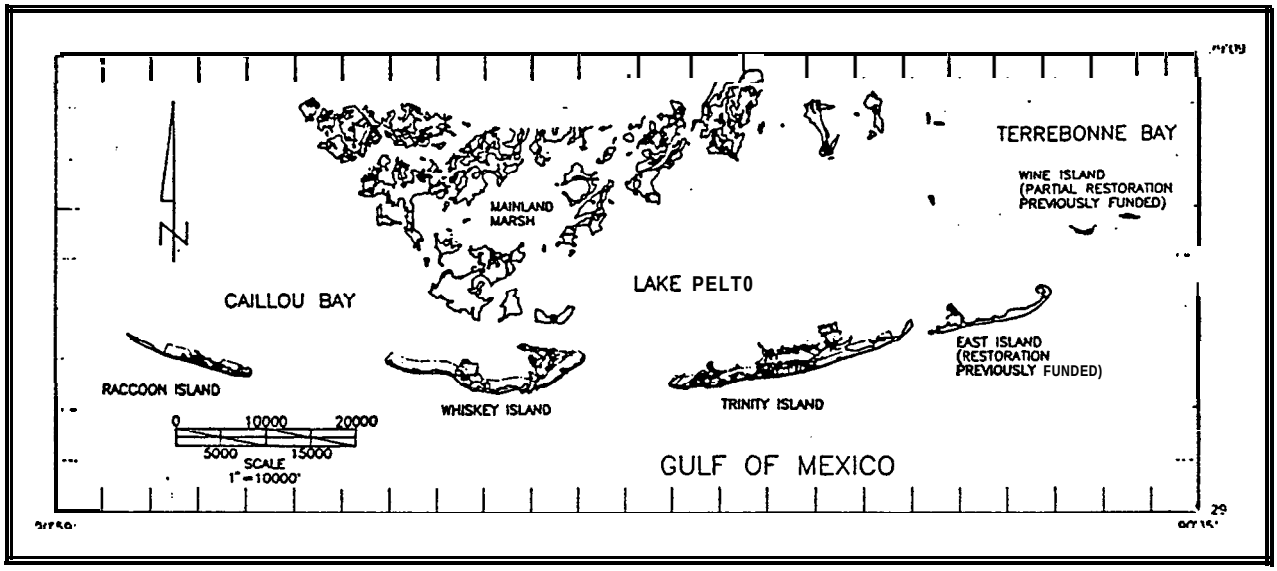


Figure 11. PTE- 15 Restoration of the Isles Demieres Barrier Islands

XTE-41 ISLES DERNIERES RESTORATION PHASE I

See project description for PTE-15

PTE-15bi ISLES DERNIERES RESTORATION PHASE II (WHISKEY ISLAND)

See project description for PTE-15

PTE-15bii ISLES DERNIERES RESTORATION PHASE II (RACCOON ISLAND)

See project description for PTE-15

XTE-45 RESTORATION OF THE TIMBALIER BARRIER ISLANDS

Location.

Timbalier and East Timbalier Islands, centered at latitude 29°03' and longitude 90°22' (Figure 12).

Problems and Opportunities.

The barrier islands in the Timbalier Subbasin offer significant protection to mainland marshes; however; the Timbalier Islands are expected to disappear within the next couple of decades if no restoration efforts are undertaken. Specific objectives of this project are to restore and elevate the coastal dunes and construct and enhance the wetlands of Timbalier and East Timbalier Islands, enhance the physical integrity of the islands, and protect the lower Terrebonne and Timbalier Bays and associated vegetated wetlands against direct exposure to the Gulf of Mexico.

Description of Features.

Detailed project plans will be developed based on expertise and engineering design developed for restoration of the Isle Demieres chain. Features would likely include filling numerous canals on Timbalier Island, rebuilding the dunes and back marshes using dredged material, and a segmented breakwater. Once construction of restoration features is completed, there are no operational features of this project, although monitoring would represent an ongoing activity. Specific features of partial restoration of East Timbalier Island are describe under project XTE-67.

Benefits and Costs.

Benefits and project costs can not be estimated until project design is completed, but the greater distance of the Timbalier chain from mainland marshes indicates that at least some parts of this project would be less cost-effective than PTE-15.

Effects and Issues.

Any dredging done to obtain overwash material or back bay muds for island restoration would disrupt benthic habitat. Construction (i.e., adding sediments to the existing dunes, etc.) would also temporarily disturb habitats on the dunes, back marshes, and overwash areas. Bird usage of the islands would also be disrupted during construction. Effects except the dredging impacts would also occur without the project. Positive effects will include restoration of the land forms, creation of additional habitat, and protection of land forms behind the islands.

If proposed, the use of segmented breakwaters would be of concern.

status.

Details of project design need to be developed. One component of restoration of the Timbalier Islands, XTE-67, is on the Third Priority List.

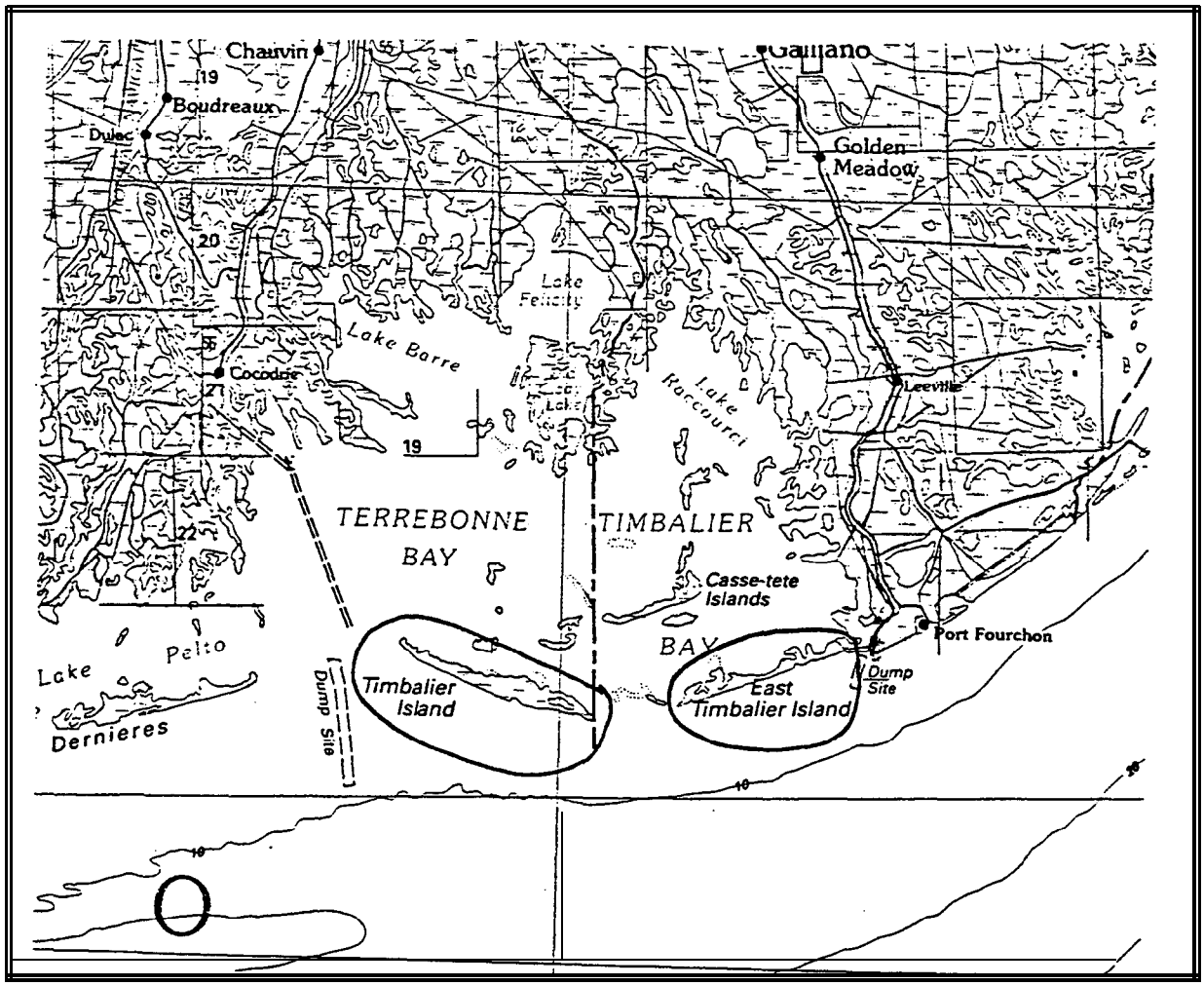


Figure 12. XTE-45 Restoration of the Timbalier Banier Islands

XTE-67 EAST TIMBALIER ISLAND RESTORATION

Location.

Western portion of East Timbalier Island, Lafourche Parish (Figure 13).

Problems and Opportunities.

The objective of this project is to improve the integrity and prolong the life of the remaining portion of East Timbalier Island.

Description of Features.

Project features include placement of dredged material in three shallow embayments. The dredged material would be obtained from Timbalier Bay and/or from maintenance dredging of existing access channels. Once construction of restoration features is completed, there are no operational features of this project, although monitoring will represent an ongoing activity.

Benefits and Costs.

Benefits from this project would include 1,013 acres of marsh created and protected. A total of 2,745 acres would be benefitted. Project costs have been estimated at $1,870,000

Effects and Issues.

Where marsh is created, shallow open water habitat and associated benthic communities would be lost; an equivalent acreage of marsh would be gained. Some minor habitat disturbance would occur during construction. No other negative impacts are anticipated.

Status.

This project is on the third priority project list.

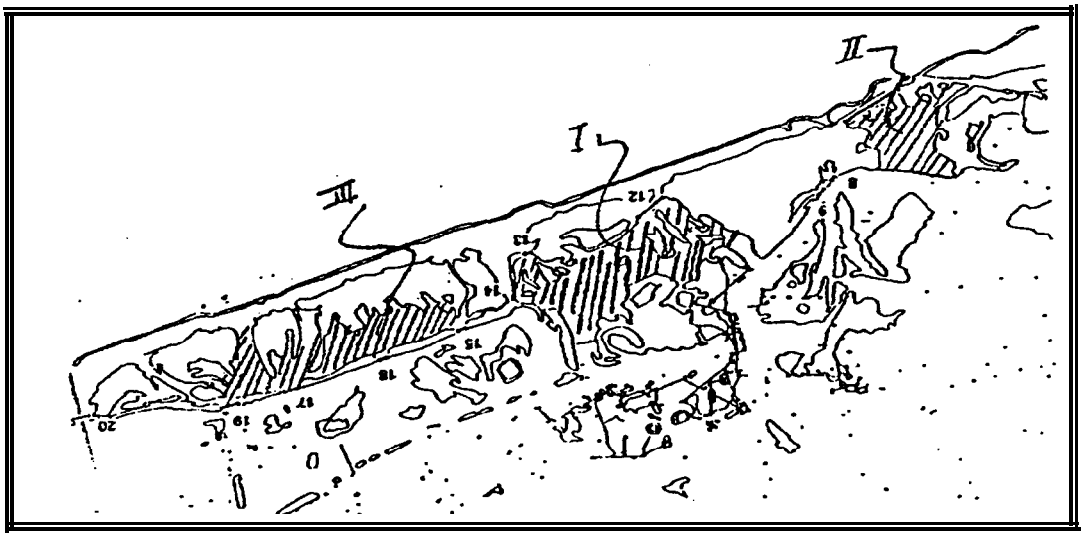


Figure 13. XTE-67 Creation/East Timbalier Island

STRATEGY 3. TIMBALIER SUBBASIN HYDROLOGIC RESTORATION

TE-7 LAKE BOUDREAUX WETLAND

Location.

The project area includes 46,000 acres in a hydrologic subbasin north of LA57 between the Bayou Grand Caillou and Bayou Petite Caillou natural levee ridges (Figure 14).

Problems and Opportunities.

The objective of this project is to provide wetland protection and enhancement through water management (primarily passive) on a basin-wide scale. Major water exchange occurs through Bayou Dulac at Dulac, the Boudreaux Canal at LA56, and the Robinson Canal at LA56. A secondary objective is to limit the area that is hydrologically connected to the Houma Navigation Canal to lessen saltwater intrusion and the rapid loss of freshwater, especially through Bayou Grand Caillou and Bayou Dulac.

Description of Features.

Three subprojects have already been defined: Upper Petite Caillou Management (TE-7a); Lower Petite Caillou Management (TE-7b); and Grand Caillou Management (TE-7c). The remaining area is being evaluated for watershed management needs by SCS (TE-7d). The upper Bayou Petite Caillou management area (7a) will be an actively managed area, while the remaining sections of the project area will be primarily passively managed. However, as management needs for TE-7d are still being developed, it is possible that some active management will be incorporated in this subproject.

Benefits and Costs.

The estimated benefits for TE-7a are 63 acres protected, 416 acres of submerged aquatic vegetation gained, and 316 acres of marsh enhanced, for a total of 796 acres, with an estimated fully funded cost of $2,665,000. For TE-7b, the estimated benefits are 203 acres protected, 204 acres of submerged aquatic vegetation gained, and 130 acres of marsh enhanced, for a total of 537 acres, with a fully funded cost of $1400,000 (7b is considered complete). For TE-7c, the estimated benefits are 108 acres protected, 109 acres of submerged aquatic vegetation gained, and 69 acres of marsh enhanced, for a total of 285 acres, with an estimated fully funded cost of $1,387,552. For TE-7d, the estimated benefits are 1,492 acres protected, 2,651 acres of submerged aquatic vegetation gained, and 1,745 acres of marsh enhanced, for a total of 5,888 acres, with a fully funded cost of about $9,364,000.

Effects and Issues.

It is proposed that this project will reduce marsh loss rates by reducing saltwater intrusion, decreasing the rapid flow-through of freshwater (i.e., increasing retention time), and managing water levels. To some extent, this will correct hydrologic modifications introduced by navigation and other canal projects, and thus restore some aspects of historic hydrology. Flow patterns will thus be altered, and navigation or recreational access may also be modified. Access for estuatine-dependent organisms and fisheries production would be

reduced over present rates, although historically, cross-sectional area of channels and thus access were likely lower.

Questions regarding adequate organism access may still need to be addressed and navigation needs will be addressed as part of the plan. Landowner cooperation will be necessary for implementation.

status.

Subprojects 7a-and d are appropriate for consideration on the third priority project list. Most components of TE-7a (Upper Petite Caillou Management) have been permitted. A feasibility report and hydrologic model are underway. TE-7b (Lower Petite Caillou Management) is essentially completed. Construction is to begin on TE-7c (Grand Caillou Management) in the summer of 1993. The remaining area watershed plan (TE-7d) is in development by SCS.

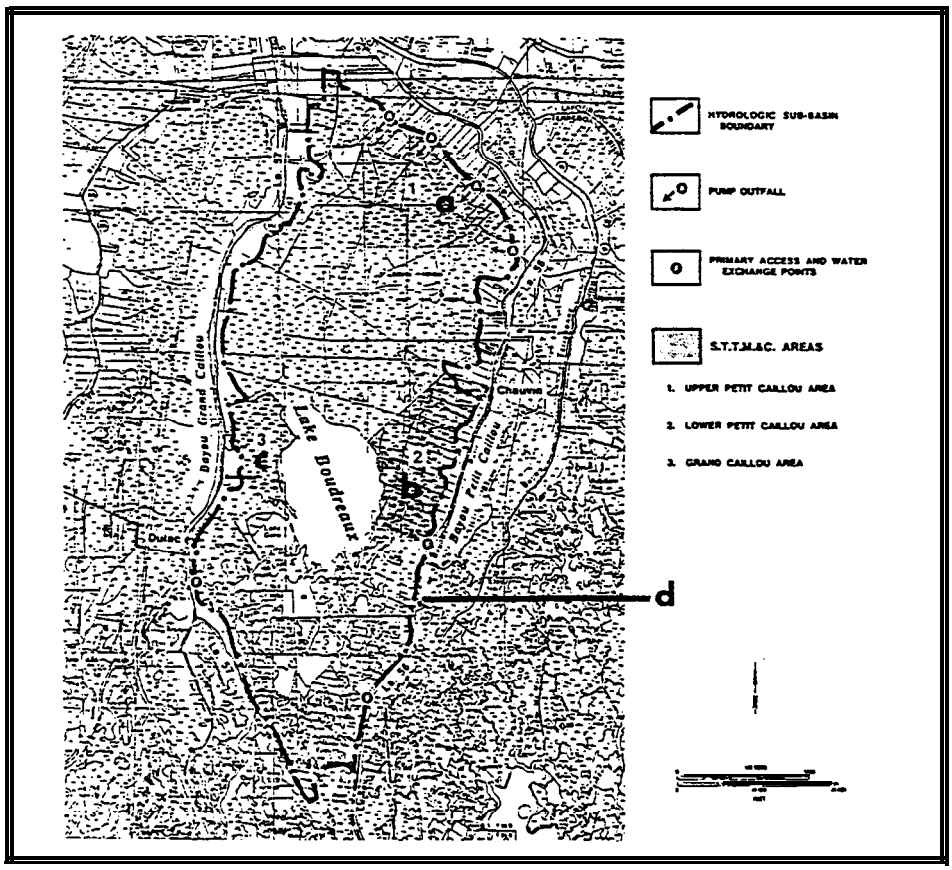


Figure 14. TE-7 Lake Boudreaux Wetland

TE-9 BULLY CAMP MARSH MANAGEMENT

Location.

The project is about 750 acres of public land located on the Pointe au Chien Wildlife Management Area just west of Galliano in Lafourche Parish (Figure 15).

Problems and Opportunities.

The Bully Camp marsh is a deteriorating brackish marsh in the zone of high marsh losses across Timbalier Subbasin that is targeted for preservation to protect marshes further inland The objective of this project is to reduce loss rates through marsh management, including periodic draw-down of water levels.

Description of Features.

The project will include at least two water control structures, levee work, and several drainage ditches. The project involves active water level management through operation of water control structures, with draw-down of water levels during the early stages of the growing season every third year.

Benefits and Costs.

The estimated benefits from this project will be the prevention of loss of 43 acres, the gain of 153 acres of submerged aquatic vegetation, and the enhancement of 39 acres, for a total of 235 acres of benefit, with an estimated fully funded cost of $638,000.

Effects and Issues.

This project is proposed to potentially reduce marsh loss rates and promote revegetation of some areas through reduction of water levels if drawdowns are successful. Other effects may include reduction of estuarine organism access over present levels and associated reduction of fisheries productivity. Structures should be operated in such a manner as to allow estuarine organism access. Questions regarding long-term land loss may still need to be addressed.

status.

This project is ready to be considered for implementation.

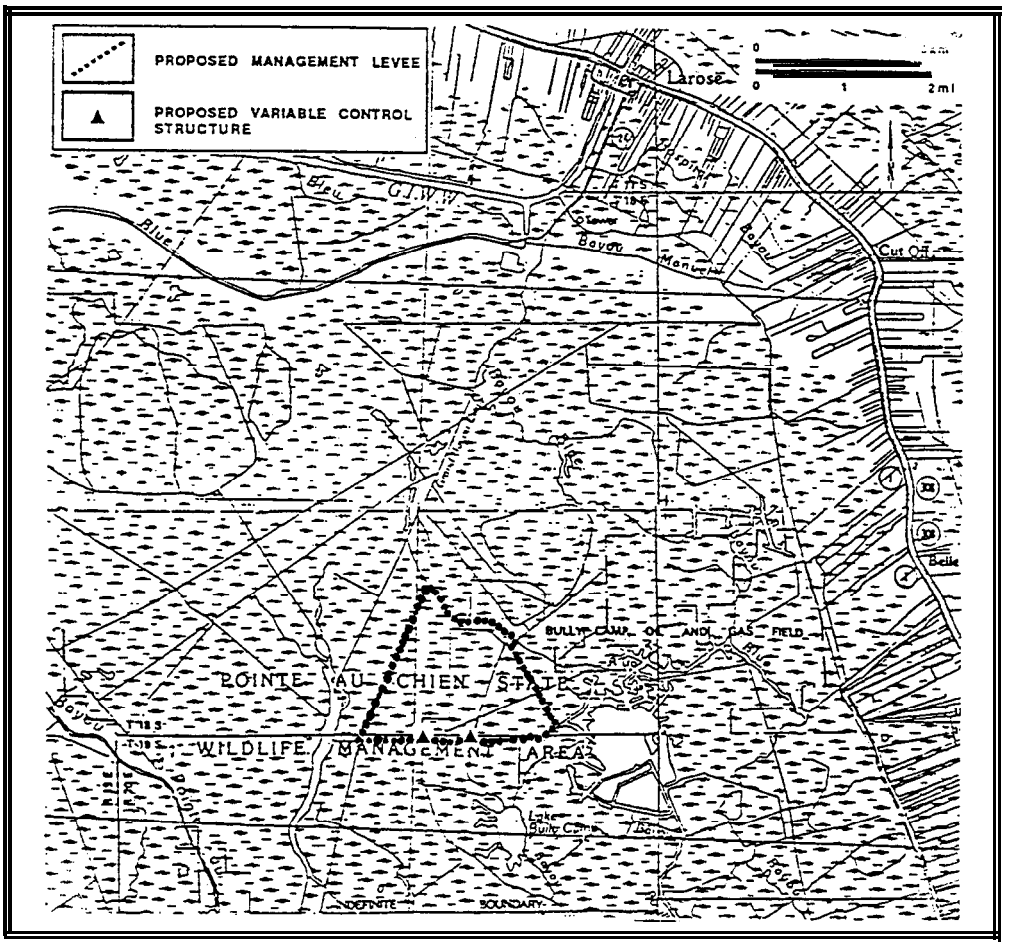


Figure 15. TE-9 Bully Camp Marsh Management

TE-lO/XTE-49 GRAND BAYOU-GIWW DIVERSION/CUTOFF CANAL PLUG

Location.

The project is located at the northern end of the Grand Bayou/Bayou Blue subestuary south to near Catfish Lake (Figure 16).

Problems and Opportunities.

The objectives of this project are to introduce sediment-laden freshwater from the GIWW into Grand Bayou in order to enhance the marsh and abate saltwater intrusion; and to restore the hydrology of the upper subestuary by reducing canal-induced saltwater intrusion through the Bayou Pointe au Chien ridge, preventing canal-induced loss of fresh water and improving the distribution of fresh water through the middle and upper estuary.

Description of Features.

Project features will include construction of a water control structure to divert additional fresh water from the GIWW south down Grand Bayou Canal, construction of a structure on Cutoff Canal to prevent loss of introduced fresh water and reduce canal-induced saltwater intrusion; and construction of a low-level levee on the east side of Cutoff Canal (from Pointe au Chien ridge to the subject structure) and planting of smooth cordgrass on both sides. Mode of operation of the water control structures is under consideration.

Benefits and Costs.

This project is estimated to protect (i.e., prevent the loss of) 1,825 acres, restore 1,785 acres of submerged aquatic vegetation, and enhance 1,319 acres, for a total benefit of 4,929 acres. The estimated fully funded cost is $5,515,000.

Effects and Issues.

Introduction of fresh water and sediments is considered beneficial to marsh health and maintenance. Impacts to navigation interests in Cutoff Canal are being considered. Impacts are largely undetermined The feasibility of diverting water at this site based on relative water levels in the GIWW and Grand Bayou must still be resolved Also, although no strong interaction between this project and the Davis Pond diversion is expected, this project may be more feasible if Davis Pond is operational, as the Davis Pond diversion would increase the amount of fresh water available to this diversion. This project will have a requirement to protect northern marshes from saltwater intrusion. Depending on final design, access to estuarine-dependent fish could be reduced.

Status.

This project was a candidate for evaluation on the third priority project list, and is ready for consideration on future lists.

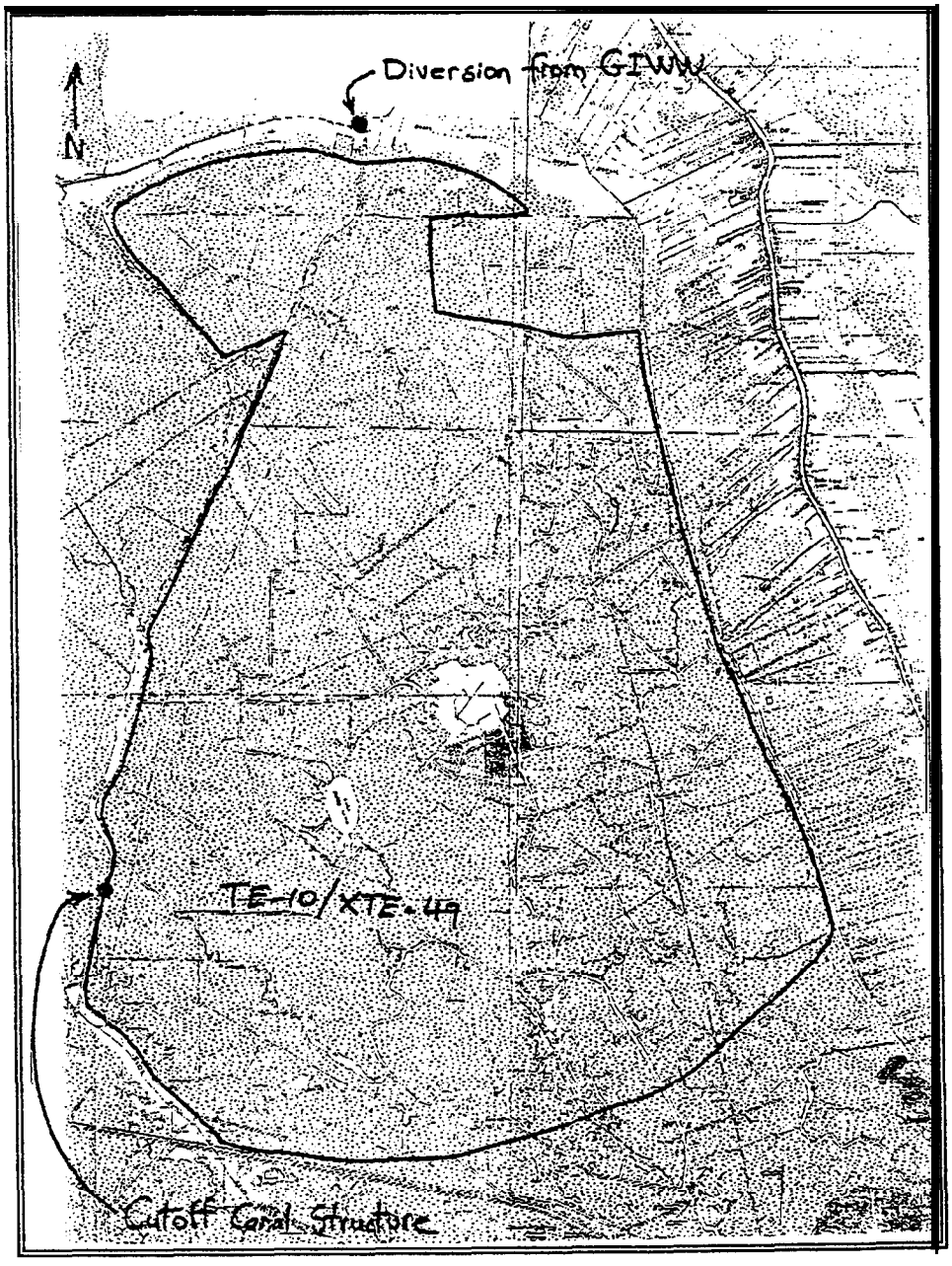


Figure 16. TE-lO/XTE-49 Grand Bayou-GlWW Diversion/Cutoff Canal Plug

TE-19 LOWER BAYOU LA CACHE WETLAND RESTORATION

Location.

The project area surrounds Lower Bayou La Cache in southern Terrebonne Parish. It is bounded by Bayou Petit Caillou to the west, Bayou Terrebonne to the east, Bush Canal to the north, and Sevin Canal/Bayou Lucien to the south. The project area encompasses 4,558 acres (Figure 17).

Problems and Opportunities.

The area currently opens to large waterways at numerous locations on the north, east, and west perimeters. Three canals cross the area, connecting Bayous Petit Caillou and Terrebonne. Ten additional access canals have been dredged. Numerous open water areas have developed or expanded in the last 20 years, especially in the areas surrounding the canals. Loss of vegetated marsh and associated fish and wildlife can be expected to continue if modification of hydrologic regimes is not affected.

Description of Features.

The project includes reconstruction of the south bank levee of Bush Canal from Bayou Petit Caillou to Bayou Terrebonne. This levee has been completely washed out over much of its length and about 65 percent of the reconstruction must be done in open water areas of some depth. A shell-reinforced plug will be placed in each of 9 access canals along Bayou Petit Caillou, with six along Bayou Terrebonne. Access canals to active sites may have to be ringed rather than plugged and provided with water control structures where the canal boundary would induce ponding of water.

Levee construction along Bush Canal involves subaerial base, shell-reinforced construction over approximately 2,647 fett, and subaqueous base, shell-reinforced construction over approximately 4,853 feet.

Benefits and Costs.

Benefits of this project would be 86 acres protected, plus an additional 206 acres enhanced, for a total benefit of 292 acres. Project costs are estimated to be $1,388,999.

Effects and Issues.

Canal plugs would require regular maintenance. The project would reduce, but not eliminate, current small boat access to the area for recreational and commercial fisheries.

status.

This project is on the First Priority Project List.

