DRAFT

Appendix B

PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT

Louisiana Coastal Area, (LCA) Louisiana — Comprehensive Coastwide Ecosystem Restoration Study

Lead Agency: U.S. Army Corps of Engineers (USACE)- Mississippi Valley, New Orleans District (MVN).

ABSTRACT: As a result of natural coastal processes and human activities, coastal Louisiana has lost more than 1.22 million acres of coastal wetlands within the last 70 years. As recently as the 1970s, the loss rate for Louisiana's coastal wetlands was as high as 25,600 acres per year (or about 40.0 square miles per year). The net rate of land loss between the years 1978-2000 was about 19,136 acres per year (or 29.9 square miles per year) (Barras et al 2003). A U.S. Geological Survey study done for this project predicts that 328,000 acres will vanish over the next 50 years. The 120-year loss (1978-2050) could exceed the combined land area of Delaware, the District of Columbia, and the Baltimore, Maryland metropolitan area. The cumulative effect of natural processes and the residual effects of past human activity in the coastal area has been to drastically alter the natural balance from the net land-building deltaic processes to land loss due to a combination of altered hydrology, subsidence, and erosion. To address the issue of coastal wetland loss, the U.S. Army Corps of Engineers (USACE), along with other Federal and state partners, is conducting the Louisiana Coastal Area Comprehensive Coastwide Ecosystem Restoration Study (LCA Comprehensive Study). The purpose of this study is to develop alternative and comprehensive plans that support the restoration of the coastal wetlands of Louisiana. The measures and alternatives defined within the study will be capable of achieving and sustaining a coastal ecosystem that can support and protect the environment, economy, and culture of southern Louisiana and thus, contribute to the economy and well being of the nation. This PEIS and report do not contain a recommended plan for implementation. The USACE is taking the opportunity to solicit additional public input on the coastwide plans in the final array in order to better scrutinize and select a recommended plan. The recommended plan will be selected with respect to achieving completeness, effectiveness, acceptability, and efficiency. Comments received during the public review process, will be used in recommending a plan for authorization. The process being employed will ensure full consideration and input from government agencies and the public on the selection of a recommended coastwide plan.

Comments:
Please send your comments or questions on the Programmatic Environmental Impact Statement to the U.S. Army Corps of Engineers, New Orleans District, Attention: William P. Klein, Jr., P.O. Box 60267, New Orleans, Louisiana 70160-0267. Telephone: (504) 862-2540.

Due date: comments are due within 45 days of the postmark date of this document.

SUMMARY

GENERAL

This draft Programmatic Environmental Impact Statement (PEIS) for the Louisiana Coastal Area (LCA), Louisiana — Comprehensive Coastwide Ecosystem Restoration Study (hereinafter LCA Comprehensive Study) was prepared by the U.S. Army Corps of Engineers (USACE)-Mississippi Valley, New Orleans District (MVN). The LCA Comprehensive Study builds on the restoration strategies presented in the Coast 2050 Plan and the May 1999, Reconnaissance Report "Section 905(b) (WRDA 86) Analysis: Louisiana Coastal Area, Louisiana—Ecosystem Restoration." The LCA Comprehensive Study is authorized through Resolutions of the U.S. House of Representatives and Senate Committees on Public Works, 19 April 1967, and 19 October 1967.

The LCA Comprehensive Study focused on "lessons learned" from previous Louisiana coastal restoration efforts, the existing Coast 2050 restoration strategies, and the best available science and technology to develop measures which were used to create a final array of programmatic, coastwide, ecosystem restoration plans.

PURPOSE AND NEED

Purpose and Goal

The purpose of this study is to develop alternative and comprehensive plans that support the restoration of the coastal wetlands of Louisiana. The measures and alternatives defined within the study will be capable of achieving and sustaining a coastal ecosystem that can support and protect the environment, economy, and culture of southern Louisiana and thus contribute to the economy and well being of the nation. To accomplish this, the study will identify a plan that is comprehensive, coordinated, and consistent with other major land use and infrastructure features, particularly with respect to navigation, hurricane protection, flood control, and oil and gas production.

The goal of the LCA Comprehensive Study is to develop a plan to rehabilitate the coastal ecosystem by promoting the distribution of riverine freshwater, nutrients, and sediments using natural processes and ensuring the structural integrity of the estuarine basins. The plan will reverse the current degradation of the coastal ecosystem. Implementing the LCA Comprehensive Plan will achieve the following:

- A restored coastal ecosystem having the highest practicable acreage of healthy, productive, and diverse wetlands.
- A sustainable coastal ecosystem with the essential functions, assets, and values of the natural ecosystem.
- A restoration accomplished through an integrated program that results in multiple use benefits; benefits not solely for wetlands, but for communities, industries, and resources of the coast.

