AUTHENTICATED
U.S. GOVERNMENT
INFORMATION
GPO

116th Congress, 1st Session – – – – – – – – – – – – – – House Document 116–69

SOUTHWEST COASTAL LOUISIANA INTEGRATED FINAL FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT STATEMENT

COMMUNICATION

FROM

THE ASSISTANT SECRETARY OF THE ARMY, CIVIL WORKS, THE DEPARTMENT OF DEFENSE

TRANSMITTING

THE CORPS' SOUTHWEST COASTAL LOUISIANA INTEGRATED FINAL FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT STATEMENT FOR APRIL 2016

PART 1 OF 2



SEPTEMBER 24, 2019.—Referred to the Committee on Transportation and Infrastructure and ordered to be printed

SOUTHWEST COASTAL LOUISIANA INTEGRATED FINAL FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT STATEMENT—PART 1 OF 2

116th Congress, 1st Session – – – – – – – – – – – – – – House Document 116–69

SOUTHWEST COASTAL LOUISIANA INTEGRATED FINAL FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT STATEMENT

COMMUNICATION

FROM

THE ASSISTANT SECRETARY OF THE ARMY, CIVIL WORKS, THE DEPARTMENT OF DEFENSE

TRANSMITTING

THE CORPS' SOUTHWEST COASTAL LOUISIANA INTEGRATED FINAL FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT STATEMENT FOR APRIL 2016

PART 1 OF 2

SEPTEMBER 24, 2019.—Referred to the Committee on Transportation and Infrastructure and ordered to be printed

U.S. GOVERNMENT PUBLISHING OFFICE

37–899 WASHINGTON : 2019

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
CIVIL WORKS
108 ARMY PENTAGON
WASHINGTON DC 20310-0108

JUL 10 2019

The Honorable Nancy Pelosi
Speaker of the House
U.S. House of Representatives
Washington, D.C. 20515

Dear Madam Speaker:

In partial response to a resolution of the U.S. House of Representatives Committee on Transportation and Infrastructure, adopted December 7, 2005, and to Section 7003 of the Water Resources Development Act (WRDA) of 2007, the U.S. Army Corps of Engineers (Corps) developed the enclosed Integrated Feasibility Report & Environmental Impact Statement, dated April 2016 (Revised September 2016), which addresses hurricane storm surge damage risk reduction and ecosystem restoration in Calcasieu, Cameron, and Vermilion Parishes in southwest Louisiana. The recommended plan for the Southwest Coastal Louisiana project is described in the report of the Chief of Engineers, dated July 29, 2016, and was authorized by Section 1401(8) of the Water Resources Development Act of 2016 (Public Law 114-322).

The recommended plan includes National Economic Development (NED) and National Ecosystem Restoration (NER) features. Implementation of the NER plan would provide substantial restoration of coastal habitat (green infrastructure) which would strengthen the resiliency of the NED plan features.

The NED plan reduces the risk of coastal storm damages in Cameron, Calcasieu, and Vermilion Parishes through independent features that elevate or flood-proof structures. The NED plan includes raising approximately 3,500 residential structures in-place above the predicted 2075 1-percent chance base flood elevation; flood-proofing approximately 350 non-residential structures; and constructing earthen berms around approximately 160 warehouses. The risk evaluation and forecast, plan selection, and risk reduction design elevations are based on the projection of an intermediate rate of relative sea level rise. The raising of residential structures, the flood-proofing of non-residential structures, and the construction of localized storm surge risk reduction measures would be implemented on a voluntary participation basis. The recommended plan has no significant adverse effects, consequently there are no compensatory mitigation requirements.

The NER plan is comprised of 49 features to restore coastal habitats in Cameron, Calcasieu, and Vermilion Parishes. The NER plan would provide benefits in two estuaries by rebuilding tidal wetlands, preventing shoreline erosion, and replanting rare native vegetation addressing land loss and ecosystem degradation. The recommended NER plan includes nine marsh restoration measures restoring a net total of 7,900 acres of brackish and saline marsh with 2,700 Average Annual Habitat Units (AAHUs); five shoreline protection measures protecting a net total of 6,135 acres of marsh with 1,738 AAHUs; and 35 chenier reforestation measures that would plant cheniers with live oak and hackberry for a net total of 1,413 acres with 538 AAHUs. Overall, the recommended NER plan would

reforest, protect, and restore a net total of 15,448 acres with a total of 4,976 AAHUs. The NER plan restores and protects 260,000 acres of habitat designated as Federal or state refuge in the study area. This includes protecting 84 miles of designated shoreline, 335 acres of designated critical wintering habitat for the threatened piping plover, and 72,000 acres of Wetland Conservation Area designated for an experimental population of the threatened whooping crane.

The Coastal Protection and Restoration Authority Board of Louisiana (CPRAB) is the non-Federal cost-sharing sponsor for all hurricane storm surge damage risk reduction and ecosystem restoration features. Based on October 2018 price levels (Fiscal Year 2019), the total estimated project first cost of the recommended Corps Plan is $3,328,964,000. The total cost of lands, easements, rights-of-way, relocations, and dredged or excavated material disposal areas is estimated at $72,100,000.

Based on October 2018 price levels, the project first cost for the NED plan is $1,056,126,000. In accordance with the cost sharing provisions of Section 103 of the Water Resources Development Act (WRDA) of 1986, as amended, the Federal share of the project first cost of the NED plan features would be $686,481,900 (65 percent). The non-Federal share of the first costs of the NED plan would be $369,644,100 (35 percent). CPRAB would be responsible for the operation, maintenance, repair, rehabilitation, and replacement (OMRR&R) of the project after construction, a cost currently estimated at about $5,000 per year. The total cost of lands, easements, rights-of-way, relocations, and dredged or excavated material disposal areas is estimated at $61,970,000.

Based on October 2018 price levels, the project first cost for the Corps NER plan is $2,272,838,000. In accordance with the cost sharing provisions of Section 103 of the WRDA 1986, as amended, the Federal share of the project first cost of the ecosystem restoration features would be $1,477,344,700 (65 percent). The non-Federal share of the first costs of the ecosystem restoration features would be $795,493,300 (35 percent). CPRAB would be responsible for the OMRR&R of the project after construction, a cost currently estimated at about $6,077,160 per year. Post-construction monitoring and adaptive management of the ecosystem restoration project may be conducted for no more than 10-years at an estimated cost of $67,394,000. The total cost of lands, easements, rights-of-way, relocations, and dredged or excavated material disposal areas is estimated at $10,130,000.

Additionally, the two long range studies recommended under the Corps NER plan are to study a hydrologic and salinity control structure (Cameron-Creole Spillway) and a long-range study of a Calcasieu Ship Channel salinity control structure estimated to cost $6,000,000, cost shared with CPRAB at a 50/50 rate, or $3,000,000 each.

Based on October 2018 price levels, a discount rate of 2.875 percent, and a 50-year period of economic analysis, the total equivalent average annual costs of the NED plan are estimated to be $37,726,000, including OMRR&R. Implementing the NED plan would reduce expected average annual flood damages by about 93 percent for structures in the projected 2025 25-year floodplain. Equivalent annual residual damages are estimated at $17,246,000. The equivalent annual benefits are estimated to be $217,651,000, with net

The total equivalent annual costs of the Corps NER plan are estimated to be $94,128,428 including OMRR&R, monitoring, and adaptive management. Implementing the Corps' NER plan would produce 4,365 average annual habitat units on more than 13,946 acres of aquatic and riparian habitat.

An Environmental Impact Statement and Record of Decision were prepared in accordance with the National Environmental Policy Act. The recommended plan has been identified as the environmentally preferred plan. Adverse environmental impacts have been avoided and minimized where practicable. No compensatory mitigation is required.

The Office of Management and Budget (OMB) advises that the project is not consistent with the policy and programs of the President. The OMB also noted that the project would need to compete with other proposed investments for funding in future budgets. A copy of OMB's letter, dated May 29, 2019, is enclosed. I am providing a copy of this transmittal and the OMB letter to the Subcommittee on Water Resources and Environment of the House Committee on Transportation and Infrastructure, and the Subcommittee on Energy and Water Development of the House Committee on Appropriations. I am also sending an identical letter to the President of the Senate.

Sincerely,

R.D. James
Assistant Secretary of the Army
(Civil Works)

5 Enclosures

1. Report of the Chief of Engineers, July 29, 2016
2. OMB Letter, May 29, 2019
3. Record of Decision, June 2019
4. State & Agency Review
5. Integrated Feasibility Report & Environmental Impact Statement/Report, April 2016 (Revised September 2016)

DEPARTMENT OF THE ARMY
CHIEF OF ENGINEERS
2600 ARMY PENTAGON
WASHINGTON, D.C. 20310-2600

DAEN

JUL 29 2016

SUBJECT: Southwest Coastal Louisiana

THE SECRETARY OF THE ARMY

1. I submit for transmission to Congress my report on hurricane storm surge damage risk reduction and ecosystem restoration in three parishes in southwestern Louisiana. It is accompanied by the report of the New Orleans District Engineer and the Mississippi Valley Division Engineer. These reports are in partial response to a resolution of the U.S. House of Representatives Committee on Transportation and Infrastructure, adopted 7 December 2005, and to Section 7003 of the Water Resources Development Act (WRDA) of 2007. The resolution requested the Secretary of the Army to survey the coast of Louisiana in Cameron, Calcasieu, and Vermilion Parishes, with particular reference to the advisability of providing hurricane protection and storm damage risk reduction and related purposes, including the feasibility of constructing an armored 12-foot levee along the Gulf Intracoastal Waterway. Section 7003 of WRDA 2007 authorized a program for ecosystem restoration for the Louisiana Coastal Area to be carried out substantially in accordance with the report of the Chief of Engineers dated 31 January 2005, which recommended further study of various large scale restoration concepts. If funded, preconstruction engineering and design activities for the National Economic Development (NED) recommended plan would continue under the authority of the 7 December 2005 resolution, and would continue for the National Ecosystem Restoration (NER) recommended plan under the authority of Section 7003 of WRDA 2007.

2. The reporting officers recommend authorizing a NED plan of localized storm surge risk reduction features to reduce hurricane storm surge damage risks in Cameron, Calcasieu, and Vermilion Parishes. The NED plan reduces the risk of coastal storm damages through independent features that elevate or flood-proof structures in the 25-year floodplain predicted to occur in 2025. The NED plan includes raising approximately 3,500 residential structures in-place above the predicted 2075 1-percent chance base flood elevation; flood-proofing approximately 350 non-residential structures; and constructing earthen berms around approximately 160 warehouses. The risk evaluation and forecast, plan selection, and risk reduction design elevations are based on the projection of an intermediate rate of relative sea level rise. The raising of residential structures, the flood-proofing of non-residential structures, and the construction of localized storm surge risk reduction measures will be implemented on a voluntary participation basis. It is recommended that the NED plan be authorized for implementation over a 20-year construction period. The recommended plan has no significant adverse effects, consequently there are no compensatory mitigation requirements.

3. The reporting officers recommend authorizing a NER plan comprised of 49 features to restore coastal habitats in Cameron, Calcasieu, and Vermilion Parishes. The NER plan will provide

benefits in two estuaries by rebuilding tidal wetlands, preventing shoreline erosion, and replanting rare native vegetation addressing land loss and ecosystem degradation. The recommended NER plan includes nine marsh restoration measures restoring a net total of 7,900 acres of brackish and saline marsh with 2,700 Average Annual Habitat Units (AAHUs); five shoreline protection measures protecting a net total of 6,135 acres of marsh with 1,738 AAHUs; and 35 chenier reforestation measures that would plant cheniers with live oak and hackberry for a net total of 1,413 acres with 538 AAHUs. Overall, the recommended NER plan would reforest, protect, and restore a net total of 15,448 acres with a total of 4,976 AAHUs. The NER plan restores and protects 260,000 acres of habitat designated as federal or state refuge in the study area. This includes protecting 84 miles of designated shoreline, 335 acres of designated critical wintering habitat for the threatened piping plover, and 72,000 acres of Wetland Conservation Area designated for an experimental population of the threatened whooping crane. This critical wintering habitat is also utilized by the rufa subspecies of the threatened red knot. The benefitted acres are located at a critical intersection of the North American flyway and support both wintering migratory water fowl and neo tropical migrant species in transit from South and Central America. The NER plan would restore very scarce marine forest habitat (oak and hackberry trees) on the coastal chenier features unique to this area of the gulf and critical to many species utilizing the flyway. The NER plan enhances overall plant productivity, which reinforces and protects critical landscape features and enhances the resilience of a geomorphic framework that support both the ecology and management of risk throughout the area. Monitoring and adaptive management of this ecosystem restoration project will be conducted for a period up to 10-years post-construction. If ecological success has not been achieved within the 10-year period, the costs for monitoring and adaptive management will be a 100% non-federal responsibility.

In addition to a construction recommendation, the reporting officers also recommend continued study of a hydrologic and salinity control structure (Cameron-Creole Spillway) and a long-range study of a Calcasieu Ship Channel salinity control structure that were identified in this study as potentially viable features but require additional analysis for construction.

Two of the nine identified marsh restoration features are partially located on United States Fish and Wildlife Service (USFWS) property (Sabine National Wildlife Refuge and Cameron Prairie National Wildlife Refuge) and are included in the recommended NER plan. These features are vitally important to help preserve the Calcasieu Lake rim and prevent vast new expanses of open water from forming should the lake rim be breached by erosional forces. The total project first costs for the measures on USFWS property are estimated at $296,839,000 and would provide 1,492 acres and 611 AAHUs. The acquisition of some privately held lands adjacent to USFWS property would be required for implementation of each feature to be complete. A cost of approximately $800,000 for this real estate acquisition is included in the estimates. Because USFWS is ultimately responsible for managing its refuge lands, USACE is not seeking authorization nor funding for the features located on USFWS lands. The reporting officers recommend development of an implementation plan by the State of Louisiana and USFWS for these two features. This subset of the NER plan, all features of the NER minus the two USFWS features, represents the "Corps Plan." The full NER plan, with all features including the two USFWS features, represents the "Federal Plan."

The two USFWS features are not included in the Land, Easements, Rights-of-Way, Relocations, and Disposal Areas (LERRDs) necessary for the construction and operation, maintenance, repair, rehabilitation and replacement (OMRR&R) of the Corps Plan.

4. The Coastal Protection and Restoration Authority Board of Louisiana (CPRAB) is the non-federal cost-sharing sponsor for all hurricane storm surge damage risk reduction and ecosystem restoration features. Based on October 2015 price levels, the total estimated project first cost of the recommended Corps Plan is $3,094,276,000. The total cost of lands, easements, rights-of-way, relocations, and dredged or excavated material disposal areas is estimated at $72,100,000.

a. Based on October 2015 price levels, the project first cost for the purposes of authorization and calculating the maximum cost of the project pursuant to Section 902 of WRDA 1986, as amended, for the NED plan is $906,091,000. The total cost of lands, easements, rights-of-way, relocations, and dredged or excavated material disposal areas is estimated at $61,970,000. In accordance with the cost sharing provisions of Section 103 of the Water Resources Development Act (WRDA) of 1986, as amended, the federal share of the project first cost of the NED plan features would be $588,959,000 (65 percent). The non-federal share of the first costs of the NED plan would be $317,132,000 (35 percent). CPRAB will be responsible for the OMRR&R of the project after construction, a cost currently estimated at about $5,000 per year.

b. Based on October 2015 price levels, the project first cost for the purposes of authorization and calculating the maximum cost of the project pursuant to Section 902 of WRDA 1986, as amended, for the NER plan is $2,188,185,000. In accordance with the cost sharing provisions of Section 103 of the WRDA 1986, as amended, the federal share of the project first cost of the ecosystem restoration features would be $1,422,321,000 (65 percent). The non-federal share of the first costs of the ecosystem restoration features would be $765,865,000 (35 percent). CPRAB will be responsible for the OMRR&R of the project after construction, a cost currently estimated at about $5,958,000 per year. Post-construction monitoring and adaptive management of the ecosystem restoration project may be conducted for no more than 10-years at an estimated cost of $62,807,000.

c. The NER plan includes a three tiered implementation sequence. (1) Tier I features may be constructed simultaneously because they would not affect the construction of any nearby Tier I NER recommended plan feature. Shoreline protection features would be constructed prior to marsh restoration features in an effort to better protect the more storm-vulnerable marsh restoration features. This approach contributes to the sustainability of the marsh restoration features. The project first cost for Tier 1 is $850,998,000 producing 1,930 AAHU. (2) Tier II NER recommended plan features were so categorized because they utilize the same borrow or staging area, and/or construction of these features would potentially interfere with construction of a Tier I NER recommended plan feature. The project first cost for Tier II is $561,186,000 producing 1,117 AAHU. (3) Tier III NER recommended plan features were so categorized because they would utilize the same borrow or staging area, and/or interfered with construction

of a Tier II feature, and/or interfered with an existing mitigation project. The project first cost for Tier III is $776,002,000 producing 1,318 AAHU.

d. Additionally, the two long range studies recommended under the NER plan are to study a hydrologic and salinity control structure (Cameron-Creole Spillway) and a long-range study of a Calcasieu Ship Channel salinity control structure estimated to cost $6,000,000, cost shared with CPRAB at a 50/50 rate, or $3,000,000 each.

5. Analyses are based on a 3.125-percent discount rate and a 50-year period of analysis.

a. Implementing the NED plan will reduce expected average annual flood damages by about 93 percent for structures in the projected 2025 25-year floodplain. Equivalent without-project damages are estimated at $219,683,000 and equivalent with-project damages are estimated at $16,129,000, resulting in equivalent annual benefits of $203,554,000. The total average annual costs of the NED plan are estimated to be $36,056,000 and the equivalent annual net benefits are estimated to be $167,498,000. The NED plan benefit-cost ratio is approximately 5.6 to 1. For the entire study area with an equivalent without-project damages of $474,998,000, the NED plan will reduce expected average annual flood damages by about 46 percent.

b. The total equivalent annual costs of the NER plan are estimated to be $66,642,000 including OMRR&R. Implementing the NER plan will produce 4,365 average annual habitat units.

6. In accordance with USACE Sea Level Change Guidance, ER 1100-2-8162, the study evaluated potential impacts of sea level change in formulating and engineering the recommended plans. The risk reduction system and ecosystem restoration features being proposed are based on the intermediate Relative Sea Level Rise (RSLR) projection. However, the USACE will continue to monitor local conditions and determine if the intermediate scenario of RSLR is occurring. If observed conditions deviate from intermediate to high sea level forecasts during design or construction, reevaluation of the NED and NER will be required.

7. The NED plan is intended to prevent damages to structures and infrastructure; it is not intended to, nor will it, reduce the risk to loss of life during major storm events. Loss of life can only be prevented by residents and visitors following the local evacuation plans that are already in place. The proposed project would greatly reduce, but not completely eliminate future storm damages. Coastal storm damages are reduced by approximately 93 percent in the location of the recommended plan, and by approximately 46 percent across the entire study area. These residual risks have been communicated to the residents of Cameron, Calcasieu, and Vermilion Parishes.

8. In accordance with the Engineer Circular (EC 1165-2-214) on review of decision documents, all technical, engineering, and scientific work underwent an open, dynamic, and vigorous review process to ensure technical quality. This included Agency Technical Review (ATR), a Type I Independent External Peer Review (IEPR), and USACE Headquarters policy and legal review. All concerns of the ATR have been addressed and incorporated into the final feasibility report. USACE conducted the IEPR in accordance with Section 2034 of the WRDA 2007, EC 1165-2-

214, and the Office of Management and Budget's Final Information Quality Bulletin for Peer Review (2004). A Section 501(c)(3) (Internal Revenue Code) non-profit science and technology organization, independent and free of conflicts of interest, established and administered the peer review panel. The IEPR panel consisted of four members with expertise in economics, civil works planning, environmental review and environmental policy, and hydrologic and hydraulic engineering. The review panel identified and documented eighteen final comments. Of these, two were identified as having medium-high significance, 10 as having medium significance, and six as having low significance. The medium-high significance comments addressed the uncertainty of Hydraulic and Hydrologic modeling in combining effects from surge and inland flooding; and potential effects of excluding or limiting impacts to the Henry Hub natural gas distribution facility, future development, Biggert-Waters flood insurance reforms, and alternative design options, on the cost/benefit analysis. All IEPR review comments have been resolved. There have been no significant changes to the plan formulation, engineering assumptions, or environmental analyses that supported the decision-making process and plan selection resulting from the resolution of comments. The final integrated report and environmental impact statement were provided for state and agency review. All comments from the above referenced reviews were addressed and incorporated into the final documents as appropriate.