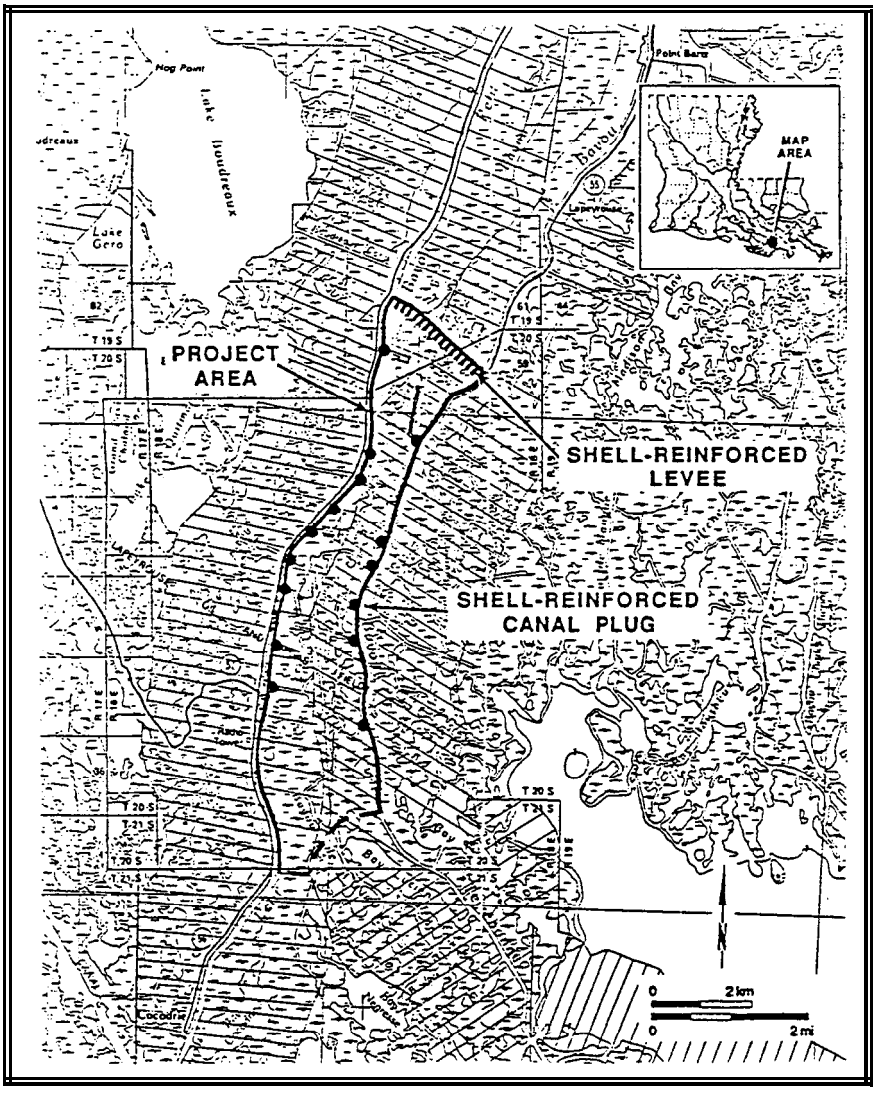


Figure 17. TE-19 Lower Bayou La Cache Wetland Restoration

TE-21 FALGOUT CANAL SOUTH WETLAND CREATION

Location.

The project area is south of Falgout Canal between Bayou DuLarge and the Houma Navigation Canal (Figure 18).

Problems and Opportunities.

Falgout Canal is an area of extensive marsh loss, with a predominance of shallow open water. It is in the zone of high marsh losses in Timbalier Subbasin that have been identified for protection to preserve interior marshes of the subbasin. This project will create marsh, increasing the integrity of the central zone in the subbasin, and test methods for distribution and spray application.

Description of Features.

Sediment application will be used to build 120 new acres of land suitable for colonization by marsh plants and 100 acres of very shallow hard bottom. New techniques for distribution and spray application of sediments will be evaluated to promote growth of submerged aquatic vegetation. The project includes hydraulic dredging of coarse Mississippi River sediment; batture impoundment and dewatering of sediment; reloading of sediment into trucks, and then hopper barges; a mobile barge-mounted unloader/booster facility; 23,000 feet of HDPE piping with multiple spray nozzles; and two marsh buggies for deployment of piping. About 600,000 cubic yards of sediment would be applied in shallow open waters to create subaerial and subaqueous deposits suitable for colonization by marsh flora and fauna.

Benefits and Costs.

The estimated areas of benefit are 104 acres created, plus 15 acres enhanced, for a total of 119 acres (114 average annual habitat units (AAHUs) as calculated by the WVA work group). The estimated cost is $5,792,000.

Effects and Issues.

Deposition of sediments will cover 220 acres of soft-bottom benthic habitat. Approximately 120 acres of this will be permanently lost and replaced with 120 acres of emergent marsh. The other 100 acres will be converted to shallow hard bottom habitat and will be recolonized by submerged aquatic vegetation and benthic fauna.

Cost of transport of dredged material over long distances remains an issue that needs demonstration and technical development. The project provides opportunity to obtain information closer to a real world scale.

status.

This project was placed on the first priority project list in deferred status. It may be constructed if other projects do not go forward

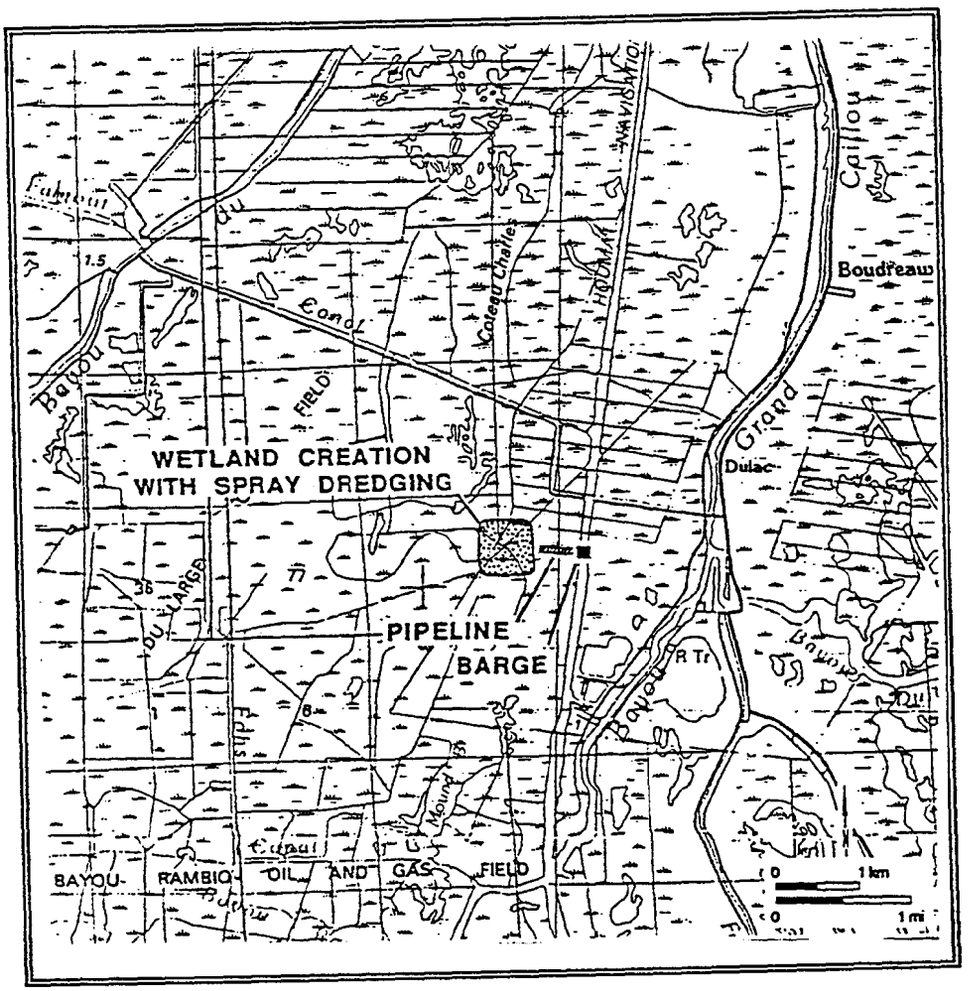


Figure 18. TE-21 Falgout Canal South Wetland Creation

PIE-3 HNC BAN-K **STABILIZATION**

Location.

The length of the HNC, especially south of its confluence with Bayou Grand Caillou (Figure 19).

Problems and Opportunities.

There are numerous areas along the Houma Navigation Canal (HNC) where erosion has led to breakthrough of the banks and washouts of marsh areas adjacent to the HNC. Marsh loss due to tidal action and possibly saltwater intrusion could be reduced and areas in imminent danger of exposure due to breakthrough could be protected with selected bank stabilization efforts.

Description of Features.

Nine particular problem areas have been identified from aerial photography and are recommended for attention: 1) east bank at mile 15,0.7 miles south of Bayou Sale - close existing washout and stabilize about 1200 ft of bank; 2) east bank at mile 16.2,0.5 miles north of Bayou Sale - stabilize 1400 ft of bank to prevent a washout; 3) east bank at mile 16.9,0.2 miles south of Four Point Bayou - stabilize 600 ft of bank to prevent a washout; 4) east bank at mile 19.2, just south of Bayou Plat - stabilize 400 ft of bank to prevent a washout; 5) west bank at mile 21,0.6 miles north of Bayou Grand Caillou - close and stabilize either the mouth or the end of an oil well access canal that has washed out at its end; 6) west bank between miles 22 and 23, 0.3 to 1.3 miles of the pontoon bridge - close existing washouts and stabilize bank to prevent new washouts; 7) east bank at mile 22.8, 0.5 miles south of the pontoon bridge - close or stabilize about 1000 ft of bank and close either the mouth or end of an oil well access canal that has washed out at its end; 8) west bank between miles 24.2 and 26.5, north from Old Falgout Canal - close existing washouts and stabilize about 12000 ft of bank, and 9) west bank at mile 31, south of pipeline canal and north of Forty Acre Canal - close existing washout and stabilize about 1600 ft of bank.

Benefits and Costs.

The anticipated benefits from this project are estimated to be the protection of 311 acres of marsh from loss, the restoration of 372 acres of submerged aquatic vegetation, and the enhancement of 377 acres, for a total benefit of 1,059 acres. Project costs are roughly estimated at $1600,000.

Effects and Issues.

The project is expected to reduce the exposure of interior marshes to wave and tidal erosion. Other effects may include disruption of bank (shoreline) habitat and increased water turbidity during construction.

status.

Details of project design need to be developed. This project should be considered for the next priority project list.

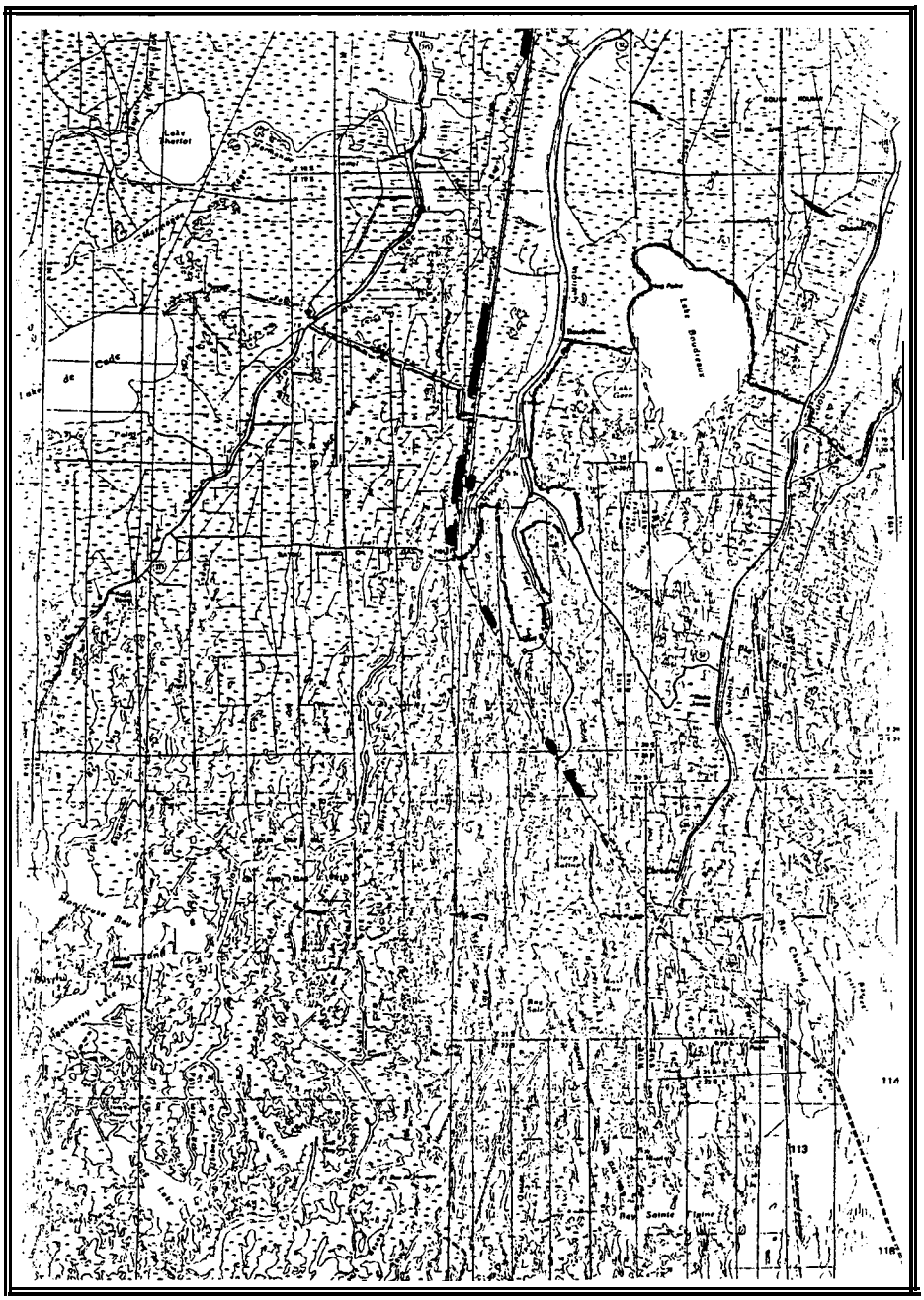


Figure 19. PTE-3 HNC Bank Stabilization

PTE-19 STORMWATER MANAGEMENT

Location.

This project would include actions in Lafourche and Terrebonne Parishes, wherever the Parish Governments have forced drainage projects. These include: Bayou DuLarge at Theriot both east into the Falgout Canal Management area and west into Falgout Canal; Bayou Grand Caillou from Ashland to Dulac; Bayou Petite Caillou from Montegut to Chauvin; Bayou Terrebonne from Montegut to Point Barre; Bayou Point au Chien; and Bayou Lafourche from Cut Off to Golden Meadow. The publication "Atlas and Database of Pump Locations …" (Himel, Reed, and Clark 1991) includes maps of each pump discharge in the Louisiana coastal zone.

Problems and Onnortunities .

In the central zone of high marsh loss in the Timbalier Subbasin, there are numerous pump stations that provide an opportunity to deliver fresh water and nutrients to deteriorating marshes. The concept of the project is to develop and implement outfall management plans for the use of existing pump station discharges to provide fresh water and nutrients to adjacent marshes in areas along the ridges in Terrebonne and Lafourche parishes.

Description of Features.

The present forced drainage systems and pump discharges are along the ridges south from Houma. The concept includes installation of plugs, weirs, and other structures in canal mouths, and gaps in existing spoil banks in order to channel water into the marsh rather than having the fresh water and nutrients flow directly down the navigation and drainage canals to the estuary. The outfall management schemes would be passive.

Benefits and Costs.

Acres of benefit and project costs can not be estimated until specific outfall management plans are developed and project areas (i.e., areas of effect) are defined. As a gross average, it can be expected that restoration of more natural hydrologic flows, as would be accomplished in these plans, would reduce loss rates in the targeted areas by 60 % . In addition, the hydrologic restoration measures contemplated for this project are typically cost effective compared to many other types of projects.

Effects and Issues.

As flow down some canals would be restricted in this project, it is possible that organism access, and small boat access could be affected. Landowner cooperation and support would be needed for implementation. Since sites would be distributed throughout the two parishes, a relatively large number of landowners may be involved.

status.

This project is under development.

PTE-25 BAYOU BLUE WATER MANAGEMENT

Location.

The project area is north of Catfish Lake in Lafourche Parish, and is bounded by the Larose to Golden Meadow Hurricane Protection Levee, the Grand Bayou Canal, and the Grand Bayou Blue distributary ridge (Figure 20). It includes approximately 18,350 acres.

Problems and Opportunities.

The proposed project is in a area of rapidly deteriorating marsh where many man-made changes to hydrology have contributed to marsh loss. The main objective of this project is to restore and preserve the natural hydrologic regime of the project area. This would be accomplished using three sets of water management measures - conservation of fresh water resources, distribution of freshwater resources, and restoration of natural patterns of saltwater exchange - to produce a progressive dissipation of tidal fluctuations inland and a retardation of freshwater loss in order to restore a gradient of vegetation, aquatic habitats, and related fauna.

Description of Features.

The project will incorporate freshwater input, overbank exchange, continuous spoil banks, plugs, and water control structures to provide for longer retention of fresh water. The water control structures will be designed to accomodated navigation and flow management priorities. Operation will include both active and passive management.

Benefits and Costs.

The estimate of benefits is 1,089 acres protected, 504 acres of submerged aquatic vegetation restored, and 838 acres enhanced, for a total benefit of 2,431 acres. Costs for this project can not be accurately estimated until project design is completed, but are roughly estimated to be $4400,000.

Effects and Issues.

Possible effects specific to this project can not be anticipated until project features are known. However, in general, hydrologic restoration and water management projects have the potential to affect organism access and navigation access.

This project area overlaps with the project area for the proposed Grand Bayou/GIWW diversion (TE-lO/XTE-49) and the Bully Camp wetland project (TE-9), and coordination would be needed to resolve any conflicting project features before this project could be implemented.

status.

This project is still largely conceptual, and needs design, and possibly some feasibility evaluation.

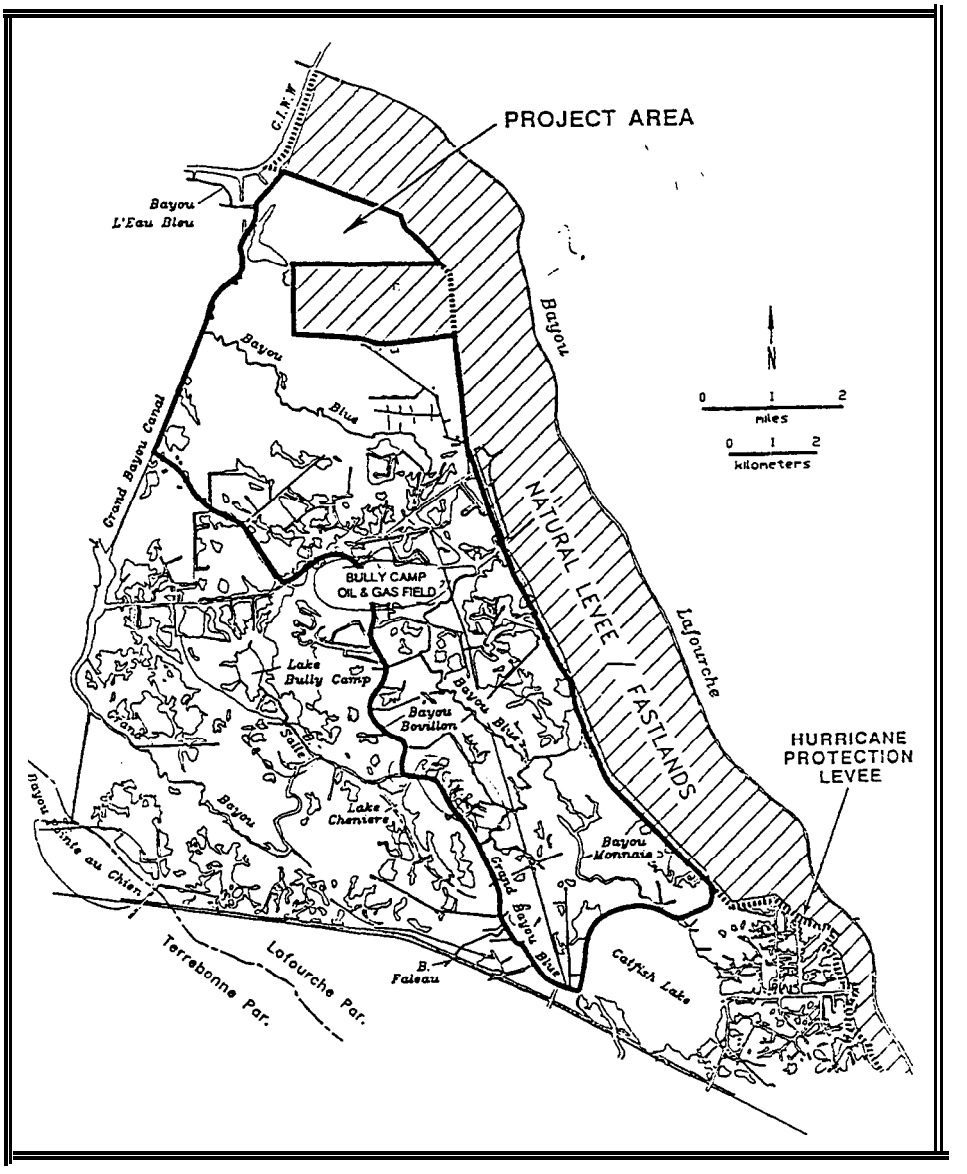


Figure 20. PTE-25 Bayou Blue Water Management

XTE-29 WONDER LAKE MARSH RESTORATION

Location.

The project is located just east of and adjacent to Point Barre in Terrebonne Parish. It is bounded on the north by the Montegut Marsh Management Project (TE-l), on the east by the Bayou Jean Charles ridge, on the south by a pipeline canal, and on the west by the Bayou Terrebonne ridge (Figure 21).

Problems and Opportunities.

The objectives of this project are to maintain the remnant marsh left in this area, and (if possible) to revegetate some of the area by extended water level draw-downs.

Description of Features.

The project features include reconstruction of approximately 10,000 linear feet of existing spoil banks, installation of four water control structures, and an expansion of an existing boat launching facility to allow access. Operation would be active, including extended periods of water level draw-down.

Benefits and Costs.

The estimated benefits from this project are 613 acres protected, 443 acres of submerged aquatic vegetation restored, and 140 acres enhanced, for a total benefit of 1,196 acres. An accurate estimate of costs for this project can not be made until project design is completed, however, costs have been roughly estimated at $2,200,000.

Effects and Issues.

As an actively managed area, this project would likely affect organism access and any naturally existing sediment input. Water depths in the project area present a concern regarding the feasibility of successful application of marsh management techniques. Hydrologic compatibility with an existing marsh management project adjacent to this project on its northern border (the Montegut Project, TE-1) is in question. In addition, any positive results of revegetation may not be maintainable. The extent to which additional marsh can be created through water management, including draw-down, is unknown. The only environmental issues anticipated related to the question of adequate organism access and effects this would have on fisheries productivity. With respect to engineering, the ability to maintain project integrity is in question, and is part of a necessary feasibility analysis.

Status.

This project requires feasibility analysis.

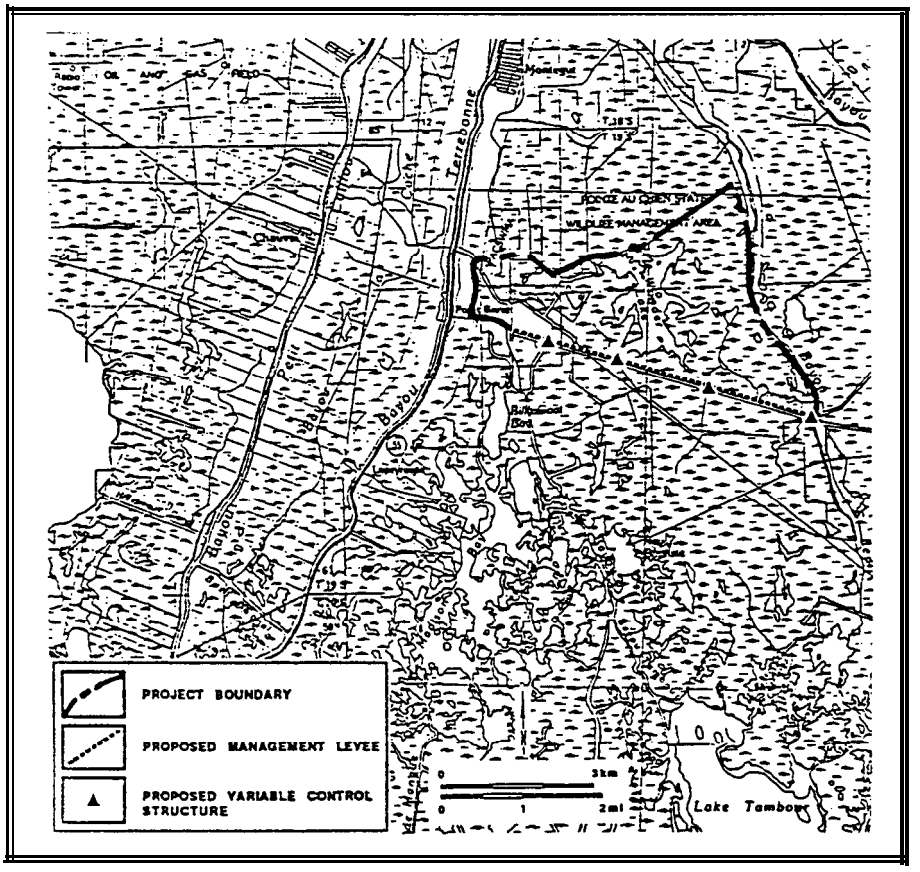


Figure 21. XTE-29 Wonder Lake Marsh

XTE-35 HNC SILL

Location.

The Houma Navigation Canal (HNC) south of Bayou Sale (Figure 22).

Problems and Opportunities.

The objectives of this project are to restrict the influx of salt water in the HNC, thereby protecting marshes near the HNC in Terrebonne Parish; and to determine the effectiveness of low-cost sills in controlling saltwater intrusion.

Description of Features.

Project features would include one low sill across the HNC about 1.4 miles south of Bayou Sale. The structure would be built of riprap 6 ft thick and having a maximum sill elevation of -24 ft. Channel bottom width would be 200 ft with 3:l side slopes up to the high-bank line on both sides of the waterway. There would be a sump area north of the sill structure, to be dredged to a depth of elevation -30 ft for a distance of 300 yd. An alternative configuration of putting the sump south of the sill will also be considered. Dredged material resulting from construction of the sump area will be used beneficially to enhance or create about 13 acres of marsh along the banks of the HNC adjacent to the project site.

Benefits and Costs.

Benefits and costs for this project are not yet available.

Effects and Issues.

Placement of the riprap sill would destroy a small area of benthic habitat, but would subsequently provide alternate habitat for invertebrates. SimiIarly, dredging of the sump area would disturb or destroy a section of soft-bottom benthic habitat, which would be expected to re-colonize after project completion. If the sill functioned successfully in the HNC, average isohalines would be altered upstream of the sill, which would alter use patterns by fish and other wildlife. It is not yet clear whether a salinity sill would function effectively in the HNC, given existing information on salinity stratification, flows, and channel confinement. However, such an option would be so much less costly and more rapidly installed than a lock or gate that examining this alternative was considered desirable.

status.

This project requires feasibility evaluation to determine whether it is appropriate to apply this technique in the HNC.

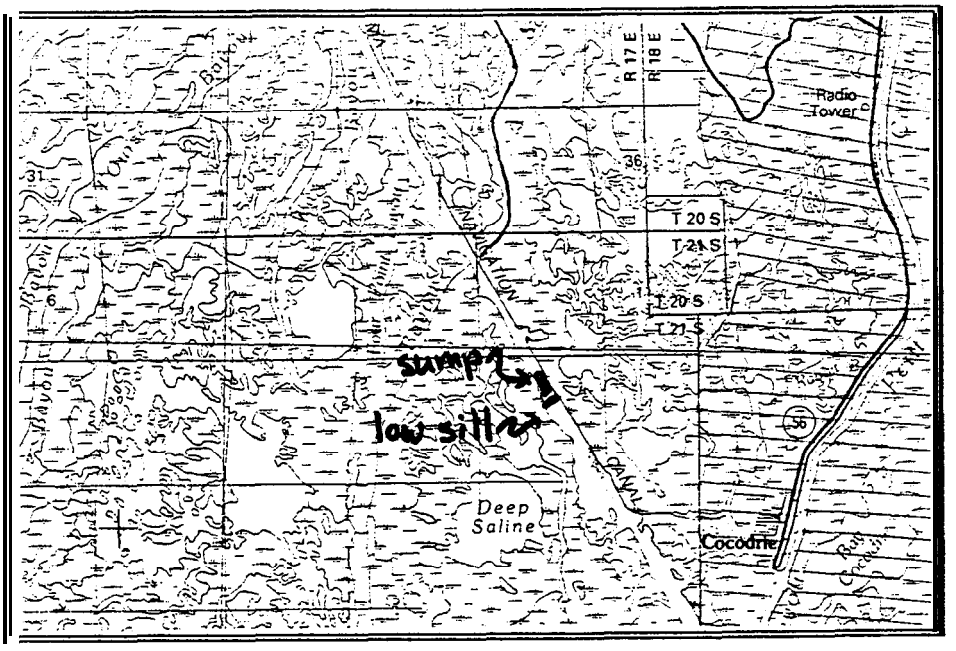


Figure 22. XTE-35 HNC Sill

XTE-42 HOUMA NAVIGATION CANAL LOCK

Location.

On the Houma Navigation Canal (HNC) just south of the intersection of the **HNC** and Bayou Grand Caillou near **Dulac** (Figure **23).**

Problems and Opportunities.

The objective of this project is to control or reduce the saltwater intrusion that has been increased by the HNC.

Description of Features.