Components of the LCA Comprehensive Plan will include structural and non-structural solutions and combinations thereof. The possible solutions include freshwater diversions, sediment diversions, outfall management, hydrologic restoration, interior shoreline protection, barrier system (i.e., barrier shoreline, headland, and island) and gulf shoreline protection, beneficial use of dredged material, and dedicated dredging. Whenever possible, the LCA Comprehensive Plan would employ restoration strategies that rely on natural processes to create and restore coastal wetlands and enhance wetland functionality. The re-introduction of freshwater and sediment from the Mississippi River and its distributaries best embodies this concept. Once a diversion is implemented, natural land building processes are re-established.

The report and PEIS do not contain a recommended plan for implementation. The USACE is taking the opportunity to solicit additional public input on the coastwide plans in the final array in order to better scrutinize and select a recommended plan. The recommended plan will be selected with respect to achieving completeness, effectiveness, acceptability, and efficiency. Comments received during the public review process, will be used in recommending a plan for authorization. The process being employed will ensure full consideration and input from government agencies and the public on the selection of a recommended coastwide plan.

Need

Mississippi River water and sediments from 31 states and 2 Canadian provinces helped form the Louisiana coastline through what is known as the "deltaic process". According to U.S. Geological Survey (USGS) data, generated in conjunction with the State of Louisiana's Department of Wildlife and Fisheries, there are approximately 1.63 million acres of non-fresh marsh, 1.15 million acres of swamp and forested scrub/shrub wetlands, and 878,000 acres of fresh marsh that encompass a total of about 3.67 million acres of coastal wetlands in Louisiana. Louisiana accounts for about 45 percent of the intertidal marsh, 14 percent of coastal wetlands (marsh, mangrove and maritime forests) and, overall, about 30 percent of all coastal marshes within the lower 48 states (USGE 2000; Field et al., 1991; Dahl 2000). However, nearly 90 percent of all coastal land loss in the lower 48 states today is occurring within Louisiana. As a result of natural coastal processes and human activities, coastal Louisiana has lost more than 1.22 million acres of coastal wetlands within the last 70 years (Dunbar et al 1992; Barras et al 1994; Barras et al., 2003). As recently as the 1970s, the loss rate for Louisiana's coastal wetlands was as high as 25,600 acres per year (or about 40 square miles per year). The net rate of land loss between years 1978–2000 was about 19,136 acres per year (or about 30 square miles per year) (Barras et al 2003).

A recent USGS study estimates that a total land loss of 674 square miles and a total land gain of 161 square miles will occur by 2050. Sources of land gains considered in the estimate include the following: Coastal Wetland Planning Protection and Restoration Act (Public Law 101-646, Title III) projects: 54 square miles; Caernarvon Freshwater Diversion: 25 square miles; Davis Pond Freshwater Diversion: 53 square miles; Atchafalaya Delta building: 14 square miles; and Mississippi River Delta building: 15 square miles. The land gains consist of (1) new land created and (2) land protected or maintained. Thus, the estimated projected net land loss by 2050 is 513 square miles.

The continued loss of Louisiana's coastal wetlands places the following wetland functions and values at risk: fishery resources; commercial and recreational North American Central Flyway waterfowl wintering habitat; resting and refueling areas for neotropical migrants; barrier reefs, headlands, shorelines, and islands that provide critical habitat not only for many species of fish and wildlife, but also for threatened and endangered species.

Equally important are the social and economic consequences resulting from coastal land loss. Overall, up to $100 billion of critical energy, transportation, and industrial infrastructure in the coastal zone is at increased risk from storm damage if coastal land loss continues unabated. The following human environmental sectors are linked, and thus impacted, by continuing coastal landscape degradation and loss: inland and deep draft navigation, flood control, water supply, agriculture (within Louisiana and nationally), tourism/recreation, hunting and fishing, utility supply and infrastructure, water quality, general industry, onshore oil and natural gas facilities, habitat/species protection, social and cultural resources, private residences and businesses, and national security issues.