9. Washington level review indicates that the project recommended by the reporting officers is technically sound, environmentally and socially acceptable, cost effective, and economically justified. The plan complies with all essential elements of the U.S. Water Resources Council's *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* and complies with other administrative and legislative policies and guidelines. Also, the views of interested parties, including federal, state, and local agencies have been considered.

10. Federal implementation of the recommended project would be subject to the non-federal sponsor agreeing to comply with federal laws and policies, including agreeing with the following requirements prior to implementation:

a. Provide 35 percent of total hurricane storm surge risk reduction costs and 35 percent of total ecosystem restoration costs, as further specified below:

1. Provide, during design, 35 percent of design costs in accordance with the terms of a design agreement entered into prior to commencement of design work for the project;

2. Provide all lands, easements, and rights-of-way, including those required for relocations, the borrowing of material, and the disposal of dredged or excavated material; perform or ensure the performance of all relocations; and construct all improvements required on lands, easements, and rights-of-way to enable the disposal of dredged or excavated material as determined by the federal government to be required or to be necessary for the construction, operation, and maintenance of the project, and provide relocation assistance, all in compliance with applicable provisions of the Uniform Relocation and Assistance and Real Property

Acquisition Policies act of 1970, as amended (42 U.S.C. 4601-4655) and the regulations contained in 49 C.F.R. Part 24;

3. Pay, during construction, any additional funds necessary to make its total contribution equal to at least 35 percent of hurricane storm surge risk reduction costs and 35 percent of total ecosystem restoration costs;

b. Operate, maintain, repair, rehabilitate, and replace the project at no cost to the federal government, in a manner compatible with the project's authorized purposes and in accordance with applicable federal and state laws and regulations and any specific directions prescribed by the federal government;

c. Prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) such as any new developments on project lands, easements, and rights-of-way or the addition of facilities which might reduce the outputs produced by the project, hinder operation and maintenance of the project, or interfere with the project's proper function;

d. Inform affected interests, at least annually, of the extent of protection afforded by the flood risk management features; participate in and comply with applicable federal floodplain management and flood insurance programs; comply with Section 402 of the WRDA 1986, as amended (33 U.S.C. 701b-12); and publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in adopting regulations, or taking other actions, to prevent unwise future development and to ensure compatibility with protection levels provided by the flood risk management features;

e. Hold and save the United States free from all damages arising from the construction, OMRR&R of the project and any betterments, except for damages due to the fault or negligence of the United States or its contractors;

f. Perform, or ensure performance of, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601-9675, that may exist in, on, or under lands, easements, or rights-of-way that the federal government determines to be necessary for the construction or operation and maintenance of the project;

g. Assume, as between the federal government and the non-federal sponsor, complete financial responsibility for all necessary cleanup and response costs of any hazardous substances regulated under CERCLA that are located in, on, or under lands, easements, or rights-of-way that the Federal government determines to be necessary for the construction, OMRR&R of the project;

DAEN
SUBJECT: Southwest Coastal Louisiana

h. Agree, as between the federal government and the non-federal sponsor, that the non-federal sponsor shall be considered the operator of the project for the purpose of CERCLA liability, and to the maximum extent practicable, operate, maintain, repair, rehabilitate, and replace the project in a manner that will not cause liability to arise under CERCLA; and

i. Not use the project or lands, easements, and rights-of-way required for the project as a wetlands bank or mitigation credit for any other project.

11. The recommendations herein reflect the information available at the time and current Department of the Army policies governing the formulation of individual projects. They do not reflect programming and budgeting priorities inherent in the formulation of national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to Congress as proposals for implementing funding. However, prior to the transmission to Congress, the state, federal agencies, and other parties will be advised of any modifications and afforded the opportunity to comment.

TODD T. SEMONITE
Lieutenant General, USA
Chief of Engineers

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

May 29, 2019

R.D. James
Assistant Secretary of the Army (Civil Works)
108 Army Pentagon
Washington, DC 20310-0108

Dear Mr. James:

As required by Executive Order 12322, the Office of Management and Budget has reviewed an October 2016 Army Corps of Engineers (Corps) Integrated Final Feasibility Report and Environmental Impact Statement (report) for the Southwest Coastal Louisiana Project (project). The report proposes to carry out nonstructural hurricane and storm surge damage risk reduction and aquatic ecosystem restoration activities in three parishes in southwest Louisiana. The report states that the total estimated first cost of the project work would be $3,094,276,000 (October 2015 prices), and that the Federal share of these first costs would be $2,011,279,000. The project was authorized in P.L. 114-322.

The report recommends raising or providing flood proofing to individual homes and businesses within the 25-year floodplain. The report has not demonstrated a robust basis for Corps involvement in these measures. While such measures may reduce the risk of flood damages, the report does not demonstrate that the Corps should be responsible for this work or is uniquely able to carry it out.

The report indicates that the aquatic ecosystem portion of the project could be carried out independently from the proposed measures to reduce the risk of flood damages. However, the report suggests the proposed aquatic ecosystem restoration work may not be self-sustaining.

The Office of Management and Budget does not object to your submitting the report to Congress. However, when you do so, please advise the Congress that the project is not consistent with the policy and programs of the President. In addition, the project would need to compete with other proposed investments for funding in future budgets.

Sincerely,

John Pasquantino
Deputy Associate Director
Energy, Science, and Water

RECORD OF DECISION

SOUTHWEST COASTAL LOUISIANA
CALCASIEU, CAMERON, AND VERMILION PARISHES, LOUISIANA

The Final Integrated Feasibility Report and Environmental Impact Statement (IFR/EIS) dated 1 April 2016, for the Southwest Coastal Louisiana project addresses hurricane storm damage risk reduction and ecosystem restoration opportunities and feasibility in the Calcasieu, Cameron, and Vermilion Parishes of Louisiana. The final recommendation is contained in the report of the Chief of Engineers, dated 29 July 2016. Based on these reports, the reviews by other Federal, State, and local agencies, Tribes, input of the public, and the review by my staff, I find the plan recommended by the Chief of Engineers to be technically feasible, economically and environmentally justified, cost effective, in accordance with environmental statutes, and the public interest.

The Final IFR/EIS, incorporated herein by reference, evaluated various alternatives that would reduce damages associated with hurricane and coastal storm surge flooding and reduce land loss and coastal erosion and restore environmental conditions in the study area. The recommended plan is the National Economic Development/National Ecosystem Restoration (NED/NER) Plan and includes:

- The NED plan reduces the risk of coastal storm damages through independent features that elevate or flood-proof structures in the 25-year floodplain predicted to occur in 2025. The plan includes:
    - Raising approximately 3,500 residential structures in-place above the predicted 2075 one-percent chance base flood elevation. If the required elevation is greater than 13 feet above ground level, the structure would be ineligible to participate due to engineering and risk related factors. Tenants of structures that would be elevated may be eligible for certain benefits in accordance with Uniform Relocation Assistance and Real Property Acquisition Policies for Federal and Federally Assisted Programs of 1970, Public Law 91-646, 84 Stat. 1894 (42 U.S.C. 4601), as amended by the Surface Transportation and Uniform Relocation Assistance Act of 1987, Title IV of Public Law 100-17, 101 Stat. 246-256; 49 Code of Federal Regulations 24; and the U.S. Department of Housing and Urban Development Handbook 1378;
    - Flood-proofing approximately 350 non-residential structures; and
    - Constructing earthen berms around approximately 160 warehouses.
    - The raising of residential structures, the flood-proofing of non-residential structures, and the construction of localized storm surge risk reduction measures will be implemented on a voluntary participation basis.
- The NER plan will provide benefits in two estuaries by rebuilding tidal wetlands, preventing shoreline erosion, and replanting rare native vegetation addressing land loss and ecosystem degradation. The plan includes:
    - Nine marsh restoration measures restoring a net total of 7,900 acres of brackish and saline marsh with 2,700 Average Annual Habitat Units (AAHUs);

- Five shoreline protection measures protecting a net total of 6,135 acres of marsh with 1,738 AAHUs
- Thirty-Five chenier reforestation measures that would plant cheniers with live oak and hackberry for a net total of 1,413 acres with 538 AAHUs.
- Two of the nine identified marsh restoration features are partially located on United States Fish and Wildlife Service (USFWS) property (Sabine National Wildlife Refuge and Cameron Prairie National Wildlife Refuge) and are included in the recommended NER plan. These features are vitally important to help preserve the Calcasieu Lake rim and prevent vast new expanses of open water from forming should the lake rim be breached by erosional forces. Because USFWS is ultimately responsible for managing its refuge lands, the U.S. Army Corps of Engineers (the Corps) is not seeking authorization nor funding for the features located on USFWS lands. The reporting officers recommend development of an implementation plan by the State of Louisiana and USFWS for these two features. This subset of the NER plan, all features of the NER minus the two USFWS features, represents the "Corps Plan." The full NER plan, with all features including the two USFWS features, represents the "Federal Plan."
- In addition to a construction recommendation, the reporting officers also recommend continued study of a hydrologic and salinity control structure (Cameron-Creole Spillway) and a long-range study of a Calcasieu Ship Channel salinity control structure that were identified in this study as potentially viable features but require additional analysis for construction.

In addition to a "no action" plan eight hurricane/storm damage risk reduction and 28 ecosystem restoration alternatives were evaluated. The alternatives included in the NED final array include a Nonstructural Justified Reaches Plan and a Nonstructural 100-year Floodplain Plan. The alternatives included in the NER final array include Plan M4 (Mermentau Small Integrated Restoration and Plan CM-4 Comprehensive Small Integrated Restoration). The NED and NER final array of alternatives are fully described in Chapters 2 and 3 of the IFR/EIS. The Nonstructural 100-Year Floodplain plan and the Comprehensive Small Integrated Restoration Plan were identified as the environmentally preferable alternative.

For all alternatives, the potential effects were evaluated, as appropriate. A summary assessment of the potential effects of the recommended plan are listed in Table 1:

Table 1: Summary of Potential Effects of Recommend Plan

	Significant adverse effect	Insignificant effects due to mitigation	Insignificant effects	Resource unaffected by action
Aesthetics	☐	☐	☒	☐
Air quality	☐	☐	☒	☐
Aquatic resources/wetlands	☐	☐	☒	☐
Invasive species	☐	☐	☒	☐
Fish and wildlife habitat	☐	☐	☒	☐
Threatened/Endangered species	☐	☐	☒	☐
Historic properties	☐	☐	☒	☐
Other cultural resources	☐	☐	☒	☐
Floodplains	☐	☐	☒	☐
Hazardous, toxic & radioactive waste	☐	☐	☒	☐

	Significant adverse effect	Insignificant effects due to mitigation	Insignificant effects	Resource unaffected by action
Hydrology	☐	☐	☒	☐
Land use	☐	☐	☒	☐
Navigation	☐	☐	☒	☐
Noise levels	☐	☐	☒	☐
Public infrastructure	☐	☐	☒	☐
Socio-economics	☐	☐	☒	☐
Environmental justice	☐	☐	☒	☐
Soils	☐	☐	☒	☐
Tax Revenues and property values	☐	☐	☒	☐
Water quality	☐	☐	☒	☐
Climate change	☐	☐	☒	☐
Employment, business, and industrial activity	☐	☐	☒	☐

All practicable means to avoid or minimize adverse environmental effects were analyzed and incorporated into the recommended plan. Best management practices (BMPs) as detailed in the IFR/EIS will be implemented to minimize impacts. BMPs proposed include those for construction practices to implement stormwater pollution prevention plans; to avoid impacts to various resources such as water quality and salinity; soils, water bottoms, and prime and unique farmlands; coastal shorelines; cheniers; essential fish habitat; and threatened and endangered species.

No compensatory mitigation is required as part of the recommended plan.

Public review of the draft IFR/EIS was completed on 4 May 2015. All comments submitted during the public comment period were responded to in the Final IFR/EIS. A 30-day waiting period and state and agency review of the Final IFR/EIS was completed on 19 June 2016. Comments from state and federal agency review did not result in any changes to the final IFR/EIS.

Pursuant to section 7 of the Endangered Species Act of 1973, as amended, the Corps determined that the recommended plan may affect but is not likely to adversely affect the following federally listed species or their designated critical habitat: red-cockaded woodpecker, piping plover, rufa subspecies of red knot, whooping crane, West Indian manatee, Gulf sturgeon, green sea turtle, Kemp's ridley sea turtle, leatherback sea turtle, hawksbill sea turtle, and loggerhead sea turtle. The USFWS concurred with the Corps' determination on 25 August 2015.

Pursuant to section 106 of the National Historic Preservation Act of 1966, as amended, the Corps determined that historic properties may be adversely affected by the recommended plan. The Corps and the Louisiana Historic Preservation Officer, and federally-recognized Tribes, in consultation with the Advisory Council on Historic Preservation entered into a Programmatic Agreement (PA), dated 26 February 2016. All terms and conditions resulting from the agreement shall be implemented in order to minimize adverse impacts to historic properties.

The Corps will also continue government-to-government consultation with federally-recognized Tribes on the potential of the recommended plans to adversely affect historic properties or tribal trust resources.

Pursuant to the Clean Water Act of 1972, as amended, all discharges of dredged or fill material associated with the recommended plan have been found to be compliant with the section 404(b)(1) Guidelines (40 CFR 230). The Clean Water Act Section 404(b)(1) Guidelines evaluation is found in Appendix A, Annex A of the IFR/EIS.

A water quality certification pursuant to section 401 of the Clean Water Act was obtained from the Louisiana Department of Environmental Quality. All conditions of the water quality certification shall be implemented in order to minimize adverse impacts to water quality.

A determination of consistency with the State of Louisiana Coastal Zone Management program pursuant to the Coastal Zone Management Act of 1972 was obtained from the Louisiana Department of Natural Resources. All conditions of the consistency determination shall be implemented in order to minimize adverse impacts to the coastal zone.

In accordance with Executive Order 12898 – Environmental Justice for Low Income and Minority Populations, the Corps conducted an analysis using the 2010 Census data at the block and block group level. The Corps concluded that implementation of the recommended plans would not have a disproportionate adverse impact on minority and/or low-income residents as implementation of the recommended plans would provide additional benefits to safety, life, health, and properties of all residents and businesses within the study area regardless of race or income level by reducing the risk of hurricane storm surge-related damage and by providing ecosystem restoration by the end of the period of analysis.

All applicable environmental laws have been considered and coordination with appropriate agencies and officials has been completed.

Technical, environmental, economic, and cost effectiveness criteria used in the formulation of alternative plans were those specified in the Water Resources Council's 1983 Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies. All applicable laws, executive orders, regulations, and local government plans were considered in evaluation of alternatives. Based on the review of these evaluations, I find that benefits of the recommended plan outweigh the costs and any adverse effects. This Record of Decision completes the National Environmental Policy Act process.

7/10/19
Date

R.D. James
Assistant Secretary of the Army
(Civil Works)



State of Louisiana

JOHN BEL EDWARDS
GOVERNOR

June 20, 2016

Headquarters
U.S. Army Corps of Engineers
ATTN: CECW-P (IP)
7701 Telegraph Road
Alexandria, VA 22315-3860

Dear Sirs:

This letter is in response to your May 19, 2016 request for the views of the State of Louisiana on the Draft Chief of Engineers Report, the Draft Record of Decision, and the Integrated Final Feasibility Report and Environmental Impact Statement (EIS) dated April 2016 for the Southwest Coastal Louisiana Feasibility Study. This study is a critical component of the 2012 Comprehensive Master Plan for a Sustainable Coast and would provide coastal restoration measures including marsh creation, chenier reforestation, shoreline protection, and nonstructural hurricane and storm surge damage risk reduction measures for eligible properties across 4,700 square miles in Calcasieu, Cameron, and Vermilion Parishes. The State understands the nonstructural measures will consist of flood proofing and elevating structures in the area. It is understood that the nonstructural program will be entirely voluntary for eligible participants. In addition to the recommended measures, the study is also recommending further study for two hydrologic/salinity control measures, the Calcasieu Ship Channel Salinity Control measure and the Cameron-Creole Spillway structure.

This letter, while not legally binding on the State as an obligation of future funds as subject to appropriation by the State Legislature, declares the State's full support for the Southwest Coastal Louisiana Feasibility Study as described in the Integrated Final Feasibility Report and Environmental Impact Statement dated April 2016, the Draft Chief's Report and the Record of Decision. The State also supports the cost sharing as recommended in the Feasibility Report/EIS as required by Section 103 of the Water Resource Development Act of 1986, as amended, for Corps ecosystem restoration and hurricane storm damage risk reduction projects. The State of Louisiana acknowledges the responsibilities of the non-Federal sponsor and will support the role as such for the design, construction, and OMRR&R phases of the project, if authorized. However, since the project is within the jurisdictional boundaries of several local levee districts with delegated local statutory responsibility for flood control and hurricane protection, CPRA notes that it may request that the local levee districts be included as co-sponsors for the project.
The State further acknowledges that the project will require the non-Federal sponsor to contribute 35 percent of the total project costs, including all lands, easements, rights-of-way, pipeline relocations, and any improvements on lands, easements, and rights-of-way required for disposal of dredged material (LERRDs). The State also acknowledges that the non-Federal sponsors will be required to perform all activities necessary to operate, maintain, repair, replace,

and rehabilitate the project at the expense of the non-Federal sponsor once the project has been completed and turned over to the State. The State will make diligent efforts to secure all necessary funding, including asking the State Legislature for additional appropriations, if necessary.

We appreciate your efforts on the study and your continued commitment to soliciting our feedback throughout the planning process. The CPRA whole-heartedly endorses this study and we look forward to working with the Corps on the implementation of this important project.

Sincerely,

Johnny B. Bradberry
Chairman
Coastal Protection & Restoration Authority Board of Louisiana

JBB/jm

c: Michael Ellis, CPRA Executive Director
Bren Haase, CPRA Administrator
Mark Wingate, USACE
Darrel Broussard, USACE

From: Jennifer Mouton
To: Broussard, Darrel M MVN
Cc: Brian Lezina; Wingate, Mark R MVN; Constance, Troy G MVN; Axtman, Timothy J MVN; Varnado, Paul A MVN; Bren Haase
Subject: [EXTERNAL] SW Coastal - Chief's Report
Date: Tuesday, July 19, 2016 11:19:57 AM
Attachments: image001.png

Darrel – As requested, the state's position regarding the two marsh creation features, 124d and 3c1, which are both partially located on USFWS property is stated below.

The State of Louisiana supports the recommendation of the two features partially located on USFWS property. The State is committed to working with USFWS to develop an implementation plan to further efforts on these two features, to include discussions on how to acquire private lands identified as part of the restoration features.

Jennifer J. Mouton

Coastal Resources Scientist Senior

Coastal Protection & Restoration Authority

450 Laurel Street, Suite 1501

P.O. Box 44027

Baton Rouge, LA 70804-4027

Main Office: 225-342-1452

Cell: 337-258-3544

Stronger Together
CHENIER PLAIN
Coastal Restoration Protection Authority

7515 Jefferson Highway #322
Baton Rouge, LA 70806
225.333.8234
www.cpcrpa.org

BOARD OF COMMISSIONERS

Mike Dever, President
Calcasieu

Phillip Trosclair, Vice President
Cameron

Skie Sagrera, Secretary
Vermilion

Kay Barnett, Treasurer
Calcasieu

Earl Landry, Past President
Vermilion

Ryan Bourriaque
Cameron

David Minton
Calcasieu

Al Vidrine
Vermilion

Earnestine Horn
Cameron

RESTORING & PROTECTING CALCASIEU, CAMERON, & VERMILION PARISHES

June 13, 2016

Headquarters
U.S. Army Corps of Engineers
ATTN: CECW-P (IP)
7701 Telegraph Road
Alexandria, VA 22315-3860

RE: Request for the views of the State of Louisiana on the Draft Chief of Engineers Report, the Draft Record of Decision, and the Integrated Final Feasibility Report and Environmental Impact Statement (EIS)

This letter is in response to your May 19, 2016 request for the views of the State of Louisiana on the Draft Chief of Engineers Report, the Draft Record of Decision, and the Integrated Final Feasibility Report and Environmental Impact Statement (EIS) dated April 2016 for the Southwest Coastal Louisiana Feasibility Study.