Features would include two 200 ft wide floodgates separated by a 1200 ft lock bay. The bottom elevation of the gate opening will be at -20.0 ft NGVD. The top of the lock will be at elevation 12.0 ft NGVD. The individual floodgates will be constructed on concrete gravity barges. A bypass channel will be constructed on the eastern side of the proposed lock system to allow hydrologic connection between the HNC and Bayou Grand Caillou on the outside of the lock system.

Benefits and Costs.

Based on the protocol for estimation of benefits for the restoration plan (using acres with and without the project at the end of 20 years and appropriate changes in loss rates), the benefit from this project would be the saving of 2,891 acres of marsh. However, additional marsh enhancement has not been calculated Based on evaluation of this as a candidate project for the second priority project list by the WVA Subcommittee, the benefit from this project is estimated to be 1,499 AAHUs The fulIy funded project cost is estimated by COE to be $122,545,000. It is believed that evaluation and application of innovative technologies would reduce this cost estimate significantly.

Effects and Issues.

This project is expected to have direct beneficial impact on stressed marshes by reducing saltwater intrusion into the area. If a separate study regarding using a sill to impede saltwater intrusion in the HNC (XTE-35) shows that option to be feasible, this project may need to be reevaluated or eliminated. However, the probability that a sill will prove feasible is considered low. The project is expected to indirectly benefit furbearer, reptile, and waterfowl populations by improving habitat suitability, and fisheries populations by increasing marsh productivity. Consideration of navigation interests, especially for passage of large oil rigs, has been a major consideration in the development and design of this project.

status.

Feasibility and design evaluation is required for this project. However, substantial effort to evaluate appropriate locations and project design needs have been undertaken, and the project is ready for consideration on future priority project lists.

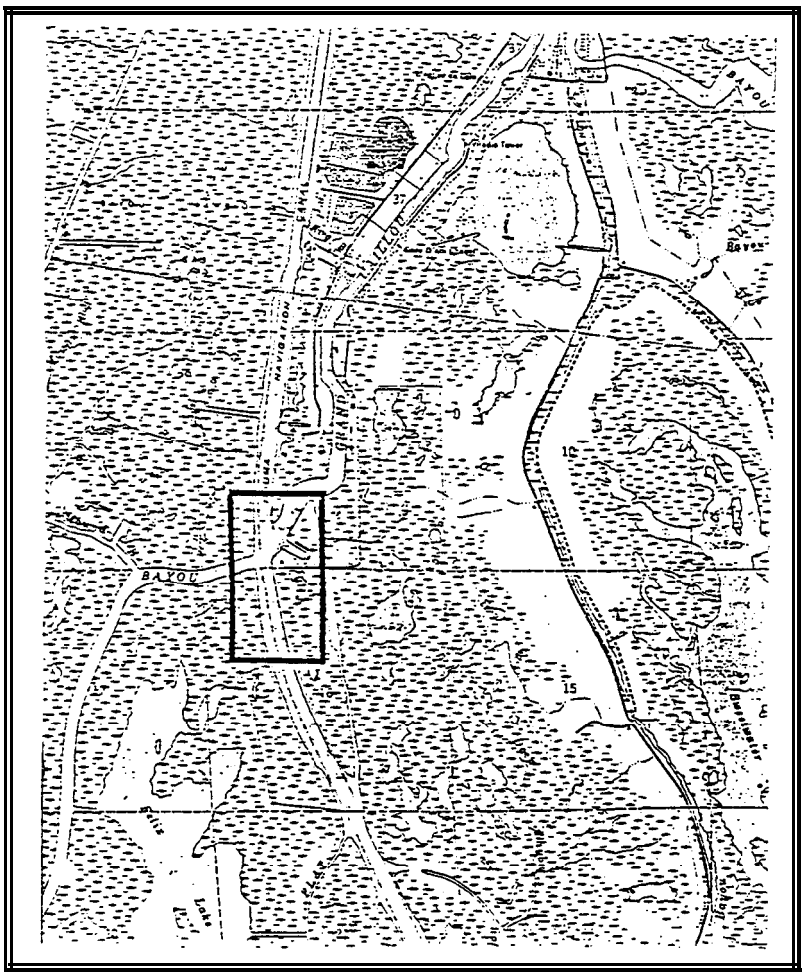


Figure 23. XTE-42 Houma Navigation Canal Lock

XTE-47/48 GRAND BAYOU BLUE/BULLY CAMP RESTORATION

Location.

The project area is located in Lafourche Parish in the vicinity of the Bully Camp Oil and Gas Field. A large portion of the project area is included in the Point au Chien Wildlife Management Area (Figure 24).

Problems and Opportunities.

The project area has experienced loss of fresh water and salt water intrusion due to navigation and access canals. Although still largely conceptual, the project is conceived as primarily active management, including that of the southern portion of the project area in a few distinct units.

Description of Features.

Features may include hydrologic restoration, incorporating diversion of additional freshwater from the GIWW down the Grand Bayou Canal; and construction of canal plugs to maximize freshwater distribution and increase freshwater retention. Management of at least one unit, bordered by Grand Bayou, Bayou Blue, and access canals in the Bully Camp oil field would include freshwater introduction structures along Bayou Blue and Grand Bayou Canal and drainage structures at the downstream end of the unit to facilitate freshwater distribution and flow-through management. The need for additional management units will be assessed based on collection of additional information from adjacent units. This project includes both passive hydrologic restoration and active marsh management.

Benefits and Costs.

The estimated benefits from this project are the protection of 247 acres, restoration of 1,053 acres of submerged aquatic vegetation, and the enhancement of 529 acres, for a total benefit of 1,829 acres. Project costs can not be accurately estimated until a more complete project design is available; however, costs have been roughly estimated at $3,300,000.

Effects and Issues.

The portions of this project utilizing active management techniques may affect access of estuarine-dependent organisms to the project area and thus affect fisheries productivity. There is a need to determine management needs and appropriate techniques for some units of the project area. If plugs are incorporated in this project, the need for project XTE-49 may be reduced or eliminated. Conversely, if it is feasible to implement the combined project TE-lO/XTE-49, the need for this project (XTE-47/48) may be reduced or eliminated.

Status.

This project is still largely conceptual, with preliminary design features sketched out. It is appropriate for consideration on the third priority project list.

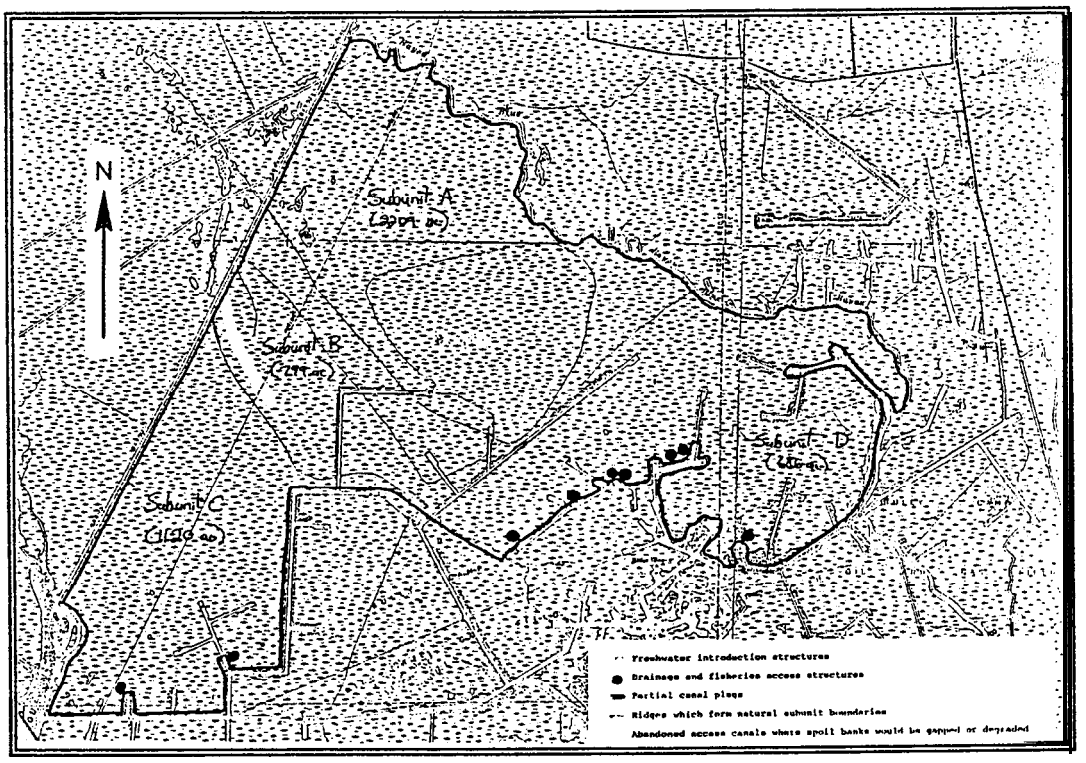


Figure 24. XTE-47/48 Grand Bayou Blue Restoration

XTE-55 SOUTH FALGOUT CANAL HYDROLOGIC RESTORATION

Location.

The project area extends south from Falgout Canal between the Bayou DuLarge Hurricane Protection Levee on the west and the HNC and Bayou Grand Caillou on the east (Figure 25).

Problems and Opportunities.

The Houma Navigation Canal (HNC) and Falgout Canal have provided a direct avenue for saltwater inflow into a previously low salinity environment and facilited rapid loss of freshwater to the bays. Incorporation of the area into the Hurricane Protection System (HPS) also reduced availability of freshwater to the lower estuary. The seaward half of the area has comparatively physically undisturbed saline and brackish marsh. In the upper half of the area, extensive marsh break-up and conversion to open water has occurred, especially around the du Large gas field The recommended approach is to restore natural hydrologic functioning and route freshwater discharges southward through the remaining brackish marsh.

Description of Features.

Measures are directed at capturing freshwater flows from the upper estuary at certain times and eliminating water exchange with the HNC other than through overbank flow. Recommended features include a control structure at the intersection of the main access canal of the du Large gas field with the HNC, two areas of bank restoration to marsh elevation along the HNC, bank restoration or closure at three sites along Bayou du Large; and water control structures along the south bank of Falgout Canal to allow introduction of fresh water when available at certain times of the year. Operation will be passive.

Benefits and Costs.

The anticipated benefits from this project are estimated to be the protection from loss of 472 acres of marsh, the restoration of 938 acres of submerged aquatic vegetation, and the enhancement of 543 acres, for a total benefit of 1,948 acres. Project costs have been roughly estimated at $2,128,000.

Effects and Issues.

In general, the project should freshen the marshes slightly due to improved fresh water retention and control of salt water intrusion. Impacts to fisheries access should be minimal, as the whole southern border of the project area would remain opened. There may be some impacts to navigation, although structures have been designed to accomodate boat traffic and access for work-over rigs. As sediment introduction/marsh creation projects are also proposed for this area (e.g., TE-21, XTE-43), interactions and synergisms between these projects and the proposed restoration should be evaluated. However, it appears that any creation projects would be fully compatible with this proposed restoration. Evaluation and formal interactions would be needed with respect to access to oil and gas facilities, existing aquaculture facilities, and commercial or recreational fisheries. Numerous landowners may be involved in developing easements or gaining support for the project.

status.

This could be accomplished in a relatively short period of time, and could be considered for one of the remaining priority project lists.

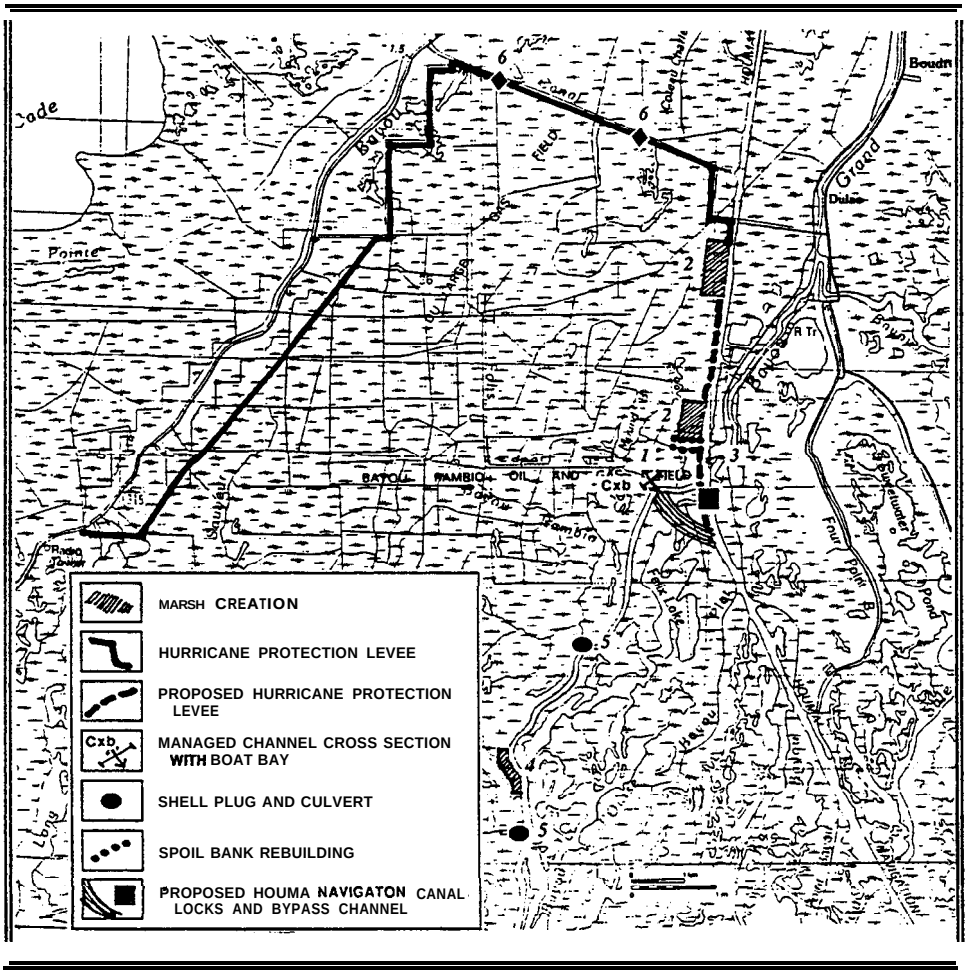


Figure 25. XTE-55 South Falgout Canal Hydrologic Restoration

XTE-56 SOUTH BAYOU PELTON HYDROLOGIC RESTORATION.

Location.

The project area is west of the HNC, south of the Bayou Pelton Wetland Project (TE-8) and the Terrebonne Hurricane Protection System (HPS), and extends over three interdistributary basins (Figure 26). Area 1 extends south of TE-8 between the HNC on the west and Bayou Grand Caillou on the east. Area 2 extends north from the HNC between Bayou Grand Caillou and the HPS on the west and Four Point Bayou on the east. Area 3 extends north fromt he HNC to the HPS between Four Point Bayou on the west and Bayou Petit Caillou ont he east.

Problems and Opportunities.

Wetland loss is comparatively limited in Area 1. However, breaching of the HNC bank appears imminent at two locations, which would result in adverse wetland conditions. Area 2 is mostly open water with fragmented brackish marsh. Wetlands are isolated from the HNC except through overbank flow; however, breaching appears imminent at two locations. Area 3 is also mostly open water with fragmented brackish and saline marsh. The upper portion is connected with the HNC through a major breach.

Description of Features.

In Areas 1 and 2, it is recommended that dredged material be used to restore the bank width at locations where breaching of the HNC banks have occurred or are imminnent. The major breach in Area 3 should be closed through marsh creation with dredged material from the HNC. Pending determination of needed water exchange capacity, it is also recommended that one of two tidal channels in the lower end of the basin be closed

Benefits and Costs.

The anticipated benefits from this project are estimated to be the protection from loss of 26 acres of marsh, restoration of 201 acres of submerged aquatic vegetation, and enhancement of 101 acres, for a total benefit of 328 acres. Project costs have been roughly estimated at $833,000.

Effects and Issues.

In general, the project should freshen the marshes slightly due to limiting saltwater exchange and intrusion. Some alterations to fisheries access could result from breach closure, however, most of the area will remain open. Any interactions or conflicts between this project, the proposed Bayou Pelton management area (TE-8), or the hurricane protection system proposed by the Terrebonne Parish government should be reviewed. Numerous landowners may be involved in developing easements or gaining support for the project.

status.

This project could be considered for one of the remaining priority project lists.

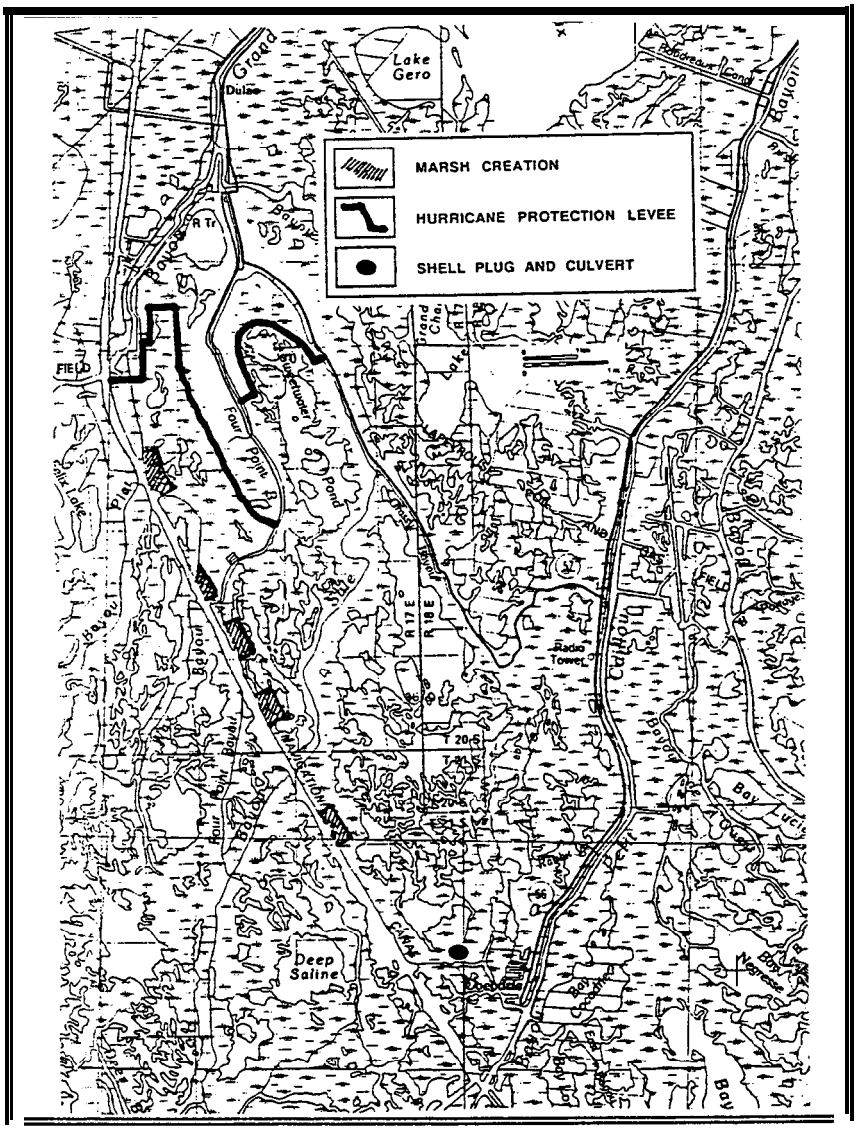


Figure 26. XTE-56 South Bayou Pelton Hydrologic Restoration

XTE-57 SOUTH POINTE AU CHIEN HYDROLOGIC RESTORATION

Location.

The project area is south of the Point au Chien Wetland Project (TE-6) between Bayou St. Jean Charles on the west and Bayou Point au Chien on the east (Figure 27).

Problems and Opportunities.

Hydrology of the project area has been greatly modified by dredging of Bayou Jean la Croix and the Grand Bayou Canal, which has increased the efficiency of saltwater intrusion and freshwater removal from the area as well as increased rates of tidal water movement. In addition, implementation of the Point au Chien Wetland Project has reduced the fresh water input to the lower estuary, and changed the input from a diffuse to a point source. This has resulted in extensive marsh loss. The outer band of salt marsh retained its physical integrity, although breakup is beginning to occur. The upper areas are dominated by open water. Loss rates in this area can only be reduced by controlling rates of water exchange between the salt marsh and the Point au Chien Wetland Project area.

Description of Features.

To achieve this control, it is recommended that marsh be created along Bayou la Croix and the Grand Bayou Canal extension, using dredged material. It is also recommended that a water control structure be placed in Bayou la Croix near its intersection with the Grand Bayou Canal to limit rates of water exchange and provide better use and distribution of available fresh water. A continuous bank along the main access canal and well slips of the Jean la Croix Oil and Gas Field should also be maintained, and the double pipeline canal should be plugged to assure it does not become a conveyance channel for higher salinity water. This management would be passive.

Benefits and Costs.

Benefits from this project are estimated to be the protection of 610 acres of marsh, restoration of 423 acres of submerged aquatic vegetation, and enhancement of 253 acres, for a total benefit of 1,285 acres. Project costs have been roughly estimated at $805,000.

Effects and Issues.

In general, the project should freshen the marshes slightly due to control of saltwater intrusion. Fisheries access may be reduced due to closure of some canals; however, much of the project area would remain open. Interactions between this project, the proposed Point au Chien management area (TE-6), or the hurricane protection system proposed by the Terrebonne Parish government should be reviewed. Evaluations are needed with respect to possible conflicts with access to oil and gas facilities or with commercial or recreational fisheries. Numerous landowners may be involved in developing easements or gaining support for the project.

status.

This project could be considered for one of the remaining priority project lists.

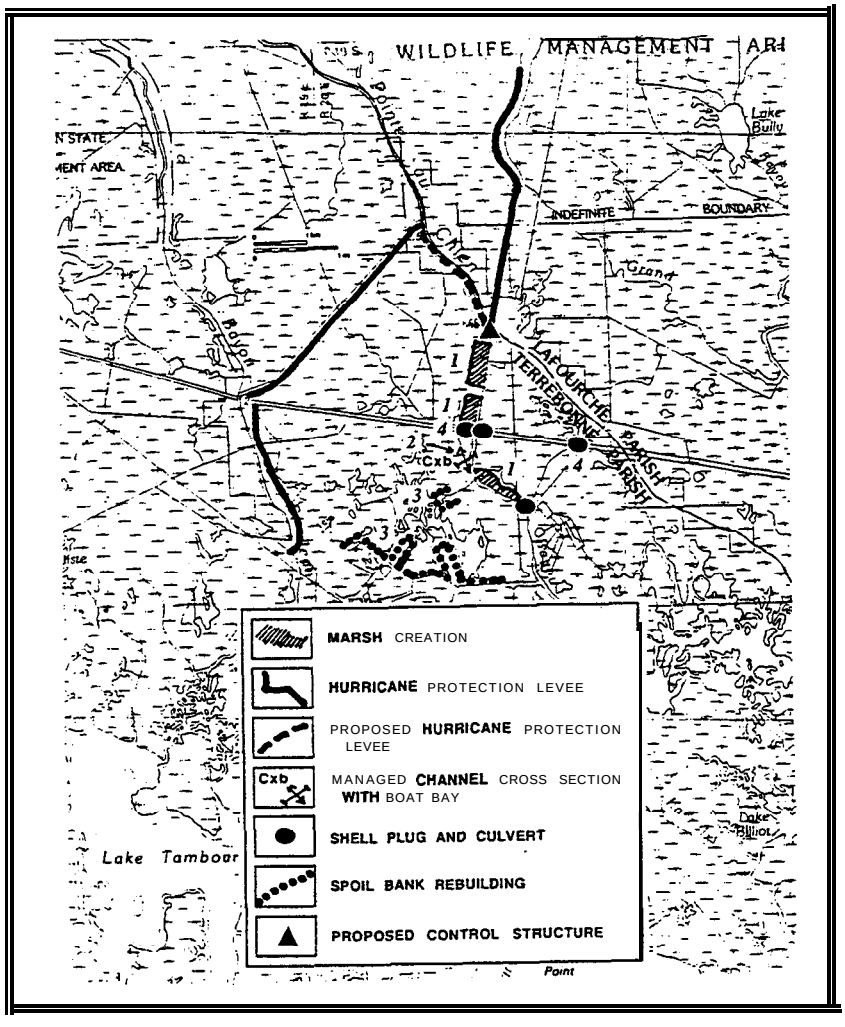


Figure 27. XTE-57 South Pointe au Chien Hydrologic Restoration

XTE-58 SOUTH BULLY CAMP HYDROLOGIC RESTORATION

Location.

The project area extends southeast from the Grand Bayou Hurricane Protection Leve between the Bayou Bouillion-Grand Bayou Blue ridge on the east side and Bayou Pointe au Chien on the west (Figure 28).

Problems and Opportunities.

The recommended measures are to restore natural hydrologic functioning of the estuary north of the double pipeline canal, route available fresh water southward through the remaining brackish marsh, capture limited freshwater flows from the GIWW diversion into the Grand Bayou Canal, and limit water exchange with Bayou Blue except through overbank flow. To achieve this, continuous banks must be maintained along both Grand Bayou and Bayou Bouillon.

Description of Features.

To accomplish this, several areas need to be restored to marsh elevation. In addition, spoil banks from Bayou Bouillon to the Bully Camp Oil and Gas Field Canal should be maintained, and a control structure (that allows intermittent access to the oil field for large vessels) installed in the canal, to separate the Bully Camp field from interior marshes. To force fresh water through the area, a weir will be constructed on Grand Bayou Blue to insure water moves through the marshes and not into canals. Five sites along Bayou Blue-Bayou Bouillon will be constricted with shell plugs and culverts to reduce the water exchange in these areas and help force fresh water southward through the area. Also, the addition of plugs with culverts will be made at three sites in rig cut canals to reduce possible impoundment within the lower areas of the project. Operation would be passive.

Benefits and Costs.

The anticipated benefits from this project are estimated to be the protection of 1,401 acres of marsh, the restoration of 913 acres of submerged aquatic vegetation, and the enhancement of 795 acres, for a total benefit of 3,109 acres. Project costs have been roughly estimated at $1,879,000.

Effects and Issues.

In general, the project should freshen the marshes slightly due to improved freshwater retention and control of saltwater intrusion. Fisheries access may be reduced to some extent, although much of the area will remain open. Needs for navigation access should be reviewed. Any interactions or conflicts between this project, the proposed Bully Camp management area (TE-9), or the hurricane protection system proposed by the Terrebonne Parish government should be reviewed. Evaluations are needed with respect to possible conflicts with access to oil and gas facilities or with commercial or recreational fisheries. Although much of the proposed project area is within the Pointe au Chien Wildlife Management Area, numerous landowners may be involved in developing easements or gaining support for the project,

Status.

This project could be considered for one of the remaining priority project lists.

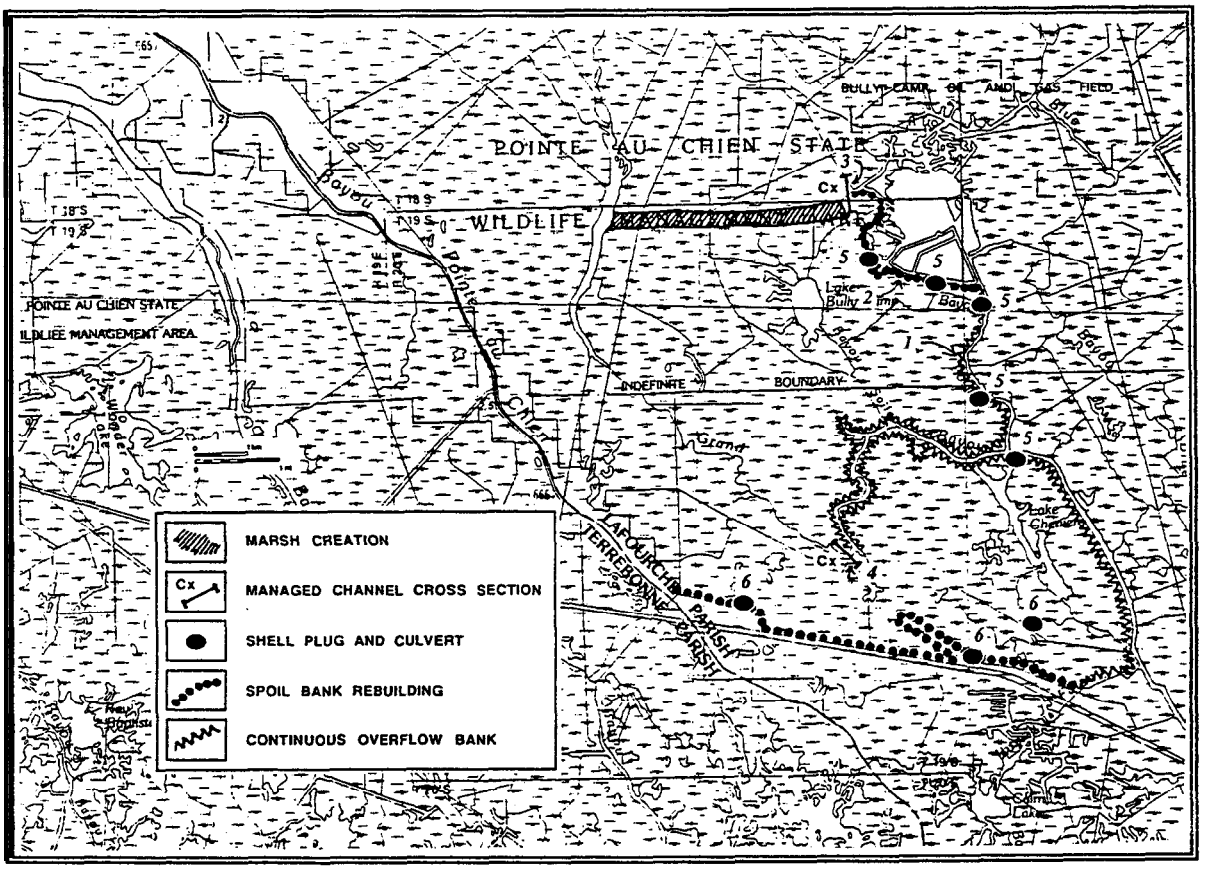


Figure 28. XTE-58 South Bully Camp Hydrologic Restoration

XTE-59 SOUTH FINA LA TERRE HYDROLOGIC RESTORATION

Location.