CAUSES OF LAND LOSS

Coastal land loss is typically the result of complex interactions among natural and human activities upon the landscape. Therefore, it is difficult to isolate any one activity as the singular cause of a specific area of coastal land loss. Many studies have been conducted to identify the major contributing factors (e.g.. Boesch et al., 1994; Turner, 1997; Gagliano, 1998; Penland et al., 2000; Day et al., 2001d; Morton, 2002). Essentially most studies agree that coastal land loss and the massive degradation of the coastal ecosystem can be attributed to natural and human factors that have lead to loss of coastal wetlands from saltwater intrusion, erosion, and disruption of natural processes. Natural factors include land subsidence, geologic faulting, compacting of muddy and organic sediments, river floods, global sea-level rise, and erosion from storms and waves erosion, and hurricanes. Human influences on the landscape include construction and management of levees and flood control structures, construction of navigation channels, canals and their dredged material embankments that disrupt the internal hydrology of the delta provide a conduit for saltwater intrusion; boat and ship traffic, mineral extraction, and jetty construction. The interaction of these and other causes have produced complex patterns and time sequences of stress to the ecosystem leading to substantial loss of coastal marshes and land.

STUDY AREA

The study area is Louisiana’s coastal area from Mississippi to Texas. This area contains two major provinces that were formed by different geologic processes: the Deltaic Plain and the Chenier Plain. The Deltaic Plain has been divided into three hydrologic subprovinces. The Chenier Plain forms a fourth subprovince (figure S-1).

Deltaic Plain

- Subprovince 1: Lower Mississippi River, Pontchartrain, Lower Pearl, and Breton Sound Basins
- Subprovince 2: Barataria Basin.

- Subprovince 3: Lower portions of Teche-Vermilion, Atchafalaya, and Terrebonne Basins.

Chenier Plain

- Subprovince 4: Lower portions of Calcasieu/Sabine and Mermentau Basins.

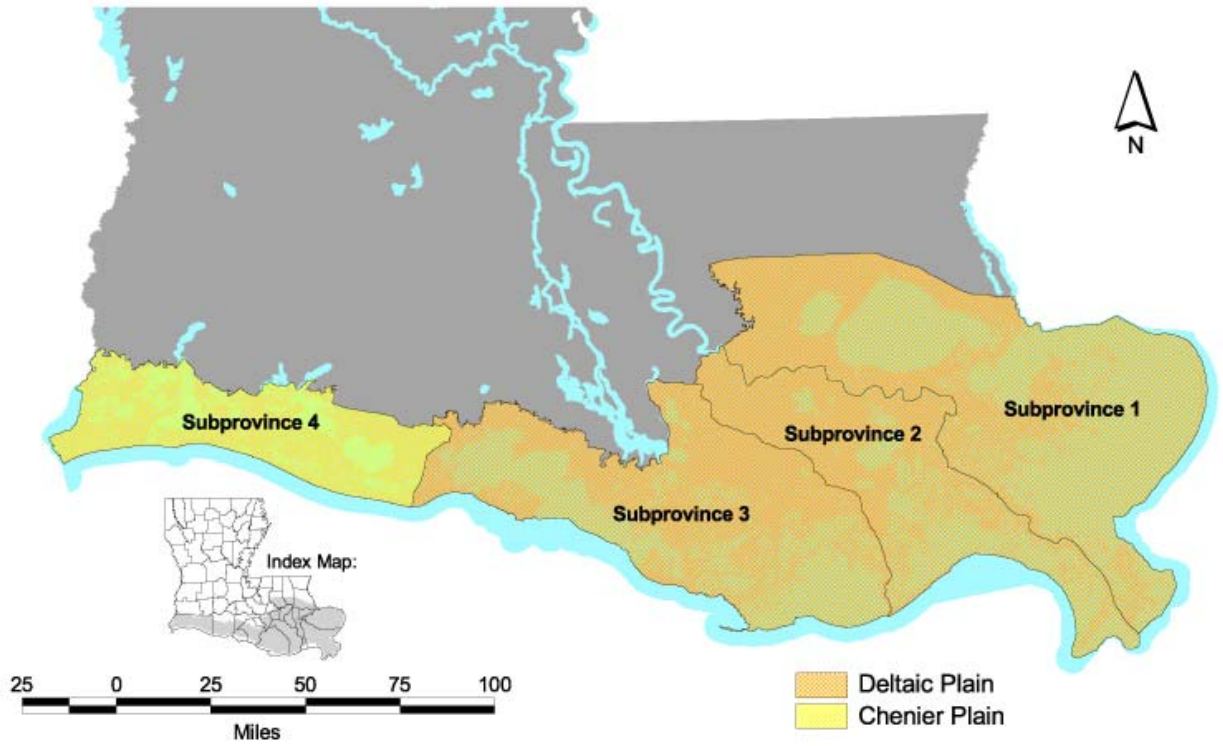

Figure S-1 Deltaic and Chenier Plains and LCA comprehensive study Subprovinces

DEVELOPMENT OF ALTERNATIVE PLANS

The first step was development of Planning Objectives:

Hydrogeomorphic:

1. Establish dynamic salinity gradients that reflect natural cycles of freshwater availability and marine forcing
    a. In the Deltaic Plain, re-establish freshwater input.
    b. In the Chenier Plain, manage freshwater inputs and limit saltwater penetration.
2. Increase sediment input to the Deltaic Plain to sustain and rejuvenate existing wetlands and rebuild marsh substrate.
3. Maintain or establish natural landscape features that are critical to sustainable ecosystem structure and function.