The Chenier Plain Coastal Restoration and Protection Authority (Chenier Plain Authority) congratulates all on the open dialog, participation and cooperation in numerous meetings, and the investment in Southwest Louisiana by numerous agencies including the U.S. Army Corps of Engineers New Orleans District (USACE MVN) and the State of Louisiana Coastal Protection and Restoration Authority (CPRA) on the Southwest Coastal Feasibility Draft Study (SWC) currently under review by the Civil Works Review Board.

The Chenier Plain Authority thanks the USACE MNV for listening to the public and local governments concerning the change to 100% voluntary program for the NED and inclusion of the Parish Master Plans. The Chenier Plain Authority maintains that no reference to involuntary participation in the NED program should be pursued. The Chenier Plain Authority also maintains the importance of the inclusion of the Parish Master Plans for Cameron and Vermilion in the appendix of this report and would like to request that the Calcasieu Master Plan be added to the appendix when it is completed.

The Chenier Plain Authority feels that the efforts of the USACE MVN, the CPRA, the Chenier Plain Authority, and the coastal parishes of Calcasieu, Cameron, and Vermilion, led to clear and concise discussions regarding this SWC report. The cooperative nature of these meetings is a model of how government is supposed to work. We feel that great improvement has taken place and all should be commended for their efforts.

The Chenier Plain Parishes (Calcasieu, Cameron, & Vermilion) have provided their comments below:

Vermilion
Vermilion Parish Police Jury applauds the efforts Coastal Protection and Restoration Authority (CPRA), and the Chenier Plain Coastal Protection and Restoration Authority (CPCPRA), and the US Army Corps of Engineers (USACE) along with Cameron and Calcasieu Parishes in showing how Federal, State and Local governing bodies can come together and resolve issues. By moving this study forward to a Final Draft and potential funding, the natural resources of Southwest Coastal Louisiana and its citizens are the true winners. – Linda Duhon, Parish Administrator

Cameron
On behalf of the citizens and elected officials of Cameron Parish, I am proud to provide these comments regarding the current status of the Southwest Coastal Study.
In my opinion, it is rare in this day and time for individuals of different goals and objectives to come together and establish common ground and fight for what they believe is right. I feel that the efforts of the United States Army Corps of Engineers, the Louisiana Coastal Protection & Restoration Authority, the Chenier Plain Coastal Restoration & Protection Authority, and last but not least, the coastal Parishes of Calcasieu, Cameron, & Vermilion, led to clear and concise discussions regarding this report.

Stronger Together
CHENIER PLAIN
Coastal Restoration Protection Authority

7515 Jefferson Highway #322
Baton Rouge, LA 70806
225.333.8234
www.cpcrpa.org

BOARD OF COMMISSIONERS

Mike Dever, President
Calcasieu

Phillip Trosclair, Vice President
Cameron

Skie Sagrera, Secretary
Vermilion

Kay Barnett, Treasurer
Calcasieu

Earl Landry, Past President
Vermilion

Ryan Bourriaque
Cameron

David Minton
Calcasieu

Al Vidrine
Vermilion

Earnestine Horn
Cameron

RESTORING & PROTECTING CALCASIEU, CAMERON, & VERMILION PARISHES

It is Cameron's opinion that the intent of this study, which for a time was misguided, has returned to form and can provide the mechanism for resiliency and growth for these three Parishes as originally intended. Quite frankly, the Parish is proud of the role it played in this exercise. From smaller technical meetings years ago to the Feasibility Report presentation last year, this has been a collective effort that all parties should be proud of. The Parish maintains that no reference to involuntary participation in the NED program should be pursued. The Parish also appreciates the inclusion of facets of the Cameron Coastal Master Plan in the appendix of this report. Although the document is still being revised, the Parish feels improvement has taken place and all should be commended for their efforts.

Thank you for the opportunity to comment on this report. The Parish stands ready to assist in any way possible to insure that our efforts to date were not in vain. – Ryan Bourriaque, Parish Administrator

Calcasieu
The Calcasieu Parish Police Jury supports the Southwest Coastal Louisiana (SWC) project proposed by the U.S. Army Corps of Engineers (USACE), Mississippi Valley Division, New Orleans District (CEMVN), which will provide nonstructural hurricane and storm surge damage risk reduction measures as well as ecosystem restoration features in the 4,700 square mile study area located in Calcasieu, Cameron, and Vermilion Parishes in Southwest Louisiana.

The parishes of Calcasieu, Cameron, and Vermilion all worked tirelessly alongside each other with the Coastal Protection and Restoration Authority (CPRA) and the Chenier Plain Coastal Protection and Restoration Authority (CPCPRA) to urge the USACE to remove the eminent domain language from the March 2015 draft which states "although the program is primarily voluntary in nature, some structures may be subject to eminent domain if certain established criteria as outlined in the National Economic Development (NED) Tentatively Selected Plan are met". During a CPRA Board meeting held on January 13, 2016, the parishes were notified that the USACE removed this eminent domain language from the SW Coastal Feasibility Study and that USACE recommended 100% voluntary participation for all elevation and acquisition projects. Calcasieu Parish encourages the State to keep this eminent domain language out and recommends that the language within the Final Draft state that the program will consist of only projects in which the property owners are willing, voluntary participants. – Laurie Cormier, Parish Coastal Zone Manager

---

The Louisiana Gulf Coast is a resilient part of our nation because of the hard-work, dedication, and culture of its people. We must never lose sight of this fact. The Chenier Plain Authority would like to thank the USACE for allowing us to comment on the Southwest Coastal Study. The Chenier Plain Authority encourages the USACE to move this study forward to a Final Draft and potential funding. Please contact us if you have any questions or concerns regarding our comments.

Thank you for your assistance and cooperation.

Sincerely,

Nedra Davis

Nedra Davis,
Executive Director

cc: Johnny Bradberry, CPRA
Jennifer Mouton, CPRA

USDA

July 7, 2016

Patricia Bee
U.S. Army Corps of Engineers
Office of Water Project Review
441 G Street NW
Washington, DC 20314

RE: Southwest Coastal Louisiana Final Integrated Feasibility Report and Programmatic Environmental Impact Statement

Dear Ms. Bee:

NRCS supports the U.S. Army Corps of Engineers' (USACE) effort to restore and protect our Coastal Resources and appreciates the opportunity to participate in this important program. The restoration identified in the Report and EIS will provide tremendous environmental and economic benefits to Louisiana.

NRCS has been engaged with the USACE throughout the Southwest Coastal Study from the project proposals submitted for consideration, to the selected restoration features included in the Final Report. As expressed in our May 5, 2015, review of this project, NRCS has concerns that evaluations by the Southwest Coastal Study Team may overestimate the realized habitat value of marsh creation projects. Specifically, after containment gapping, the Wetland Value Assessment (WVA) of marsh creation projects assigned optimum values to the aquatic organism access variable (V6) to marshes that flood less than 10% of the time. According to key scientific studies, projects that are constructed to elevations of minimal flooding duration and therefore, limit aquatic organism access throughout much of the project life do not provide optimal access. We reiterate this concern in light of the large estimated construction budget for proposed marsh creation projects.

In response to our previous concern, you pointed out that the guidance documentation for V6 in the "Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) - Wetland Value Assessment Methodology - Coastal Marsh Community Models" from March 19, 2010, restricts fish access scores based on control structures, not marsh elevation relative to tidal range and that there was no established mechanism for assigning a reduced suitability for fish access for partially flooded marshes. We suggest the USACE review Step 1 of the procedure for evaluating V6 in the WVA to determine the percentage of the created marsh area accessible by estuarine organisms during normal tidal fluctuations and identified as (P) in the Access Value equation. We also point out that the CWPPRA WVA procedural manual describes that the Environmental Work Group, through consensus, agreed to deviate from a strictly biologically-based habitat suitability index graph for V1 in a manner that prioritizes maximum land creation over optimal habitat suitability. The Corp model used in the Southwest Coastal Study uses the biological-based model for V1 but our concern is with the like-wise consensus

Natural Resources Conservation Service
State Office
3737 Government Street
Alexandria, Louisiana 71302
Voice: (318) 473-7751 Fax: (844) 325-6947
An Equal Opportunity Provider and Employer

approach being used in the interpretation of the (P) value in V6. Specifically, we do not agree with assigning optimal fisheries access to areas that rarely flood.

In addition, we feel that the project selection criteria used for this effort may have overestimated the overall benefits for marsh creation projects and underestimated the overall benefits of hydrologic restoration benefits. Perhaps the use an of initial cost/benefit analysis and subsequent screening based on an estimated cost/benefit ratio may have resulted in hydrologic restoration projects to be more competitive for funding, especially considering the high cost of marsh creation.

NRCS is certainly not opposed to prioritizing maximum land protection and restoration and continues to be a major partner and supporter of coastal restoration in Louisiana. However, we are also dedicated to insuring that the work done to protect and restore coastal wetlands is done in a manner that provides the most benefit for the costs involved. We encourage the most rigorous and accurate scientific analyses of each project feature be performed so that the public can be assured that the benefits, in terms of both land area and habitat value, are accurately reflected in the cost of this very important work.

Thank you for the opportunity to comment on the Report and EIS. If you have any questions please contact Troy Mallach at 337-291-3064 or troy.mallach@la.usda.gov.

Respectfully,



Kevin D. Norton
State Conservationist

cc: W. Britt Paul, ASTC(WR), SO, NRCS, Alexandria, LA
Randolph Joseph, Jr., ASTC(FO), AO, NRCS, Alexandria, LA
Frank Chapman, DC, FO, NRCS, Lake Charles, LA
Troy Mallach, WB, FOPSS, NRCS, Lafayette, LA
Michael Nichols, WB, SO, NRCS, Alexandria, LA

United States Department of the Interior
Office of the Secretary
Office of Environmental Policy and Compliance
1849 C Street, NW - MS 2462 - MIB
Washington, D.C. 20240

JUN 14 2016

9043.1
PEP/NRM

ER15/0184

Mr. Theodore A. Brown, PE
Chief, Planning and Policy Division
Directorate of Civil Works
U.S. Army Corps of Engineers
441 G Street, NW
Washington, DC 20314-1000

Re: Southwest Coastal Louisiana Project

Dear Mr. Brown:

The Department of the Interior (Department) has reviewed the U.S. Army Corps of Engineers' Proposed Chief of Engineers Report, the Final Environmental Impact Statement, and the Final Feasibility Report regarding the Southwest Coastal Louisiana Project in Calcasieu, Cameron, and Vermilion Parishes, Louisiana. The Department has no comments on the documents.

For questions or further information regarding this response, please contact Cheryl Kelly on my Natural Resources Management Team, at 202-208-7565 or at cheryl_kelly@ios.doi.gov.

Thank you for the opportunity to review and comment on this plan and environmental document.

Sincerely,

Mary Josie Blanchard, Acting Director
Office of Environmental Policy and Compliance

TRANSMITTED ELECTRONICALLY – NO HARDCOPY TO FOLLOW

United States Department of the Interior
Office of the Secretary
Office of Environmental Policy and Compliance
1849 C Street, NW - MS 2462 - MIB
Washington, D.C. 20240

SEP - 6 2016

9043.1
PEP/NRM

ER 15/0184

Mr. Theodore A. Brown, PE
Chief, Planning and Policy Division
Directorate of Civil Works
U.S. Army Corps of Engineers
441 G Street, NW
Washington, DC 20314-1000

Re: Southwest Coastal Louisiana Project - Final Integrated Environmental Impact Statement and Feasibility Report and Draft Chief's Report

Dear Mr. Brown:

The Department of the Interior (Department) has reviewed the U.S. Army Corps of Engineers (USACE) Proposed Chief of Engineers Report (Chief's Report) and the Final Integrated Environmental Impact Statement and Feasibility Report regarding the Southwest Coastal Louisiana Project in Calcasieu, Cameron, and Vermilion Parishes, Louisiana. On June 14, 2016, the Department provided a no comment letter to USACE regarding the documents. After receipt of the letter, USACE reached out to the Department and requested comments from the U.S. Fish and Wildlife Service (USFWS) due to the inclusion of two National Wildlife Refuges, the Sabine and Cameron Prairie National Wildlife Refuges, in the Chief's Report and the potential ecosystem improvements that would benefit the Department's trust resources. We are following up with the comments below provided by the USFWS.

The USACE was requested to conduct the Southwest Coastal Louisiana Feasibility Study via Resolution Docket 2747 adopted on December 7, 2005, by the U.S. House of Representatives Committee on Transportation and Infrastructure. Numerous measures to provide storm damage reduction and ecosystem restoration measures were evaluated within the study area. Those measures included: potential levees designed to provide hurricane storm surge protection; protection and restoration of coastal wetlands and unique natural ecosystem features (such as cheniers); the construction of shoreline protection projects (for navigation canals, interior lakes and bays, and the Gulf of Mexico); and the implementation of non-structural projection measures such as structure relocations and buyouts. Of the flood projection features, only the non-structural projection measures in selected locations were cost effective and included in the Tentatively Selected Plan. The ecosystem restoration features will benefit wetlands (with benefits to migratory wading birds and waterfowl), forested areas (with benefits to migratory song birds), and other aquatic habitats (e.g., enhancing shorelines that provide habitat to the threatened red knot and piping plover) that support the Department's trust resources. Given the

TRANSMITTED ELECTRONICALLY – NO HARDCOPY TO FOLLOW

potential benefit to those trust resources, we support the implementation of those features described as Tier I and Tier II features in the proposed Chief's Report.

The proposed Chief's Report also includes two long range studies pertaining to the installation of structures characterized as the Cameron-Creole Spillway and the Calcasieu Ship Channel salinity control structure. The USFWS looks forward to working with the USACE on studies to further define those features.

Two of the proposed nine marsh restoration features are partially located within the USFWS's Southwest Louisiana Refuge Complex on the Sabine and Cameron Prairie National Wildlife Refuges, i.e., West Cove – 124d and East Cove 3cl, respectively. Of the 7,900 acres of potential marsh restoration proposed, the Chief's Report recommends restoring approximately 1,492 acres of marsh at the two Refuges. Those marsh restoration sites would benefit the long-term sustainability of those areas and adjacent on- and off-refuge wetlands and would help off-set the on-going wetland loss within coastal Louisiana, thus providing valuable habitat to coastal fish and wildlife dependent species. The Department supports the Chief's Report and accompanying National Ecosystem Restoration (NER) Recommended Plan, which will help restore lands upon which our trust resources depend. The USFWS looks forward to participating in the detailed design and construction phases.

The Department understands that inclusion of restoration features on the USFWS lands in the proposed Chief's Report and NER Plan does not obligate us to actively pursue construction or finance of those features. We also understand that the USACE is not seeking authorization or funding to construct those features because of policy constraints regarding construction of restoration features on Federal lands not owned by USACE. The two marsh restoration features that are located on Refuge land are projected to cost more than what is typically provided to the entire National Wildlife Refuge System for restoration; as such, we look forward to partnering with the USACE to find a solution that would allow the entire Southwest Louisiana ecosystem restoration project to be completed, including those features on USFWS lands. Any features constructed on the USFWS lands would need a compatibility determination and special use permit.

Thank you for the opportunity to provide additional comments on the proposed Chief's Report for the Southwest Coastal Louisiana Project. If you have any questions concerning our comments, please contact Mr. Chris Eggleston with the Southwest Louisiana National Wildlife Refuge Complex at 337-598-2216 or at Christian_Eggleston@fws.gov.

Sincerely,

Michaela Noble

Michaela E. Noble
Director, Office of Environmental Policy
and Compliance

TRANSMITTED ELECTRONICALLY – NO HARD COPY TO FOLLOW

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 6
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

June 20, 2016

U.S. Army Corps of Engineers
New Orleans District
Attn: William P. Klein, Jr.
CEMVN-PDN-CEP
P.O. Box 60267
New Orleans, LA 70160-0267

Mr. Klein,

In accordance with our responsibilities under Section 309 of the Clean Air Act (CAA), the National Environmental Policy Act (NEPA), and the Council on Environmental Quality (CEQ) regulations for implementing NEPA, the U.S. Environmental Protection Agency (EPA) Region 6 office in Dallas, Texas, has completed its review of the United States Army Corps of Engineers (USACE) Integrated Final Feasibility Report and Environmental Impact Statement (Final EIS) for Southwest Coastal Louisiana. The purpose of the proposed action is to provide non-structural hurricane and storm surge risk reduction measures, as well as, ecosystem restoration features in southwest Louisiana.

EPA's review of the Draft Environmental Impact Statement (Draft EIS) identified potential adverse impacts. For these reasons we rated the Draft EIS as "environmental concerns – requests additional information" (EC-1). The EPA's Rating System Criteria can be found here: http://www.epa.gov/oecaerth/nepa/comments/ratings.html. In regard to the Final EIS, EPA continues to have concerns for shoreline erosion. We have enclosed detailed comments which clarify our concerns.

If you have any questions or concerns, I can be reached at 214-665-8565, or contact Keith Hayden of my staff at hayden.keith@epa.gov or 214-665-2133.

Sincerely,

Robert Houston
Chief, Special Projects Section

Enclosure

XXX

**DETAILED COMMENTS ON THE
U.S. ARMY CORPS OF ENGINEERS
FINAL ENVIRONMENTAL IMPACT STATEMENT
FOR SOUTHWEST COASTAL LOUISIANA**

BACKGROUND: Southwest Coastal Louisiana (SWCL) communities are at increasing risk to storm surge flooding due to wetland loss, relative sea level rise, and land subsidence. The SWCL project proposed by the U.S. Army Corps of Engineers, Mississippi Valley Division, New Orleans District, will provide nonstructural hurricane and storm surge damage risk reduction measures as well as ecosystem restoration features in the 4,700 square mile study area located in Calcasieu, Cameron, and Vermilion Parishes in southwest Louisiana.

Proposed measures of the National Economic Development (NED) nonstructural plan include residential structure elevation, flood proofing, and the acquisition of qualifying structures to reduce potential damages from future tropical storms and hurricanes. The National Ecosystem Restoration (NER) plan includes nine marsh restoration measures which would restore 9,424 acres and nourish 3,181 acres; A hydrologic and salinity control measure to create a 267 average annual habitat unit (AAHU) benefit; five shoreline protection measures that span 252,000 linear feet, and a Chenier reforestation program that includes invasive species control and planting seedling trees on 1,400 acres in multiple locations in Cameron and Vermilion Parishes.

4.0 TENTATIVELY SELECTED PLAN (TSP)

4.2.1 Description of the NER TSP

EPA made the following comment for the Draft EIS:

"The ecosystem restoration component of the Southwest Coastal Louisiana plan includes shoreline erosion reduction measures. The use of rocks and other hard materials for shoreline erosion reduction can provide targeted environmental benefits for important landscape features. Such measures can also have unintended adverse effects due to alteration of sedimentation patterns (which, for example, can increase erosion in unprotected areas) and reduced fish access. Subsequent project-specific NEPA documentation for shoreline erosion projects should assess such potential unintended adverse impacts and include mitigation measures as appropriate. This could possibly include the use of alternative "soft" approaches to shoreline erosion reduction and "fish dips" to allow for greater ingress and egress of aquatic organisms."

While more information on fish dips in breakwater structures was included in the Final EIS, it was not clear how indirect effects on sedimentation patterns were determined to be "not significant". A study related to Holly Beach sedimentation and breakwaters is referenced, but very minimal detail is provided concerning the analysis of longshore transport and sedimentation at this or other breakwater locations. It is not clear that any modeling or analysis was done to support the conclusion that indirect effects on sedimentation patterns were not significant.

1

From: Redican, Joseph H HQ02
To: Douglass, Edward C HQ
Subject: FW: DEQ SOV 160525/0555 Southwest Coastal Louisiana Integrated Final
Date: Thursday, June 16, 2016 3:39:48 PM

Joseph Redican

Deputy Chief, Mississippi Valley Division Regional Integration Team

US Army Corps of Engineers, Headquarters

441 G. Street NW (CECW-MVD)

Washington, DC 20314-1000

Ph: (202) 761-4523

Cell:(202) 412-8390

joseph.h.redican@usace.army.mil <mailto:joseph.h.redican@usace.army.mil>

From: Linda (Brown) Hardy [mailto:Linda.Hardy@la.gov]
Sent: Thursday, June 16, 2016 2:42 PM
To: Redican, Joseph H HQ02 <Joseph.H.Redican@usace.army.mil>
Cc: Yasoob Zia <Yasoob.Zia@LA.GOV>
Subject: [EXTERNAL] DEQ SOV 160525/0555 Southwest Coastal Louisiana Integrated Final

June 16, 2016

Theodore A. Brown, P.E.