The project area extends southward from Falgout Canal between Lake DeCade and Bayou de Cade on the west, and Bayou du Large on the east (Figure 29). It is south of the Final La Terre management area. The project area is divided into two hydrologically well defined sub-estuaries by Small Bayou la Pointe and its adjacent natural-levee ridges (eastern and western units).

Problems and Opportunities.

In the western unit, marsh loss is occurring primarily south of Lake de Cade, attributable to increased salinities that resulted from structural isolation from the lake and its fresh water.

Description of Features.

It is recommended that control structures be installed in the southwest portion of the Fina La Terre management levee surrounding Lake de Cade, to allow inflow from the lake during low salinity conditions. To address wetland losses in the northern portion of this unit, it is recommended that the Falgout Canal spoil bank be restored to marsh elevation in an area of imminent breaching, and that control structures be installed in the northernmost well access to provide for drainage of the impounded area following high salinity events. If well access is no longer required, these objectives could be achieved by placing a structure in the main access canal at its intersection with the Falgout Canal, and gapping spoil banks. In the eastern unit, marshes appear to be healthy, and no measures are recommended. Operation of structures would be passive.

Benefits and Costs.

The anticipated benefits from this project are estimated to be the protection of 18 acres of marsh, the restoration of 151 acres of submerged aquatic vegetation, and the enhancement of 219 acres, for a total benefit of 387 acres. Project costs costs have been roughly estimated at $499,000.

Effects and Issues.

In general, the project should freshen the marshes slightly due to improved freshwater retention and control of saltwater intrusion. Some reduction of fisheries access may occur, although most of the project area will remain open. Any interactions between this project and the existing Fina LaTerre management area should be reviewed Evaluations are needed with respect to possible conflicts with access to oil and gas facilities or with commercial or recreational fisheries. Numerous landowners may be involved in developing easements or gaining support for the project.

status.

This project could be considered for one of the remaining priority project lists.

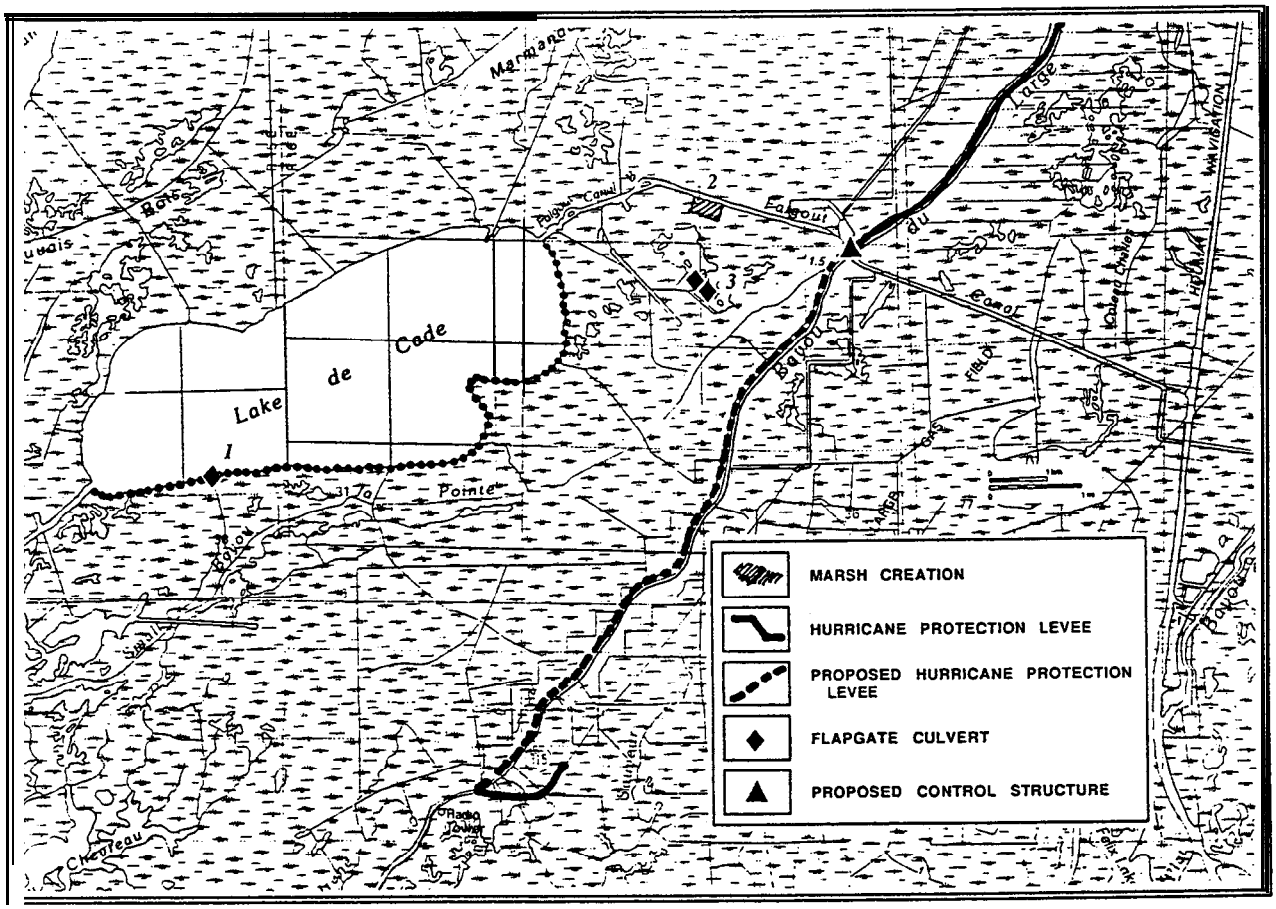


Figure 29. XTE-59 South Fina La Terre Hydrologic Restoration

XTE-60 SOUTH WONDER LAKE HYDROLOGIC RESTORATION

Location.

The project area extends from Montegut Wetland Project southward between Bayou Terrebonne on the west and Bayou St. Jean Charles on the east (Figure 30). The area is divided into two hydrologically distinct sub-estuaries (eastern and western units).

Problems and Opportunities.

In the western unit, marsh loss has been severe. Only the outer fringe of salt marsh retains physical integrity, although extensive formation of water bodies has occurred here as well, indicating the role of subsidence in marsh loss. Some low salinity marsh remains at the upper end along Bayou Terrebonne. Given the current characteristics of an advanced state of wetland loss, enlarged estuarine tidal prism, and the large number of channels connecting the central, open water portion of the area to the bay, it is believed that enhancement of hydrologic conditions must remain limited to the upper estuary. In this area, wetlands losses can be retarded by restoring estuarine exchange patterns so that they occur primarily across the lower boundary at reduced rates.

Description of Features.

To achieve this, it is recommended that a fringe of wetlands be created across the lower Madison Bay area, connecting remaining wetlands with the natural levee ridge of Bayou Barre. This should be accomplished using dredged material from an external source. Two options should be considered for reducing lateral flow, depending on mineral access requirements in the adjacent eastern unit. Either the well access canal that connects Bayou Barre with the Madison Bay area could be plugged, and spoil banks maintained that confine a similar access canal in the vicinity of Point Barre; or a structure could be placed across Bayou Barre with provision for removal of the closure to allow passage of work-over rigs and barges. The eastern unit has equally severe wetlands losses, and more extensive hydrologic modifications resulting from a complex network of pipeline and access canals, and the recent severing of the upper estuary through implementation of the Montegut marsh management project and incorporation of the area into the hurricane protection system. Thus, opportunities for restoring hydrologic conditions and retarding loss of remaining fragments of brackish marsh are limited Restoration and maintenance of the lateral estuarine boundaries is recommended to restore exchange patterns and reduce adverse effects of tidal forces. On the east side, this could be accomplished by the proposed hurricane protection levee along Bayou St. Jean Charles. On the west side, this can only be achieved by restriction of flows through Bayou Barre. An alternate access route for the mineral industry and fisheries activities remains through the connection of Bayou Barre with Bayou Terrebonne. Water exchange with saline marshes to the south is limited to flow through Bayou Barre and across a one mile area of wetland This would remain as the primary flow route, with additional outflow capacity and prevention of ponding achieved through installation of water control structures in the canal spoil bank. It is also recommended that additional marsh be created using dredged material, and that a well slip be isolated to inhibit development of new major channels for water exchange. Operation would be passive.

Benefits and Costs.

The anticipated benefits from this project are estimated to be the protection of 1,635 acres of marsh, the restoration of 1,032 acres of submerged aquatic vegetation, and the enhancement of 421 acres, for a total benefit of 3,088 acres. Project costs have been roughly estimated at $2,060,000.

Effects and Issues.

In general, the project should freshen the marshes slightly due to improved freshwater retention and control of saltwater intrusion. Some reduction of fisheries access may occur, although much of the project area will remain open. Any interactions between this project and the proposed Wonder Lake management area (XTE-29) should be reviewed. Evaluations are needed with respect to possible conflicts with access to oil and gas facilities or with commercial or recreational fisheries. Numerous landowners may be involved in developing easements or gaining support for the project.

Status.

This project could be considered for one of the remaining priority project lists.

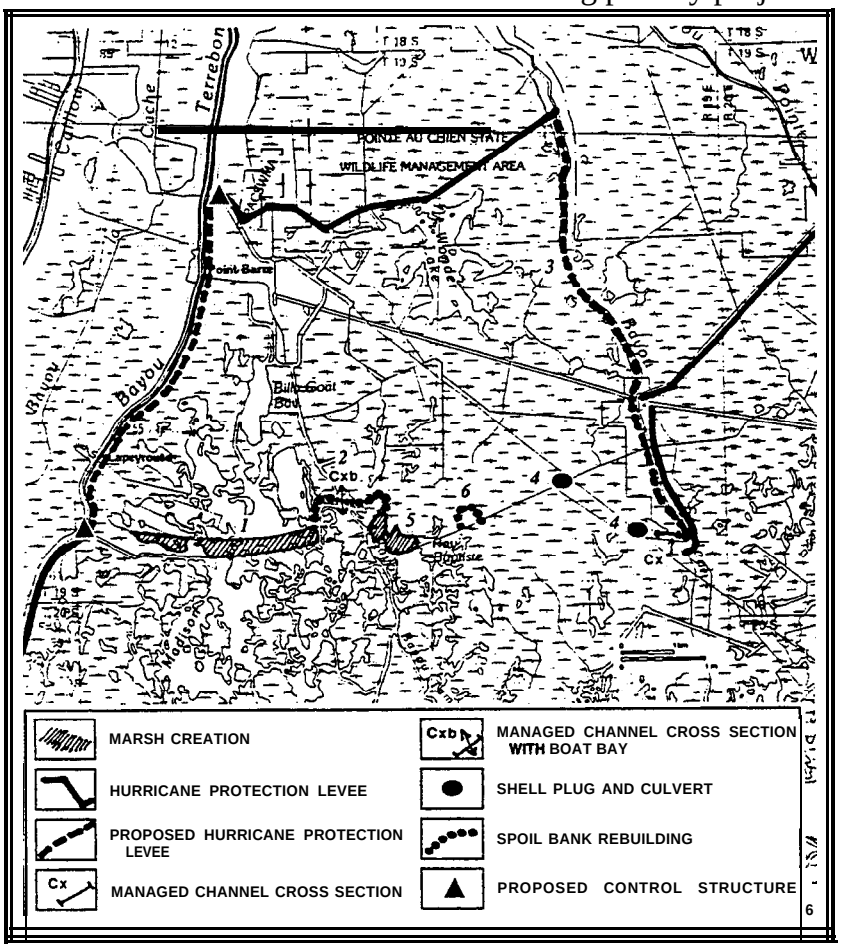


Figure 30. XTE-60 South Wonder Lake Hydrologic Restoration

CRITICAL LONG-TERM PROJECTS

STRATEGY 5: PENCHANT SUBBASIN SEDIMENT DIVERSION

PTE-5 ATCHAFALAYA RIVER DIVERSION WEST OF TERREBONNE PARISH FLOOD PROTECTION

Location.

St. Mary and Terrebonne Parishes, from Bayou Shaffer across Avoca Island and Bayou Chene, and into the western reach of Bayou Penchant (Figure 31).

Problems and Opportunities.

The project proposes a diversion of sediment-laden Atchafalaya River water into the wetlands of western Terrebonne Parish, using Bayou Penchant as the primary conveyance and the GIWW as the secondary conveyance.

Description of Features.

A diversion structure would be constructed in the Avoca Island Levee bordering Bayou Shaffer to allow controlled diversions into Avoca Island Lake. Diverted flows would be directed to Penchant Subbasin wetlands, and to a lesser extent, Timbalier Subbasin wetlands.

Benefits and Costs.

Approximately 5,000 acres of wetlands are anticipated to be built in Avoca Island Lake, although at present there is no estimate of acreage that would be lost over the project life. In addition, approximately 1,000 acres of wetland would be protected from loss, assuming a 50 year project life. These estimates have not been reviewed by the WVA Subcommittee. No estimate of project cost is currently available.

Effects and Issues.

Diversions are considered beneficial in that they help restore natural processes of wetlands building and maintenance. Before this project could be undertaken, flooding problems in the Verret Subbasin would need to be addressed and a wetland/water management plan for the Penchant Subbasin would need to be developed and implemented.

status.

This project requires further development and planning.

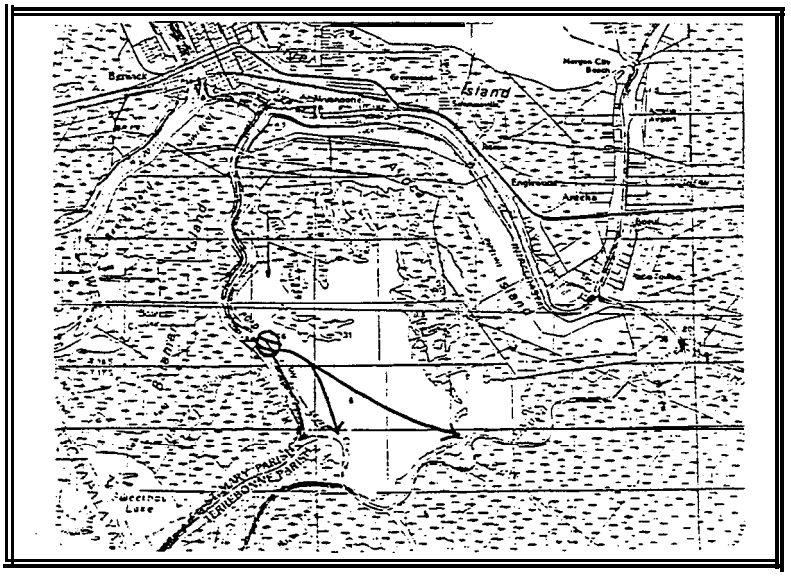


Figure 31. PTE-5 Atchafalaya River Diversion West of Terrebonne Parish Flood Protection

STRATEGY 6: TIMBALIER SUBBASIN SEDIMENT INPUT FROM RIVERS

XTE-52 MISSISSIPPI RIVER/BAYOU LAFOURCHE DIVERSION

Location.

Bayou Lafourche from Donaldsonville to Fourchon (Figure 32).

Problems and Opportunities.

Prior to 1904, Bayou Lafourche carried approximately 12% of the discharge of the Mississippi River. The bayou was cut off from the Mississippi apparently as a flood protection measure. A lock was planned to allow waterborne traffic to continue, but funding was never made available for construction. Isolation from fresh water and sediment from the Mississippi River has contributed to the high marsh loss rates, as well as to impacts on the fresh (drinking) water supply.

Description of Features.

This project proposes to reconnect Bayou Lafourche to the Mississippi River with the goal of eventually having an average discharge down the Bayou of 55,000 cfs. Approximately half of this, or 27,500 cfs, would be diverted into the Timbalier Subbasin of Terrebonne basin (the other half would be diverted into Barataria Basin). Sediment from the bayou and diversions will be utilized to create, restore, and enhance wetland along both sides of the Bayou. The structure would be located 2 miles east of Donaldsonville. The diversion channel would follow the toe of the natural levees along the east bank of Bayou Lafourche and would feed into the Bayou immediately south of the village of Plattenville. This course would eliminate the route through congested Donaldsonville and would allow establishment of a small port facility at the diversion. A weir in Bayou Lafourche immediately upstream of the channel connection will eliminate the chances of back-flooding in Donaldsonville. A spillway will be constructed 2 miles downstream of the diversion in the left descending bank to divert some of the discharge (not to exceed 5000 cfs) into Bayou Vex-ret, from which it would flow slowly to Lac Des Allemands. Channel cross-section increases in Bayou Lafourche will be required through dredging, with the material used to create marsh. Approximately 3,000,000 to 5,000,000 cubic yards of material would have to be removed, which could build over 2000 acres of new marsh. Approximately 27 bridges would have to be modified_ Approximately nine diversion could be constructed in each bank of the bayou, although the exact nature of the construction has not been determined.

Benefits and Costs.

The net gain in marsh acres created and prevention of loss of existing acres, representing net acres of benefit, have not been estimated However, it is anticipated that diversion of approximately 27,500 cfs of fresh water and sediment into the TimbaIier Subbasin at multiple points could be used to restore and protect a substantial proportion of the existing marsh acreage in the subbasin (about 300,000 acres), by reversing the trend to more saline marsh types and promoting growth of fresher species of vegetation, and increasing the delivery of sediment to offset subsidence. The marshes on the eastern side of the subbasin would be

those most readily accessible by such diversions (i.e., the characteristic longitudinal ridges that subdivide Timbalier Subbasin would make it unlikely that the western-most marshes would be impacted). It has been estimated that, over a 20 year project life, approximately 12,000 acres of marsh would be created (i.e., half of this or 6,000 acres in Timbalier Subbasin), and 16,000 acres (8,000 acres in Timbalier Subbasin) would be restored Project costs have preliminarily been estimated at $1.5 billion over an eight year period.

Effects and Issues.

The proposed project would freshen large areas of Terrebonne Basin and could be used to help deliver sediment to offset the accretion deficit. It would, of course, divert a portion of the available sediment and freshwater resource from the Mississippi River from possible use elsewhere. Other specific or more local impacts will have to be evaluated as details of project plans are developed. Issues may include competition for a common resource (i.e., Mississippi River fresh water and sediment), flooding and protection of existing human developments, and management of diversion outfalls.

status.

This project requires feasibility analysis.

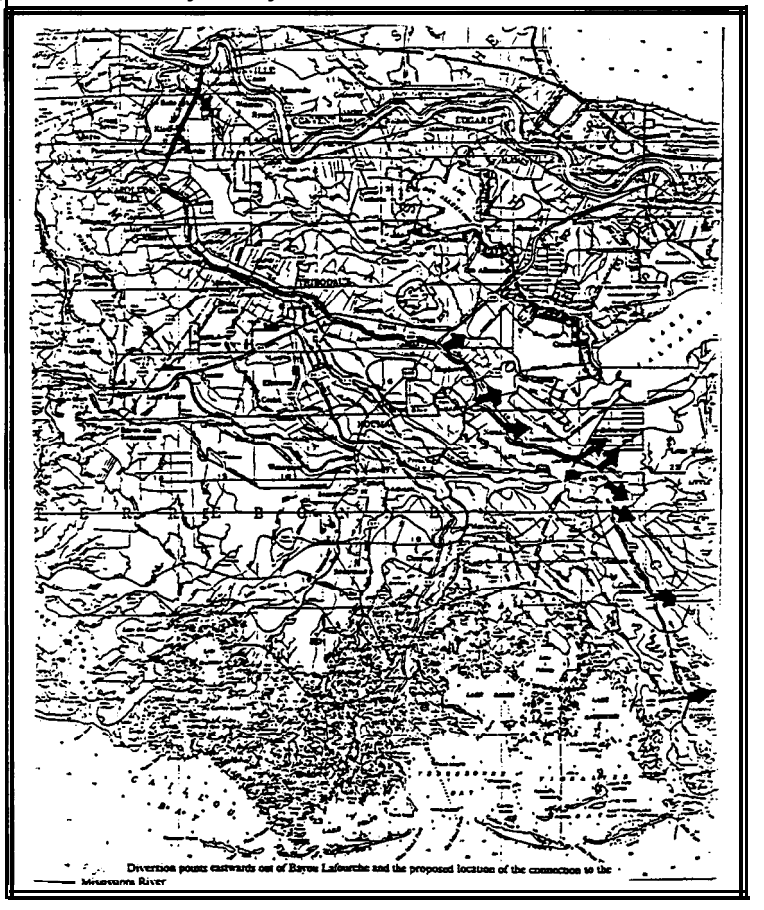


Figure 32. XTE-52 Mississippi River/Bayou Lafourche Diversion

XTE-63 SEDIMENT DISTRIBUTION/30-INCH PIPELINE

Location.

Problems and Opportunities .

Description of Features.

Benefits and Costs.

Effects and Issues.

status.

STRATEGY 7: TIMBALIER SUBBASIN SEDIMENT INPUT BY DEDICATED DREDGING

XI-E-44 LARGE SCALE CREATION/LINE OF DEFENSE

Location.

The project extends from Ship Shoal and Cat Island Pass to the northern parts of Timbalier and Terrebonne Bays (Figure 33).

Problems and Opportunities.

The objective of this project is to provide in a cost-effective manner the sediment necessary for the large-scale creation of salt marsh in the area between the barrier islands (the outer line of defense) and the Parish inner line of defense. Sediment would also be available for barrier island restoration and other purposes.

Description of Features.

The project will use sediment to build 2500 acres of emergent marsh per year over a 40 year period. Three technical approaches are possible: a high-capacity dredge feeding a submerged high density slurry pipeline; a high-capacity dredge loading a fleet of specialized shallow-draft 'unloaders"; or a fleet of specialized shallow draft hopper dredges which can dredge the sediment, transport it, and place it by dumping or pump out. Because of the long project life, the large capital costs and the modifications of existing technology required, significant work (feasibility studies and demonstration projects) will have to be done at the beginning to determine the best approach.

Benefits and Costs.

Nominally, 2500 acres of marsh would be built each year for 40 years, totalling 100,000 acres. If the average loss rate of 0.67%/year for the Timbalier Subbasin is applied to the acreage built each year over the period remaining in the project life (i.e., the loss rate over 40 years for the 2500 acres built in year 1, over 39 years for the 2500 acres built in year 2, etc.), then a total of 86,311 acres will be gained over the proposed 40 year project life. Project costs have not been estimated as yet.

Effects and Issues.

This project would provide extensive areas of new marsh habitat that would provide multiple marsh functions, including support of fish and wildlife, hydrologic control, storm buffering, and water quality conditioning. In addition, the new marsh would provide a barrier to marine processes that currently reach inland marshes. Cost-effectiveness and the need for technological advances to increase the practicality of transporting large volumes of sediment over long distances is important for this project and for the Timbalier Subbasin.

status

This project is largely conceptual, and requires feasibility analysis.

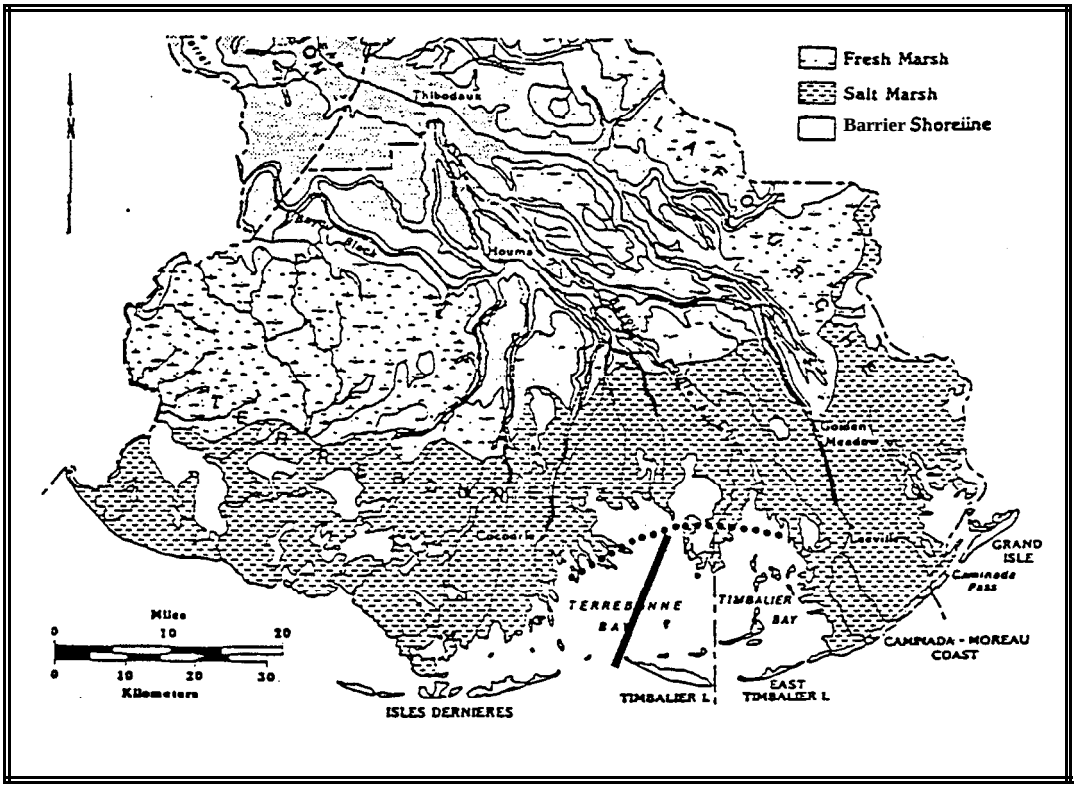


Figure 33. XTE-44 Large Scale Creation/Line of Defense

STRATEGY 8: VERRET SUBBASIN HYDROLOGIC RESTORATION

XTE-32 BAYOU BOEUF PUMP STATION/BARRIER

Location.

St. Mary and Assumption Parishes; Bayou Boeuf at Amelia (Figure 34).

Problems and Opportunities.

The objectives of this project are to manage water levels in the Verret Subbasin to enhance the productivity of about 300,000 acres of wetlands and 37,000 acres of lakes and streams. This project is part of the Amelia to Gibson Barrier Plan and would address the objectives of PTE-12 and allow the implementation of PTE-5.

Description of Features.

The overall project would consist of a barrier levee between Morgan City and Gibson in the vicinity of U.S. Highway 90, and a large pump/drainage station at Bayou Boeuf. Pump discharge capacity would be 5-10,000 cfs to regulate water levels in the Verret Subbasin. Mode of operation must be determined, but will likely include active pumping.

Benefits and Costs.

Specific benefits and costs can not be estimated until the project is further developed.

Effects and Issues.

Not yet evaluated

Status.

The Barrier Plan will require extensive study, making it a long-term project.

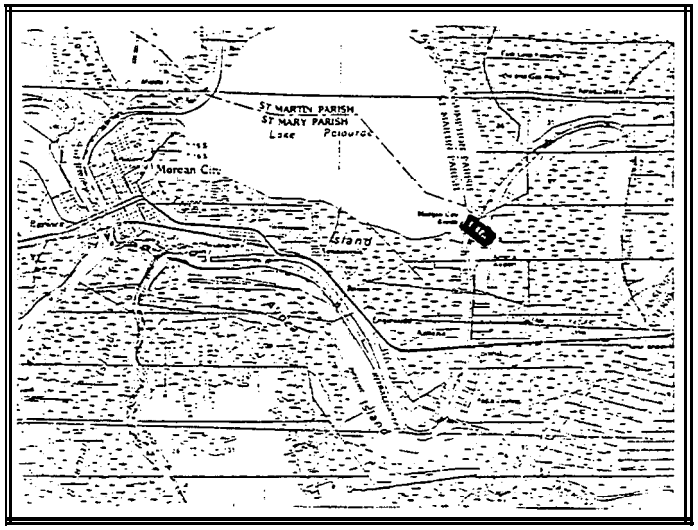


Figure 34. XTE-32 Bayou Boeuf Pump Station/Barrier

XTE-50 PARTIAL DIVERSION OF VERRET SUBBASIN DRAINAGE INTO BAYOU LAFOURCHE AND THE GIWW

Location.

Bayou Lafourche and the GIWW in the vicinity of Lockport or Larose.

Problems and Onnortunities.

The opportunity exists to use freshwater resources that need to be removed from the Verret Subbasin to relieve stress on cypress swamps in the Timbalier Subbasin, where fresh water is in short supply. The objectives of this project are to tie drainage of excess water from the Verret Subbasin with increasing the fresh water available in the GIWW and improving the effectiveness of a diversion into the Grand Bayou Blue interdistributary.

Description of Features.

Project features would include a diversion of fresh water from the Verret Subbasin, possibly through Canciennne Canal from Lake Verret, into Bayou Lafourche, and from there into the GIWW at either Lockport or Larose.

Benefits and Costs.

Benefits and cost of this project can not be estimated until approach and design of the project are better developed.

Effects and Issues.

This project would maximize beneficial use of fresh water that must be drained from the Verret Subbasin and bring the benefits of introducing fresh water and sediment to the Timbalier Subbasin. Other more specific effects require greater project detail to anticipate. This proposed action must be compatible and coordinated with XTE-32, the plan to restore hydrologic conditions in Verret Subbasin, and must be reconciled with hydrologic restoration and freshwater diversion projects in the Timbalier Subbasin.

status.