Ecosystem:

4. Increase land-water ratios and increase connectivity and material exchanges to improve productivity and sustain diverse fish and wildlife habitats.
5. Reduce nutrient delivery to the shelf by routing Mississippi River waters through estuarine basins.

Following this step, the project delivery team (PDT) assessed the Coast 2050 for keystone strategies that were ecosystem scale. Using the ecosystem strategies for coastal restoration from the Coast 2050 Plan as a guide, the PDT undertook the development of restoration measures for each of the subprovince. The measures that were developed also needed to be able to be combined to achieve the established planning targets. The PDT assembled into sub-groups to develop restoration measures to fit the strategic requirements of each subprovince. This phase of plan formulation identified a range of practical and accepted restoration measures along with their characteristics. The PDT succeeded in developing and quantifying an initial suite of discreet possible solutions for coastwide restoration.

Over 160 preliminary restoration measures were initially developed. These measures were then screened amongst all significant resources to derive a shortened list of measures that would best address the restoration strategy for each subprovince. The following restoration targets for each subprovince were then developed:

Reduce: Rate of annual net land loss reduced by 50 percent of the future with no action annual net land loss rate (-5 mi^2/yr)
Maintain: No net loss of land (land gain would equal land loss)
Increase: Rate of annual net land loss stopped and in addition, a 50 percent annual net gain would be achieved (+5 mi^2/yr)

FINAL ARRAY OF COASTWIDE PLANS

With a "toolbox" of restoration measures developed and a range of quantitative targets for the study identified, the next plan formulation step was the combination of these restoration measures into a variety of alternatives for meeting the targets in each subprovince. These subprovince alternatives were then combined to produce the most cost effective coastwide plans.

Coastwide plans were developed with a level of detail sufficient to assess the impacts and benefits of the different plans and to estimate preliminary costs. However each of the measures in these plans will require further feasibility level analysis to support future project authorization. Therefore, each of the detailed restoration measures listed in the final array of plans below should be regarded as an example to be further developed in terms of pinpointing the site and manner of operation.

In the following descriptions, a small diversion is less than 10,000 cubic feet per second (cfs), a medium diversion is from 10,000 to 20,000 cfs and a large diversion is more than 20,000 cfs. In addition to the description below, also see Table ES-1 in Executive Summary of Main Report

Plan *5110*

This plan relies solely on reintroduction of the Mississippi River in Subprovince 1 where it has two small diversions in the Pontchartrain Basin and two mediums and one large diversion in the Breton Basin. In Subprovince 2, this plan emphasized minimizing salinity change with a small diversion with sediment enrichment in the upper basin, a small diversion in the mid basin, combined with sediment delivery by pipeline, a large diversion in the lower basin, and barrier island restoration and marsh creation at Feasibility Study Sites. In Subprovince 3, this plan maximizes use of the Atchafalaya flow eastward and Atchafalaya delta development, rebuilding historic reefs at the south end of Atchafalaya Bay, multi-purpose operation of the Houma Navigation Canal Lock and maintaining the land bridge between Bayou du Large and Bayou Grand Caillou. A study would be conducted on modification of the operational scheme of the Old River Control Structure (ORCS). In Subprovince 4, this plan would have perimeter salinity control at the remaining four uncontrolled bayous in the western Calcasieu/Sabine Basin, a lock on the Gulf Intracoastal Waterway (GIWW), freshwater introduction at 5 sites along Highway 82, modification of the existing Cameron-Creole Watershed structures, salinity control at two sites near the Sabine River, East Sabine Hydrologic Restoration project, gulf shoreline stabilization on Rockefeller Refuge, beneficial use from the Calcasieu Ship Channel and dedicated dredging for marsh creation. In addition, it would study freshwater allocation in the Chenier Plain. This plan is estimated to create/preserve a net of 365,230 acres of by 2050.