US Army Corps of Engineers, Attn: CECW-P (IP)

7701 Telegraph Road

Alexandria, VA 22315-3860

joseph.h.redican@usace.army.mil <mailto:joseph.h.redican@usace.army.mil>

RE: 160525/0555

Southwest Coastal Louisiana Integrated Final

Feasivility Report and Environmental Impact Statement

US ACE Funding

Cameron, Calcasieu and Vermilion Parishes

Dear Mr. Brown:

The Department of Environmental Quality (LDEQ), Business and Community Outreach Division has received your request for comments on the above referenced project.

After reviewing your request, the Department has no objections based on the information provided in your submittal. However, for your information, the following general comments have been included. Please be advised that if you should encounter a problem during the implementation of this project, you should immediately notify LDEQ's Single-Point-of-contact (SPOC) at (225) 219-3640.

* Please take any necessary steps to obtain and/or update all necessary approvals and environmental permits regarding this proposed project.

* If your project results in a discharge to waters of the state, submittal of a Louisiana Pollutant Discharge Elimination System (LPDES) application may be necessary.
* If the project results in a discharge of wastewater to an existing wastewater treatment system, that wastewater treatment system may need to modify its LPDES permit before accepting the additional wastewater.
* All precautions should be observed to control nonpoint source pollution from construction activities. LDEQ has stormwater general permits for construction areas equal to or greater than one acre. It is recommended that you contact the LDEQ Water Permits Division at (225) 219-9371 to determine if your proposed project requires a permit.

* If your project will include a sanitary wastewater treatment facility, a Sewage Sludge and Biosolids Use or Disposal Permit is required. An application or Notice of Intent will be required if the sludge management practice includes preparing biosolids for land application or preparing sewage sludge to be hauled to a landfill. Additional information may be obtained on the LDEQ website at Blockedhttp://www.deq.louisiana.gov/portal/tabid/2296/Default.aspx <Blockedhttp://www.deq.louisiana.gov/portal/tabid/2296/Default.aspx> or by contacting the LDEQ Water Permits Division at (225) 219- 9371.

* If any of the proposed work is located in wetlands or other areas subject to the jurisdiction of the U.S. Army Corps of Engineers, you should contact the Corps directly regarding permitting issues. If a Corps permit is required, part of the application process may involve a water quality certification from LDEQ.
* All precautions should be observed to protect the groundwater of the region.
* Please be advised that water softeners generate wastewaters that may require special limitations depending on local water quality considerations. Therefore if your water system improvements include water softeners, you are advised to contact the LDEQ Water Permits to determine if special water quality-based limitations will be necessary.
* Any renovation or remodeling must comply with LAC 33:III.Chapter 28, Lead-Based Paint Activities; LAC

33:III.Chapter 27, Asbestos-Containing Materials in Schools and State Buildings (includes all training and accreditation); and LAC 33:III.5151, Emission Standard for Asbestos for any renovations or demolitions.

* If any solid or hazardous wastes, or soils and/or groundwater contaminated with hazardous constituents are encountered during the project, notification to LDEQ's Single-Point-of-Contact (SPOC) at (225) 219-3640 is required. Additionally, precautions should be taken to protect workers from these hazardous constituents.

Currently, Cameron, Calcasieu and Vermilion Parishes are classified as attainment with the National Ambient Air Quality Standards and has no general conformity determination obligations.

Please send all future requests to my attention. If you have any questions, please feel free to contact me at (225) 219-3954 or by email at linda.hardy@la.gov <mailto:linda.hardy@la.gov> .

Sincerely,

Linda M. Hardy

Louisiana Department of Environmental Quality

Office of the Secretary

P.O. Box 4301

Baton Rouge, LA 70821-4301

Ph: (225) 219-3954

Fax: (225) 219-3971

Email: linda.hardy@la.gov <mailto:linda.hardy@la.gov>

From: Bee, Patricia L HQ02
To: Douglass, Edward C HQ
Cc: Redican, Joseph H HQ02
Subject: FW: FAA Comments regarding report on proposed Southwest Louisiana Coastal project
Date: Monday, September 26, 2016 11:38:35 AM
Importance: High

FAA response!

-----Original Message-----
From: Tim.Tandy@faa.gov [mailto:Tim.Tandy@faa.gov]
Sent: Monday, September 26, 2016 10:46 AM
To: Bee, Patricia L HQ02 <Patricia.L.Bee@usace.army.mil>
Cc: Lacey.Spriggs@faa.gov
Subject: [EXTERNAL] FAA Comments regarding report on proposed Southwest Louisiana Coastal project

Ms. Bee,

The FAA has reviewed the report outlining and addressing the proposed actions. Based upon the nature and locations of those actions, the FAA does not anticipate adverse impacts to civil aviation. We appreciate the opportunity to comment. If you have any questions, please do not hesitate to contact me by email or telephone 817-222-5644. Thanks.

Tim Tandy

Environmental Protection Specialist

Louisiana/New Mexico Airports District Office

From: Bee, Patricia L HQ02
To: Douglass, Edward C HQ; Nicholson, Scott R HQ02
Subject: FW: Southwest Coastal Louisiana Proposed Report
Date: Wednesday, July 06, 2016 12:21:34 PM
Importance: High

NOAA comment response.

-----Original Message-----
From: Richard Hartman - NOAA Federal [mailto:richard.hartman@noaa.gov]
Sent: Wednesday, July 06, 2016 12:14 PM
To: Bee, Patricia L HQ02 <Patricia.L.Bee@usace.army.mil>
Cc: Rachel Lipsy - NOAA Affiliate <rachel.lipsy@noaa.gov>; Swafford, Rusty <rusty.swafford@noaa.gov>
Subject: [EXTERNAL] Southwest Coastal Louisiana Proposed Report

Ms. Bee: NOAA's National Marine Fisheries Service (NMFS) has received the Proposed Report for the Chief of Engineers for the Southwest Coastal Louisiana project. Staff of NMFS have previously served on a Project Delivery Team for the project, have participated in numerous meetings and teleconferences, and reviewed both the draft and final Environmental Impact Statements (EIS). The NMFS has previously provided comments to the USACE on the draft EIS for the project but did not provide comments on the final EIS. The NMFS' comments on the draft EIS were adequately addressed in the final document.

The project entails a number of non-structural risk reduction features to reduce hurricane storm surge risks, as well as ecosystem restoration features which benefit wetlands and aquatic habitats supportive of marine fishery resources. Given the potential benefit to habitat supportive of NMFS trust resources, we support implementation of those features described as the Tier I and Tier II features in the Proposed Report.

The Proposed Report also includes two long range studies pertaining to the installation of structures characterized as the Cameron-Creole Spillway and the Calcasieu Ship Channel salinity control structure. The NMFS supports further studies of those features. However, the NMFS does not support installation of those features at this time.

We appreciate the opportunity to review and comment on the Proposed Report.

Richard Hartman
Fishery Biologist
NOAA/NMFS

From: Bee, Patricia L HQ02
To: Nicholson, Scott R HQ02; Douglass, Edward C HQ
Cc: Redican, Joseph H HQ02
Subject: FW: Southwest Coastal Louisiana
Date: Thursday, June 23, 2016 11:28:13 AM
Importance: High

Scott / Eddie,

Please see USCG comment response below.

Trish

-----Original Message-----
From: Dittman, Paul E CAPT [mailto:Paul.E.Dittman@uscg.mil]
Sent: Thursday, June 23, 2016 11:23 AM
To: Bee, Patricia L HQ02 <Patricia.L.Bee@usace.army.mil>
Subject: [EXTERNAL] RE: Southwest Coastal Louisiana

Trish:

I have reviewed the below referenced report.

My only comment is that if any of the storm damage risk reduction and/or restoration projects will require/precipitate any change or disruption to routine navigation, temporary or long term, before, during or after the project is completed, that the cognizant Captain of the Port for the area in question be advised well in advance to ensure all navigation interests are made aware of the project, have an opportunity to comment and have sufficient lead time to develop and implement potential mitigating actions to eliminate or minimize any disruptions to navigation.

The area in question (Calcasieu, Cameron and Vermillion Parishes) is home to some of the most robust and important inland waterways in the United States including the Gulf Intracoastal Waterway and the Calcasieu River. Disruptions to commercial navigation along these waterways have immediate and very significant negative economic impacts which get worse with time the longer the disruption remains in effect.

Close coordination between the USACE and the USCG, along with key port/waterways stakeholders, will be critical as soon as potential navigation impacts are identified.

V/r

CAPT P. E. Dittman, USCG
Eighth Coast Guard District
Director of Western Rivers and Waterways Management
Hale Boggs Fdrl Bldg
500 Poydras St. Suite 1230
New Orleans , LA 70130
(O) 504.671.2263
(C) 618.225.7865
Paul.E.Dittman@uscg.mil

"I, do solemnly swear (or affirm) that I will support and defend the Constitution of the United States against all enemies, foreign and domestic; that I will bear true faith and allegiance to the same; that I take this obligation freely, without any mental reservation or purpose of evasion; and that I will continue to well and faithfully discharge the duties of the office on which I have already entered. So help me God."

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
441 G STREET, NW
WASHINGTON, DC 20314-1000

Mr. Kevin D. Norton
State Conservationist
Natural Resources Conservation Service
3737 Government Street
Alexandria, LA 71302

JUL 27 2016

Dear Mr. Norton:

This letter is in response to your July 7, 2016 letter on the U.S. Army Corps of Engineers draft Chief of Engineers Report and District Engineers Report to include the final integrated Feasibility Report and Environmental Impact Statement (EIS) for the Southwest Coastal, Louisiana, Hurricane and Storm Damage Risk Reduction and Ecosystem Restoration Feasibility Report. Your letter indicated concern with the Wetland Value Assessment (WVA) tool, and specifically the aquatic organism access variable (V6), and its application in the study.

The Corps of Engineers project teams are continuously working to refine application of this tool. As noted from your comments on the WVA methodology and documented through the Coastal Planning Protection and Restoration Act, there are areas of refinement identified with virtually every application of an evaluation tool. The Corps of Engineers has established a process of regularly reviewing and certifying the modeling tools used to support our planning and decision making process.

Our study team has indicated that a modification of the aquatic organism access variable, while effecting the relative unit benefits for marsh creation projects, would not result in a change in the selected plan. However, the team will continue to refine the assessment of the recommended features and their outputs throughout implementation.

The recommended project will involve an extended period of implementation and the Corps of Engineers looks forward to the Natural Resources Conservation Service's continued participation in the process of implementing and improving efforts to restore Louisiana's coastal ecosystem. Thank you for your comments and I look forward to future coordination with your agency.

Sincerely,

Theodore A. Brown

Theodore A. Brown, P.E.
Chief, Planning and Policy Division
Directorate of Civil Works

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
441 G STREET, NW
WASHINGTON, DC 20314-1000

JUL 27 2016

Captain P.E. Dittman, United States Coast Guard
Eight Coast Guard
Director of Western Rivers and Waterways Management
Hale Boggs Federal Building
500 Poydras Street, Suite 1230
New Orleans, Louisiana 70130

Dear Mr. Dittman:

This letter is in response to your June 23, 2016 email on the U.S. Army Corps of Engineers draft Chief of Engineers Report and District Engineers Report to include the final integrated Feasibility Report and Environmental Impact Statement (EIS) for the Southwest Coastal, Louisiana, Hurricane and Storm Damage Risk Reduction and Ecosystem Restoration Feasibility Report. Your email requested specific coordination with the cognizant Captain of the Port if any project feature would require or precipitate any change or disruption to routine navigation.

It is not anticipated that the project features will affect navigation. However, if a situation arises that has the potential to adversely affect navigation, we concur with your recommendation for early coordination. The New Orleans District currently employs a process administered through our Operations and Readiness Division, Technical Support Branch to provide Navigation Bulletins for any work affecting navigation channels. These bulletins are posted on the New Orleans District website and emailed to US Coast Guard Personnel in the Eighth District, as well as to a broad distribution list. The Eighth District also distributes the information to USCG personnel from Texas to Florida, and posts the information from these bulletins on it's website. We strive to work closely with the Coast Guard to improve communication and navigation safety.

We appreciate the cooperative role that the United States Coast Guard has played in facilitating the development of this project. Thank you for your comments and I look forward to future coordination with your agency.

Sincerely,

Theodore A. Brown

THEODORE A. BROWN, P.E.
Chief, Planning and Policy Division
Directorate of Civil Works

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
441 G STREET, NW
WASHINGTON, DC 20314-1000

JUL 27 2016

Mr. Robert Houston
Chief, Special Projects Section
U.S. Environmental Protection Agency
Region 6
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

Dear Mr. Houston:

This letter is in response to your letter of June 20, 2016, regarding your review comments on the U.S. Army Corps of Engineers draft Chief of Engineers Report and District Engineers Report to include the final integrated Feasibility Report and Environmental Impact Statement (EIS) for the Southwest Coastal, Louisiana, Hurricane and Storm Damage Risk Reduction and Ecosystem Restoration Feasibility Report. In regard to the Final EIS, you indicated the EPA continues to have concerns with shoreline erosion. Your detailed comments clarifying these concerns indicated that while more information on fish dips in breakwaters structures was included in the Final EIS, it was not clear regarding how indirect effects of breakwater structures on sedimentation patterns were determined to be "not significant".

We concur with your comment and the New Orleans District has provided a supplemental response (see attached) to your original comment letter dated, April 30, 2015. The information in this supplemental response will also be integrated into the Comment Response Appendix of the Final Southwest Coastal feasibility report.

We appreciate the cooperative role that the United States Environmental Protection Agency has played in facilitating the development of this project. Thank you for your comments and I look forward to future coordination with your agency.

Sincerely,

Theodore A. Brown, P.E.
Chief, Planning and Policy Division
Directorate of Civil Works

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, NEW ORLEANS DISTRICT
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO
ATTENTION OF

SEP 2 0 2016

Regional Planning and Environment
Division South
Environmental Planning Branch

Mr. Robert Houston
Chief, Special Projects Section
U.S. Environmental Protection Agency
Region 6
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

Dear Mr. Houston:

This letter is in response to your letter of June 20, 2016, regarding your review comments on the Integrated Final Feasibility Report and Environmental Impact Statement (Final EIS) for Southwest Coastal Louisiana. Also please reference telephone conversation on July 6, 2016, with Mr. Keith Hayden of your office regarding the Final EIS review comments. In regard to the Final EIS, you indicated the EPA continues to have concerns with shoreline erosion. Your detailed comments clarifying these concerns indicated that while more information on fish dips in breakwaters structures was included in the Final EIS, it was not clear regarding how indirect effects of breakwater structures on sedimentation patterns were determined to be "not significant".

We concur with these comments. This letter supplements our initial response to your April 30, 2015 comment letter and will be incorporated into the "Comment Response" Appendix of the EIS. The following additional response provides additional background associated with the study conclusions and outlines future actions to assure desired project outcomes.

> Fish dips will be provided for the foreshore rock dike shoreline protection measures to allow for ingress and egress of aquatic organisms. Sediment starvation is not expected to occur with the proposed Gulf shoreline breakwater measures along the shoreline of Rockefeller Refuge because this area is composed of a shell veneer covering marsh sediments with little long-shore movement of sediments in this system. The proposed breakwater measure to be connected to the existing breakwaters at Holly Beach would provide continuous shoreline protection to the western Calcasieu Ship Channel jetty.

The Calcasieu Ship Channel, and the jetties lining it, currently influence the longshore transport of coarse-grained material from east of the channel. By tying into the western jetty and fully extending project to the existing breakwater field to the west, the longshore transport would be normalized to a more uniform rate, which will decrease erosion.

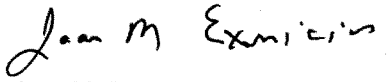
Additionally, the area immediately west of the Calcasieu Ship Channel jetty has been used as a single point discharge for maintenance dredging sediment from the jetty channel. Its probable continued use as such in the future should also help to further offset down current sediment starvation caused by the jetty.

In addition to consideration of studies and monitoring reports, an analysis of survey data and tracer data reported in a Louisiana State University thesis study was considered which indicated the beach/breakwater system at Holly Beach is in a state of dynamic equilibrium at high tide, and static equilibrium at low tide. The existing "East Sabine Lake Hydrologic Restoration" project has introduced sands and increased the sediment budget for this area, so downstream sediment starvation is not expected to be a problem. Although the proposed breakwaters have been designed to initially capture sediment moving through the system, there will also be periods wherein sediments will flow freely through the system.

In order to refine designs and implement the most effective possible projects we typically undertake additional assessment during Pre-construction Engineering and Design (PED). In collaboration with your agency, the final design of the shoreline protection measures will be more fully developed and evaluated during the PED phase of the project through wave and sediment transport modeling. Included in this evaluation would be the indirect effects of proposed shoreline protection measures on down drift beaches.

We appreciate the cooperative role that the U.S. Environmental Protection Agency has played in facilitating the development of this project. Thank you for your comments and I look forward to future coordination with your agency.

Sincerely,



Joan M. Exnicios
Chief, Environmental Planning Branch

Southwest Coastal Louisiana



Integrated Final Feasibility Report
and
Environmental Impact Statement

US Army Corps of Engineers®

U.S. Army Corps of Engineers
Mississippi Valley Division
New Orleans District

April 2016
Addendum September 2016

(1)



Hurricane Ike flooding in Delcambre, Louisiana.

The Recommended Plan (RP) described in the Southwest Coastal Louisiana Integrated Final Feasibility Report and Environmental Impact Statement provides nonstructural hurricane and storm surge damage risk reduction and ecosystem restoration across 4,700 square miles in Calcasieu, Cameron, and Vermilion Parishes in southwest Louisiana.

The National Economic Development (NED) RP, *Modified Plan 8 – Nonstructural 0-25-Year Floodplain Plan*, would implement nonstructural measures to reduce coastal storm surge damages to 3,462 residential structures, 342 commercial structures and public buildings, and 157 warehouses. This would be achieved by elevating residential structures, dry flood proofing non-residential structures, and constructing localized storm surge risk reduction measures around warehouses. Residential structures would be elevated to the base flood elevation predicted to occur in the year 2075. Non-residential structures would have flood proofing measures applied generally up to 3 feet above ground level. Localized storm surge risk reduction measures would be less than 6 feet in height. Any structure that requires raising more than 13 feet above ground level would be ineligible to participate due to engineering and risk related factors. Implementation of the NED RP would directly, indirectly, and cumulatively benefit socioeconomic resources such as population and housing, tax revenue and property values, and community cohesion. Participation in the NED RP is entirely voluntary. The NED RP is fully compliant with Executive Order (EO) 12898 and no environmental justice issues are expected. The expected equivalent annual net benefits are $167.4 million dollars, with $906.1 million in project first costs, and a benefit-to-cost ratio of 5.65:1.

The Federal National Ecosystem Restoration (NER) RP, *Plan CM-4 – Small Integrated Restoration*, includes 49 ecosystem restoration measures that address land loss and ecosystem degradation and would stabilize the wetland perimeter geomorphology and is the least-cost, cost-effective, comprehensive ecosystem restoration plan. The Federal NER RP includes 9 marsh restoration measures restoring a net total of 7,900 acres of brackish and saline marsh with 2,700 Average Annual Habitat Units (AAHUs); 5 shoreline protection measures protecting a net total of 6,135 acres of marsh with 1,738 AAHUs; and 35 chenier reforestation measures that would plant cheniers with live oak and hackberry for a net total of 1,413 acres with 538 AAHUs. Overall, the Federal NER RP would reforest, protect, and restore a net total of 15,448 acres with a total of 4,976 AAHUs at a cost of $2.485 billion. This includes protecting 335 acres of designated critical wintering habitat for the threatened piping plover that is also utilized by the rufus subspecies of the threatened red knot; enhancing plant productivity; and reinforcing and protecting critical landscape features.