Details of this proposal need to be developed. As a result, this project has been classified as long term. This would be an alternate approach to that proposed in XTE-5 1.

XTE51 DREDGE A DISCHARGE CHANNEL FROM THE SOUTHEAST CORNER OF THE VERRET SUBBASIN TO NEAR HOUMA

Location.

The vicinity of Houma.

Problems and Opportunities.

The opportunity exists to use freshwater resources that need to be removed from the Verret Subbasin to relieve stress on cypress swamps in the Timbalier Subbasin, where fresh water is in short supply.

Description of Features.

The objectives of this project are to tie drainage of excess water from the Verret Subbasin with increasing the fresh water available in the GIWW and improving the effectiveness of a diversion into the Grand Bayou Blue interdistributary. Additional information must be gathered so that project features can be proposed.

Benefits and Costs.

Benefits and cost of this project can not be estimated until approach and design of the project are better developed.

Effects and Issues.

This project would maximize beneficial use of fresh water that must be drained from the Verret Subbasin and bring the benefits of introducing fresh water and sediment to the Timbalier Subbasin. Other more specific effects require greater project detail to anticipate. This proposed action must be compatible and coordinated with XTE-32, the plan to restore hydrologic conditions in Verret Subbasin, and must be reconciled with hydrologic restoration and freshwater diversion projects in the Timbalier Subbasin.

status.

A project plan and specific features must be developed. As a result, this project has been classified as long term. This would be an alternate approach to that proposed in XTE-50.

SUPPORTING SHORT-TERM PROJECTS

TIMBALIER SUBBASIN

TE-5 GRAND BAYOU WETLAND

Location.

The project area includes 35,857 acres between Bayou Blue, Bayou Pointe au Chien, and Grand Bayou Canal (Figure 35).

Problems and Opportunities.

The mostly fresh and intermediate marshes in the project area are exposed to the encroachment of salt water, aggravated by Grand Bayou Canal and Cutoff Canal, which are major navigation canals and avenues for saltwater intrusion. Tidal processes have led to considerable marsh loss in the southern part of the project area Since there is little reliable freshwater inflow into the area, these habitats must depend on conservation of rainfall within the watershed.

Description of Features.

This project is divided into a southern management area (TE-5a), and a northern management area (TE-5b). Features of this active management project include a management levee and variable control structures (flapgated culverts with variable crest weir headers on the marsh side) along Grand Bayou Canal, rehabilitation of existing spoil banks along the northwest boundary of Area A (an existing northeast-southwest canal), extension of the management levee along Grand Bayou Canal from the United Gas Pipeline Canal to the Bayou Blue Ridge, and installation of a major structure in the southwest corner of the project area to control water exchange with Bayou Pointe au Chien.

Benefits and Costs.

The estimate of benefits is 823 acres protected, 4,051 acres of submerged aquatic vegetation restored, and 2,169 acres enhanced, for a total benefit of 7,043 acres. Estimated project cost is $2,500,000.

Effects and Issues.

Because this project includes levees and water control structures with some active management, there is some concern regarding estuarine organism access and sediment dynamics. The relationship of this project to the hurricane protection system proposed by Terrebonne Parish, which would follow the lower border of the project area, should be evaluated. If a hurricane protection levee is installed, measures to maintain appropriate water levels behind the levee (i.e., in this project area) may become important There is the potential for this project to incurr high operation and maintenance costs over the life of the project.

Status.

TE-5A is mostly constructed; TE-5B is in preliminary feasibility planning.

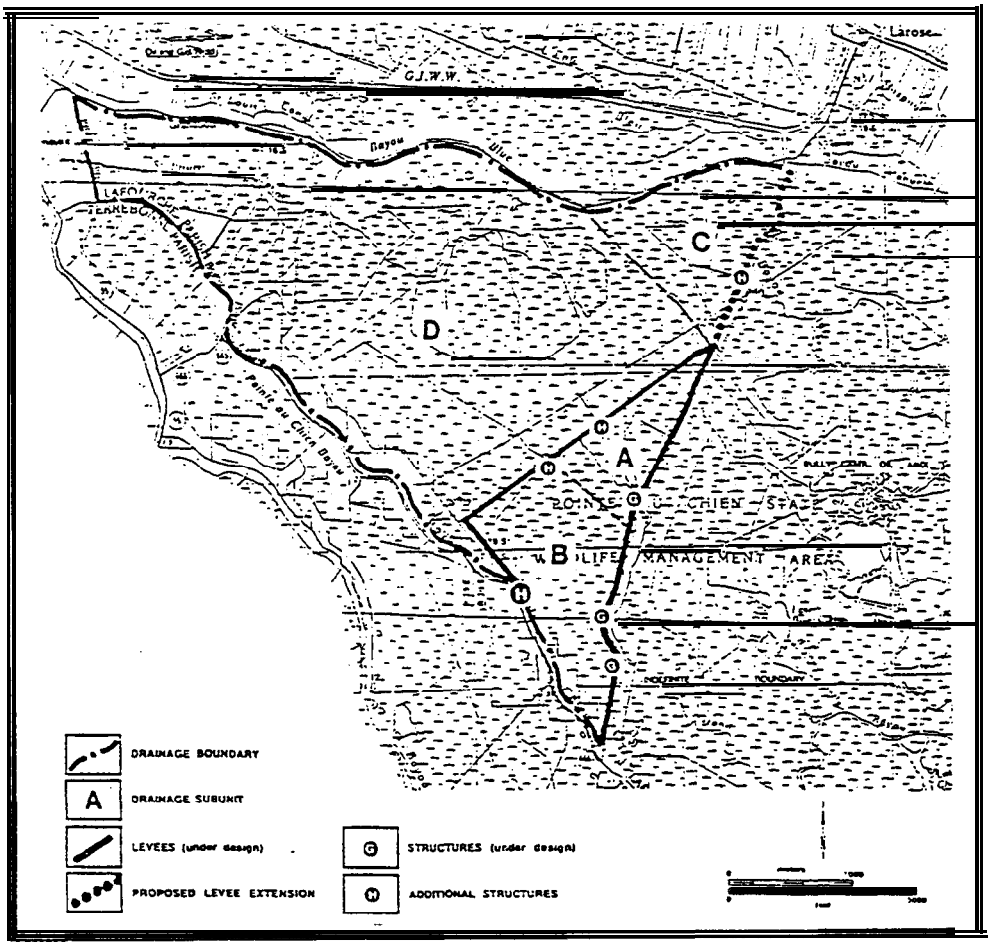


Figure 35. TE-5 Grand Bayou Wetland

TE-6 POINTE AU CHIEN WETLAND

Location.

The project area is located near Montegut in Terrebonne Parish, and extends southward between Bayou St. Jean Charles and Bayou Pointe au Chien (Figure 36). The southern boundary is formed by the embankment of a road traversing the marsh from east to west.

Problems and Opportunities.

Marine tidal processes, wave action, and subsidence have caused removal of organic substrate in this area, resulting in conversion to open water. The remaining marshes are not able to revert rapidly enough to more saline marsh to maintain a living root mat, resulting in further erosion. The project is intended to prolong the integrity of the remaining wetlands by maintaining less saline conditions and allowing for a more gradual transition toward brackish marsh. This is a defensive project addressing the inner line of defense int he Timbalier Subbasin.

Description of Features.

Features of this project would include a southern embankment with control structures, maintenance of 1,088 ft of the lower part of the Bayou St. John Charles natural levee ridge, and installation of three water control structures To provide additional fresh water and nutrients, it is proposed that outfall from the forced drainage area to the north be routed through the management unit.

Benefits and Costs.

Project benefits are estimated to be the protection of 589 acres, the restoration of 827 acres of submerged aquatic vegetation, and the enhancement of 279 acres, for a total benefit of 1,695 acres. Project costs are estimated at $3,800,000.

Effects and Issues.

It is anticipated that this project will reduce marsh loss rates by reducing saltwater intrusion, decreasing the rapid flow-through of fresh water (i.e., increasing retention time), and managing water levels. Access for estuarine-dependent organisms will also likely be reduced. The relationship of this project to the hurricane protection system proposed by Terrebonne Parish, which would follow the lower border of the project area, should be evaluated. If a hurricane protection levee is installed, measures to prevent associated wetlands stress behind the levee (i-e., in this project area) may become important.

Status.

State DNR is in the process of engineering design for this project.

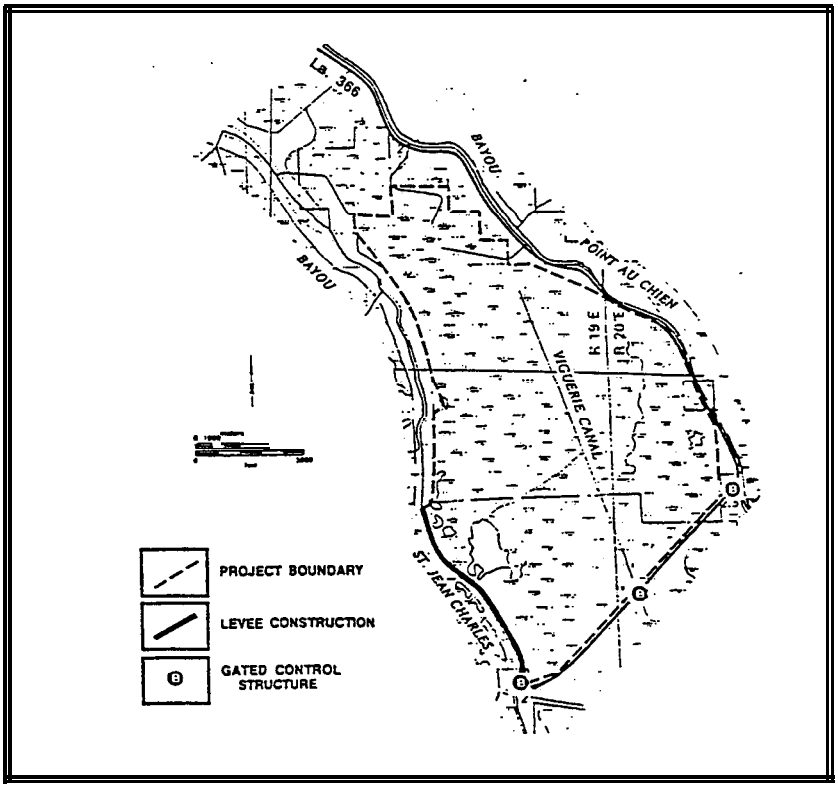


Figure 36. TE-6 Pointe au Chien Wetland

TE-8 BAYOU PELTON WETLAND

Location.

The 2,400 acre project area is between the Houma Navigation Canal and Bayou Grand Caillou, bordered on the north by Bayou Pelton, and extending south to Dulac (Figure 37).

Problems and Opportunities.

The project area experiences saltwater inflow and rapid loss of fresh water, especially via its connection with the Houma Navigation Canal.

Descrimion of Features.

Project features would include closure of tidal connections at five or six locations and 5,000 ft of bank stabilization along the Houma Navigation Canal. Water control structures have been proposed for the intersections of Falgout Canal and Bayou Provost to provide freshwater conservation and water exchange with Bayou Grand Caillou. An adjustable water control structure for drainage and flow-through is proposed for the southwest corner of the project area along the Houma Navigation Canal. Operation is largely passive, with some active management.

Benefits and Costs.

Benefits derived from this project are estimated to be the protection of 137 acres of marsh, the restoration of 331 acres of submerged aquatic vegetation, and the enhancement of 327 acres, for a total benefit of 795 acres. Fully funded project costs are estimated to be $1,720,313.

Effects and Issues.

Portions of the project area may be freshened in the short term due to management of fresh- and saltwater exchange. Estuarine organism access may be reduced compared to present rates. However, if the Houma Navigation Canal were not present, organism access would be primarily through Bayous Prevost and Pelton The relationship of this project to the hurricane protection system proposed by Terrebotme Parish, which would follow the lower border of the project area, should be evaluated If a hurricane protection levee is installed, measures to address expected stress to wetlands behind the levee (i.e., in this project area) may become important.

status.

This project is ready to be considered for implementation.

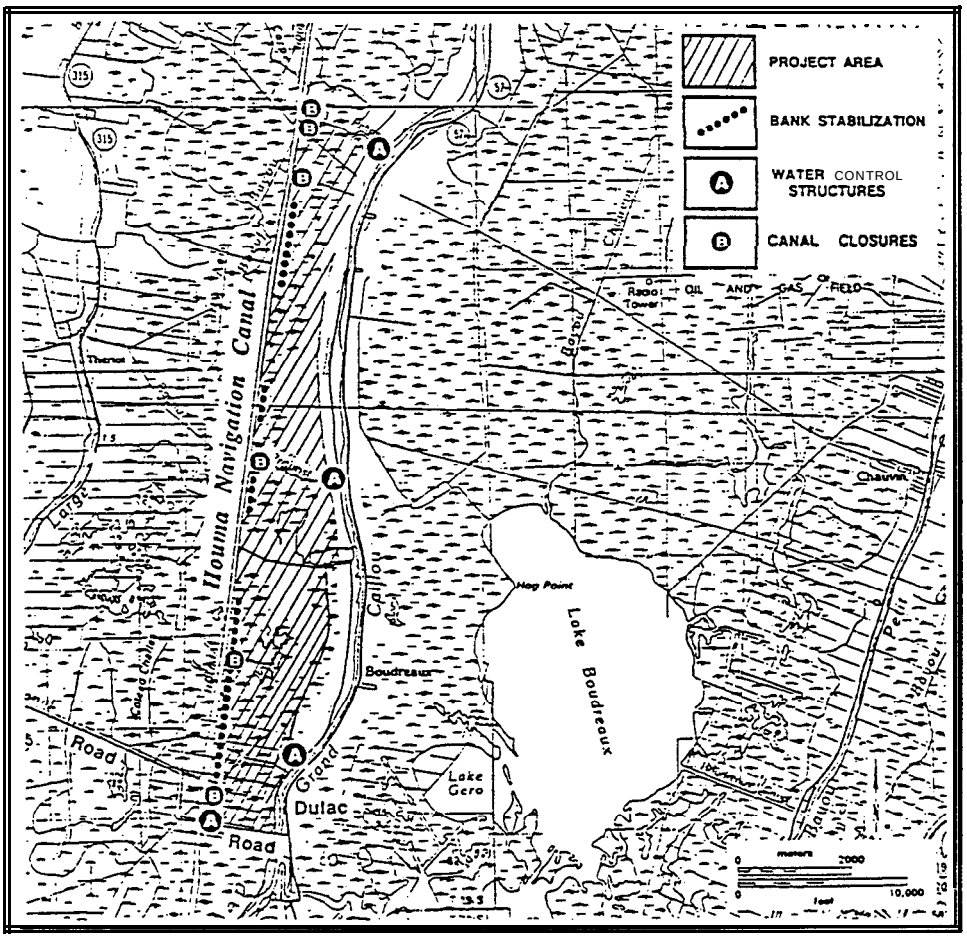


Figure 37. TE-8 Bayou Pelton Wetland

TE-12 BIRD ISLAND RESTORATION

Location.

The project is located in Lake Pelto, immediately to the north of central Isles Demieres (Figure 38).

Problems and Opportunities.

Bird Island has almost completely disappeared, with an associated loss of shore-bird habitat.

Description of Features.

The project would involve construction of a low retention dike around a 60-80 acre shallow open water area. A suction dredge would then be used to fill the confined area of open water with dredged material to an elevation conducive to the establishment of marsh.

Benefits and Costs.

Benefits from this project are estimated to be the creation of a net of 5 acres of marsh, and the enhancement of 10 acres, for a total benefit of 15 acres. Fully funded project costs are estimated to be $2,117,432.

Effects and Issues.

There is evidence that Bird Island has completely disappeared; the feasibility of this project should be investigated

status.

The project needs feasibility analysis, but could be considered for the next priority project list.

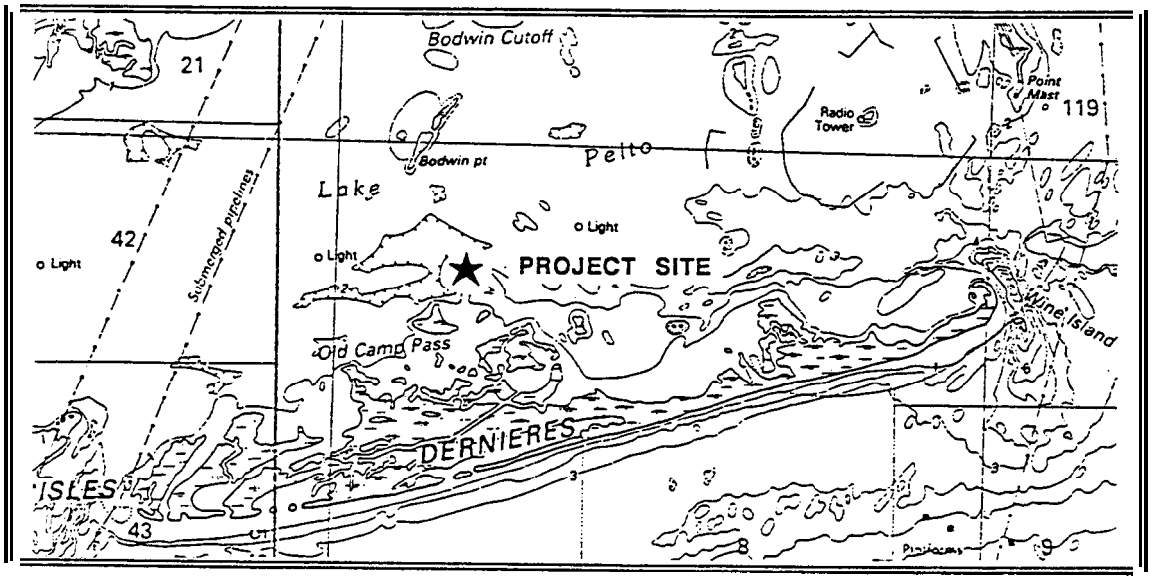


Figure 38. TE-12 Bird Island Restoration

TE-17 FALGOUT CANAL PLANTING

Location.

Northern bank of Falgout Canal between Bayou du Large and the HNC (Figure 39).

Problems and Opportunities.

Vegetation in many areas has died as a result of rapid water level fluctuations, ponding, and saltwater intrusion. This loss of vegetation conbined with natuaral and boat induced wave action increases the erosion rate of shorelines, canal banks, and natural levees. This project is designed to minimize coastal wetland erosion and restore vegetation zones.

Description of Features.

Vegetation suited to the salinity and habitat type of the FaIgout Canal area will be planted in a strip as shown in Figure 39.

Benefits and .Costs.

This project will create and restore about 49 acres, with additional enhancement of 4 acres, for a total benefit of 53 acres. Costs are estimated at $161,000.

Effects and Issues.

No adverse impacts are anticipated,

Status.

This project is on the First Priority Project List.

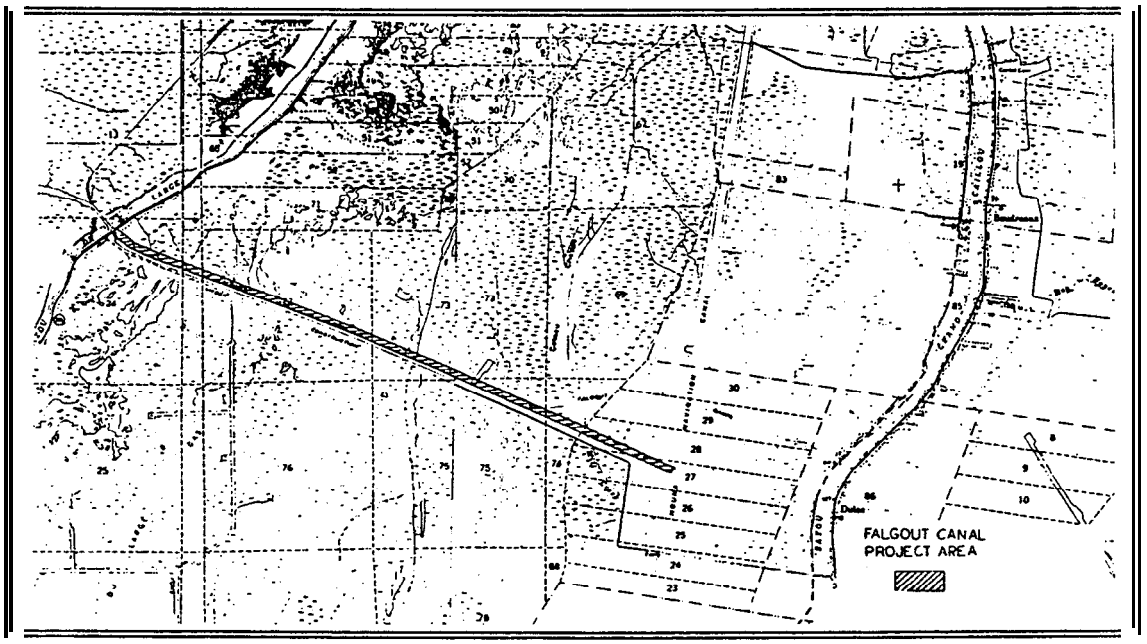


Figure 39. TE-17 Falgout Canal Planting

TE-18 TIMBALIER ISLAND PLANTING

Location.

Various locations along Timbalier Island (Figure 40).

Problems and Opportunities.

Vegetation in many areas has died as a result of rapid water level fluctuations, ponding, and saltwater intrusion. This loss of vegetation conbined with natuaral and boat induced wave action increases the erosion rate of shorelines, canal banks, and natural levees. This project is designed to minimize coastal wetland erosion, restore vegetation zones, and help maintain the integrity of the barrier island

Description of Features.

Vegetation suited to the salinity and habitat type of Timbalier Island will be planted in several areas as shown in Figure 40.

Benefits and Costs.

This project will create and restore about 178 acres, with additional enhancement of 319 acres, for a total benefit of 497 acres. Costs are estimated at $390,000.

Effects and Issues.

No adverse impacts are anticipated.

status.

This project is on the First Priority Project List.

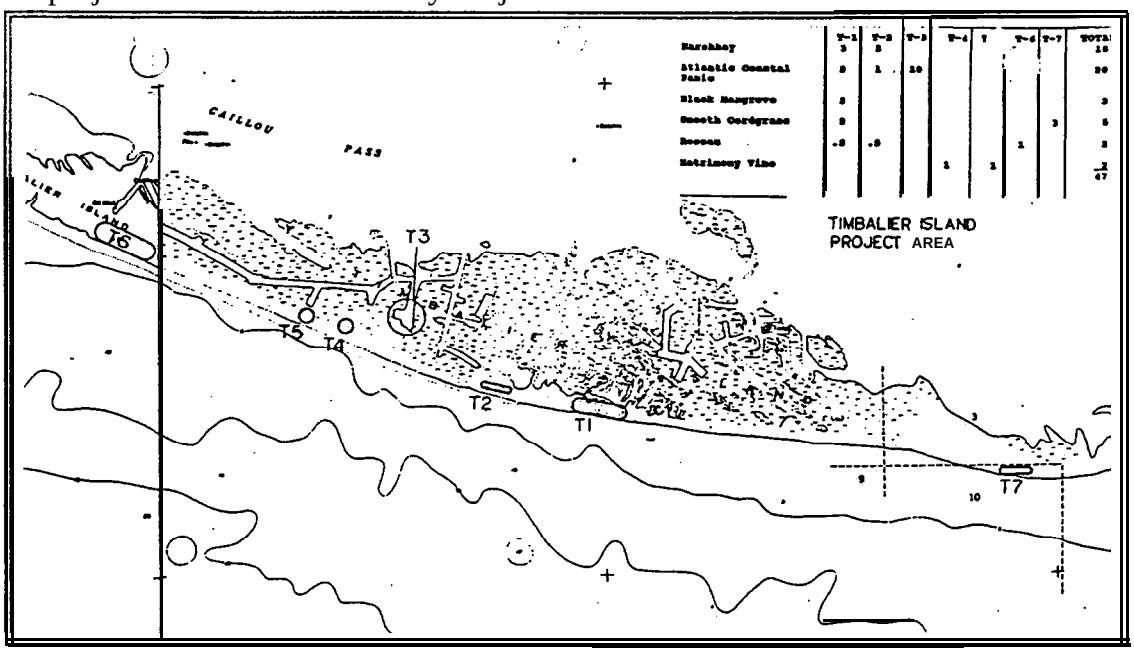


Figure 40. TE-17 Falgout Canal Planting

PTE-27 WEST BELLE PASS HEADLAND

Location.

The project area is 2,459 acres of marsh just west of Port Fourchon, Lafourche Parish. The project area is bounded by Timbalier Bay on the west, Bayou Lafourche and Bell Pass on the east, and the Gulf of Mexico on the south (Figure 41).

Problems and Opportunities.

Timblaier Bay is encroaching into the marshes on the west side of Bayou Lafourche and wave action is eroding the bankds of Bayou Lafourche. Openings along the banks of Bayou Lafourche are causing tidal scour in the interior marshes of the project area.

Description of Features.

Approximately 2,700,000 cuvic yards of material will be dredged from Bayou Lafourche and used to build about 184 acres of marsh on the west side of Belle Pass. A water control structure in the Evans Canal and plugs on other canals will reduce tidal influence in the project area. Riprap will be placed on the west side of Belle Pass and Bayou Lafourche from the jetty north 17,000 feet to reduce shoreline erosion into the wetlands.

Benefits and Costs.

This project will create, protect and restore about 474 acres, with additional enhancement of 165 acres, for a total benefit of 639 acres. Costs are estimated at $4,424,000.

Effects and Issues.

No adverse impacts are anticipated.

Status.

This project is on the Second Priority Project List.

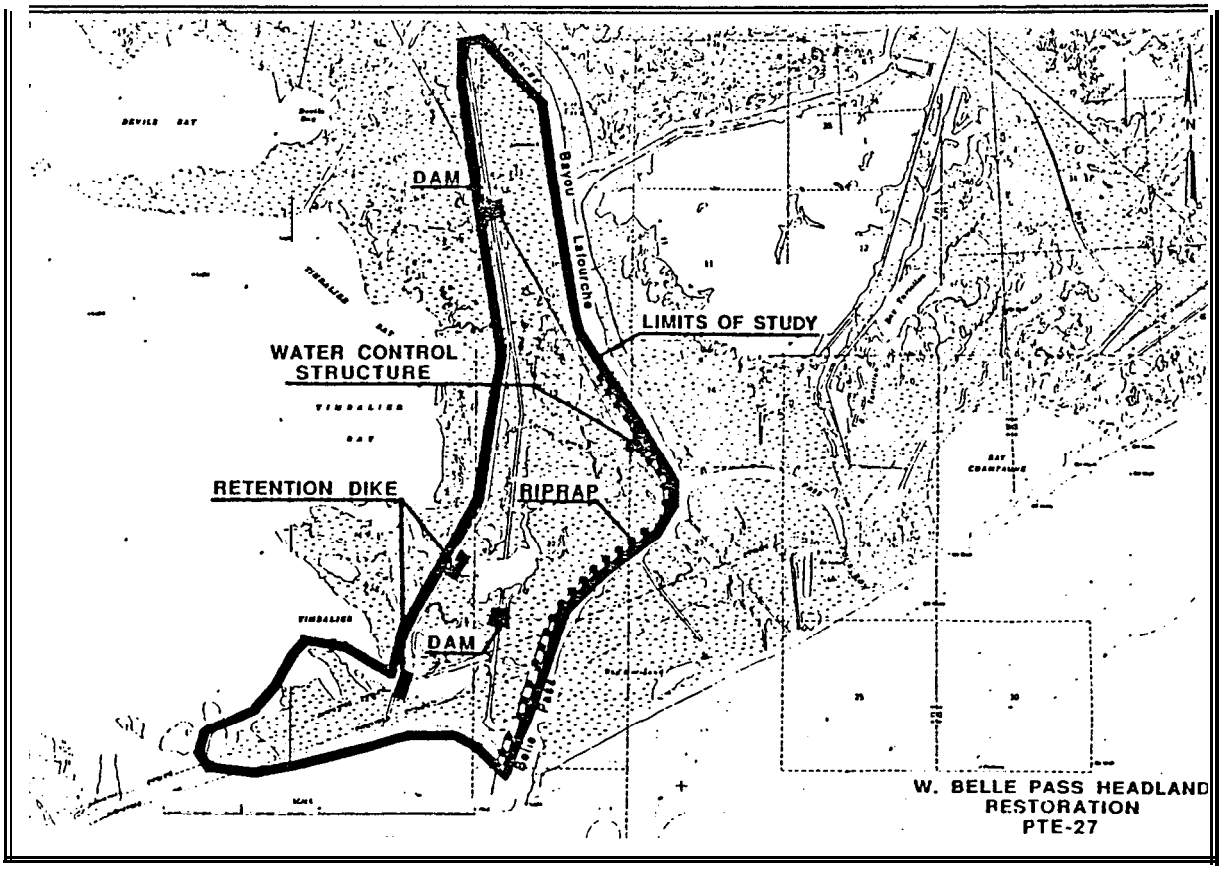


Figure 41. PTE-27 West Belle Pass Headland

XTE-40 TlMBALIER ISLAND SEDIMENT TRAPPING

Location.

A 410 acre marsh on the north side of Timbalier Island (Figure 42).

Problems and Opportunities.

A need exists to slow down tidal exchange to encourage sediment deposition in a shallow open water area on the north side of Timbalier Island

Description of Features.

Features include a 3000 ft rubber tire segmented breakwater in 100 ft sections offset by *10 ft* intervals. Vegetation will be planted after sufficient build-up occurs.

Benefits and Costs.

The estimated benefits from this project are the accretion of 4 acres of marsh, and the enhancement of 89 acres, for a total benefit of 93 acres. Project costs have been estimated at $1,358,500.

Effects and Issues.