Plan *10130*

This plan modifies Plan *5110* by adding studies of several large projects and various small projects in each subprovince. It uses continuous reintroduction in Subprovince 1 with two small diversions in the Pontchartrain Basin and two mediums and one large diversion in the Breton Basin. It adds the environmental features to be chosen in the Mississippi River Gulf Outlet (MRGO) Reevaluation Study, a hydrologic restoration, two small diversions, and the authorized CWPPRA project for opportunistic use of the Bonnet Carre Spillway and marsh creation in the Pontchartrain Basin. Plan *10130* also recommends reauthorization of the Caernarvon Diversion with marsh creation as a purpose. This plan attempts to minimize salinity change in Subprovince 2 with four small diversions in the upper basin and one in the lower basin with accompanying marsh creation by pipeline plus a large diversion in the lower basin. The plan includes barrier island restoration and marsh creation at the Feasibility Study Sites. It also adds reauthorization of Davis Pond Diversion at 5,000 cubic feet per second (cfs) and studies of the feasibility of the "third delta" and Mississippi River Delta management. This plan relies on maximizing Atchafalaya flow eastward and Atchafalaya delta development in Subprovince 3 as well as multi-purpose operation of the Houma Navigation Canal Lock and maintaining the land bridge between Bayou du Large and Bayou Grand Caillou. It adds stabilization of the north shore of East Cote Blanche Bay, restoration of the barrier islands (including a second lift), an additional land bridge, rebuilding the historic Point Chevreuil Reef and gulf shoreline stabilization on Pointe Au Fer Island. It also includes the above-mentioned study of the third delta and a study of modification of the ORCS operational scheme to benefit coastal wetlands. The Perimeter Plan, freshwater introduction at five sites along Highway 82, modification of the existing Cameron-Creole Watershed structures, salinity control at two sites near the Sabine River, East Sabine Hydrologic Restoration project, gulf shoreline stabilization on Rockefeller Refuge, beneficial use

from the Calcasieu Ship Channel and dedicated dredging for marsh creation are chosen in Subprovince 4 with an additional set of culverts and dedicated dredging added. The lock in the GIWW is not part of this plan. In addition, a study of the freshwater allocation in Vermilion Parish is recommended. This plan is estimated to create/preserve a net of 431,369 acres of by 2050.

Plan *7410*

In Subprovince 1, this plan attempts to minimize salinity change with a one small and one medium diversion in the Pontchartrain Basin, and one small and two medium diversions in the Breton Basin in conjunction with numerous sediment deliveries via pipeline projects. In Subprovince 2, this plan minimizes salinity change with a small diversion in the upper basin with sediment enrichment, a small diversion in the mid-basin with accompanying sediment delivery by pipeline, a large diversion in the fresher part of the lower basin, several sediment delivery by pipeline in the lower basin and barrier island restoration and marsh creation at Feasibility Study Sites. In Subprovince 3, this plan maximizes use of the Atchafalaya flow eastward and Atchafalaya delta development, rebuilding historic reefs at the south end of Atchafalaya Bay, multi-purpose operation of the Houma Navigation Canal Lock and maintaining the land bridge between Bayou du Large and Bayou Grand Caillou. A study would be conducted on modification of the operational scheme of the ORCS. In Subprovince 4, this plan would have perimeter salinity control at the remaining four uncontrolled bayous in the western Calcasieu/Sabine Basin, a lock on the GIWW, freshwater introduction at 5 sites along Highway 82, modification of the existing Cameron-Creole Watershed structures, salinity control at two sites near the Sabine River, East Sabine Hydrologic Restoration project, gulf shoreline stabilization on Rockefeller Refuge, beneficial use from the Calcasieu Ship Channel and dedicated dredging for marsh creation. In addition, it would study freshwater allocation in Vermilion Parish. This plan is estimated to create/preserve a net of 384,713 acres of by 2050.

Plan *5610*

This plan relies solely on reintroduction of the Mississippi River in Subprovince 1 where it has two small diversions in the Pontchartrain Basin and two mediums and one large diversion in the Breton Basin. In Subprovince 2, this plan attempts to mimic historic hydrology with four small diversions in the upper basin, two large diversions in the lower basin and barrier island restoration. In Subprovince 3, this plan maximizes use of the Atchafalaya flow eastward and Atchafalaya delta development, rebuilding historic reefs at the south end of Atchafalaya Bay, multi-purpose operation of the Houma Navigation Canal Lock and maintaining the land bridge between Bayou du Large and Bayou Grand Caillou. A study would be conducted on modification of the operational scheme of the ORCS. In Subprovince 4, this plan would have perimeter salinity control at the remaining four uncontrolled bayous in the western Calcasieu/Sabine Basin, a lock on the GIWW, freshwater introduction at 5 sites along Highway 82, modification of the existing Cameron-Creole Watershed structures, salinity control at two sites near the Sabine River, East Sabine Hydrologic Restoration project, gulf shoreline stabilization on Rockefeller Refuge, beneficial use from the Calcasieu Ship Channel and dedicated dredging for marsh creation. In addition, it would study freshwater allocation in Vermilion Parish. This plan is estimated to create/preserve a net of 462,566 acres of by 2050.