Two marsh restoration features (124d - *Marsh Restoration at Mud Lake* and 3c1 - *Beneficial Use of Dredged Material from the Calcasieu Ship Channel*) are partially located on United State Fish and Wildlife Service (USFWS) refuge lands. These two features provide 1,492 acres and 611 AAHUs at a cost of $297 million. The U.S. Army Corps of Engineers (USACE) recommends that USFWS seek authorization and appropriation to construct these projects as part of the overall Federal NER RP. The Corps NER RP presented for authorization is comprised of the remaining features which provide 13,950 acres and 4,365 AAHUs. The Calcasieu Ship Channel Salinity Control Structure and the Cameron-Creole Watershed Spillway are recommended as additional long-range studies at a cost of $6 million. The NER RP features comprise an integrated restoration plan that would have synergy with other ecosystem restoration projects and would facilitate hydrologic and geomorphic stability and resilience. Implementation of the NER RP would directly, indirectly, and cumulatively benefit chenier forests, brackish and saline marsh, essential fish habitat, wildlife, fisheries, the threatened piping plover and the rufus subspecies of the red knot, water quality, and recreation. The NER RP is fully compliant with EO 12898 and no environmental justice issues are expected. The Corps NER RP project first cost estimate is $2.188 billion.

The estimated total project cost for the Corps NED RP and NER RP (excluding projects that will be authorized, funded, and implemented as USFWS projects) is $3,094,276,000 at FY 2016 price levels.

Comments: Please send comments to the U.S. Army Corps of Engineers, New Orleans District, Attention: William P. Klein, Jr., CEMVN-PDN-CEP, P.O. Box 60267, New Orleans, LA 70160-0267, by e-mail: SWCoastalAdmin@usace.army.mil or by Fax: (504) 862-1892. Please direct questions by telephone: (504) 862-2540. The comment period closing date will be 30 days from the date of publication of the Notice of Availability in the *Federal Register*.



This Report Southwest Coastal Louisiana Final Integrated Feasibility Report and Environmental Impact Statement ("2016 Final Report") updates and finalizes the 2015 Revised Draft Report (which concluded its public review in May 2015). This report contains the Recommended Plan (RP) for the NED and the NER components of the Study.

The people, economy, environment, and cultural heritage of coastal areas in Southwest Louisiana are at risk from damages caused by hurricane storm surge flooding. Southwest coastal Louisiana's topography and low elevation, proximity to the Gulf of Mexico, subsiding lands, and rising seas, are all contributing factors which cause coastal flooding, shoreline erosion, saltwater intrusion, and loss of wetland and Chenier habitats which are conditions that are expected to continue to worsen.

Through separate authorizations, Congress authorized the investigation of alternatives to: (1) provide risk reduction from damages deriving from hurricane storm surge, and (2) significantly restore environmental conditions. Planning to address hurricane storm surge risk reduction (the NED component) was primarily focused on communities and areas located north of the Gulf Intracoastal Waterway (GIWW), but measures for all at-risk structures both inside and outside of the coastal zone were considered. Planning measures for ecosystem restoration (the NER component) concentrated exclusively on locations within the coastal zone.

The Southwest Coastal Louisiana study area encompasses over 4,700 square miles of varying terrain in Calcasieu, Cameron, and Vermilion Parishes. The major physiographic divisions are the Gulf Coast Prairie and the Gulf Coast Marsh. The major hydrologic basins in the Study Area are the Mermentau River, the Calcasieu-Sabine Lakes, and the Teche/Vermilion Basin. Dominant water features in the Study Area are the Calcasieu, Sabine, Neches, Mermentau, and Vermilion Rivers and Calcasieu, Sabine, Grand, and White Lakes. Man-made channels in the Study Area are the Sabine-Neches Waterway, Calcasieu Ship Channel, GIWW, Mermentau Ship Channel, and Freshwater Bayou Canal. The channels and waterways, except for the GIWW, are oriented north to south along the Gulf coast.

The GIWW is the longest channel crossing the Study Area and generally runs along the State's coastal zone boundary. Water control structures in the Study Area are the Calcasieu and Leland Bowman Locks, the Freshwater Bayou Canal Lock, the Schooner Bayou Canal Structure, and the Catfish Point Control Structure. Key highways in the Study Area are LA-82, LA-27, and I-10. Population centers are mainly north of the GIWW, and the largest include the municipalities of Lake Charles, Sulphur, and Abbeville.

The Project Delivery Team (PDT) used information from prior Federal, state, and local efforts to focus the Study on the most critical areas. System-wide problems and opportunities were used to identify and define site-specific problems and opportunities. Problems in the SWC Study Area include:

- Flooding from tidal surge and waves associated with hurricanes and tropical storms.
- Increased flood durations in wetlands, resulting in wetland loss.
- Erosion of channel banks and shorelines, resulting in wetland loss.
- Deforestation and mining of chenier ridges.

Opportunities to solve these problems include:

- Incorporate structural and nonstructural hurricane storm damage risk reduction measures to reduce the risk of damages and prevent loss of community cohesion.
- Improve internal system hydrology to restore wetlands.
- Manage salinity levels to maintain fresh and intermediate marsh.
- Reduce bank and shoreline erosion.
- Prevent loss of significant cultural and historic resources.

The PDT developed the following five planning objectives to apply to the entire study area for the 50-year period of analysis (2025-2075):



- *Objective 1.* Reduce the risk of damages and losses from hurricane storm surge flooding.
- *Objective 2.* Manage tidal flows to improve drainage and prevent salinity from exceeding 2 parts per thousand (ppt) for fresh marsh and 6 ppt for intermediate marsh.
- *Objective 3.* Increase wetland productivity in fresh and intermediate marshes to maintain function by reducing the time water levels exceed marsh surfaces.
- *Objective 4.* Reduce shoreline erosion and stabilize canal banks to protect adjacent wetlands.
- *Objective 5.* Restore landscapes, including marsh, shoreline, and cheniers to maintain their function as wildlife habitat and improve their ability to serve as protective barriers.

The following planning constraints to be avoided or minimized were identified:

- *Commercial navigation.* The Calcasieu and Sabine ship channels and the GIWW carry significant navigation traffic. Therefore, features that might result in shipping delays or undermine the purposes of authorized navigation projects would likely result in negative NED impacts.
- *Federally listed threatened and endangered species and their critical habitats.* Construction windows for resident and migratory species overlap and/or may include the entire year: piping plover, Gulf sturgeon, red-cockaded woodpecker, rufa subspecies of red knot, whooping crane, West Indian manatee, and several species of sea turtles.
- *Essential fish habitat (EFH), especially intertidal wetlands.* Conversion of one EFH type to another should be done without adversely impacting various fish species. For example, conversion of shallow open water EFH to marsh EFH.
- *Cultural and historic resources.* Prehistoric and historic archeological sites, buildings, structures, and properties that may be of religious and cultural significance to Indian tribes are located in the study area, including properties included in or eligible for inclusion in the National Register of Historic Places, although the majority of cultural and historic resources have not been assessed for eligibility.

National Economic Development (NED) Planning

Hurricane storm damage risk reduction measures were developed and screened using preliminary costs and benefits to identify a focused array of NED alternatives. In addition to the "No Action" alternative, the focused array contained three levee alignments in the Lake Charles area; three levee alignments around the towns of Abbeville, Delcambre, and/or Erath; and two stand-alone nonstructural alternatives.

NED Focused Array includes:

- No Action
- Lake Charles Eastbank
- Lake Charles Westbank Sulphur Extended
- Lake Charles Westbank Sulphur South
- Delcambre/Erath
- Abbeville to Delcambre
- Abbeville
- Nonstructural Justified Reaches Plan
- 100-Year Floodplain [1% Annual Chance Exceedance (ACE)] Nonstructural Plan

The assessment of economic feasibility for six independent structural measures was conducted in the focused array analysis. As a result of this additional evaluation, none of the structural levee alignments were found to be economically justified and none were carried into the final array. The evaluation of the focused array determined that the most cost-effective solution to reduce hurricane storm surge risk within the study area is through nonstructural measures. The No Action Plan, Plan 7 "Nonstructural - Justified Reaches Plan" (based on 11 economically justified reaches) and Plan 8 "100-Year Floodplain Plan" were carried into the final array with Plan 7 being selected as the NED TSP in the 2013 Initial Draft Report.

After its release for public review and the receipt of comments on the 2013 Initial Draft Report, structures in the 0-10-year floodplain were added to the structure inventory and additional economic calculations were performed to determine net NED benefits and a new benefit/cost ratio (BCR). That effort led to release of the 2015 Revised Draft Report which identified a new TSP based on these results. Further analysis after the release of the 2015 Revised Draft Report, resulted in refinements to the TSP, the results of which are presented here

as the NED RP in this 2016 Final Report. These revisions resulted from the evaluation of every structure in the updated inventory with a First Floor Elevation (FFE) below the 100-year stage for water surface elevations prevailing in the year 2025 rather than the year 2075. Now, the final NED RP would provide hurricane storm surge risk reduction for all structures in the study area with a FFE at or below the 25-year stage based on predicted year 2025 hydrologic conditions. The RP reduces the risk of hurricane storm surge damage for a total of 3,961 structures. The RP is 100% voluntary in nature and is comprised of 3,462 residential structures, 342 commercial structures and public buildings, and 157 warehouses. The equivalent annual net benefits are approximated at $167.5 million dollars, with ~$906 million in first costs, and a BCR of 5.65:1.

A brief summary of the components of the NED RP includes:

1. Elevation of eligible residential structures. This measure requires lifting the entire structure or the habitable area to the predicted 2075, 100-year base flood elevation unless the required elevation is greater than a maximum of 13 feet above ground level (structures requiring elevation greater than 13 feet above ground level would be ineligible to participate due to engineering and risk related factors).
2. Dry flood proofing of eligible non-residential structures (excluding large warehouses). Dry flood proofing consists of sealing all areas below the hurricane storm surge risk reduction level of a structure to make it watertight and to ensure that floodwaters cannot get inside by making walls, doors, windows, and other openings resistant to water penetration.
3. Construction of localized storm surge risk reduction measures less than 6 feet in height around non-residential warehouse structures. These measures are intended to reduce the frequency of flooding from hurricane storm surge, but not to eliminate floodplain management and flood insurance requirements.

NED Implementation Strategy

This Final Report recommends a strategy to implement the nonstructural project for eligible structures. Structures that have been identified as preliminarily eligible as part of the RP are located across the 4,700 mile, three-parish study area. In order to effectively implement the RP, clusters of eligible structures that represent the highest risk for hurricane storm surge damages (i.e. those with a FFE below the 10-year stage) would be identified and prioritized for construction. Individual structures would be addressed based on a ranking of risk from highest to lowest within the cluster. The ranking of individual structures would be revisited as elevation work is completed, as additional funding is distributed, and as new clusters are identified. Addressing multiple groups of structures within a small geographic area would be more cost-effective, efficient, and would also allow for a more strategic methodology for applying nonstructural measures to at-risk structures. More details on this process can be found in Appendix L.

National Ecosystem Restoration (NER) Planning

NER plan screening was based on monetary and non-monetary evaluations. Preliminary costs and benefits for marsh restoration, shoreline protection, chenier reforestation, oyster reef preservation, and water control features were estimated. Screening criteria included planning constraints; support for objectives; measure effectiveness; and efficiency. Measures that did not meet the screening criteria were retained only in limited instances in which they supported critical adjacent features.

Alternative plans were created by combining measure types into comprehensive strategies. The measures include hydrologic and salinity control, marsh restoration, shoreline protection, and chenier reforestation. The NER focused array contains a "No Action" alternative and 27 other plans that were based on 8 restoration strategies.

NER Strategies:

- No Action
- Large Integrated Restoration
- Moderate Integrated Restoration (Hydrologic Emphasis)
- Moderate Integrated Restoration, including Gum Cove Lock

- Small Integrated Restoration
- Interior Perimeter Salinity Control
- Marsh and Shoreline (Minimal Hydrologic & Salinity Control)
- Entry Salinity Control

Scales and combinations of these strategies were developed resulting in 28 NER alternatives in the focused array. Benefits in the Calcasieu-Sabine Basin were considered separately from the Mermentau/Teche-Vermilion Basin. Benefits were also considered jointly as comprehensive plans (covering both basins). Alternatives were evaluated for cost effectiveness and incremental costs.

The NER RP is "Small Integrated Restoration", also known as NER Plan CM-4, which consists of 49 ecosystem restoration features recommended for construction (9 marsh restoration features; 35 chenier reforestation features; and 5 shoreline protection features). The Federal NER RP is the least-cost, cost-effective, comprehensive ecosystem restoration plan that addresses land loss and ecosystem degradation. The Federal NER RP contains features to restore 15,448 acres of wetlands; restore and protect 335 acres of designated critical habitat (for threatened piping plover and red knot); enhance plant productivity; and reinforce and protect critical landscape features. The Calcasieu Ship Channel Salinity Barrier and the Cameron-Creole Watershed Spillway are recommended as additional long-range studies. Two marsh restoration features, located partially on U.S. Fish and Wildlife Service (USFWS) refuge lands are included as part of the Federal NER RP [Feature 124d Marsh Restoration at Mud Lake (Sabine National Wildlife Refuge)] and Feature 3c1 Beneficial Use of Dredged Material from Calcasieu Ship Channel (Cameron Prairie National Wildlife Refuge). These two features make up an important and integral component of the overall restoration plan. Because USFWS is ultimately responsible for managing its refuge lands, USACE is not seeking authorization and funding for these two features. Rather, USACE supports USFWS in seeking its own authorization and appropriation to construct these features and offers USFWS the information that USACE developed under this study effort as a starting point for those efforts. The Federal NER RP project first cost estimate (which includes costs associated with these two features) is $2.49 billion. Of that cost, the USACE estimates approximately $297 million for the design, construction, and construction management costs of these two features. However, it is anticipated that USFWS would develop its own costs in connection with these features. The total ecosystem benefits associated with the two USFWS features are 1,492 acres and 611 average annual habitat units. The remainder of the NER RP benefits and costs, less those attributed to the USWFS features, represents the Corps NER RP.

NER Implementation Strategy

The Corps NER RP includes a three tiered implementation sequence. (1) Tier I features may be constructed simultaneously because they would not affect the construction of any nearby Tier I NER Recommended Plan feature. Shoreline protection features would be constructed prior to marsh restoration features in an effort to better protect the more storm-vulnerable marsh restoration features. This approach contributes to the sustainability of the marsh restoration features. The project first cost for Tier 1 is $850,998,000 producing 1,930 AAHU. (2) Tier II NER Recommended Plan features were so categorized because they utilize the same borrow or staging area, and/or construction of these features would potentially interfere with construction of a Tier I NER Recommended Plan feature. The project first cost for Tier II is $561,186,000 producing 1,117 AAHU. (3) Tier III NER Recommended Plan features were so categorized because they would utilize the same borrow or staging area, and/or interfered with construction of a Tier II feature, and/or interfered with an existing mitigation project. The project first cost for Tier III is $776,002,000 producing 1,318 AAHU.

Risk and Uncertainty

In accordance with USACE Sea Level Change Guidance, ER 1100-2-8162, the study evaluated potential impacts of sea level change in formulating and engineering the recommended plans. The risk reduction system and ecosystem restoration features being proposed are based on the intermediate relative sea level rise projection. However, the Corps will continue to monitor local conditions and determine if the

intermediate scenario of RSLR is occurring. If observed conditions deviate from intermediate to high sea level forecasts during design or construction, reevaluation of the NED and NER will be required.

The NED/NER RPs, and their integrated performance allow the direct management of the greatest identified risks and extend the performance and effectiveness of local hazard mitigation actions, as well as increase valuable ecosystem outputs. The NER RP tiered implementation assures that features will be implemented in a manner that will address the most potentially far reaching impacts. These impacts also represent the most likely threat to existing critical landscape features. The interface between the NER RP and these identified critical features produces additional resilience in the geomorphic structure and sustainability of the area and adds reliability in the ability of the landscape to support risk management. This in turn allows the NED RP features to perform in the most effective and efficient manner for the greatest possible duration.

Areas of Controversy Addressed During the Course of Study

The initial 2013 Southwest Coastal Louisiana Draft Integrated Feasibility Report and Programmatic Impact Statement ("2013 Initial Draft Report") identified a Tentatively Selected Plan (TSP) for the National Economic Development (NED) and the National Ecosystem Restoration (NER) aspects of the study. However public and internal policy comments on the 2013 Draft Report identified significant issues requiring resolution prior to completing a final report. As a result, in March 2015, a Revised Integrated Draft Feasibility Report and Environmental Impact Statement ("2015 Revised Draft Report") was released with updated NED and NER TSPs that differed from those identified in 2013. Additional public and policy comment on the 2015 Revised Draft Report resulted in final modification of the recommended plans and their implementation. This final report ("2016 Final Report") updates and finalizes the 2015 Revised Draft Report (which concluded its public review in May 2015). Listed below are significant areas of controversy identified over, and addressed during, the course of the study.

1. The 2013 Initial Draft Report primary area of controversy was public demand for design and implementation of structural risk reduction measures (e.g., levees), not non-structural measures.

2. Controversy over the perceived insufficient number of ecosystem restoration projects throughout the study area. The large study area has numerous areas in need of ecosystem restoration. However, the PDT took an approach to address those areas in greatest need of restoration. The public demands more acres of restoration to this area due to the rapid land loss being experienced.

3. Controversy over insufficient number of hydrologic/salinity control measures identified in the NER TSP, as well as controversy over recommending hydrologic/salinity control measures for future study instead of providing such measures for immediate construction.

4. The single-most important area of controversy focused on the 2015 Revised Draft Report TSP that included the mandatory removal of structures identified as being at high-risk of coastal flooding. This aspect of the NED TSP generated over 2,540 oral and written comments and signatures on a petition to "PLEASE TAKE IT OUT!"; and to completely remove any and all references or language to 'eminent domain' and 'mandatory/involuntary participation' from the study. The property owner's choice to remain at their 'own risk' or possibly without future assistance is considered the only appropriate course of action. Furthermore, the statement has been made that the goal of the plan was to restore and protect the coast and marshes, and assist in preserving the unique cultural heritage of Southwest Louisiana, not forcibly remove people from their homes and family lands.

5. Over 2,540 signatures on a petition and several oral and written comments requested that reforestation measures be replaced by shoreline protection measures. As stated in the petition: "Shoreline protection would be a better investment for our coast's future."

6. Over 2,540 signatures on a petition and several oral and written comments requested that a 'local sponsor' be chosen to have an immediate 'voice' in the remaining planning process of the study. The petition states that local sponsors can assist in making valid and important corrections and local concerns could be immediately addressed.

7. Over 2,540 signatures on a petition and several oral and written comments stating that "our parish deserves 'protection'." The report should include Parish Priority Restoration Projects and insert a list of all of the measures and projects proposed in the parishes' existing and proposed Coastal Restoration & Protection Plans. The stated purpose of this request is that the inclusion of all such measures and projects will eliminate the unintentional exclusion of projects that were not selected and will clearly indicate the worthiness for future consideration for funding.

8. Controversy over the lack of salinity and flood control measures to prevent the Calcasieu River from flooding areas upstream during storm surge events.

9. A primary issue for resolution in the Final Report was the development of a prioritization for implementation of the NED RP. This Final Report recommends a strategy to implement the nonstructural Project for eligible structures. Structures that have been identified as preliminarily eligible as part of the NED RP are located across the 4,700 mile, three-parish study area.

10. A second issue for resolution in the Final Report related to the costs of structure raising/flood proofing and the potential for significant inflation of these costs.

Information about the Areas of Controversy as well as their resolution can be found in Section 4.5 of Chapter 4, which describes the Final Recommended Plan.