None identified.

Status.

This project could be considered for the next priority project list.

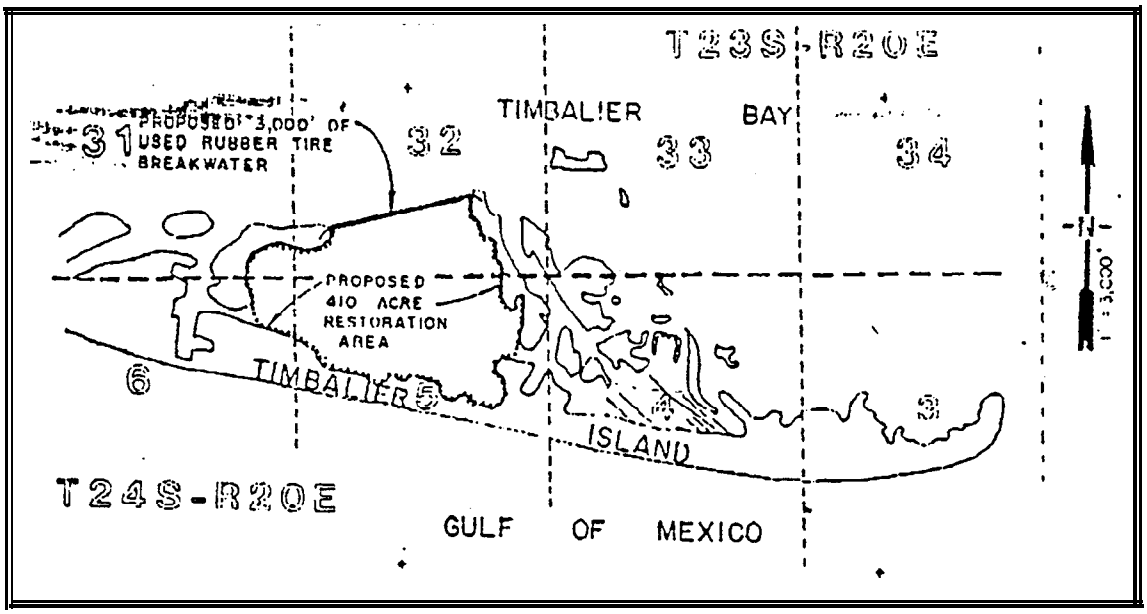


Figure 42. XTE-40 Timbalier Island Sediment Trapping

XTE-62 CREATION AT WINE ISLAND WITH DREDGED MATERIAL FROM CAT ISLAND PASS

Location.

Wine Island Shoals, east of East Island in the Isles Dernieres (Figure 43).

Problems and Opportunities.

Past maintenance dredging by the Corps of Engineers at Cat Island Pass has been used to help restore Wine Island, historically considered part of the Isles Demieres. During the most recent dredging cycle (1990/91), the material was placed inside a rock ring levee at Wine Island Shoal to begin recreation of the barrier island The opportunity exists to continue this effort during the upcoming dredging cycle. A state project on the island has been completed, however the island is not restored.

Description of Features.

Continuation of past practices.

Benefits and Costs.

An estimated 5 acres of marsh would be created, 5 acres of submerged aquatic vegetation would be restored, and 3 acres would be enhanced, for a total benefit of 13 acres. Project costs have not yet be estimated, but were approximately $500,000 for the previous effort and as before, would only include the additional costs of transport and disposal of the material.

Effects and Issues.

None identified.

status.

Details of this project must be developed and coordinated with the Corps of Engineers maintenance dredging program. This project should be considered for funding in a time frame (i.e., the upcoming priority list) that would allow coordination with the next maintenance dredging effort.

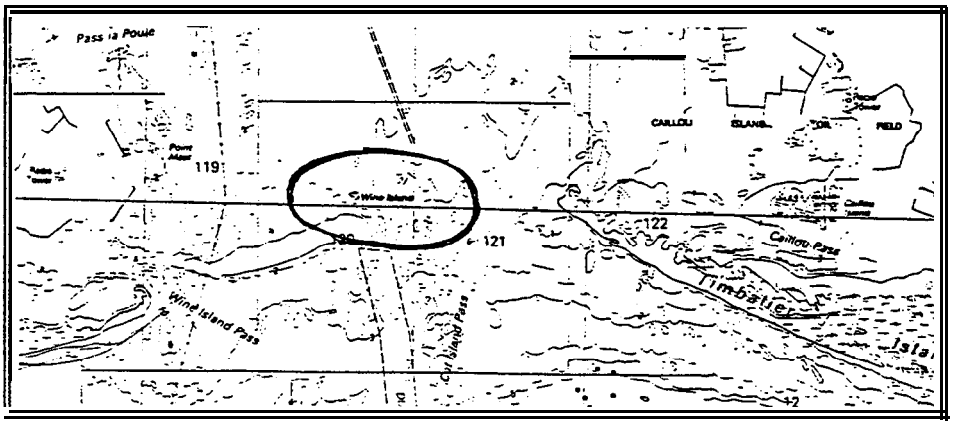


Figure 43. XTE-62 Creation at Wine Island with Dredged Material from Cat Island Pass

PENCHANT SUBBASIN

PTE-22/24 PONT AU FER CANAL CLOSURE

Location.

Point au Fer Island, adjacent to the Gulf of Mexico, Oyster Bayou, and Atchafalaya Bay in western Terrebonne Parish (Figure 44).

Problems and Opportunities.

As a consequence of man-made canals, saltwater has intruded and substantial acreage of marsh has been lost. In addition, areas of the beach between the gulf and the canal parallel to the shore were breached in Hurricane Andrew, allowing salt water in to brackish and intermediate marshes.

Description of Features.

Four plugs, with a maximum settled height equal to local marsh height, will be constructed of local material in the canal linking Mosquito Bay and Bay Castagnier. Three similar plugs will be placed in the north-south canal between Mosquito Bay and the Gulf of Mexico. The existing plug at the seaward end of this canal will be stregthened. Two hundred feet of the canal will be backfilled. The shoreline adjacent to both canals will be enhanced using shell or limestone for a 600-foot and a 1,800-foot stretch of shoreline. Both canals will be backfilled.

Benefits and Costs.

Benefits for this project will be approximately 375 acres created, protected and restored, with an additional 429 acres enhanced, for a total benefit of 804 acres. Project costs are estimated at $978,000.

Effects and Issues.

Though canals will be plugged, fish will still have access to this area via other routes. Preservation of the marsh will preserve waterfowl and wildlife habitat.

status.

This project is on the Second Priority Project List.

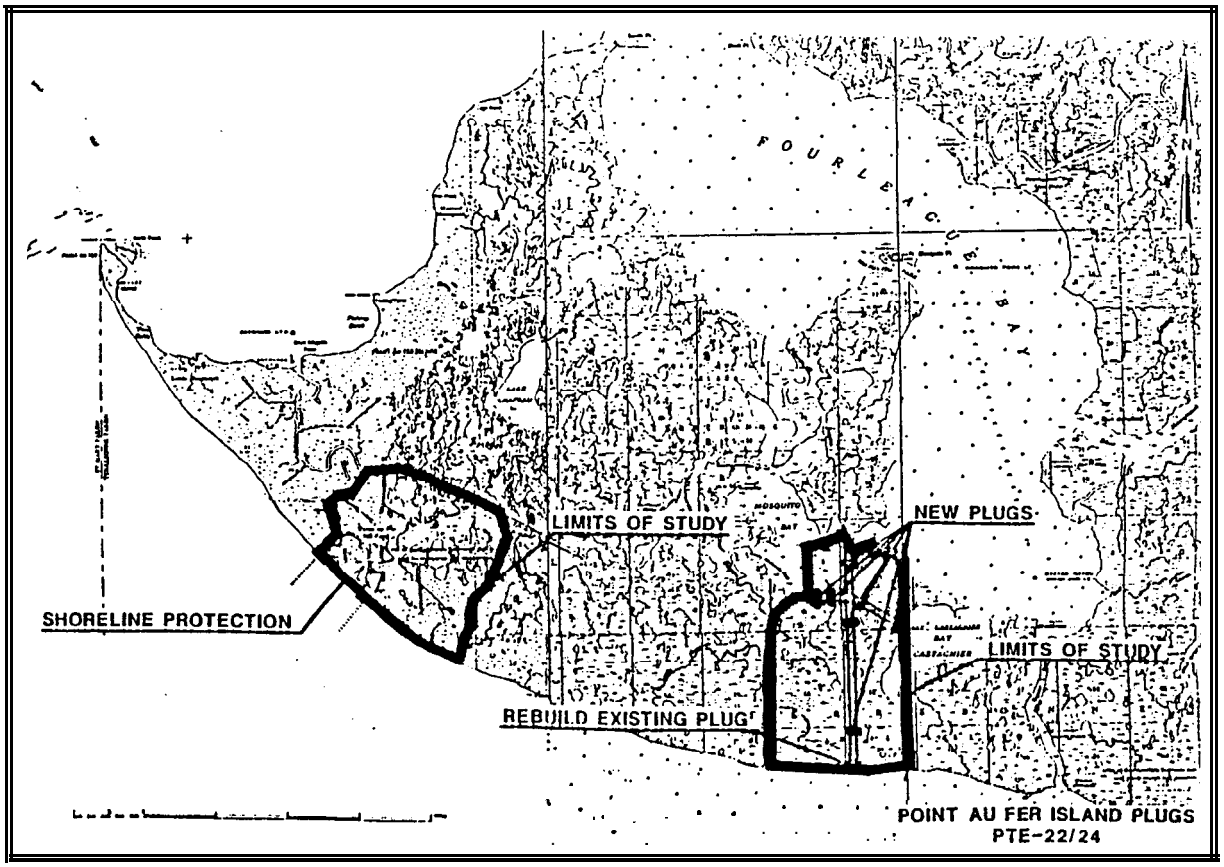


Figure 44. PTE-22/24 Point au Fer Canal Closure

XTE-38 GIWW BANK RESTORATION

Location.

The length of the GIWW from Larose to Amelia (Figure 45).

Problems and Opportunities.

There are numerous areas along the Gulf Intercoastal Waterway (GIWW) where erosion has led to breakthrough of the banks and washouts of marsh areas adjacent to the HNC. Marsh loss. due to tidal action, boat wakes, and saltwater intrusion could be reduced and areas in imminent danger of exposure due to breakthrough could be protected with selected bank stabilization efforts.

Description of Features.

Ten problem areas have been identified from aerial photography for immediate attention:

North bank west of Larose - use riprap to close breach, backfii area behind the riprap with dredge material, and plant the backfill with vegetation.

GIWW mile 49.6, just west of the Company Canal, northwest of Bourg - stabilize the north bank to limit further erosion and avoid breakthrough and future harm to the marsh.

GIWW mile 56.4, just north of Houma - m-establish and reinforce levees along the curved north bank.

GIWW mile 63.3,, south of Mandalay - repair gaps and reinforce levee on the south bank just north of a curve in the GIWW to limit further marsh breakup.

GIWW mile 63.7-66.1, just south of Mandalay - erosion that is occurring along both banks into the numerous oil and gas canals and causing extensive marsh loss should be limited by re-establishing and reinforcing the levees, with appropriate structures to prevent impoundment.

GIWW mile 66.5-69.5, adjacent to the Lake Hatch Oil and Gas Field - limit further erosion from both banks into the adjacent marshes and forestall future loss by m-establishing and reinforcing the levees on both banks.

GIWW mile 70-72, just south of Humphrey's and the Humphrey's Oil and Gas Field - limit further erosion of the south bank into adjacent oil and gas canals and thus limit further breakup of the interior marshes by m-establishing and reinforcing the levee along the south bank.

GlWW mile 74-75.6, where the GIWW intersects Lake Hackberry (on Bayou Cocodrie) - limit further erosion from the south bank west of Copasaw Canal into the adjacent marshes and forestall future loss by re-establishing and reinforcing the levee along the south bank.

GIWW mile 77.5, at the east end of Lake Cocodrie - limit further breakup of interior marshes by re-establishing and reinforcing the levee along the south bank of Lake Cocodrie.

GIWW mile 79.4-79.9, at the north end of Lake Cocodrie - limit further erosion into the marsh by plugging breaches along the south bank of Lake Cocodrie.

Benefits and Costs.

Anticipated benefits from this project are estimated to be the protection from loss of about 160 acres of marsh, the restoration of 431 acres of submerged aquatic vegetation, and the

enhancement of 253 acres, for a total benefit of 844 acres. Project costs have only been grossly estimated at $4,115,000.

Effects and Issues.

None identified.

Status.

Details of project design need to be developed. This project can be considered for the next priority project list.

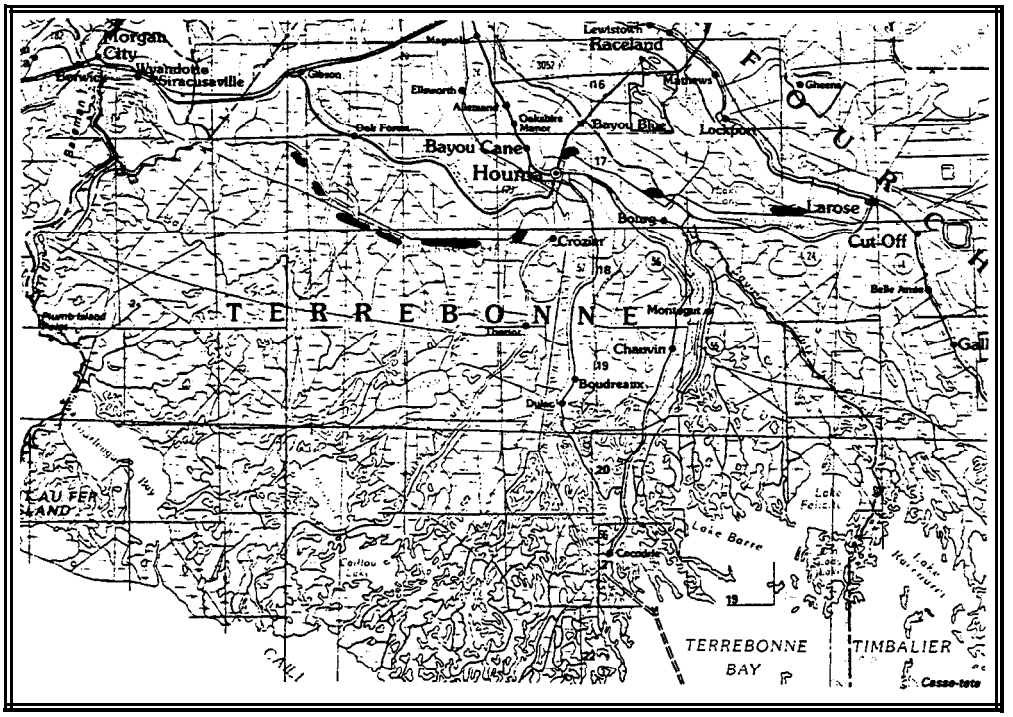


Figure 45. XTE-38 GIWW Bank Restoration

XTE-64 AVOCA ISLAND SEDIMENT DIVERSION

Location.

The 3500 acre project area lies 1.0 miles south of Morgan City in St. Mary Parish, Louisiana. The project is bordered by the GIWW and Bayou Boeuf lochs to the north, Bayou Shaffer to the west, and Bayou Chene to the south and east (Figure 46).

Problems and Opportunities.

A large area of fresh marsh has been cut off from sediment delivery by the construction of the Avoca Island Levee, and is subsiding and converting to open water. Bayou Shaffer, a distributary of the Atchafalaya River, lies immediately adjacent to the Avoca Island Levee. If water flow from this distributary was re-established to Avoca Island wetlands, it is believed marsh loss rates would be decreased and emergent wetlands recreated.

Description of Features.

The project entails directionally drilling several 24-inch diameter pipelines through the Avoca Island Levee and allowing water and sediment to flow through the pipelines into the project area. The levee borrow canal would be plugged, forcing the water to flow through a pipeline canal into the north of the project area, depositing sediments in shallow open water areas south of the pipeline canal. During mid to late summer, flows would be halted to allow the growth of submerged aquatic vegetation.

Benefits and Costs.

Approximately 165 acres of marsh would be created and 248 acres would be protected from loss. An additional 215 acres of submerged aquatic vegetation would be restored, and 402 acres of marsh would be enhanced, for a total benefit of 1,030 acres. Project costs are estimated at $921,500.

Effects and Issues.

As flooding is an existing problem in Penchant, it is important no diversions be undertaken that do not address this issue. The project should be designed and operated not to flood the marsh during the majority of the growing season. Because this area is heavily used by hunting interests, the project should be operated not to adversely impact the growth of submerged aquatic vegetation. Finally, the project should be constructed such that the integrity of the Avoca Island Levee is not compromised.

status.

The project was evaluated as a candidate for the third priority project list, and is presently undergoing feasibility analysis and design.

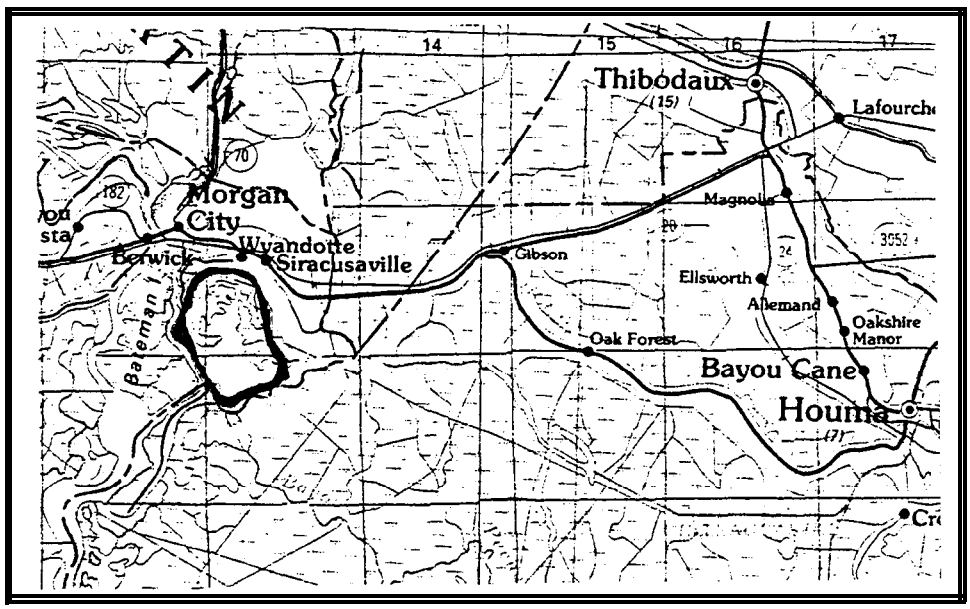


Figure 46. XTE-64 Avoca Island Sediment Diversion

XTE-65 SPRAY DREDGING WEST OF LOCUST BAYOU

Location.

The northern shoreline of Point au Fer Island, west of Locust Bayou in Terrebonne Parish, Louisiana, about 25 miles south of Morgan City (Figure 47).

Problems and Opportunities.

There are numerous hydrologic connections between Atchafalaya Bay and canals constructed to access oil and gas exploration sites that could be plugged or significantly constricted to reduce marsh losses. The proximity of the site to Atchafalaya Bay offers a significant opportunity to use the renewable sediment resource for this (relatively) small-scale restoration.

Description of Features.

Hydrologic connections would be filled using a spray dredge, with material obtained from Atchafalaya Bay, and/or reduced by restoring spoil banks along the access canals.

Benefits and Costs.

Project benefits have been estimated to include the restoration of 1,300 acres of broken marsh and open water to healthy marsh. No additional estimated of "enhancement" have yet been made. Project costs are estimated at $3,318,000.

Effects and Issues.

None identified to date.

S tatus.

This project will be ready for consideration on future priority project lists.

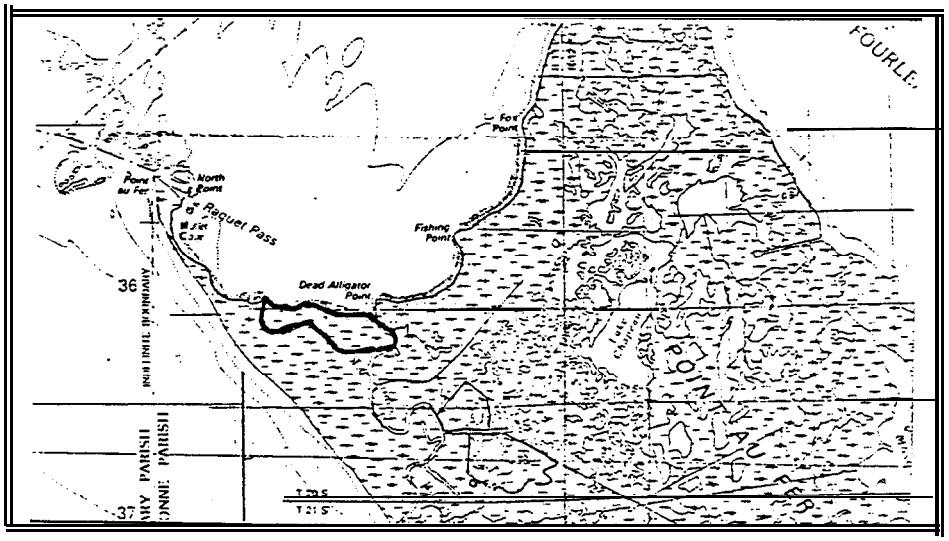


Figure 47. XTE-65 Hydrologic Restoration West of Locust Bayou

FIELDS SUBBASIN

TE-16 ST. LOUIS WETLAND

Location.

The majority of the project is located on the west side of the St. Louis Canal between the GIWW and Bayou Blue and at a site just north of US 90 at Savoie (Figure 48).

Problems and Opportunities.

The project area was previously fresh marsh, but has converted to open water.

Description of Features.

The project would entail placement of approximately 600,000 cubic yards of dredged material into 160 acres of open water to provide subaerial land for colonization by marsh vegetation. Selected plant species may also be sprigged into the new spoil if necessary. Material would be dredged from the St. Louis Canal.

Benefits and Costs.

Project benefits are estimated to be the creation of a net of 31 acres of marsh, the restoration of 30 acres of submerged aquatic vegetation, and the enhancement of 22 acres, for a total benefit of 83 acres. Fully funded project costs am estimated to be $500,000.

Effects and Issues.

None anticipated

status.

The project requires permitting, but is ready for consideration on the next priority project list.

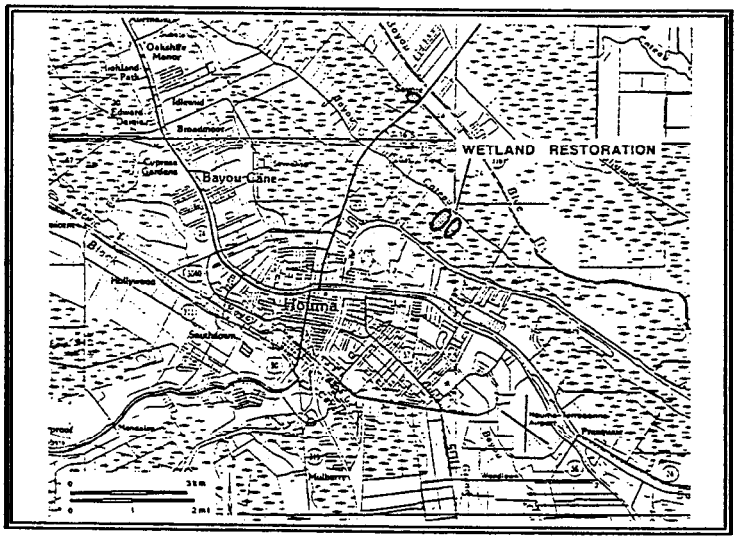


Figure 48. TE-16 St. Louis Wetland

XTE-38(a-c) GIWW BANK RESTORATION

See project description for XTE-38

SUPPORTING LONG-TERM PROJECTS

TIMBALIER SUBBASIN

PTE-1 BAYOU TERREBONNE DREDGING

Location.

Bayou Terrebonne south of Lapeyrouse, approximately eight miles downstream of Bayou Jack (Figure 49).

Problems and Opportunities.

The proximity of Bayou Terrebonne offers a source of sediment that could be used to create marsh in a badly deteriorating marshland

Description of Features.

This project involves creating marsh by dredging approximately 1,500,000 cubic yards of sediment from Bayou Terrebonne along an eight mile stretch and discharging the material on the east bank of Bayou Terrebonne to create a strip of marsh 300 feet wide and eight miles long. Seven cuts along the east bank would also be plugged to control saltwater intrusion.

Benefits and Costs.

About 291 acres of marsh will be built initially. However, there is at present no estimate of how much of this acreage would be lost over the 20 year life of the project, and thus of net acres benefitted. A rough estimate of project cost (not yet reviewed by the Corps of Engineers or the Economics Subcommittee) is $1,500,000.

Effects and Issues.

The project would both create new marsh and, to some extent, improve the hydrologic integrity of the area No other effects have been evaluated.

status.

This project is largely conceptual, and requires further development and evaluation.

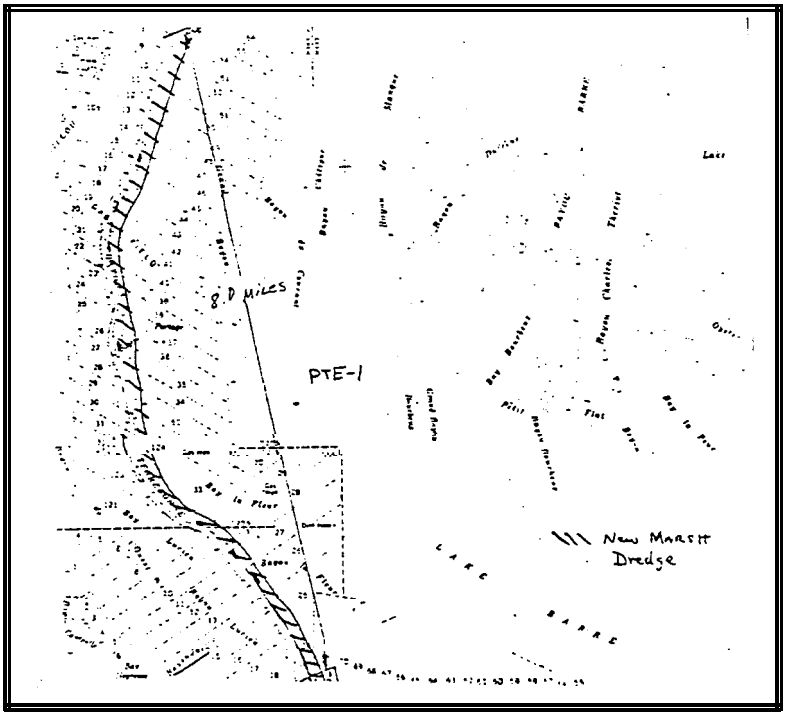


Figure 49. PTE-1 Bayou Terrebonne Dredging

PIE-14 BELLE PASS MARSH CREATION

Location.

The marshes along the western flank of Bayou Lafourche from Golden Meadow to Fourchon (Figure 50).

Problems and Opportunities.

The concept of this project is to use a nearby resources (Bayous Fourchon and Lafourche) to create and restore adjacent marshes that are deteriorating.

Description of Features.

This project proposed to obtain dredged material from the Bayou Fourchon Project (approximately 2,000,000 cubic yards) and spread it in such a manner as to create wetlands. At four selected points in lower Bayou Lafourche, freshwater diversions will be opened into the marshes.

Benefits and Costs.

Neither the approximate acreage of marsh that would be created and restored by this project nor the project costs have yet been estimated.

Effects and Issues.

The use of dredged material to create marsh coupled with freshwater diversion to help maintain that marsh as well as surrounding marsh would be beneficial, if feasible. Some or all of the creation features of this project overlap with that to be undertaken as part of PIE-27 (West Belle Pass Headland Restoration) which is on the Second Priority Project List. There is also some question as to the feasibility of the proposed diversions. The feasibility of the diversions may be tied to increasing the discharge from the Mississippi River down Bayou Lafourche (XTE-52).

status.

This project requires feasibility analysis.

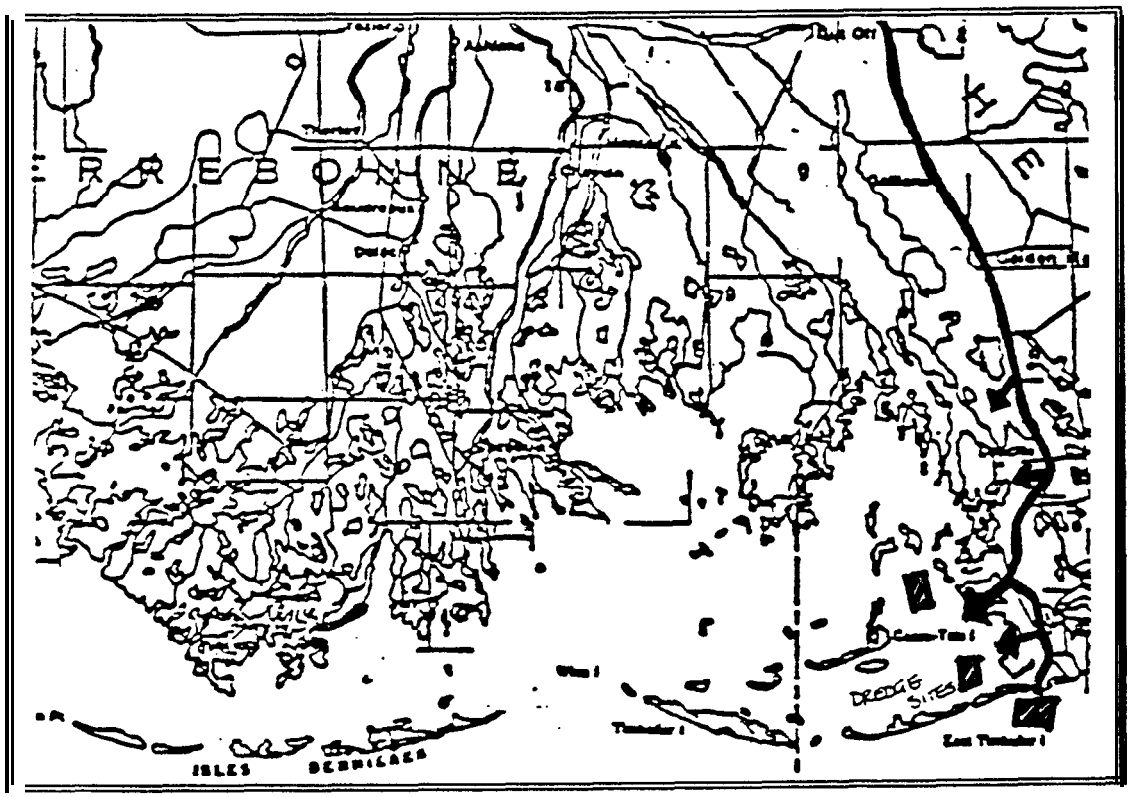


Figure 50. PTE-14 Belle Pass Marsh Creation

PTE-17 BAYOU LAFOURCHE DREDGING

Location.