Plan *5410*

This plan relies solely on reintroduction of the Mississippi River in Subprovince 1 where it has two small diversions in the Pontchartrain Basin and two mediums and one large diversion in the Breton Basin. In Subprovince 2, this plan minimizes salinity change with a small diversion in the upper basin with sediment enrichment, a small diversion in the mid-basin with accompanying sediment delivery by pipeline, a large diversion in the fresher part of the lower basin, several sediment delivery by pipeline in the lower basin and barrier island restoration and marsh creation at Feasibility Study Sites. In Subprovince 3, this plan maximizes use of the Atchafalaya flow eastward and Atchafalaya delta development, rebuilding historic reefs at the south end of Atchafalaya Bay, multi-purpose operation of the Houma Navigation Canal Lock and maintaining the land bridge between Bayou du Large and Bayou Grand Caillou. A study would be conducted on modification of the operational scheme of the ORCS. In Subprovince 3, this plan maximizes use of the Atchafalaya flow eastward and Atchafalaya delta development, rebuilding historic reefs at the south end of Atchafalaya Bay, multi-purpose operation of the Houma Navigation Canal Lock and maintaining the land bridge between Bayou du Large and Bayou Grand Caillou. A study would be conducted on modification of the operational scheme of the ORCS. In Subprovince 4, this plan would have perimeter salinity control at the remaining four uncontrolled bayous in the western Calcasieu/Sabine Basin, a lock on the GIWW, freshwater introduction at 5 sites along Highway 82, salinity control at two sites near the Sabine River, East Sabine Hydrologic Restoration project, gulf shoreline stabilization on Rockefeller Refuge, beneficial use from the Calcasieu Ship Channel and dedicated dredging for marsh creation. In addition, it would study freshwater allocation in Vermilion Parish. This plan is estimated to create/preserve a net of 411,497 acres of by 2050.

Plan *7610*

In Subprovince 1, this plan attempts to minimize salinity change with a one small and one medium diversion in the Pontchartrain Basin, and one small and two medium diversions in the Breton Basin in conjunction with numerous sediment deliveries via pipeline projects. In Subprovince 2, this plan attempts to mimic historic hydrology with four small diversions in the upper basin, two large diversions in the lower basin and barrier island restoration. In Subprovince 3, this plan maximizes use of the Atchafalaya flow eastward and Atchafalaya delta development, rebuilding historic reefs at the south end of Atchafalaya Bay, multi-purpose operation of the Houma Navigation Canal Lock and maintaining the land bridge between Bayou du Large and Bayou Grand Caillou. A study would be conducted on modification of the operational scheme of the ORCS. In Subprovince 4, this plan would have perimeter salinity control at the remaining four uncontrolled bayous in the western Calcasieu/Sabine Basin, a lock on the GIWW, freshwater introduction at 5 sites along Highway 82, modification of the existing Cameron-Creole Watershed structures, salinity control at two sites near the Sabine River, East Sabine Hydrologic Restoration project, gulf shoreline stabilization on Rockefeller Refuge, beneficial use from the Calcasieu Ship Channel and dedicated dredging for marsh creation. In addition, it would study freshwater allocation in Vermilion Parish. This plan is estimated to create/preserve a net of 435,782 acres of by 2050.

Plan *7002*

In Subprovince 1, this plan attempts to minimize salinity change with a one small and one medium diversion in the Pontchartrain Basin, and one small and two medium diversions in the Breton Basin in conjunction with numerous sediment deliveries via pipeline projects. In Subprovince 2, this plan attempts to increase acreage while minimizing salinity change by providing a small diversion in the upper basin with sediment enrichment, a small diversion in the lower basin with sediment delivery by pipeline, a large diversion in the fresher portion of the lower basin, and numerous sediment delivery by pipeline projects in the lower basin. Barrier island restoration at Feasibility Study sites would be included. This alternative also includes study of relocation of the Mississippi River Navigation Channel, the Third Delta and modification of operational scheme of the ORCS. In Subprovince 3, this plan would attempt to achieve no net loss. It maximizes use of the Atchafalaya flow eastward and Atchafalaya delta development, rebuilding historic reefs at the south end of Atchafalaya Bay, multi-purpose operation of the Houma Navigation Canal Lock and maintaining the land bridge between Bayou du Large and Bayou Grand Caillou. A study would be conducted on modification of the operational scheme of the ORCS. In addition this plan would stabilize banks of Southwest Pass, maintain northern shore of East Cote Blanche Bay at Point Marone, rebuild the historic Point Chevreuil Reef, rehabilitate Terrebonne barrier islands, rehabilitate northern shorelines of Terrebonne/Timbalier Bays, backfill selected pipeline canals, maintain land bridge between Caillou Lake and gulf, stabilize gulf shoreline of Point Au Fer Island, and maintain Timbalier land bridge. In Subprovince 4, this plan would have perimeter salinity control at the remaining four uncontrolled bayous in the western Calcasieu/Sabine Basin, a lock on the GIWW, freshwater introduction at 5 sites along Highway 82, modification of the existing Cameron-Creole Watershed structures, salinity control at two sites near the Sabine River, East Sabine Hydrologic Restoration project, gulf shoreline stabilization on Rockefeller Refuge, beneficial use from the Calcasieu Ship Channel and dedicated dredging for marsh creation. In addition, it would study freshwater allocation in Vermilion Parish. This plan is estimated to create/preserve a net of 577,198 acres of by 2050.