Contents

Abstract i
Executive Summary i
Introduction 1-1
1.0 Project Setting 1-1
2.0 Plan Formulation 2-1
3.0 Environmental Consequences (*NEPA Required) 3-1
4.0 Recommended Plan 4-1
5.0 Environmental Laws and Compliance (*NEPA Required) 5-1
6.0 Public Involvement (*NEPA Required) 6-1
7.0 Recommendations 7-1

Appendices

Appendix A: Environmental Appendix
Appendix B: Engineering Report
Appendix C: Plan Formulation Appendix
Appendix D: Economics Appendix
Appendix E: Real Estate Plan
Appendix F: References
Appendix G: Index
Appendix H: List of Preparers (*NEPA Required)
Appendix I: List of agencies, organizations, and persons to whom copies of the report were sent (*NEPA Required)
Appendix J: Comments Received (*NEPA required)
Appendix K: Ecosystem Restoration Feature Fact Sheets
Appendix L: Nonstructural Implementation Plan
Appendix M: December 2013 Draft Integrated Feasibility Report and Programmatic Environmental Impact Statement Main Report and March 2015 Revised Integrated Draft Feasibility Report and Environmental Impact Statement (weblink provided)
Appendix N: NED Plan Maps
Appendix O: Climate Preparedness and Resilience Register
Appendix P: Parish NER Priority Projects

LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS

AAA	Average Annual Acres
AAHUs	Average Annual Habitat Units
ACE	Annual Chance Exceedance Event
ACHP	Advisory Council on Historic Properties
ACS	American Community Survey
ADCIRC	Advanced Circulation Modeling
AEP	Annual exceedance probability
AM&M	Adaptive Management & Monitoring
APE	Area of Potential Effect
ASACW	Assistant Secretary of the Army for Civil Works
BCR	Benefit-to-Cost Ratio
BFE	Base Flood Elevation
BGEPA	Bald and Golden Eagle Protection Act
BLH	Bottomland hardwood
BMP	Best management practices
CAA	Clean Air Act
CAR	Coordination Act Report
CEMVN	U.S. Army Corps of Engineers, Mississippi Valley Division, New Orleans District
CEM	Conceptual Ecological Model
CE/ICA	Cost Effectiveness/Incremental Cost Analysis
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cfs	Cubic Feet Per Second
CIAP	Coastal Impact Assistance Program
CPRAB	Coastal Protection Restoration Authority of Louisiana Board
CSB	Calcasieu/Sabine Basin
CSC	Calcasieu Ship Channel
CWA	Clean Water Act
CWPPRA	Coastal Wetlands Planning, Protection and Restoration Act
cy	Cubic Yards
dBA	A-weighted Decibels
DIVR	Division Regulation
DO	Dissolved oxygen
EAD	Expected Annual Damage
EC	Engineering Circular
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EJ	Environmental Justice
EO	Executive Order
EPA	Environmental Protection Agency
EQ	Environmental Quality

ERDC	Engineering Research and Development Center
EQ	Environmental Quality
ER	Engineering Regulation
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Maps
FMA	Flood Mitigation Assistance
FPPA	Farmland Protection Policy Act
ft	Feet
FWCA	Fish and Wildlife Coordination Act
FWOP	Future Without Project
FWP	Future With Project
GIS	Geographic Information System
GIWW	Gulf Intracoastal Waterway
HEC-FDA	Hydrologic Engineering Center Flood Damage Analysis
HEC-RAS	Hydrologic Engineering Center River Analysis System
HFIAA	Homeowner Flood Insurance Affordability Act
HHS	U.S. Department of Health and Human Services
HI	Hydrologic Indices
HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
HSI	Habitat Suitability Index
HSDRR	Hurricane and Storm Damage Risk Reduction
HTRW	Hazardous, Toxic, and Radioactive Waste
Hwy	Highway
I-10	Interstate 10
IBA	Important Bird Area
IPCC	International Panel on Climate Change
km	Kilometer
LA	Louisiana
LACPR	Louisiana Coastal Protection and Restoration
LADNR	Louisiana Department of Natural Resources
LADOT	Louisiana Department of Transportation and Development
LCA	Louisiana Coastal Area
LCWCRTF	Louisiana Coastal Wetlands Conservation and Restoration Task Force
LDEQ	Louisiana Department of Environmental Quality
LDHH	Louisiana Department of Health and Hospitals
LDWF	Louisiana Department of Wildlife and Fisheries
LERRD	Land, Easements, Rights-Of-Way, Relocations, and Disposal Areas
LF	Linear Foot
LIDAR	Light Detection and Ranging data
LNHP	Louisiana Natural Heritage Program
MB	Mermentau Basin
MBI	Mitigation Banking Instrument

MBTA	Migratory Bird Treaty Act
MII	Micro-Computer Aided Cost Estimating System
MMPA	Marine Mammal Protection Act
MOU	Memorandum of Understanding
MR&T	Mississippi River and Tributaries
NAAQS	National Ambient Air Quality Standards
NAVD	North American Vertical Datum
NED	National Economic Development
NEPA	National Environmental Policy Act
NER	National Ecosystem Restoration
NFIP	National Flood Insurance Program
NFS	Non-Federal Sponsor
NGO	Non-Governmental Organizations
NGVD	National Geodetic Vertical Datum
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWR	National Wildlife Refuge
O&G	Oil and Gas
O&M	Operations and Maintenance
OMRR&R	Operation, Maintenance, Repair, Rehabilitation and Replacement
OSE	Other Social Effects
PDT	Project Delivery Team
PDM	Pre-Disaster Mitigation
PED	Preconstruction Engineering and Design
PM	Particulate Matter
PMP	Project Management Plan
PPA	Project Partnership Agreement
ppt	Parts Per Thousand
Principles and Guidelines	1983 Economic and Environmental Principles and Guidelines for Water and Related Land Implementation Studies
RED	Regional Economic Development
REP	Real Estate Plan
RESTORE Act	Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies (Act)
Revised Draft Report	Revised Integrated Draft Feasibility Report and Environmental Impact Statement
ROD	Record of Decision
ROM	Rough Order of Magnitude
ROW	Right of Way
RP	Recommended Plan
RSLR	Relative Sea Level Rise
SAV	Submerged Aquatic Vegetation

SHPO	State Historic Preservation Office
SLR	Sea Level Rise
SMART	Specific, Measurable, Attainable, Risk Informed, Timely
SMP	State Master Plan
SoVI®	Social Vulnerability Index
SWPPP	Storm Water Pollution Prevention Plan
SWR	State Wildlife Refuge
T&E	Threatened and Endangered
TMDL	Total Maximum Daily Load
TSP	Tentatively Selected Plan
TY	Target Year
URA	Uniform Relocation Assistance
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
U.S.	United States
WIK	Work in Kind
WRDA	Water Resources Development Act
WRRDA	Water Resources Reform and Development Act
WCRA	Wetlands Conservation and Restoration Authority
WMA	Wildlife Management Area
WR	Wildlife Refuge
WSE	Water Surface Elevation
WVA	Wetland Value Assessment

INTRODUCTION

This Integrated Final Feasibility Report and Environmental Impact Statement (Integrated Final Report & EIS) is the result of considering and incorporating responses to the public and policy comments on the Southwest Coastal Louisiana Integrated Draft Feasibility Report and Programmatic Environmental Impact Statement released on December 13, 2013 and the Revised Integrated Draft Feasibility Report and Environmental Impact Statement released on March 20, 2015. This Integrated Final Report & EIS documents revisions to the detailed feasibility design, analysis and impacts analyses of the Recommended Plan on significant resources. Revisions from the Revised Integrated Draft Feasibility Report and Environmental Impact Statement include changing the programmatic NED plan to a detailed and constructible nonstructural flood risk reduction plan and further development of a detailed and constructible ecosystem restoration plan.

Purpose of Action and Scope (*NEPA Required)

The low elevation and proximity of the Study Area to the Gulf of Mexico puts the unique environment and cultural heritage of southwest coastal Louisiana communities at risk of damages from hurricane storm surge and coastal erosion. Land subsidence and rising sea level are expected to increase the potential for coastal flooding, shore erosion, saltwater intrusion, and loss of wetlands and chenier habitats into the future. Through separate authorizations, Congress authorized the investigation of alternatives to: (1) provide hurricane protection and storm damage risk reduction, and (2) significantly restore the natural ecosystem including the Chenier Plain in Calcasieu, Cameron, and Vermilion parishes in Louisiana. The intent is to develop potential solutions to address these water resource problems. Both the Nonstructural National Economic Development (NED) hurricane storm damage risk reduction measures and the National Ecosystem Restoration (NER) measures have been developed to a feasibility-level of design and are recommended for construction.

Federal Objectives

The Federal objective of water and related land resources planning is to provide the greatest net contribution to the NED consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements. The ecosystem restoration objective is to contribute to the NER by restoring degraded ecosystem structure, function, and dynamic processes to a less degraded, more natural condition.

1.0 PROJECT SETTING

This chapter describes the historic and existing conditions of the affected environment and forecasts the future without-project conditions (FWOP) (No Action Alternative) which provide the basis for plan formulation. More detailed information concerning historic and existing conditions for a number of the important resources discussed in Chapter 1 is provided in Appendix A.

1.1 Affected Environment (*NEPA Required)

Study Area

The study area (Figure 1-1) is located in southwest Louisiana and includes all of Calcasieu, Cameron, and Vermilion parishes encompassing approximately 4,700 square miles. Cameron Parish is located in the southwest corner of Louisiana. The southern boundary of the parish is the Gulf of Mexico. Eighty-two percent of Cameron Parish is coastal marshes. Geographically, it is one of the largest parishes in Louisiana. The parish is chiefly rural and the largest communities are Cameron and Hackberry. Cameron is located along LA-82, while Hackberry is located along LA-27. Other smaller communities include Creole, Johnsons Bayou, and Holly Beach. Calcasieu Parish is located due north of Cameron Parish. The city of Lake Charles is the parish seat, which is the largest urban area in the study area. Only a small portion of the parish is located in the coastal zone. Vermilion Parish is located due east of Cameron Parish. The southern boundary of the parish is the Gulf of Mexico. Large expanses of Vermilion Parish are open water (lakes, bays, and streams). Approximately 50 percent of the land is coastal marshes. The parish is chiefly rural and the town of Abbeville is the parish seat as well as the largest urban area in the parish. Other communities include Delcambre, Kaplan, and Gueydan, which are all located along LA-14 in the northern part of the study area. Pecan Island and Forked Island are smaller communities, both located along LA-82 in lower Vermilion Parish. Located along LA-333, Intracoastal

City supports the area's oil and shrimp industries and is the nearest access to Vermilion Bay and the Gulf of Mexico in this region.

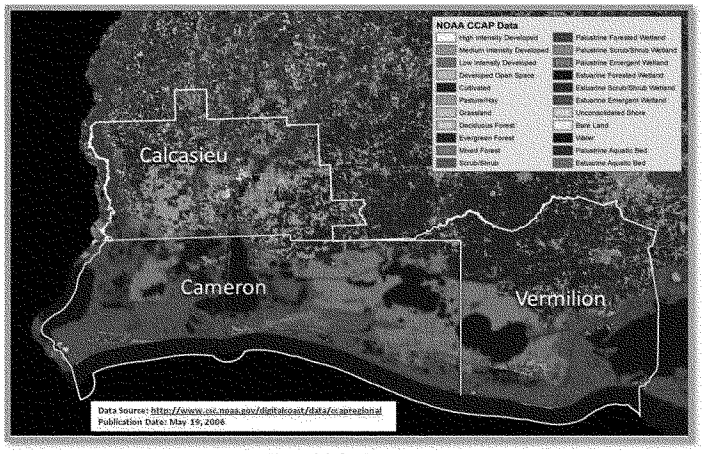


Figure 1-1: Study area map.

Geomorphic and Physiographic Setting

The area is characterized by extensive coastal marshland interrupted by forests atop relict chenier ridges and natural ridges. The cheniers are unique geological features that are critical components of the ecology. Cheniers and natural ridges were formed over thousands of years by the deltaic processes of the Mississippi River and other streams. The chenier ridges run laterally to the modern shoreline and rise above the surrounding marshes by as little as a few inches or as much as 10 feet (Byrne et al. 1959). These ridges can range from 100 to 1,500 feet wide with some ridges extending along the coast for a distance of up to 30 miles. Cheniers were created during the Pleistocene epoch by river sediments being pushed westward by shoreline currents in the Gulf of Mexico (Gould and McFarlan 1959). Natural ridges were formed by the repeated overbank flood sedimentation of rivers in southeast Louisiana (Fisk 1944). Principally, the rivers involved in creating these natural levees are past distributaries of the Mississippi River.

The main physiographic zones of the Chenier Plain include the Gulf Coast Marsh, Gulf Coast Prairies, and Forested Terraced Uplands. The Gulf Coast Marsh is at or near sea level and borders the Gulf of Mexico and most of the large lakes are in this area. The Gulf Coast Prairie extends from the central part of Vermilion and Cameron Parishes into the southern part of Calcasieu Parish; while the Forested Uplands, which occur at or near 25-foot elevation, are located in the northern part of Vermilion and Calcasieu Parishes. Louisiana's coastal prairies, once encompassing an estimated 2.5 million acres in the southwest portion of the state, now are considered critically imperiled with less than 600 acres remaining. The relationship between the forested cheniers and the surrounding aquatic ecosystem is inextricably linked. Cheniers provide valuable habitat for wetland-dwelling animal species in the form of cover, food, and nesting. Additionally, cheniers offer a protective element to nearby wetlands by reducing wave energies and diverting water flow that can come ashore from tropical events. These remnant beachheads, although elevated, offer a unique and important habitat that is currently in a degraded form. Land cover classifications from the Louisiana Coastal Area (LCA) habitat dataset

for calendar year 2000, the most recent data set available from the U.S. Geological Survey (USGS), are presented in Table 1-1. The 2000 LCA habitat data composition does not cover the portion of the study area north of the coastal zone (USGS 2013). See Appendix A, for more detailed information concerning the study area.

Table 1-1: Year 2000 area habitat classification.

Habitat Class	Acres	Percent of Project Area
Water	286,086	9.79%
Water - Fresh Zone	73,262	2.51%
Water - Intermediate Zone	84,736	2.90%
Water - Brackish Zone	49,896	1.71%
Water - Saline Zone	5,309	0.18%
Water - Swamp Zone	0	0.00%
Fresh Marsh	336,406	11.51%
Intermediate Marsh	310,577	10.62%
Brackish Marsh	177,369	6.07%
Saline Marsh	35,518	1.22%
Non-wetlands	15,651	0.54%
Wetland Forest	16,208	0.55%
Upland Forest	7,709	0.26%
Swamp	0	0.00%
Wetland Shrub/Scrub	17,076	0.58%
Upland Shrub/Scrub	10,745	0.37%
Agriculture/Pasture	67,842	2.32%
Developed	7,211	0.25%
Barren	9	0.00%
*Out of Analysis	1,421,582	48.63%
Total Acres	2,923,194	

*Out of analysis—this area, primarily north of the Coastal Zone, was not included in the original data set from which the data is derived.
(source: USGS Map ID USGS-NWRC 2014-11-0001 Map Date: October 18, 2013.)

Climate

The climate is subtropical marine with long humid summers and short moderate winters. The average temperatures range from 59 to 78°F; with August being the warmest and December the coolest. Average annual rainfall is 57 inches; with June the wettest and April the driest month (Source: http://www.srh.noaa.gov/lch/?n=KLCH, accessed December 14, 2015). During the summer, prevailing southerly winds produce conditions favorable for afternoon thundershowers. In the colder seasons, the area is subjected to frontal movements that produce squalls and sudden temperature drops. River fogs are prevalent in the winter and spring when the temperature of the major water bodies is somewhat colder than the air temperature. Since 1865 a total of 16 hurricanes have made landfall within 65 nautical miles of Lake Charles (source:http://csc.noaa.gov/hurricanes/#app=6078&7239-selectedIndex=0&3722-selectedIndex=0, accessed December 14, 2015).

1.2 Human Environment

Communities include the cities of Lake Charles and Sulphur; the towns of Vinton and Iowa in Calcasieu Parish; the towns of Cameron, Grand Lake, Hackberry, and Grand Chenier in Cameron Parish; and the city of Abbeville, the towns of Erath, Kaplan, and Pecan Island in Vermilion Parish; and the town of Delcambre in Vermilion and Iberia parishes. These parishes have historically suffered extensive damage from hurricanes and tropical storms due to insufficient hurricane storm surge damage risk reduction features. The impact of preparing for, mitigating, and recovering from these damages has placed a significant physical and emotional burden on both individuals and communities. Most recently, Hurricanes Rita (2005) and Ike (2008) caused

significant damage to homes and businesses. In this section, socioeconomic and other social effects (OSE) data for Calcasieu, Cameron, and Vermilion Parishes provide a context from which to evaluate potential effects of the proposed action.

1.2.1 Population and Housing

Table 1-2 shows the population trend in the three-parish area from 1970 to 2012. Population increases between 2000 and 2010 reflect similar growth patterns state-wide over this period. Population in the three-parish area in 2012 was 259,918, although there was a decline of population, due in large part to impacts from tropical storms and hurricanes, in Cameron Parish from 2000 to 2012. It is probable that recovery requirements and updated FEMA base flood delineation following this series of storms had a more pronounced effect on redevelopment in predominantly coastal Cameron Parish. Significant elevation requirements in order to achieve FEMA compliance likely resulted in a northward population shift. Such a shift would be consistent with the observed population trend in Calcasieu Parish.

Table 1-2: Population in the study area.

Parish	1970	1980	1990	2000	2010	2012
Calcasieu	145,415	167,223	168,134	183,577	192,768	194,493
Cameron	8,194	9,336	9,260	9,991	6,839	6,702
Vermilion	43,071	28,458	50,055	54,014	57,999	58,723
Total	**196,680**	**205,017**	**227,449**	**247,582**	**257,606**	**259,918**

Sources: U. S. Census, 2010 and U.S. Census Abstract, 2013

The trend in household formation, shown in Table 1-3, parallels the growth in population. Most households are located in the metropolitan areas which include: Lake Charles in Calcasieu Parish; Cameron (which serves as the seat of government in Cameron Parish); and Abbeville located in Vermilion Parish.

Table 1-3: Households (in thousands) in the study area.

Parish	1970	1980	1990	2000	2010	2012
Calcasieu	42.1	56.8	60.4	68.6	70.6	72.2
Cameron	2.3	3.0	3.1	3.6	2.5	2.4
Vermilion	12.8	16.3	17.7	19.9	21.1	21.6
Total	**57.2**	**76.1**	**81.3**	**92.1**	**94.2**	**96.2**

Sources: U. S. Census, 2010 and U.S. Census Abstract, 2013

According to the Federal Emergency Management Agency (FEMA 2013), flood claims from all sources for the three-parish area between 1978 and 2012 totaled $420,900,000 (Table 1-4). (NOTE: FEMA flood claims occur due to a property experiencing inundation regardless of the source of flooding; however, in the study area, the majority of the flooding experienced derives from a combination of storm surge and heavy rainfall associated with tropical events. The subject study is limited to addressing the risk of damages from flooding derived from hurricane storm surge and does not address flooding associated with rainfall events, even those associated with a hurricane or tropical storm event.)

Table 1-4: Summary of flood claims data for the period 1978 to 2012.

Parish	Claims	Total Nominal Dollar Amount (in millions)	Average Amount per claim
Calcasieu	4,008	$132.0	$32,930
Cameron	3,061	$173.5	$56,679
Vermilion	3,218	$115.4	$35,860
Total	**10,287**	**$420.9**	**$41,823**

Note: Dollar amounts reflect the amount paid out at time of claim

1.2.2 Employment, Business, and Industrial Activity

Economic growth is highly dependent upon the major employment sectors. With the exception of the cities of Lake Charles, Sulphur, Abbeville, and Delcambre, the study area is sparsely populated. The area is rich in natural resources and industrial infrastructure. The economy of the coastal communities is centered on fishing, shrimping, and offshore oil services. The agricultural land located 30 to 40 miles inland is used for rice, sugar cane, and livestock production. The northern-most portion is heavily forested and supports a substantial timber industry. Lake Charles, which is the population center of the region, is the home of large oil refineries, petro-chemical plants, a deep-water port, McNeese State University, and casinos along the lakefront.

Table 1-5 shows the growth of non-farm employment over the last four decades. The leading employment sectors are education, healthcare, petroleum production, and petrochemical refining. Other significant employment sectors include education, manufacturing, accommodations and social services, and retail trade. Employment growth was steady from 1970 to 2012 for Calcasieu and Vermilion parishes, although employment in Cameron parish declined since 2000, and is reflected in the population estimates previously described. See Appendix A for more detailed information concerning non-farm employment by industry for each parish.

Table 1-5: Non-farm employment in the study area (in thousands).