Bayou Lafourche in Assumption and Lafourche Parishes (Figure 51).

Problems and Opportunities.

The concept of this project is to use the resource of sediment from Bayou Lafourche to create marsh along the length of the bayou.

Description of Features.

This project proposes to dredge Bayou Lafourche from Donaldsonville to Pass Fourchon using either hydraulic or bucket dredges, and using the material to create marsh in open water areas outside of the leveed areas on either side of the bayou. The Lafourche Parish Freshwater District has cross sectional data from Bayou Lafourche and an estimate of the amount of material that could be removed

Benefits and Costs.

Estimates of the acreage of marsh that would be created or restored by this project and of project costs have not yet be made.

Effects and Issues.

Specific project effects can not be evaluated until details of project design (e.g. specific locations of material placement) are developed. This project overlaps to some extent PTE-2 (Bank Stabilization on the West Side of Bayou Lafourche) and PTE-27 (West Belle Pass Headland Restoration), which is on the Second Priority Project List. It would also be necessary to coordinate this project with the proposal to increase the discharge from the Mississippi River down Bayou Lafourche (XTE-52).

status.

This project is largely conceptual, and requires additional development and feasibility analysis.

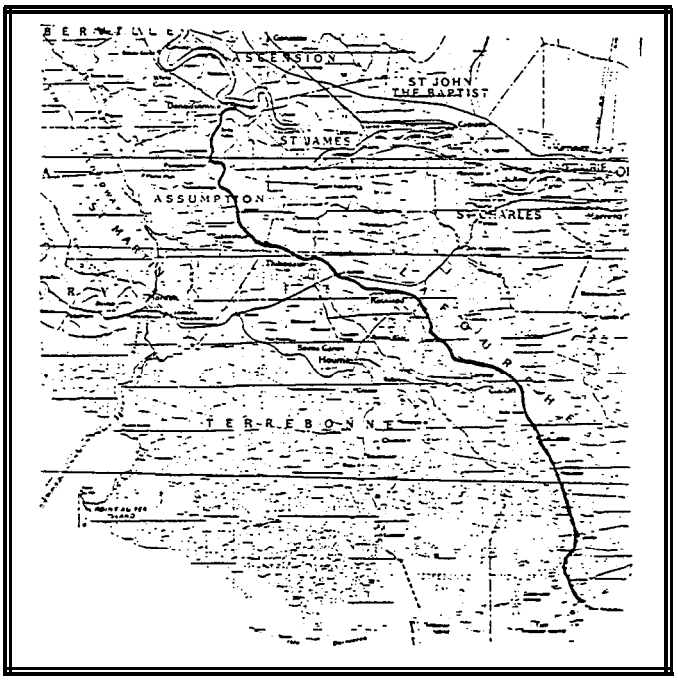


Figure 51. PTE-17 Bayou Lafourche Dredging

PTE-21 BAYOU TERREBONNE AND BAYOU LAFOURCHE CONNECTING CHANNEL

Location.

From Bayou Terrebonne to Bayou Lafourche near Thibodaux (Figure 52).

Problems and Opportunities.

The concept of this proposal is to reconnect Bayou Terrebonne with Bayou Lafourche in Thibodaux to supply Bayou Terrebonne and surrounding marshes with more fresh water.

Description of Features.

To reconnect the two bayous along the original route (approximately 3.5 miles) which is now heavily developed, probably would require installation of pumps and a large diameter pipeline. An alternative channel route south of the Southern Pacific Railroad would be approximately 5.2 miles long.

Benefits and Costs.

Project costs and benefits have not yet been estimated.

Effects and Issues.

The effects of this project need to be evaluated after the project design is better developed. There is some question as to the feasibility and environmental benefits of this project. The amount of water to be diverted to Bayou Terrebonne would also have to be evaluated carefully so that populations in the lower reaches of Bayou Lafourche continue to receive an adequate freshwater supply.

status.

This project requires further development and evaluation.

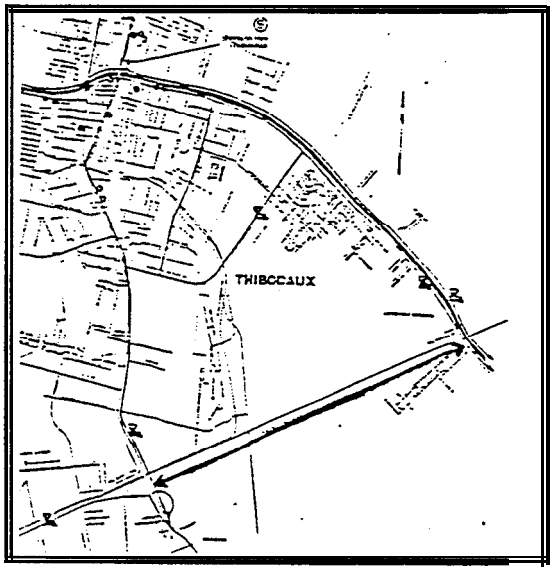


Figure 52. PTE-21 Bayou Terrebonne and Bayou Lafourche Connecting Channel

XTE-28 PARISH LINE OF DEFENSE

Location.

Timbalier subbasin, Terrebonne and Lafourche Parishes (Figure 53).

Problems and Opportunities.

The objective of this project is to develop a levee barrier inland of the barrier islands to protect interior marshes from saltwater intrusion, erosion, and storm surge.

Description of Features.

Alignment of the defense levee with the Parish's Overall Hurricane Protection (OHP) levee should be considered, predicated on comprehensive review of the proposed OHP levee alignment and of alternatives with consideration of wetland benefits and consequences as well as on storm surge and flood protection to populations. If aligned together, the height of the levee will be defined by hurricane protection needs. However, water control structures to protect the marshes behind the levees from inundation and to allow access for estuarine organisms will have to be incorporated in the design (refer to the Lake Pontchartrain hurricane protection levee where this has been done).

Benefits and Costs.

No estimate of benefits from the project is currently available. Costs for several alternative alignments of the proposed OHP levee range from about $9,528,091 to $25947,841 (STTMCD 1992). It is not clear whether these cost estimates include marsh protection features. However, only the wetland protection portion of the project would be proposed for CWPPRA funding, any hurricane protection features would be funded separately.

Effects and Issues.

The general effects of this project, beyond the intended effects of retarding the inland progress of marine processes (saltwater intrusion, tidal effects) as marshes subside and deteriorate inland, may include partial exclusion of estuarine-dependent fish and other organisms, hydrologic separation of marshlands north and south of the levee, and artificial control of the hydrology of the marshes north of the levee. The efficacy of placing a levee for marsh protection in largely open water in some segments rather than further north and closer to the line of healthier marsh should be evaluated. Extensive levee construction would also greatly restrict aquatic organism access, with possible associate reduction in fisheries production. Impacts to basin hydrology would also have to be evaluated.

Status.

An EIS evaluating alternative alignments for the proposed Overall Hurricane Protection levee is under development by the parish. When this information becomes available, further planning for this project could take place.

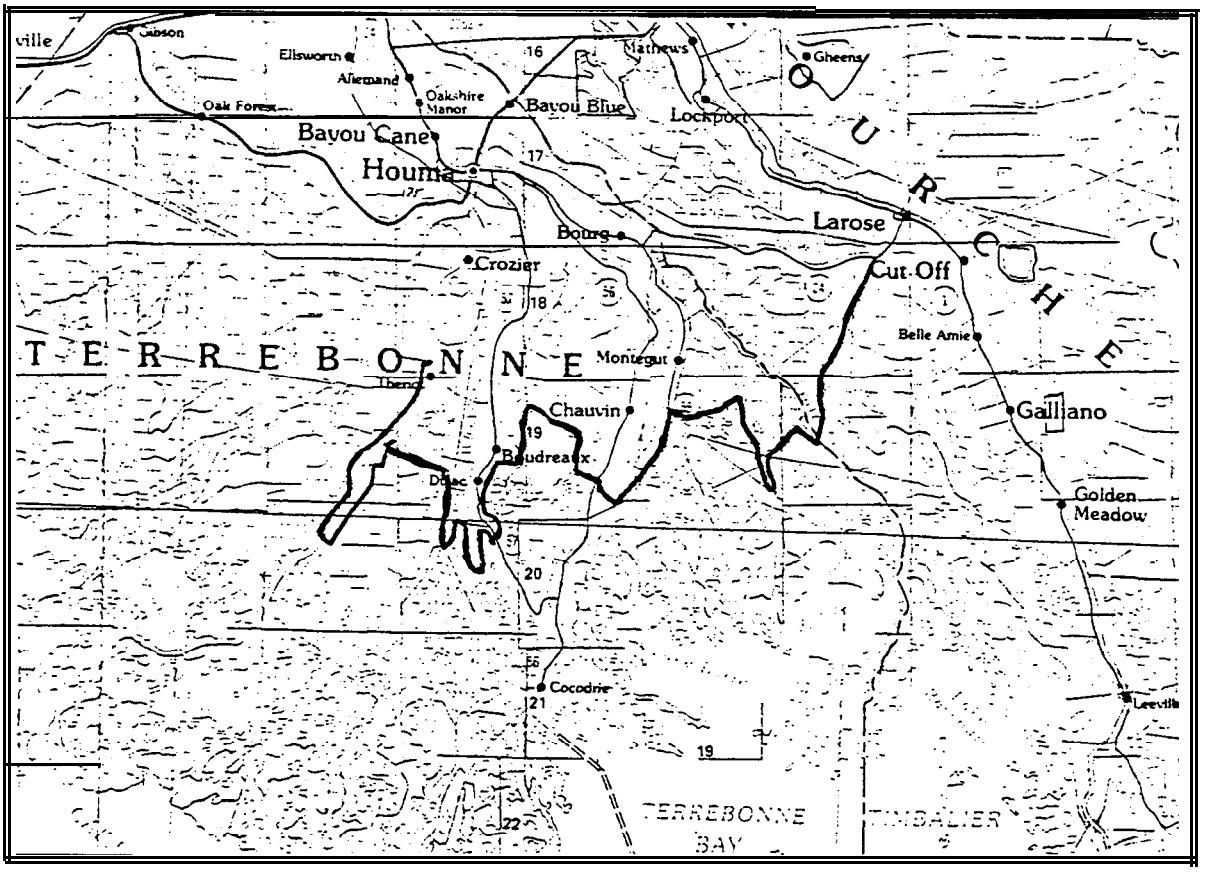


Figure 53. XTE-28 Shoreline Barrier - Second Line of Defense

PENCHANT SUBBASIN

PTE-8 MARSH CREATION WEST OF HOUMA AND NORTH OF THEGIWW

Location.

Large open ponds west of Houma and north of the GIWW (Figure 54).

Problems and Opportunities.

This project proposes to use dredged material to create wetlands, and enhance existing wetlands with sediment runoff from the placement activity.

Description of Features.

Project features would include a mobile barge mounted unloader/booster facility connected to flexible distribution piping with telescoping nozzle sections; hopper barges and tugs to transport material, material aquisition site with hydraulic dredge and site to dewater material and load it onto barges, or material acquisition from navigation channel dredging loaded onto hopper barges (sediment source options similar to Falgout projects).

Benefits and Costs.

This project is largely conceptual and needs details of design to be developed. As a result, expected benefits have been only grossly estimated as the creation of about 115 acres of marsh; with an estimated project cost of about $6,000,000.

Effects and Issues.

Use of dredged material to create marsh in areas that have deteriorated to open water is considered beneficial in that it increased the integrity of the marsh and improves marsh function. Other possible effects (e.g., dredging effects at the material acquisition site) will need to be evaluated when project design is established

status.

This project is largely conceptual, and requires further development and evaluation before it could be considered for implementation.

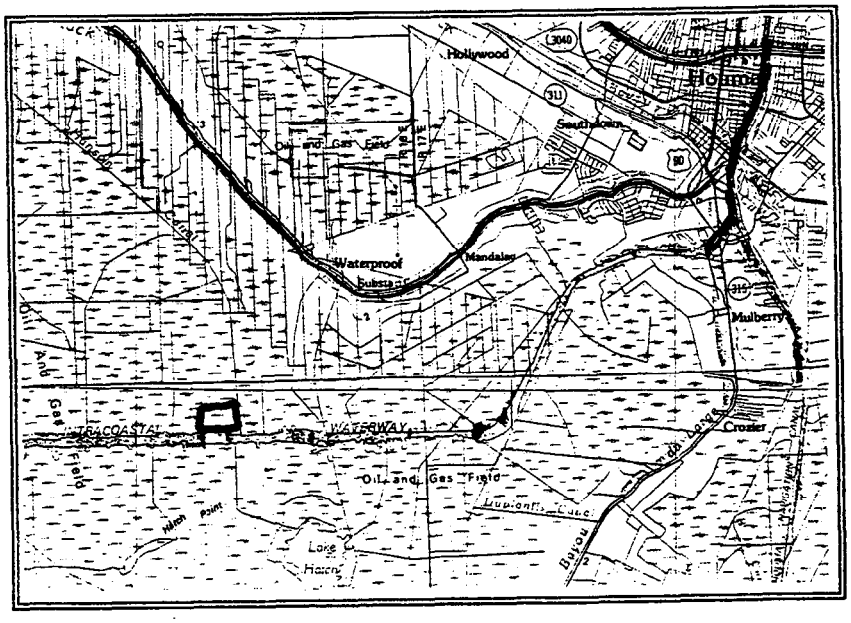


Figure 54. PTE-8 Marsh Creation West of Houma and North of the GIWW

PTE-13 BAYOU CHENE, BOEUF, AND BLACK WETLAND RESTORATION

Location.

The Bayou Chene, Boeuf, and Black navigation channel between the GIWW and the Lower Atchafalaya River (Figure 55).

Problems and Opportunities.

The opportunity exists to make specific beneficial use of maintenance dredge material in combination with bank stabilization measures to benefit marsh that has been adversely affected by this navigation channel.

Description of Features.

The project proposes to install appropriate bank stabilization measures along the Bayou Chene, Boeuf, and Black navigation channel between the GIWW and the Lower Atchafalaya River, and then restore wetlands behind the stabilization works using material dredged during normal maintenance.

Benefits and Costs.

Project benefits and costs cannot be estimated until additional project design work is completed.

Effects and Issues.

Bank erosion along the navigation channel constitutes a wetland loss problem, which would be arrested and wetland losses restored by the proposed project. This project would need to be coordinated with the Penchant Subbasin Watershed Management Plan (PTE-26) being developed by SCS.

status.

This projects needs further development and feasibility analysis.

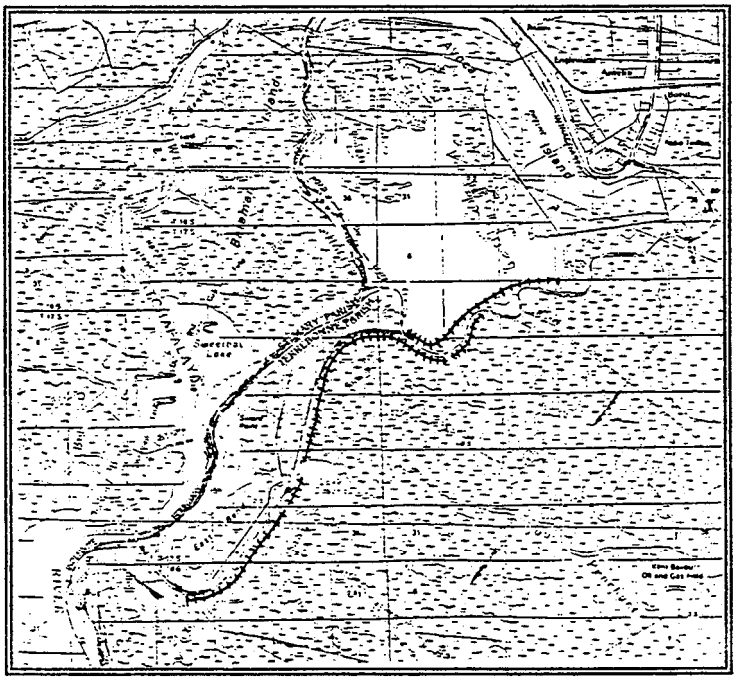


Figure 55. PTE-13 Bayou Chene, Boeuf, and Black Wetland Restoration

VERRET SUBBASIN

XTE-3 1 SEDIMENT DIVERSION/VERRET SUBBASIN

Location.

Assumption and St. Martin Parishes, in the Lake Verret-Lake Palourde area in the vicinity of the East Atchafalaya Basin Protection Levee.

Problems and Opportunities .

The proximity of the sediment resources of the Atchafalaya River and Floodway to the degrading wetlands in the Verret Subbasin provide the opportunity to transport sediment for marsh restoration.

Description of Features.

Site specific wetlands could be restored by transporting dredged material by pipeline from the Atchafalaya Floodway. Material could be obtained from high depositional areas in the Floodway by dedicated dredging or as the result of routine channel maintenance of the Alternate Route of the GIWW between Morgan City and Port Allen. Material could be deposited in existing wetlands stressed by excessive flooding and located along the western side of the Verret Subbasin.

Benefits and Costs.

No estimates of benefits or costs have yet been developed for this project.

Effects and Issues.

Aside from the anticipated effects of building and restoring wetlands, and associated effects of improving area hydrology, other project specific effects would have to be evaluated when details of project design are developed. This project is not dependent on other basin features.

status.

This project is largely conceptual, and requires further design development and evaluation.

XTE-34 SAVANNE BASIN HYDROLOGIC RESTORATION

Location.

Savanne Road between Bayou Terrebonne and Little Bayou Black, near Houma (Figure 56).

Problems and Opportunities.

The objective of this project is to restore the hydrologic flow of a twelve square mile area known as Savanne Basin, now adversely impacted by the construction of a 2.5 mile long segment of Savanne Road.

Description of Features.

The project would consist of the construction of five additional openings along the 2.5 mile roadway now obstructing the hydrologic flow across the basin.

Benefits and Costs.

Benefits have not yet been estimated for this project. The five bridge crossings would cost approximately $75,000 each for a total cost of $375,000.

Effects and Issues.

The project is expected to restore hydrologic flows and thus positively affect the area wetlands. The additional flow (or pump discharge) of fresh water into the area adjoining this project area may be able to be used beneficially, and should be reviewed. There has been recent input suggesting that the problem is not so much the road as that there is only on discharge on Little Bayou Black, and that the project should be modified to use a pump station. This possible modification should be evaluated.

status.

This project requires further design and feasibility analysis.

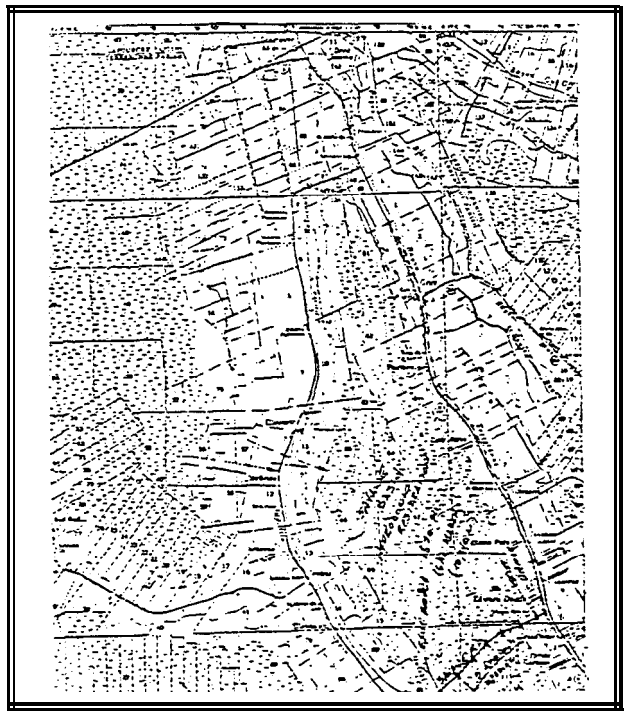


Figure 56. XTE-34 Savanne Basin Hydrologic Restoration

FIELDS SUBBASIN

TE-15 GIWW LEVEE PLANTING

Location.

The project area includes the berms of a newly constructed forced drainage project along the GIWW from Caro Canal to Devil's Swamp in Terrebonne Parish (Figure 57).

Problems and Opportunities.

The objective of this project is to create productive habitat on newly exposed ground flanking a levee on both sides. If left unplanted, the levee berm will become vegetated with shrubs and other undesirable plants.

Description of Features.

Approximately 1500 seedlings of bottomland hardwood species and 6400 baldcypress seedlings will be planted at two different time periods. Seedlings will be surrounded with predator guards. Undesirable vegetation will be controlled for one year after planting.

Benefits and Costs.

Approximately 15 acres of cypress swamp and 9 acres of bottomland hardwood forest will be initially created. There is currently no estimate of how much of this area would persist over the 20 year life of the project. Fully funded cost is estimated to be $194,000.

Effects and Issues.

The project may convert some area to cypress swamp that would otherwise persist as less productive shrub/scrub habitat. It appears that the effects of this project would be local. Given the character of the area to be planted (levee flanks), some have questioned whether this project is appropriate for CWPPRA.

Status.

This project could be considered for any of the upcoming priority project lists.

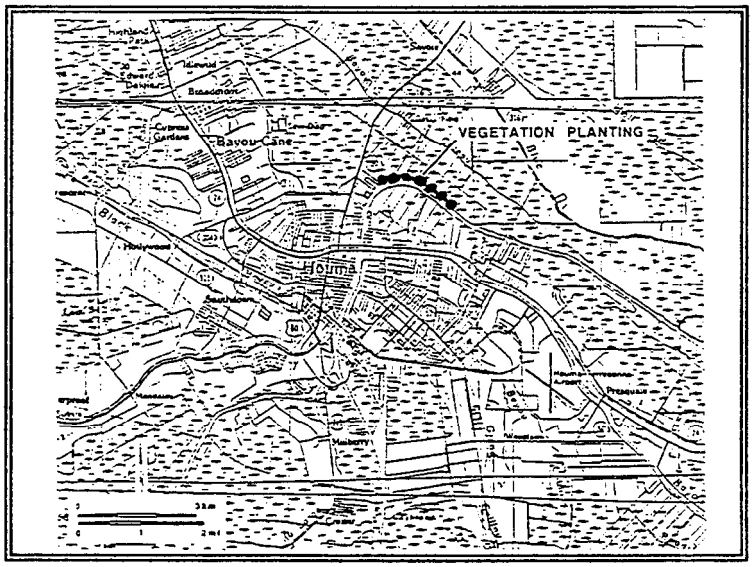


Figure 57. TE-15 GIWW Levee Planting

DEMONSTRATIONS

PTE-10 POINT AU FER RESTORATION

Location.

Point au Fer island, approximately 25 miles south of Morgan City, Louisiana; just east of Locust Bayou in the southwest portion of the island (Figure 58).

Problems and Opportunities.

The problem of marsh loss due to unintentional impoundments and other effects of canal constructions and networks is well known in coastal Louisiana. The rationale is based on reversing the consequences of documented cause-and-effect relationships between wetland loss and hydrologic change. The objective of this proposal is to demonstrate the effectiveness of restoration of marsh wetlands by re-establishment of overland flow and removal of spoil bank effects in degrade areas. Cost effectiveness will be analyzed for potential regional scale use in restoration efforts.

Description of Features.

The main feature is to modify the interlocking network of dredged spoil deposits, or spoil banks, and re-establish a more natural water flow. Spoil removal would be selective; that is, the size and locations of openings needed to restore more natural hydrology would be determined with the aid of a hydrologic model and photographic analysis of historic hydrologic flows and recent wetland change. This information will be used to identify the relationship between spoil bank placement and wetland loss. Spoil bank modification (i.e., depth of cut and percent of area removed) will be done to assure that flow velocities will remain at or below the average flow observed in healthy marsh (<5 cm/sec), to avoid the possibility of surface scour.

Benefits and Costs.

Costs and benefits for restoration at a Point au Fer site have only been estimated as a proportion of a previously proposed larger project, at 75 acres and $78,112. However, this cost estimate is questionable and needs to be reviewed.

Effects and Issues.

No adverse impacts are anticipated from this project.

status.

This project is ready for consideration on any of the upcoming priority project lists.

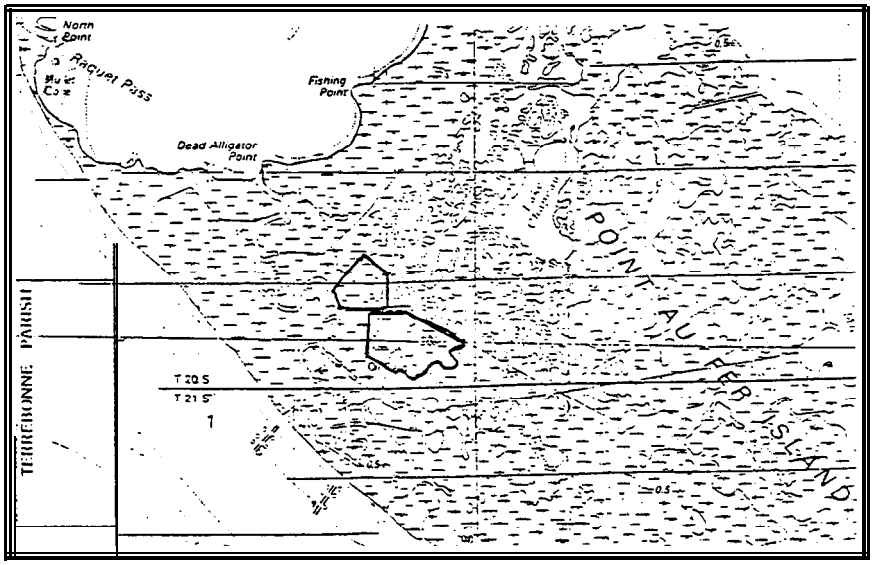


Figure 58. PTE-10 Point au Fer Restoration

XTE-53 POINT AU FER RESTORATION/SPRAY DREDGING

Location.

Areas of saline, brackish, and intermediate marshes on Point au Fer Island din western Terrebonne Parish (Figure 59). The project center is approximately 29"26'00"N, 91"15'OO"W.

Problems and Opportunities.

Losses on Point au Fer are a result of subsidence; direct loss due to construction of oil and gas canals; inpoundment and disruption of natural hydrologic patterns by artificial levees associated with oil and gas canals; increased salt loadings due to pipeline canals that are breached at their gulf ends; and natural shoreline erosion. Some decrease in wetland loss rate and marsh repair is occurring due to the increasing influence of the Atchafalaya River. The objective of this project is thus to ensure the freer movement of water, sediments, and nutrients and minimize impounding by modifying spoil banks and re-establishing a more natural water flow at moderate flow velocities (<5 centimeters per second). This will reduce plant stress by aiding the below-ground accumulation of plant material that holds soil together, stimulating the vertical accretion of the soil, and improving the plants ability to resist wave erosion.

Description of Features.

Site 1 includes degraded marsh and petroleum canals south of Locust Bayou and bounded on the west by Atchafalaya Bay. At least six spoil gap sites are needed. The material obtained from the gapping plus some mined from the canal could be dredged and sprayed to strengthen the bank line along the west central portion of the main canal.

Site 2 includes a canal that extends southwest from Locust Bayou that has modified the local drainage patterns. Three gap sites are probably needed to improve local drainage.

Site 3 includes an abandoned oil and gas canal that extends west from Locust Bayou, and splits into two canals a mile down its length. These canals will be plugged as part of CWPPRA project PTE-23/26a/33. However, at least six sites for spoil bank gapping are needed on both sides of the canal between the plugs and Locust Bayou, where the marshes are converting to open water due to impounding. The material obtained from gapping could be sprayed into the shallow water bodies adjacent to the canal to further enhance marsh recovery and development.

Benefits and Costs.

Project benefits have not been evaluated by the WVA committee. However, it is anticipated that about 1,030 acres (330 in Site 1, 100 in Site 2, and 600 in Site 3) will be protected from future losses due to impoundment. Enhanced input of Atchafalya River water and sediment, and spraying of sediment that is removed from the spoil banks is also expected to stimulate some marsh creation. Project costs are estimated at $126,615.

Effects and Issues.

No adverse impacts are anticipated from this project.

Status.

This project is ready for consideration on any future priority project list.