IMPACTS OF FINAL ARRAY

The comparison of the percentage of total wetlands in Future with No Action with percentages of total in the final array plans shows that in every plan, brackish marsh disappears in Subprovince 2 and the percent brackish marsh declines in all subprovinces except with Plan *7002*. Saline marsh disappears in No Action and all final array plans in Subprovinces 2 and 4. Saline marsh percentage of the total increases from 17 to 110 percent in all plans. Swamp percentage of total declines slightly from No Action in every plan. Intermediate marsh percentage of total increases from 7 to 37 percent above No Action in all plans. Fresh marsh percentage of total increases significantly above No Action in all plans in every Subprovince. Plans *5610*, *5110*, *10130* and *5410* have the smallest percentages of saline and brackish marsh while Plan 7002 has the highest percentage. The exact differences between plans are fully described in chapter 4 of the PEIS. Plan *7002* produces the most land of all the plans in the final array, and Plan *5110* the least.

Each of the seven plans in the final array would have a positive effect on wildlife resources by increasing riverine and sediment input from the Mississippi River in Subprovinces 1 through 3, in concert with marsh creation in key areas, which would greatly sustain and rejuvenate existing wetland habitats, promote significant land-building, and promote fresher habitat conditions. Increased acreage marsh in Subprovince 4 would be more productive and provide improved habitat conditions for many wildlife species.

A U.S. Fish and Wildlife Service Habitat Evaluation Procedures (HEP) model shows that of the wildlife analyzed, those which prefer fresher habitats (mink, otter, dabbling ducks and alligator) would benefit in all plans in the final array. The muskrat would decline in all plans except Plan *7002*, which increases brackish marsh. The dabbling ducks and American alligator would increase from 10-20 percent with each plan while the changes in other wildlife are less than 10 percent.

The fisheries impacts were assessed by utilizing the predictions of the Land-Building and Habitat Switching Models (see appendix D), along with the consideration of seasonal variation in salinity, temperature and freshwater discharge.

Many of the plans in the final array have similar impacts. Nearly all would improve habitat suitability for freshwater fisheries. In addition, most plans would improve habitat for low and moderate salinity fisheries (gulf menhaden, blue crab, white shrimp and red drum) that utilize submerged aquatic vegetation. In Subprovince 4, if the water control structures are designed and operated to maximize estuarine and marine fisheries while minimizing salt-water events, the plan should improve fishery productivity. In general, Plans *5110*, *10130*, and *5410* would improve fisheries overall (freshwater, estuarine and marine) except for oysters, because they would increase the amount of marsh and nutrients available to fisheries.

Plan *7410*, which depends less on diversions than most other plans would have the least adverse impact on estuarine and marine fisheries.

In most plans American oysters could be adversely impacted by sedimentation and over-freshening.

Species that use higher salinity areas (brown shrimp and spotted seatrout) would be displaced in nearly all plans and severely impacted in some plans. Plan *7002* with the largest diversions would have the most severe impact on marine fisheries. The diversity of habitat types in Subprovince 2, and the eastern portion of Subprovince 3, would be significantly decreased. Many fishery species that utilize those areas would be displaced. In Subprovince 2 and the eastern portion of Subprovince 3, it is possible that species assemblages that utilize barrier islands may be displaced offshore to areas where they may not survive. Less freshwater tolerant species, such as spotted seatrout and brown shrimp, may be entirely displaced from those areas directly affected by the large diversions (reintroductions). Immigration of larvae and juveniles of many fishery species may be affected by the large amount of water flowing into the subprovinces. Plan *7002* would also have the most significant impact on oysters. Plans *5610* and *7610* would also have significant displacement of brown shrimp and spotted seatrout in Subprovinces 1 and 2.