Parish	1970	1980	1990	2000	2010	2012
Calcasieu	41.1	67.0	69.0	84.6	87.9	93.3
Cameron	2.8	4.4	4.1	3.9	2.6	2.7
Vermilion	9.4	16.6	13.3	14.7	15.5	16.9
Total	53.3	88.0	86.4	103.2	106.0	112.9

Source: Moody's 2013

1.2.3 Public Facilities and Services

Public facilities and services have historically grown to meet population demands. The area includes a mixture of community centers, schools, hospitals, airports, colleges, and fire protection. The Port of Lake Charles is a key center for international trade, and is among the top 15 busiest ports in the nation. A total of 603 public and quasi-public buildings were specifically inventoried in 2012.

1.2.4 Transportation

The transportation infrastructure includes major roads, highways, railroads, and navigable waterways that have developed historically to meet the needs of the public. Interstate 10 (I-10), an east-west bi-coastal thoroughfare that connects Houston and Baton Rouge, crosses the northern part of the area and is a primary route for hurricane evacuation and post-storm emergency response. US-165, another evacuation and emergency response route, is located north of I-10. Most of I-10 is either at or just below the 100-year floodplain. Other major highways include US-13 and US-26, which run north-south and intersect I-10 in the northeastern portion of the parishes. LA 82 is an east-west state highway that serves as a vital route for the area's fishing, oil and gas, and seafood industries as well as hurricane evacuation. Like portions of LA 82, LA 27 is part of the Creole Nature Trail, also known as Louisiana's Outback, and the Gulf Beach Highway. Portions of LA 27 and LA 82 run east-west along the Gulf shoreline between Holly Beach and Cameron, LA. Other modes of transportation include water transport along the Gulf Intracoastal Waterway (GIWW) and the Sabine and Calcasieu Rivers, all of which accommodate ocean-going vessel and barge traffic. See Appendix A for more detailed information concerning navigation projects including: the GIWW, the Sabine-Neches Waterway and Sabine Pass Ship Channel, the Calcasieu River and Pass, the Mermentau River, the Freshwater Bayou and Freshwater Bayou Lock, and the Bayou Teche and Vermillion River. See Appendix A for information concerning the operations and maintenance dredging of navigation channels.

Rail and aviation facilities are spread throughout. During Hurricanes Rita and Ike, portions of I-10 were inundated by a combination of storm surge and rainfall. This interfered with emergency service access and

prevented local and regional residents from returning to their primary residences and businesses. This delay in repopulation results in additional emergency costs, due to the longer time periods required for sheltering residents until the area was made safe to return.

1.2.5 Community and Regional Growth (Income)

Community and regional growth primarily track population and employment trends that were described in the preceding sections. Table 1-6 shows per capita growth in income since 1990.

Table 1-6: Nominal per capita income in the study area.

Parish	1990	2000	2010	2012
Calcasieu	$15,511	$23,034	$29,021	$34,577
Cameron	$13,001	$18,433	$20,739	$33,784
Vermilion	$12,343	$19,130	$23,091	$29,873

Note: Dollar amounts reflect the income in associated year prices

1.2.6 Tax Revenue and Property Values

Historically, damages from storm surge events have adversely impacted business and industrial activity, agricultural activity, and local employment and income, which then led to commensurate negative impacts to property values and the tax base upon which government revenues rely. As in other developed communities, the presence of high risk of damages from hurricane storm surge has reduced property values since the cost of repairing those damages [whether directly by property owners or through claims made through the National Flood Insurance Program (NFIP) for which annual premiums are charged] increases the long-term cost of property ownership. Measurement of this loss is problematic since the market price of properties captures an extensive array of factors such that the contribution of hurricane storm surge risk to changes in market value cannot be directly ascertained. As described in detail in the Economics Appendix, structure characteristics for 46,860 residential and 4,997 non-residential structures were collected to assist in evaluating the impacts of hurricane storm surge risk under existing and future conditions. As this data reflects, currently, the median depreciated replacement value of housing units is $115,684 (in 2012 price prices).

1.2.7 Community Cohesion

Community cohesion is based on the characteristics that keep the members of the group together long enough to establish meaningful interactions, common institutions, and agreed upon ways of behavior. These characteristics include race, education, income, ethnicity, religion, language, and mutual economic and social benefits. The area is comprised of communities with a long history and long-established public and social institutions including places of worship, schools, and community associations. In 2005 with Hurricane Rita, and again in 2008 with Hurricane Ike, communities in Calcasieu, Cameron, and Vermilion Parishes were inundated by storm surge. Due to the absence of hurricane storm surge risk reduction measures, and the resulting direct impacts to existing structures, local populations were forced to evacuate and/or relocate for significant time periods, thereby significantly disrupting temporarily, and in some instances, permanently, community cohesion throughout the study area.

1.2.8 Other Social Effects (OSE)

In accordance with the USACE Institute for Water Resources (IWR) handbook in Applying Other Social Effects in Alternatives Analysis (USACE, 2013) seven social factors that describe the social fabric of a community were identified. The social factors identified and described in Table 1-7 are based on conventional psychological Human Needs Theory and Abraham Maslow's Hierarchy of Needs (USACE 2013). These social factors are also covered in the socioeconomic sections of the report. Additional detailed information is included in the Other Social Effects section of Appendix A.

Table 1-7: Social Factors

Social Factor	Description
Health and Safety	Refers to perceptions of personal and group safety and freedom from risks
Economic Vitality	Refers to the personal and group definitions of quality of life, which is influenced by the local economy's ability to provide a good standard of living
Social Connectedness	Refers to a community's social networks within which individuals interact; these networks provide significant meaning and structure to life
Identity	Refers to a community member's sense of self as a member of a group, in that they have a sense of definition and grounding
Social Vulnerability and Resiliency	Refers to the probability of a community being damaged or negatively affected by hazards, and its ability to recover from a traumatic event
Participation	Refers to the ability of community members to interact with others to influence social outcomes
Leisure and Recreation	Refers to the amount of personal leisure time available and whether community members are able to spend it in preferred recreational pursuits

Socioeconomic data for Calcasieu, Cameron, and Vermilion Parishes are presented in order to provide a context from which to evaluate the potential social impacts of the proposed project. A more detailed explanation of socioeconomic characteristics is available in Sections 1.2.1, 1.2.2, 1.2.5 and 1.2.9. The Social Profile of Communities provides a baseline profile of existing and future without project conditions for the social communities in the study area. Data for the social profile were obtained from a variety of sources including 2010 U.S. Census records, the 2007-2011 U.S. Census Bureau's American Community Survey (ACS) estimates, ESRI data, public meetings, interviews with local representatives, and aerial photography. The baseline characteristics are considered the existing and future-without project conditions.

The Hazards and Vulnerability Research Institute at the University of South Carolina created an index that compares the social vulnerability of U.S. counties/parishes to environmental hazards. The variables included in the index are based on previous research which has found that certain characteristics (e.g., poverty, racial/ethnic composition, educational attainment, and proportion over the age of 65) contribute to a community's vulnerability when exposed to hazards. According to the Institute for Water Resources Other Social Effects handbook (USACE 2008), the Social Vulnerability Index (SoVI®) is a valuable tool that can be used in the planning process to identify areas that are socially vulnerable and whose residents may be less able to withstand adverse impacts from hazards. The SoVI® was computed as a comparative measure of social vulnerability for all counties/parishes in the U.S., with higher scores indicating more social vulnerability than lower scores. Calcasieu Parish has a SoVI® 2006-10 score of -1.21 (0.28 national percentile), Cameron Parish has a SoVI® 2006-10 score of -3.59 (.08 national percentile), and Vermilion Parish has a SoVI® 2006-10 score of -0.04 (0.49 national percentile). Based on these scores, Calcasieu Parish is rated as more socially vulnerable than roughly 72 percent of counties/parishes in the U.S.; Cameron Parish is rated as more socially vulnerable than about 92 percent of counties/parishes in the U.S.; and Vermilion Parish is rated as more socially vulnerable than roughly 51 percent of counties/parishes in the U.S. By comparison, Orleans Parish, notorious for its enduring levels of high poverty, has a SoVI® 2005-09 score of -0.92 making it more socially vulnerable than 33 percent of counties/parishes in the nation. Hence, Cameron Parish is by far the most socially vulnerable to hurricane storm surge damage consequences in the study area followed by Calcasieu Parish and Vermilion Parish is the least socially vulnerable in the area. However, all three parishes are ranked as being more socially vulnerable to hurricane storm surge damage consequences than Orleans Parish.

1.2.9 Environmental Justice

The Environmental Justice (EJ) study area contains all Census Tracts and Census block groups located within Calcasieu, Cameron, and Vermilion parishes.

Table 1-8 shows the racial characteristics of the three parishes according to the 2010 U.S. Census. Overall, minority residents make up 29% of the population in Calcasieu, 4% of the population in Cameron and 20% of

the population in Vermilion Parishes. According to the 2010 U.S. Census data, there are 42 block groups in Calcasieu Parish and 8 block groups in Vermilion Parish where 50 percent or more of the population identify themselves as part of a minority group. There are no block groups in Cameron Parish where more than one percent identify themselves as part of a minority group (Figure 1-2).

Table 1-8: Racial characteristics.

Parish	White	African American*	American Indian/Alaska Native*	Asian*	Hawaiian/Pacific Islander*	Total	Percent Minority**
Calcasieu	136,514	47,782	898	2,073	93	192,768	29%
Cameron	6,546	119	36	6	0	6,839	4%
Vermilion	46,922	8,286	209	1,160	5	57,999	20%

* 2010 Census / ** 2007 – 2011 Census

Soutwest Coastal Study Area Percent Majority Population by US Census Block Group

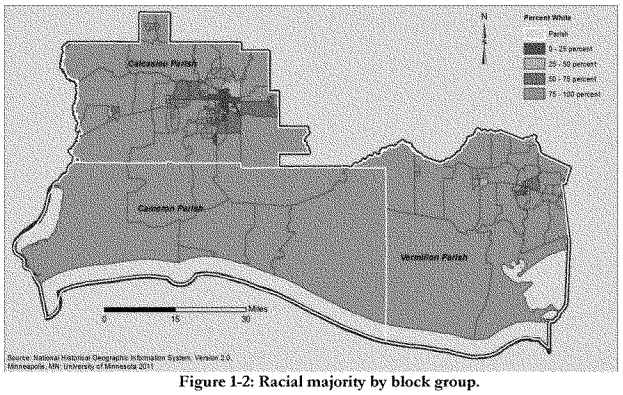


Figure 1-2: Racial majority by block group.

High poverty rates negatively impact the social welfare of residents and undermine the community's ability to provide assistance to residents in times of need. The 2007-2011 American Community Survey (ACS) data indicate that 9 percent of households in Calcasieu Parish, 5 percent in Cameron Parish, and 10 percent in Vermilion Parish fell below the poverty line (Figure 1-3). The 2007-2011 Census ACS data indicate that there are:

- 17 poverty areas and 2 extreme poverty areas (block groups) in Calcasieu Parish
- 0 poverty areas or extreme poverty areas (block groups) in Cameron Parish
- 7 poverty areas and 1 extreme poverty areas (block groups) in Vermilion Parish

Soutwest Coastal Study Area Percent Poverty by US Census Block Group

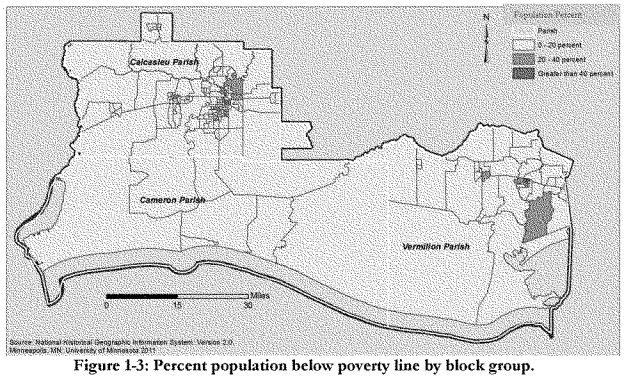


Figure 1-3: Percent population below poverty line by block group.

1.3 Water Environment (Hydrology and Hydraulics)

The two major hydrologic basins in the Chenier Plain are the Mermentau Basin and the Calcasieu-Sabine Basin (LCA, 2004). The Teche-Vermilion Basin is another significant hydrologic basin in the study area. The general location and major features/water bodies in each basin are described below. Figure 1-4 identifies major hydrologic features. For the most part, areas below the GIWW are within the coastal zone.

Calcasieu-Sabine Basin - The Calcasieu-Sabine Basin lies in the western portion of the Chenier Plain in Cameron and Calcasieu Parishes. It is bounded to the east by LA-27, to the south by the Gulf of Mexico, and to the west by the Sabine River and Sabine Lake. The Basin is a shallow coastal wetland system with freshwater input at the north end, a north-south flow through Calcasieu and Sabine Lakes, and some east west water movement through the GIWW and interior marsh canals (e.g., North Starks and South Starks canals on the Sabine National Wildlife Refuge). The dominant hydrologic features of the basin are the Calcasieu and Sabine Lakes, which are directly influenced by the Calcasieu, Sabine, and Neches Rivers. Navigation channels include the Sabine-Neches Waterway, and the Calcasieu River and Pass. Water control structures in the area include the Calcasieu Locks. Managed wetlands, which utilize natural and manmade features to regulate water level and quality, and marsh productivity, are a significant feature of the Calcasieu-Sabine Basin (LADNR 2002). The Calcasieu drainage basin north of the point where the Sabine River crosses the GIWW is 3,235 square miles. The Sabine drainage basin has a drainage area of 9,760 square miles. The headwaters start in northeastern Texas and the river runs about 150 miles before it meets the Louisiana-Texas state line, then runs to the Gulf. The Toledo Bend Reservoir and Sabine Lake are the major hydrologic features of the Sabine Basin.

The GIWW from the Sabine River to the Calcasieu River is a 125 feet (ft.) wide x 12 ft. deep. Construction of the GIWW significantly altered regional hydrology by connecting the two major ship channels. Prior to the construction of the GIWW, the Calcasieu and Sabine estuaries were mostly distinct and were more influenced by the Calcasieu and Sabine rivers, respectively. The Gum Cove Ridge once separated the Sabine Basin from the Calcasieu Basin, with little water exchange between the basins. Removing the mouth bars and deepening the Calcasieu Ship Channel (CSC) and the Sabine-Neches channels, as well as the GIWW and interior canals bisecting the Gum Cove Ridge, made the region hydrologically indistinct, which caused water flow and salinity patterns of one basin to profoundly affect those patterns of the other basin. In addition to combining the two

basins, the GIWW severed hydrologic connections (e.g., bayous and sheet flow) between the northern and southern portions of these basins, and channelized these freshwater flows directly to the Gulf of Mexico, thereby partially bypassing the southern marshes.

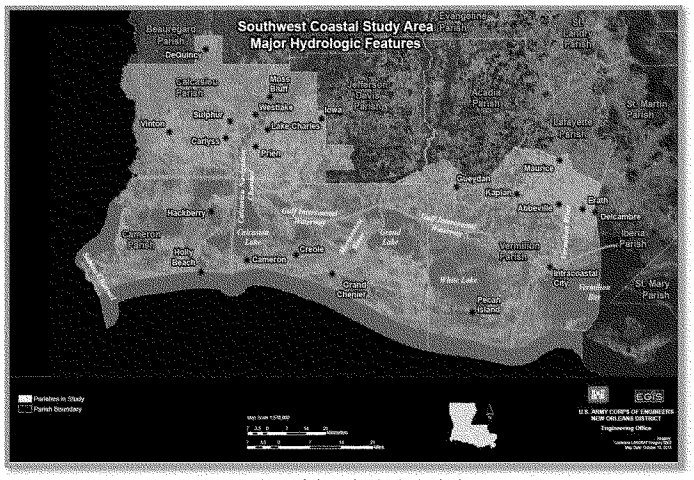


Figure 1-4: Major hydrologic features.

Mermentau Basin - The Mermentau Basin lies in the eastern portion of the Chenier Plain in Cameron and Vermilion Parishes. The Mermentau River Basin can be divided into three sub-basins: Upland, Lakes, and Chenier. The Upland Sub-basin covers an area of 3,683 square miles of predominantly agricultural land. The Lakes Sub-basin is delineated by the Freshwater Bayou Canal on the east, the limit of the coastal zone on the north, LA-27 on the west, and LA-82 on the south. LA-82 runs atop and between the Grand Chenier-Pecan Island ridge complex. The Chenier Sub-basin lies south of this ridge complex. The dominant hydrologic features of the Mermentau basin are the Grand and White Lakes and the Mermentau River. Navigation channels include the Mermentau Ship Channel. Various water control structures include the Freshwater Bayou Canal Lock, the Schooner Bayou Canal Structure, and the Catfish Point Control Structure.

Before human-induced hydrologic alterations from navigation channels in the early 1900s, the natural drainage in the Mermentau Basin was dominantly north-south through the Mermentau River, Freshwater Bayou, Bayou Lacassine, and Rollover Bayou. The eastern portion of the basin also drained in an easterly direction through Belle Isle and Schooner bayous. In addition, sheet flow over the marsh occurred between Grand Chenier and Pecan Island ridges, as well as to the west into the Calcasieu/Sabine Basin. Human activities related to wildlife management, navigation improvement, flood control, agriculture, and petrochemical exploitation have dramatically altered the hydrology of the Mermentau Basin. The net effect of these alterations is that drainage through the Lakes Sub-basin is now predominantly east-west and hydrologically isolated from the Chenier Sub-basin. The Lakes Sub-basin now functions more as a freshwater reservoir and less as a low-salinity estuary, its natural form (Gunter and Shell 1958; Morton 1973).

Teche/Vermilion Basin - The Teche/Vermilion Basin extends from Point Chevreuil to Freshwater Bayou Canal and includes East and West Cote Blanche Bays, Vermilion Bay, and the surrounding marshes. Navigation features include the Freshwater Bayou Canal Navigational Channel and the Leland Bowman Lock. The Basin has a drainage area of 3,040 square miles (LCA 2004). Only the western extent of this hydrologic basin lies within the authorized Southwest Coastal study area.

1.3.1 Water Stage Duration and Frequency

Normal astronomical tides are diurnal (one high tide and one low tide per day) and can have a spring range of as much as 2 ft. The mean tidal range is approximately 1.28 ft. at Calcasieu Pass and 1.48 ft. at Freshwater Canal. Amplitudes are influenced by tides, but are generally controlled by meteorological events. South winds drive water into the marshes.

1.3.2 Relative Sea Level Rise

In coastal Louisiana, relative sea level rise (RSLR) is the term applied to the difference between the change in eustatic (global) sea level and the change in land elevation. According to Intergovernmental Panel on Climate Change (IPCC 2007), the global mean sea level rose at an average rate of about 1.7 mm/yr during the 20th Century. Recent climate research has documented global warming during the 20th Century, and has predicted either continued or accelerated global warming for the 21st Century and possibly beyond (IPCC 2007).

Land elevation change can be positive (accreting) or negative (subsiding). Land elevations decrease due to natural causes, such as compaction and consolidation of Holocene deposits and faulting, and human influences such as sub-surface fluid extraction and drainage for agriculture, flood protection, and development. Forced drainage of wetlands results in lowering of the water table resulting in accelerated compaction and oxidation of organic material. Areas under forced drainage can be found throughout coastal Louisiana and the study area. Land elevations increase as a result of sediment accretion (riverine and littoral sources) and organic deposition from vegetation. Vertical accretion in most of the area, however, is insufficient to offset subsidence, causing an overall decrease in land elevations. The combination of subsidence and eustatic sea level rise is likely to cause the landward movement of marine conditions into estuaries, coastal wetlands, and fringing uplands (Day and Templet, 1989; Reid and Trexler 1992).

Subsidence Rates - Subsidence rates vary considerably across coastal Louisiana. A coast wide system for quantifying and predicting subsidence on a regional scale has not yet been established. Therefore, subsidence rates are estimated using a combination of benchmark leveling, tide gauge measurements, and radiometric dating of buried marsh horizons. The subsidence rate for most of the study area is considered low, at 0 to 1 ft/century; however, the subsidence rates in the Mermentau Basin for Hackberry Ridge, Big Lake, Cameron-Creole, Brown Lake, Hog Island Gully, and Mud Lake watersheds, all located within the study area, are considered intermediate, at 1.1 – 2 ft per century. Perry Ridge in the Calcasieu/Sabine Basin and Locust Island and Little Prairie in the Mermentau Basin are considered stable (Coast 2050, 2009).