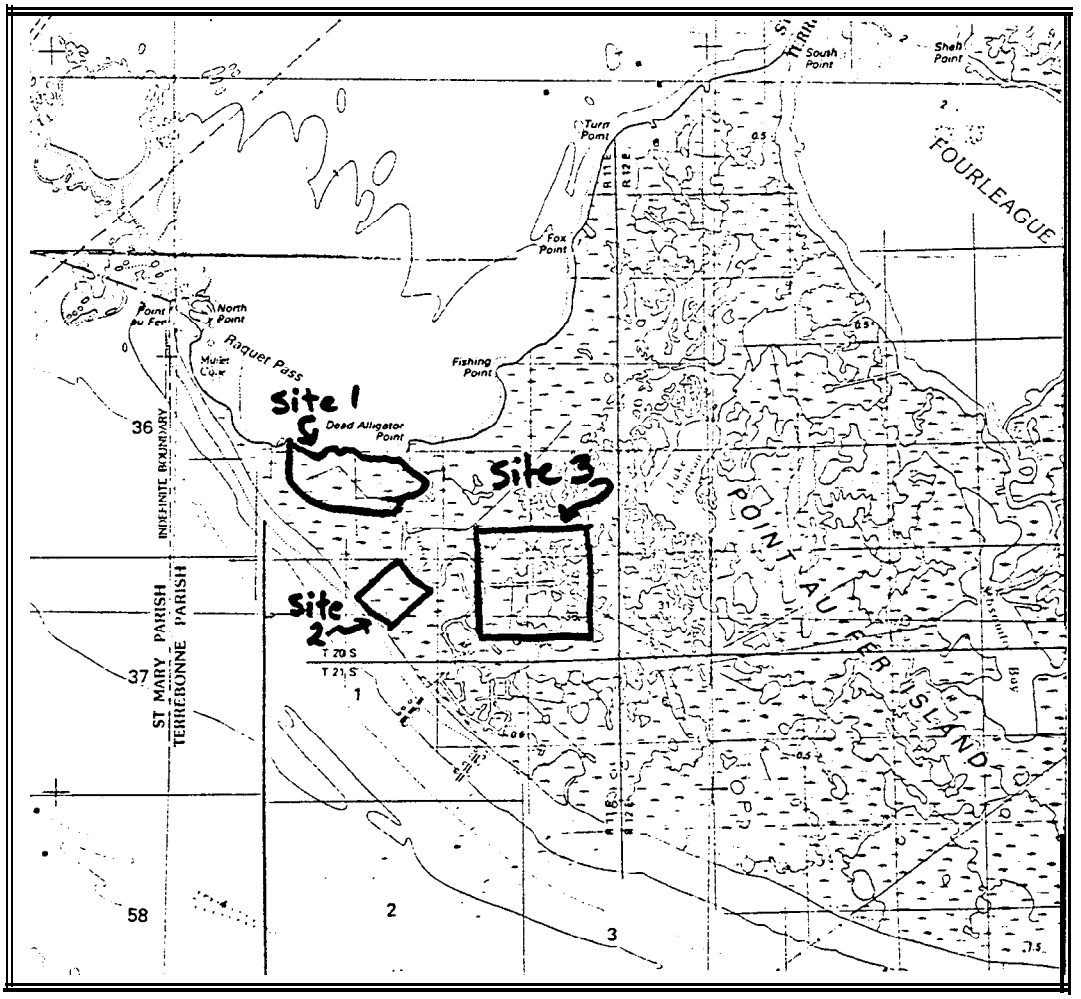


Figure 59. Point au Fer Restoration/Spray Dredge

XTE-39 LAKE BARRE OYSTER REEF DEMONSTRATION PROJECT

Location.

The proposed project area is on the north shore of Lake Barre, Terrebonne Parish. The project would extend approximately 1500 feet along the shoreline on the rapidly eroding point between Bayou Chitigue and Bayou De Mangue (Figure 60).

Problems and Opportunities.

The objectives of this demonstration project are to reduce shoreline erosion immediately by acting as a wave break, to provide a long-term source of granular material, in the form of degraded oyster shell, to area shorelines, further reducing erosion; and to enhance biological productivity and diversity.

Description of Features.

The project includes the construction of a high-profile living oyster reef in shallow water. Reef block units (each 5 ft wide by 3 ft high) would be constructed of heavy wire mesh and oyster shell on which a remote set of oyster spat had been induced. Reef blocks would be securely anchored on steel mesh and spaced on 7.5 fi centers over a 1,500 ft span immediately adjacent to the shoreline in water of 2.5-3.0 ft depth. At two year intervals during the first six years of the project, repairs to reef blocks and replenishment with spat-set shell would be make.

Benefits and Costs.

Shoreline erosion in the vicinity of the proposed project area is about 13 ft/yr (May and Britsch 1987). Halting this erosion for 10 years would preserve about 4 acres of marsh. The addition of coarse mineral matter from eroding oyster shells to the mostly organic substrates of the shoreline marshes would reduce erosion rates over a larger area over the long term, for an estimate of total benefits including enhancement of 41 acres. In addition, examining the feasibility of re-establishing viable oyster reefs, which provide habitat and biological diversity as well as direct protection against shoreline erosion, would have valuable application to many coastal regions in Louisiana. The cost of this project is estimated to be $301,000.

Effects and Issues.

Oyster reefs are known to concentrate desirable species of fish for enhanced sport and commercial harvest. No adverse environmental impacts are anticipated. It is uncertain whether a viable and self-sustaining oyster reef can be initiated and established artificially. In addition, there is concern that oysters initially introduced for establishment of the reef would be harvested by the public, destroying the reef.

status.

This project is ready for consideration on any future priority project list.

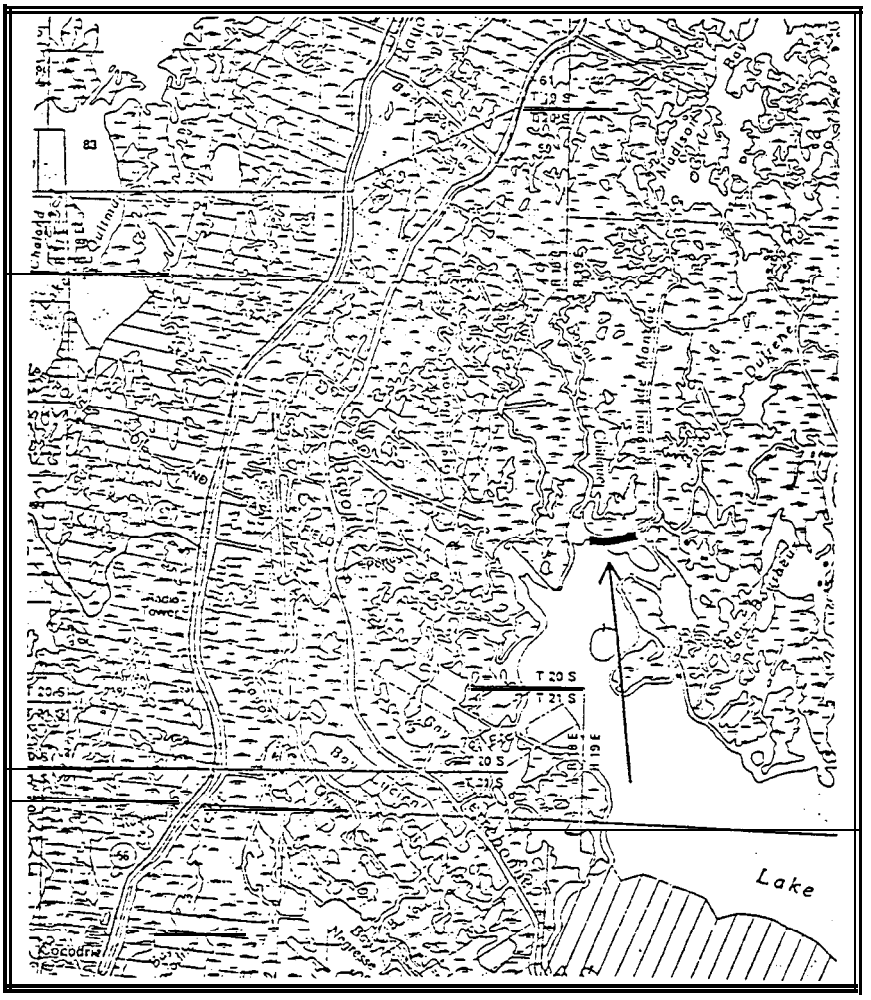


Figure 60. XTE-39 Lake Barre Oyster Reef Demonstration Project

PTE-20 BAYOU LAFOURCHE SALINITY BARRIER

Location.

Bayou Lafourche with possible locations north and south of Bollinger Shipyard, south of Golden Meadow, and north of Port Fourchon, Lafourche Parish, Louisiana (Figure 61).

Problems and Opportunities.

Project objectives are to reduce salinity levels in Bayou Lafourche to enhance adjacent marshes and improve potable drinking water.

Description of Features.

The project concept is to construct a series of low level sills in Bayou Lafourche to retard saltwater intrusion. The sill would allow navigation but constrict the cross-sectional area of the Bayou.

Benefits and Costs.

Project costs and benefits are not yet available.

Effects and Issues.

Possible impacts have not yet been evaluated. There is a concern that this is not entirely a CWPPRA project, as a major objective is to improve potable drinking water. If a major diversion of fresh water from the Mississippi River into Bayou Lafourche (XTE-52) were implemented, the need for this project would likely be eliminated. In addition, if freshwater were pumped from Verret Subbasin into Bayou Lafourche to benefit Timbalier Subbasin (XTE-50), the need for this project and/or project design may be affected.

Status.

This project requires feasibility study.

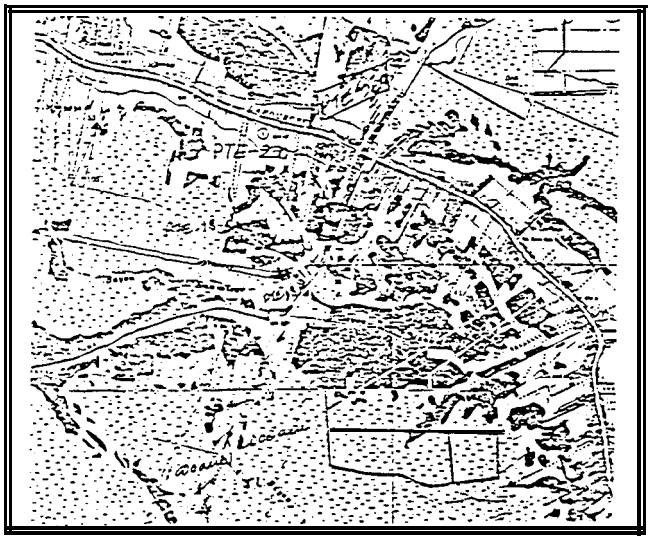


Figure 61. PTE-20 Bayou Lafourche Salinity Barrier

XTE-54A FLOTANT MARSH CREATION/ENHANCEMENT- ABANDONED CANALS

Location.

To be selected within the Penchant Subbasin.

Problems and Onnortunities.

The objective of this project is to demonstrate the technology of coastal freshwater floating marsh creation and enhancement. Since floating marshes exist in different hydrological environments, the project proposes to demonstrate several approaches that appear to have the greatest possibility for success.

Description of Features.

Project features for this subproject include manipulation of abandoned canals to encourage development of flotant marsh. Eight canals of similar length will be selected. Four will be plugged and four will be fenced to retain the plantings. Water hyacinth and maidencane will be planted. Half of the canals will be fertilized and one of each half will be protected from grazing. Monitoring will be a major part of this project.

Benefits and Costs.

Project benefits (in terms of acres created) can not be estimated until a specific project site is identified. Project costs are estimated to be $673,578.

Effects and Issues.

No adverse environmental impacts are anticipated at this time.

status.

This project was evaluated as a candidate for the Third Priority Project List, and should be considered for future lists.

XTE-54B FLOTANT MARSH CREATION/ENHANCEMENT- FENCING LEVEE BREAKS

Location.

To be selected within Penchant Subbasin.

Problems and Opportunities.

The objective of this project is to demonstrate the technology of coastal freshwater floating marsh creation and enhancement. Since floating marshes exist in different hydrological environments, the project proposes to demonstrate several approaches that appear to have the greatest possibility for success.

Description of Features.

Project features for this subproject include identification of suitable areas in freshwater floating marshes in the Penchant Subbasin, and construction of fences across levee (natural or spoil) breaks. Fencing materials include chain-link wire fencing, hog-wire fencing, etc. The project design will include an open gap, and spoil levee as "control" treatments in the design, in order to legitimately compare the new demonstration project barriers to existing conditions.

Benefits and Costs.

Project benefits (in terms of acres created) can not be estimated until a specific project site is identified. Project costs are estimated to be $8 12,612.

Effects and Issues.

No adverse environmental impacts are anticipated at this time.

status.

This project was evaluated as a candidate for the Third Priority Project List, and should be considered for future lists.

XTE-61 SEDIMENT/CYPRESS SWAMP

Location.

An area of stressed cypress swamp in Verret subbasin, probably between Lakes Palourde and Verret, Grassy Lake, and Bayou Milhomme where access to the Atchafalaya would optimize access to dredged sediments and transport distances (Figure 62).

Problems and Opportunities.

The objectives of this project are to remediate stressed conditions in the cypress swamps of Verret subbasin by nourishment with moderate applications of sediment, where subsidence and sediment starvation have led to conditions of flooding and no regeneration of the cypress; and to test and evaluate methods for introduction and distribution of sediments within a swamp.

Description of Features.

Details of this demonstration project need to be developed, but would include dredging of sediment from the Atchafalaya River, transport through pipelines or by barge, and distribution within the swamp. Sediment is available on a renewable basis from the Atchafalaya River and Stouts Pass just west of Flat Lake. It may be advisable to use multiple methods of application of the sediment as part of the demonstration, to determine whether spray application of sediments within the swamp is necessary for even application at the desired thickness or whether making use of the natural flooding regime by introduction of a sediment slurry will suffice. Movement of pipes and any delivery system among the trees must be worked out as part of this project, as do possible modifications that may be needed to protect the standing trees (e.g., from high pressure of spray applicators).

Benefits and Costs.

An estimate of the acreage benefitted by this proposed project will require final definition of the project area, amount of sediment to be delivered, and other design features. Project costs are also not yet available.

Effects and Issues.

No adverse environmental impacts are anticipated. This project would need to be coordinated with the lynchpin project of hydrologic restoration in Verret subbasin.

Status.

This project requires further design and feasibility analysis.

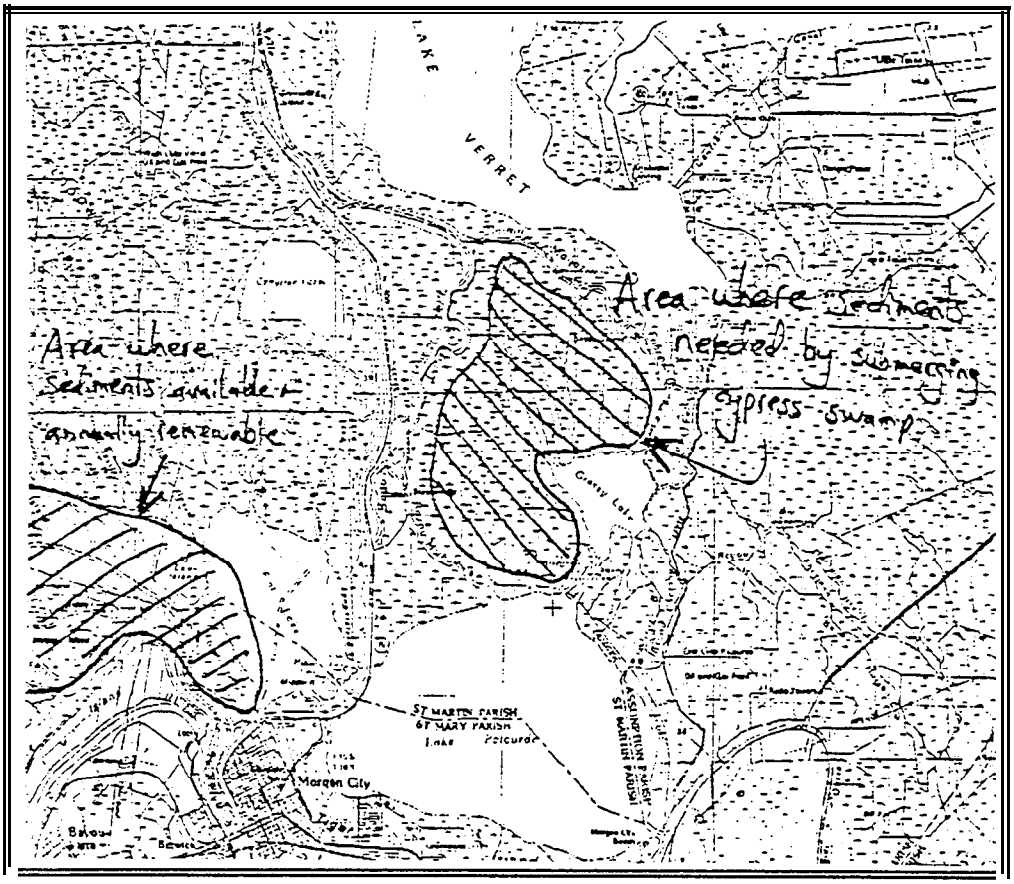


Figure 62. Sediment . . . . . Cypress Swamp

XTE-43 RED MUD COASTAL RESTORATION DEMONSTRATION

Location.

The site of the proposed wetland restoration project is in St. James Parish, Louisiana, about 14 miles east of Sorrento at 30'03'50"N and 90'40'35"W (Figure 63). The site is roughly rectangular in shape and measures approximately 3 acres.

Problems and Opportunities.

A rich source of sediment is no longer available to many wetland areas under the present hydrologic regime, and this absence of suitable sediment to replenish vital wetlands is a major problem in Louisiana. Application of processed Bauxite soil (commonly referred to as red mud) to eroding marsh environments represents a portentially viable solution for curtailing coastal land loss.

Description of Features.

The objectives of this project are to demonstrate in the field that the red mud can provide a substrate suitable for creation of emergent marsh that sustains wetlands biota in a cost-effective and environmentally unobtrusive manner. This field-based study is a necessary complement to the controlled laboratory experiments currently funded by Kaiser Aluminum and Chemical Company at Louisiana State University. This project will provide a qualitative comparison of plant growth on various red mud applications, an indication of potential ecological effects, nad rates of sediment transport. Approximately 3 acres of fresh marsh will be created with red mud at a test site in Gramercy. The red mud will be pumped from the plant to the test area using existing pipes. The application areas will be separated by low levee or sill type structures or silt curtains.

Benefits and Costs.

Approximately 3 acres of deteriorating shallow fresh water will be restored to emergent fresh marsh. The hydrodynamic conditions under which the red mud behaves will be characterized for potential application to the much-needed open water environments. Project costs have been estimated at $529,000.

Effects and Issues.

Where marsh is re-created in open water, benthic habitat will be lost in proportion to the emergent marsh created. No adverse effects will occur to neighboring wetlands because of the inert nature of the red mud, and because this project will be performed in a confined area to eliminate off-site concerns during the test situation. The main issue regarding use of this sediment is whether contaminants occur in the sediment that would be biologically available and toxic upon deposition at the creation site. Chemical and biotoxicity assay have been conducted on this material, indicating the material is non-toxic. Additional chemical and toxicological testing is being conducted; these and previous results are being compared and evaluated with respect to background levels and regulated limitations. In addition, studies to determine the growth characteristics of this sediment and possible nutrient or organic requirements are being conducted.

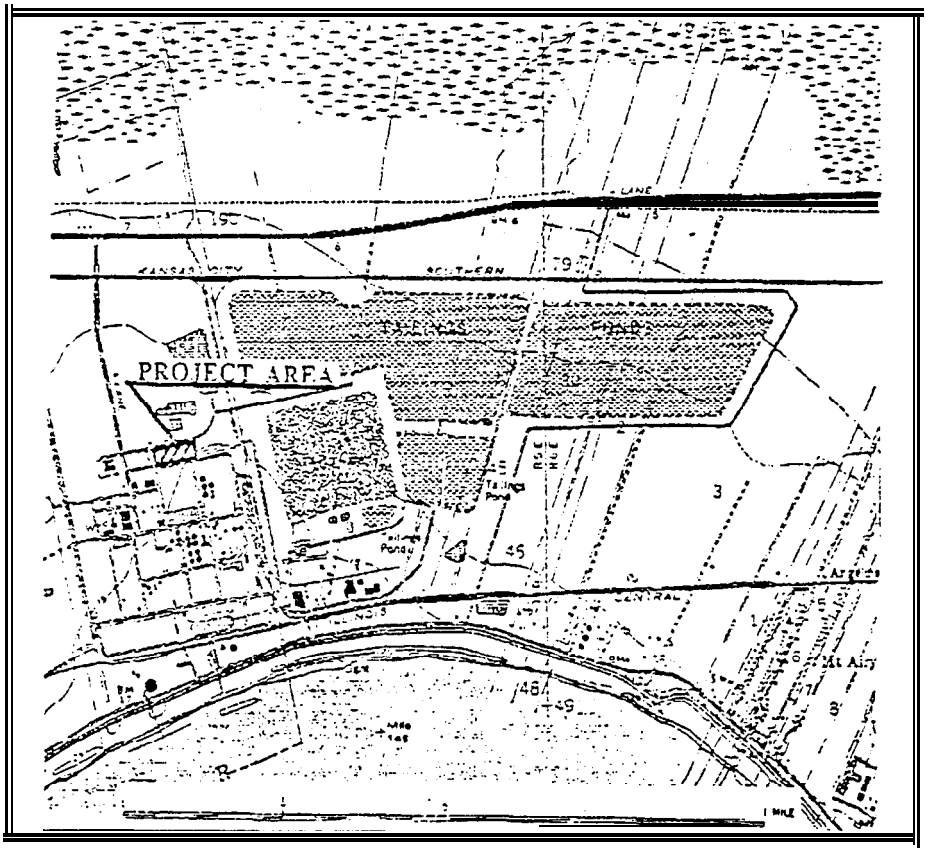


Figure 63. Red Mud Coastal Restoration Demonstration.

XTE-66 SEDIMENT CONVEYANCE DEMONSTRATION

Location.

The west bank of the Houma Navigation Canal from the intersection of the HNC and Bayou Grand Caillou, extending north for a distance of 13,000-13,500 feet, and extending back from the bank for a distance of approximately 4,000 feet (Figure 64). The area does not overlap the Falgout Canal South Marsh Creation site (TE-21).

Problems and Opportunities.

This project would focus on the delivery (i.e., sediment application) and evaluate the potential for its use as part of a needed regional, and coast-wide, sediment conveyance system for wetland restoration.

Description of Features.

The objective of this project is to test the effectiveness of a gravity driven overland flow system for direct application of sediment as a wetland creation and enhancement technique. The project has the possibility of testing a most cost effective technique for applying a variety of sediments to wetlands in a manner that most nearly mimics natural processes. The project would help to determine how a specified amount of deposition can be obtained over wide areas of wetlands having different plant densities. The project is proposed to pump hydraulically slurried sediments into a pipeline placed along the inside of the bank of the HNC. The pipeline would be perforated at several locations to produce a l-dimensional flow into the wetland. The project would involve applying approximately 200,000 to 300,000 cy of sediment in an area of approximately 12,400 acres. Slurries of various concentrations, discharges, and durations would be applied at several points along the length of the project at the HNC border. This area contains broken and degraded marsh, and open water areas. This project continues the efforts to lead to development of a system for introduction of sediment into deficit areas that cannot benefit from a direct diversion. This project has been coordinated with the Corps of Engineers.

Benefits and Costs.

Benefits are estimated as 20 acres of marsh created/restored, 530 acres protected, and 530 acres enhanced, for a total benefit of 1,080 acres. Project costs are estimated at $1,228,000.

Effects and Issues.

Where marsh is re-created in open water, benthic habitat will be lost in proportion to the emergent marsh created. Other disturbances during project implementation should be minimal, as no heavy equipment would be deployed in the marsh being restored.

status.

This project is ready for consideration on any future priority project list.

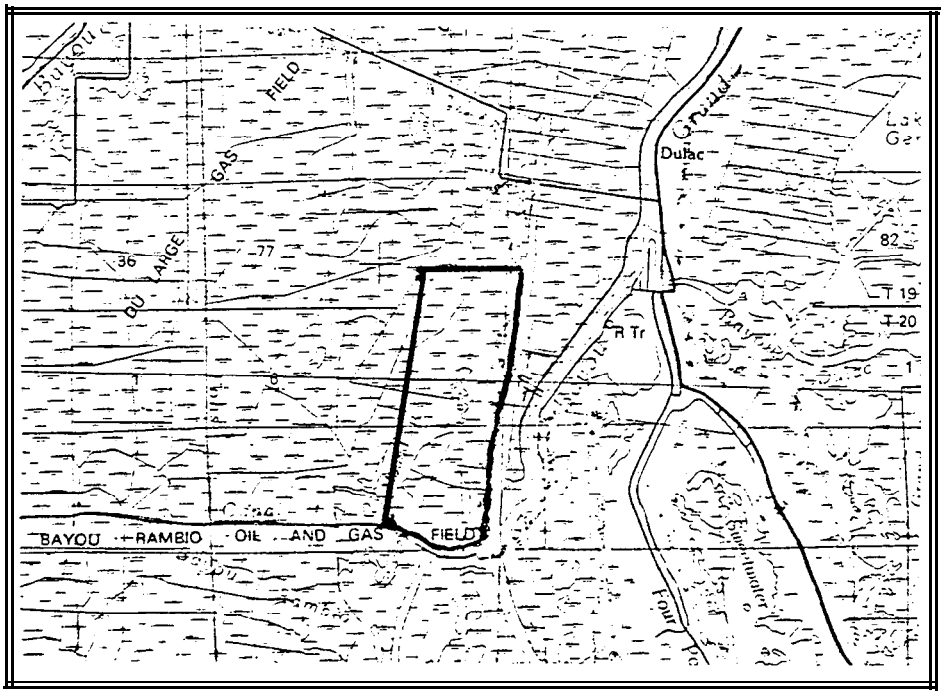


Figure 64. Sediment Conveyance Demonstration

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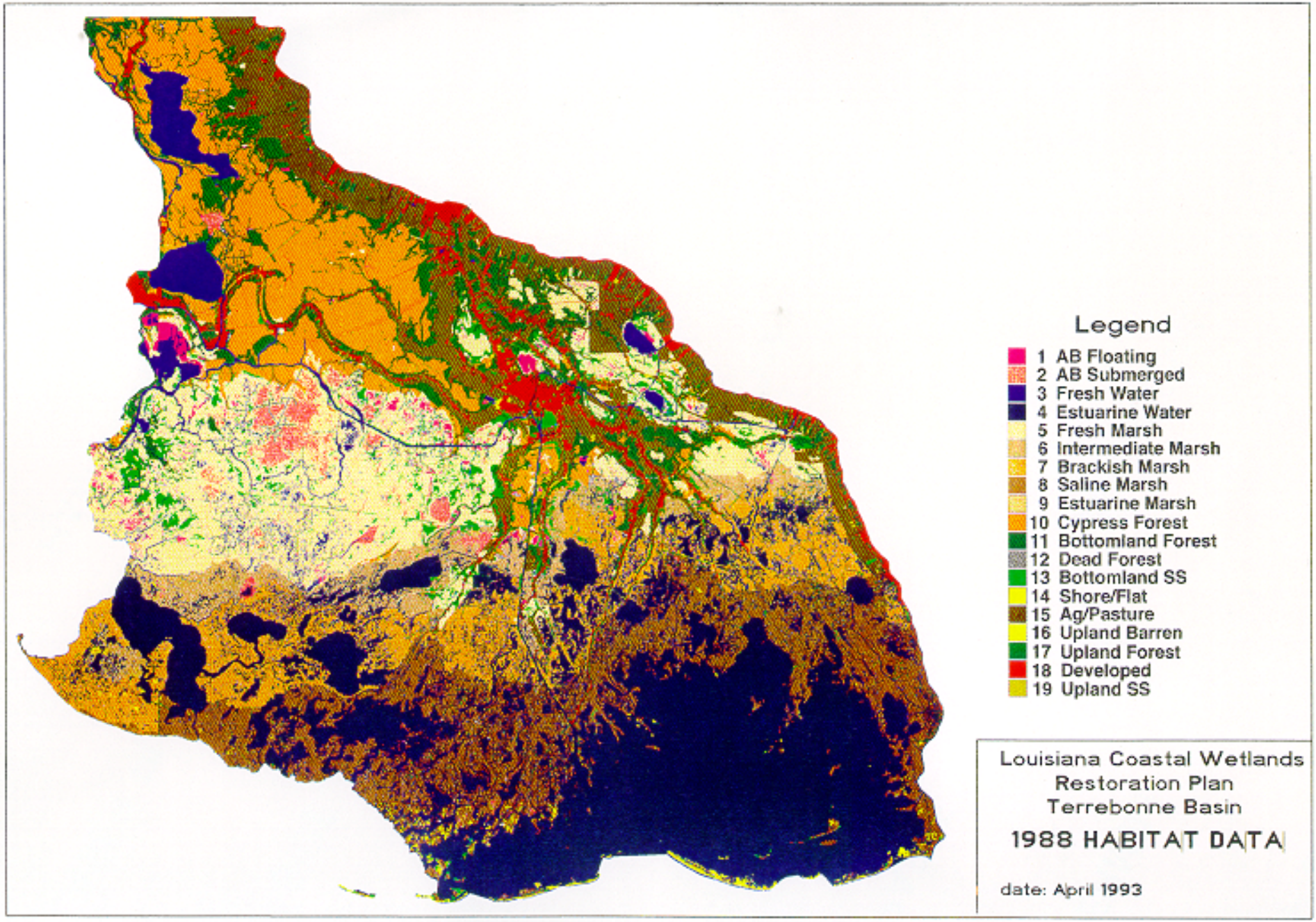

Louisiana Coastal Wetlands
Restoration Plan
Terrebonne Basin

1988 HABITAT DATA

date: April 1993

PLATE 1