In terms of impacts to other significant resources, all plans have similar results, just varying in amounts. There would be a decrease in the loss of the following habitats: shell reefs, barrier islands and gulf shoreline. Amphibians and reptiles, mammals, birds would have an increase in habitat, as would threatened and endangered species. Gulf hypoxia would be reduced. Storm damage to infrastructure such as oil and gas facilities, pipelines, hurricane protection levees and navigation channels, as well as homes and businesses, would be reduced.

CONSISTENCY OF THE FINAL ARRAY OF COASTWIDE PLANS WITH OTHER EFFORTS

Louisiana's wetlands are working wetlands in that humans live and work in the same wetlands they rely on and must restore. All alternatives include goals for consistency with the Clean Water Act, Coastal Zone Management Act, and future USACE hurricane and flood protection projects and navigation projects.

Ecosystem Sustainability

The USACE Environmental Operating Principles promote projects that "Strive to achieve environmental sustainability." The need to move towards ecosystem sustainability was considered throughout the LCA Comprehensive Study planning process, from development of the Comprehensive Study Guiding Principles and identification of core ecosystem restoration strategies to the formulation of specific measures and coastwide alternatives. As a result of this continuous emphasis on sustainability, the final array alternatives, while representing a mix of approaches to coastal restoration, nevertheless rely extensively on river-reintroduction projects for restoring coastal Louisiana.

Adaptive Management And Monitoring

The final array of plans for the LCA Comprehensive Study contains plans that are designed to help restore natural ecosystem processes, such as reintroduction of the river, which in turn would build landscapes and help to restore ecosystem functions. Because these landscape and ecosystem changes depend on the degree to which natural processes can be restored, it is difficult to predict with great certainty their resulting temporal and spatial configurations. Hence, adaptive management and monitoring would be an integral part of the LCA Comprehensive Study effort.

Monitoring may reveal where projects have exceeded or fallen short of a desired response. It would be necessary to constantly assess the landscape and ecosystem response to the restoration actions. Such information may necessitate changes in design and/or operation for both existing and future projects to ensure that the selected alternative reaches the expected targets. It is also possible that monitoring would reveal where the expectations for the ecosystem should be adjusted to reflect new understandings with respect to the effectiveness of specific projects or types of projects. Hence, both the expectations and the projects would be subject to change in response to new data and the evolving scientific understanding of coastal restoration in Louisiana.

CONCLUSION

The LCA Comprehensive Coastwide Ecosystem Study report evaluates an array of coastwide plans, presenting the effects of each plan and comparisons of all the plans. This report does not contain a recommended plan for implementation. The USACE is taking the opportunity to solicit additional public input on the coastwide plans in the final array in order to assure as open a process as possible in the selection of a recommended plan. The recommended plan will be selected with respect to achieving completeness, effectiveness, acceptability, and efficiency. Comments received during the public review process will be used in recommending a plan for authorization. The process being employed will ensure full consideration and input from government agencies and the public on the selection of a recommended coastwide plan.

The final array of alternatives consists of the most cost-effective and implementable plans to address comprehensive coastwide ecosystem restoration in the State of Louisiana. Each of the alternative plans considered includes ecosystem restoration measures in all four coastal Louisiana subprovinces.

The final array accomplishes the Hydrogeomorphic Planning Objectives 1 and 2 (described earlier on page PEIS-4). In the Deltaic Plain, the alternatives reintroduce significant freshwater and sediment from the Mississippi River at multiple locations and scales. In the Chenier Plain, the alternatives employ salinity controls to manage freshwater inputs and limit saltwater penetration from the coast.

Components of the final array are directed at Hydrogeomorphic Planning Objective 3 (described earlier on page PEIS-4) through conservation and restoration of barrier islands and shorelines, several critical land bridges, and historic shell reefs.

The final array meets Ecosystem Panning Objective 1 (described earlier on page PEIS-5) by increasing total wetland area in all subprovinces. The increased introduction of Mississippi River water and sediment, as well as the improved management of Atchafalaya River water throughout Subprovince 3, provides significant opportunities to improve connectivity and material exchange. The array increases vegetative productivity in Subprovinces 1-3 and reduces it by less than 2 percent in Subprovince 4.

The final array meets Ecosystem Planning Objective 2 (described earlier on page PEIS-5) by reducing Gulf of Mexico hypoxia.

The final array complies with the National goal of “no net loss of wetlands” and the USACE’s Environmental Operating Principles.

DRAFT

Appendix B

PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT

Louisiana Coastal Area, (LCA) Louisiana — Comprehensive Coastwide Ecosystem Restoration Study

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