Accretion Rates - Net accretion varies significantly on a local level and over time. Average measurements of accretion across the Louisiana coastal region indicate that current accretion rates are 0.7 to 0.8 cm per year (ERDC/EL TN-10-5). Since there is currently a lack of evidence to support applying a habitat specific accretion rate, a long-term accretion estimate of 0.7 cm per year captures the central tendency of all herbaceous marsh data that have been reviewed for this analysis.

1.3.3 Storm Surge

While the study area has periodically experienced localized flooding from excessive rainfall events, the primary cause of the flooding events has been the storm surges from hurricanes and tropical storms. During the past eight years, the area has been greatly impacted by storm surges associated with four Category 2 or higher hurricanes (Lili, Rita, Gustav, and Ike), which inundated structures and resulted in billions of dollars in damages to southwest coastal Louisiana. Hurricane storm surge also causes significant permanent damage to wetlands. Hurricane surge has formed ponds in stable, contiguous marsh areas and expanded existing, small ponds, as

well as removed material in degrading marshes (Barras, 2009). Fresh and intermediate marshes appear to be more susceptible to surge impacts, as observed in Barras (2006).

1.3.4 Storms of Record

Hurricane Audrey (June 25 - 29, 1957) ranks as the 7th deadliest hurricane to strike the United States and was the deadliest natural disaster in the history of southwest Louisiana in modern record-keeping with at least 500 deaths (source: http://www.srh.noaa.gov/lch/?n=audrey; accessed January 7, 2016).

Hurricane Lili (September 23 - October 3, 2002) was originally a Category 4 hurricane and first made landfall near Marsh Island in Iberia Parish with maximum sustained winds of 92 mph. Highest recorded rainfall amount was about 9 inches in some parts of Louisiana. The highest storm surge was over 11 feet in St. Mary Parish (source: https://coast.noaa.gov/hes/docs/postStorm/Lili_%20final.pdf; accessed December 15, 2015).

Hurricane Rita (September 24 - 26, 2005) Hurricane Rita, reaching its peak intensity southeast of the mouth of the Mississippi River as a Category 5, first made landfall just west of Johnson's Bayou and east of Sabine Pass at the Texas-Louisiana border as a Category 3 hurricane. Sensors recorded storm-surge water levels over 14 ft above NAVD 88 at Constance Beach (LC11), Creole (LA12), and Grand Chenier (LA11), La., about 20 miles, 48 miles, and 54 miles, respectively, east of Sabine Pass, Texas. In general, storm-surge water levels increased eastward from the Sabine River into southwest Louisiana. The magnitude of the storm surge was greatest near the coast and decreased inland through the approximate latitude of I-10, about 35 miles inland from the coast (source: http://pubs.usgs.gov/circ/1306/pdf/c1306_ch7_i.pdf; accessed December 15, 2015).

Hurricane Gustav (August 25 - September 4, 2008) Gustav made landfall near Cocodrie, Louisiana on September 1, 2008 as a strong category 2 (based on 110 mph sustained winds) and continued to move northwest, spreading hurricane force wind gusts across portions of Southeast and South Central Louisiana (http://www.srh.noaa.gov/lix/?n=gustavsummary; accessed January 26, 2016). Due to the storm making landfall east of the study area, storm surge values were only 4-5 feet across St. Mary, Iberia, and Vermilion parishes (http://www.srh.noaa.gov/images/lch/tropical/HPW1-SUN.pdf; accessed January 26, 2016).

Hurricane Ike (September 1-14, 2008) first made landfall near Galveston, Texas on September 13, 2008 as a Category 2 hurricane with maximum sustained winds of 110 mph (http://www.srh.noaa.gov/hgx/?n=projects_ike08; accessed December 15, 2015). Ike was a large hurricane with tropical-storm-force and hurricane-force winds associated at the time of its landfall extending approximately 275 miles and 120 miles from the storm center, respectively. In Louisiana, estimated wind speeds ranged from 80 mph near the Texas-Louisiana border to 50 mph in Vermilion Parish. Storm surge caused flooding in Cameron, Vermilion, and many parishes to the east, with over 9 foot stillwater levels estimated for Lake Charles (http://www.fema.gov/media-library-data/20130726-1648-20490-1790/757_ch1_final.pdf; accessed December 15, 2015).

1.3.5 Flow and Water Levels

The marsh area of southwest Louisiana extends northward and slightly beyond the GIWW. Rainfall runoff drains from the higher elevations in the north and is trapped in the marsh area to the south due to chenier ridges that parallel the coast. The natural drainage pattern prior to the construction of the GIWW was for rainfall in the basin to drain through the Mermentau River and empty into the Gulf of Mexico. However, some of that flow is now redistributed to the east and west along the GIWW. The Calcasieu Lock, Catfish Point Control Structure, Leland Bowman Lock, and Schooner Bayou Lock were created to allow for navigation and salinity control.

Land stewardship through hydrologic management and shoreline protection are the mainstays of coastal restoration in the Calcasieu-Sabine basin. Water control structures are operated both passively and actively. Virtually all hydrologic management focuses on controlling salinity and minimizing tidal fluctuations by constructing and operating levees, weirs, and a variety of gated structures. A 1990 inventory of such water

control structures identified 174 individual structures in the interior and along the perimeter of the basin (LADNR 2002; Marcantel 1996).

The Cameron-Creole Watershed Project covers approximately 176 square miles in Cameron Parish. The area is bounded by the GIWW on the north; Calcasieu Lake and Calcasieu Pass on the west; LA-27, Little Chenier Ridge, and Creole Canal on the east; and the Gulf of Mexico and Mermentau River on the south. To counter this conversion of marsh to open water, the Cameron-Creole Watershed Project was initiated cooperatively by the Soil Conservation Service (now Natural Resource Conservation Service [NRCS]), Gulf Coast Soil and Water Conservation District, Cameron Parish Police Jury, Cameron Parish Gravity Drainage Districts 3 and 4, the Miami Corporation, and the United State Fish and Wildlife Service (USFWS), Sabine National Wildlife Refuge. The water control structures began operation in 1989 (LADNR 2002).

1.3.6 Water Quality and Salinity

Water quality is influenced by chenier plain elevations, surface water budget, land cover and use, chenier plain geomorphologic processes, and regional weather. The study area occupies most of the Louisiana chenier plain, and consists of low relief topography to the north and estuary to the south, with increasing estuary salinity southward. The area includes the Calcasieu and Mermentau River basins; the former is connected to the Gulf of Mexico via the Calcasieu ship channel, while the latter is maintained as freshwater environ via several water control structures (Rosen and Xu 2011). The area has experienced hydromodification via the construction of water control structures, canals, and embankments (Demcheck et al. 2004). Chemical transformations occurring in the estuary can be biologically mediated by estuary wetlands (Mitsch and Gosselink 2000); a diversity of wetland types exist within the study area which are affected by chenier plain geomorphology and anthropogenic factors (Visser et al. 2000). Weather patterns can affect marine influence, flow direction, water level, and wetlands biogeochemistry (Gosselink 1984). Timing and amount of precipitation can also affect water quality (Demcheck et al. 2004).

Demcheck et al. (2004), Garrison (1997), Waldon (1996), Skrobialowski et al. (2004), Demcheck and Skrobialowski (2003), Macdonald et al. (2011), Rosen and Xu (2011), and Steyer et al. (2008) provide detailed descriptions of water quality and salinity in the study area. In general, water quality concerns are related to urbanization in the parts of the area where hurricane storm surge risk reduction measures are proposed, oil and gas activities and saltwater intrusion in the Calcasieu River basin, and agriculture in the Mermentau River basin.

The Sabine River is the dominant influence across most of the basin in moderating gulf salinity and tidal fluctuations. Observations by USFWS personnel reveal that strong and prolonged south and southeast winds result in large volumes of Gulf of Mexico water being pushed into Calcasieu and Sabine lakes, which causes the water level in the marshes to rise (Paille 1996). A similar effect on marsh water level has been observed during periods of low barometric pressure in the region (LADNR 2002; Paille 1996).

The primary saltwater barrier in the Calcasieu Basin is the Calcasieu Lock, located approximately two miles east of the CSC. This sector-gated lock, which opened in 1950, was designed to prevent saltwater intrusion into the Mermentau Basin, and is operated primarily for navigation.

Louisiana Water Quality Inventory: Historical (1998-2012) Clean Water Act (CWA) Section 305(b) assessments of study area sub-segments were evaluated. For each sub-segment, an average designated use support value was calculated (0=always impaired, 1=unimpaired; see the unabridged report for methodology and details). Long-term average support values reveal that impairments are most common in the uppermost sub-segments in the study area in the Calcasieu and Teche-Vermilion watersheds. The most commonly suspected causes of impairment included in the 305(b) assessments were low dissolved oxygen, elevated total suspended solids, mercury, elevated turbidity, nitrate/nitrite, carbofuran, and total phosphorus, while the most commonly suspected sources of impairment were unknown sources, agriculture, natural sources, atmospheric deposition, flow alteration, urban runoff, and on-site treatment systems.

In the 305(b) assessment for 2012, the frequently cited suspected causes of impairment included fecal coliform, low dissolved oxygen, turbidity, mercury, total suspended solids, and carbofuran, while most frequently cited suspected sources of impairment included unknown sources, agriculture, natural sources, on-site treatment systems, atmospheric deposition, and drought-related impacts (LDEQ 2013).

1.4 Natural Environment

1.4.1 Sedimentation and Erosion

The study area is divided by the Sabine, Calcasieu, Mermentau, and Vermilion rivers which flow in a north-south direction. These rivers have been highly altered by the placement of locks and dams, dredged channels, manmade outlets to the Gulf, and bisected by the GIWW. These alterations influence the movement of sediment throughout the area. The rivers and interior lakes which they enter (Sabine, Calcasieu, and Grand) act as sediment sinks. Overbank deposition into adjacent marshes is minimal in these low flow rivers. Sediments in the interior lakes can be re-suspended and deposited in adjacent marshes during storm events and cold front passages. Extensive hydrologic alterations within the area (levees, channels, roads, locks, control structures, etc.) influence sediment movement throughout. Sediments in the rivers that make it to the coast are deposited at the mouths and generally move westward nourishing the beaches and marshes.

A significant source of sediment is the Atchafalaya River (McBride et al. 2007). Sediment travels westward from Atchafalaya Bay and the GIWW and enters the area through tidal exchange at the Gulf and from flooding during storm events. A large percentage of Atchafalaya River sediments are deposited along the Gulf shoreline in the vicinity of Freshwater Bayou as mudflats while coarser sediments continue westward along the shoreline.

The shorelines of most channels, lakes, and the Gulf are experiencing erosion with erosion rates generally highest where the shorelines protrude into the lakes, focusing wave and current action For example, White Lake average shoreline erosion rate of 15 feet per year (USACE 2006); southwest Grand Lake shoreline erosion rate of approximately 11 feet per year to 32 feet per year (source: https://lacoast.gov/reports/PPL/24/REGION4FSpwptsUPDATED.pdf; accessed January 6, 2016; and Sabine Lake about 10 feet per year (personal communication Darryl Clark, USFWS, January 6, 2016). The Louisiana coast has approximately 350 miles of sandy shoreline along its barrier islands and gulf beaches; however, there are about 30,000 miles of land-water interface along bays, lakes, canals, and streams. Most of these shores consist of muddy shorelines and bank lines, and virtually all are eroding. In many instances, rims of firmer soil around lakes and bays, and natural levees along streams have eroded away leaving highly organic marsh soils directly exposed to open water wave action. Examples include Redfish Point, Grassy Point, Umbrella Point, Short Point, and Commissary Point. High rates of Gulf shoreline erosion occur from the vicinity of Rollover Bayou, west to the Mermentau River. Accelerated shoreline loss occurs where erosion has caused Gulf, lake, and channel shorelines to intersect interior water bodies.

1.4.2 Soils, Water Bottoms, and Prime and Unique Farmlands

Both hydric and non-hydric soils are found throughout. The area consists generally of forested terrace uplands and Gulf Coast Prairies in the northern portions and Gulf Coast Marsh habitats in the southernmost portions. Predominant soils are described in Appendix A. The major water bottoms throughout include: Lake Charles, Prien Lake, Sabine Lake, Calcasieu Lake, Grand Lake, White Lake, and Vermilion Bay. There are numerous smaller lakes such as Sweet Lake, Mud Lake, Black Lake, Big Constance Lake, and Lake Misere. Rivers include the Calcasieu, Sabine, Mermentau, and Vermillion Rivers. A listing of the water bottoms is described in Appendix A.

Prime and Unique Farmlands: Prime farmlands are present and make up approximately 941,196 acres, or 34.3 percent of the soils; breakdown by parish is as follows: Calcasieu Parish is 479,426 acres, or 51 percent; Cameron Parish is 106,008 acres, or 11 percent; Vermilion Parish is 355,761 acres, or 38 percent. The majority of the Gulf Coast Marshes consists of wetland type soils and shorelines that are prone to frequent flooding and not suitable for agricultural use. Prime farmland is more predominant inland, and outside, of the Gulf Coast Marsh physiographic area. Prime farmland can also be found on natural ridge tops and cheniers (Hackberry loamy fine sand). Prime farmland soils are best suited for producing food, feed, forage, fiber, and oilseed crops, and possess

qualities that are favorable for crop production using only acceptable farming methods (NRCS Soil Survey of Calcasieu Parish, dated June 1988). Several soil types exist that meet those qualities and are identified as prime farmlands (see Appendix A). Urban areas, like Lake Charles and Abbeville, as well as industrial areas have excluded some prime farmlands from agricultural use.

1.4.3 Gulf Coastal Shorelines

Gulf coastal shorelines, located along the northern rim of the Gulf of Mexico, provide essential and critical shelter, nesting, feeding, roosting, cover, nursery, and other habitats and life requirements for fish and wildlife. They function as the boundary between marine and estuarine ecosystems and provide protection to the estuarine wetlands, bays, and other inland habitats. Coastal shorelines, as well as other coastal landscape features such as shoals, coastal marshes, and forested wetlands, can provide a significant and potentially sustainable buffer from wind wave action and storm surge generated by tropical storms and hurricanes. Rapid deterioration of the barrier coast is resulting in a transformation of low-energy, semi-protected bays into high-energy, open marine environments (Stone et al. 2005). Numerical modeling by Stone et al. (2005) demonstrated that physical loss of the barrier system and marsh results in a considerable increase in modeled storm surge levels and wave heights. Geomorphic features such as coastal shorelines and barrier islands, as well as coastal marsh and other wetland land masses can block or channelize flows (Working Group for Post-Hurricane Planning for the Louisiana Coast 2006). The area's coastal shorelines are experiencing some of the highest land loss rates in the Nation, due to both natural and man-made factors (USACE 2004).

Barrier beach and surf, dune, supratidal and intertidal wetlands, and swale habitats have undergone substantial loss due to oil and gas activities (e.g., pipeline construction), construction of navigation channels and jetties, subsidence, sea-level rise, and marine and wind-induced erosion. For example, the average long-term erosion rate at Rockefeller Wildlife Refuge was estimated to be 30.9 ft/yr (Connor et al. 2004). Recent estimates of Gulf shoreline recession rates by Kindinger et al (2013) vary from -4.4 feet per year near Hackberry Beach, +8.7 feet per year at Ocean View Beach, -36.1 feet per year at Mermentau Beach and -52.4 feet per year at Rockefeller Wildlife Refuge. (Kindinger et al. 2013). The 9-mile stretch of the Gulf shoreline, starting on the western side of the Calcasieu Ship Channel's gulf outlet and proceeding to approximately two miles west of Holly Beach is presently eroding at a rate of 5 to 30 feet per year and is threatening coastal highways LA 82/27 (source: http://coastal.la.gov/project/cameron-parish-shoreline-protection/; accessed January 6, 2016).

1.4.4 Vegetation Resources

The area consists of open water ponds and lakes, cheniers, Gulf shorelines, and freshwater, intermediate, brackish, and saline marsh. Table 1-9 compares habitat types pre- and post- Hurricane Rita.

Table 1-9: Habitat types by basin in acres.

Habitat Type	Calcasieu/Sabine Basin		Mermentau Basin		Teche/Vermilion Basin	
	2004	2005	2004	2005	2004	2005
Forested Wetlands	0.00	0.00	0.00	0.00	46,080	46,080
Other Land	46,080	45,4400	51,840	38,400	21,760	20,480
Freshwater Marsh	96,000	89,600	281,601	230,401	33,280	32,640
Intermediate Marsh	177,520	163,200	119,680	103,040	122,880	122,600
Brackish Marsh	81,280	78,720	60,800	55,680	82,560	80,640
Saline Marsh	8,960	8,960	26,240	25,600	5,120	5,120
Water	184,961	202,881	202,241	289,281	348,162	353,281
Totals	588,803	588,803	742,403	742,403	659,843	659,843

Gulf Coast Prairie and Forested Terraced Uplands vegetation includes:

- Swamp, found in low-lying areas typically adjacent to waterways, is dominated by cypress and tupelo-gum.
- Riverine habitats along stream and river bottoms and bottomland forests are comprised of water tupelo, willow, sycamore, cottonwoods, green ash, pecan, elm, cherrybark oak, white oak; these are often

interspersed with Chinese tallow. Depending upon the locations, riverine habitats grade into higher elevated and better drained areas comprised of oak-pine forests.

- Oak-pine forest types dominate the better drained areas especially surrounding Lake Charles and Sulfur and include longleaf pine, loblolly pine, slash pine, sweetgum, elm, southern red oak, water oak, black gum and Chinese tallow.
- Pasture and rangelands with mixtures of perennial grasses and legumes (e.g., bermundagrass, Pensacola bahiagrass, tall fescue, and white clover) comprise the majority of the outlying areas surrounding Abbeville, Erath, and Delcambre.

Gulf Coast Marsh consists of back barrier vegetated areas; cheniers; freshwater, intermediate, brackish, and saline marsh; interspersed with bayous, lakes, ponds and other waters some of which may include submerged aquatic vegetation (SAVs). Vegetation typically follows the salinity gradient (O'Neil 1949; Chabreck et al. 1972; Gosselink et al. 1979; Visser et al. 2000).

- Gulf shorelines vegetation includes sea-beach orach, sea rocket, pigweed, beach tea, salt grass, seaside heliotrope, common and sea purslane, marsh-hay cordgrass, and coastal dropseed (LCA 2004, Gosselink et al. 1979).
- Cheniers are live oak-hackberry forests with live oak and hackberry the dominant tree canopy species with other typical species including swamp red maple, toothache tree, green ash, and American elm. Although this forest type is the typical habitat, some areas may be scrub thicket or grasslands (source: http://dnr.louisiana.gov/assets/docs/coastal/227-009-001NG-Chenier-Rpt-DNR.pdf; accessed December 14, 2015; LADNR 2009).
- Marsh types: Visser et al. (2000), expanding on previous studies by Penfound and Hathaway (1938) and Chabreck (1970), classified freshwater marsh in the Chenier Plain as a combination of maidencane and bulltongue arrowhead; intermediate marsh as sawgrass, saltmeadow cordgrass, and California bulrush; brackish marsh as saltmeadow cordgrass, chairmaker's bulrush, and sturdy bulrush; and saline marsh as smooth cordgrass, needlegrass rush, and saltgrass.
- Submerged Aquatic Vegetation (SAV): wild celery, duckweed, pickerelweed, sago pondweed, southern naiad.

Invasive plants include water hyacinth, alligatorweed, hydrilla, common salvinia, giant salvinia, Chinese tallow, Chinese privet, Cogon grass, Johnsongrass, Japanese privet, Japanese honeysuckle, common ragweed, rescuegrass, sticky Chickweek, purple nutsedge, mimosa tree (personal communication Cindy Steyer, NRCS on September 20, 2013). These invasive species compete with native flora for resources such as nutrients and light, community structure and composition, and ecosystem processes. Water hyacinth, common salvinia, giant salvinia, and hydrilla all limit the amount of light penetrating the water column which effects plankton biomass production. Alligatorweed, Chinese tallow and Chinese privet are of minimal wildlife value and can proliferate until nearly monocultural stands exist, limiting food available for wildlife.

Land Loss – The processes of wetland loss can result from the gradual decline of marsh vegetation due to inundation and saltwater intrusion, as well as from storm surge events; both of which can eventually lead to complete loss of marsh vegetation. As marsh vegetation is lost, underlying soils are more susceptible to erosion and are typically lost as well, leading to deeper water and precluding marsh regeneration. Significant accretion of sediments is then required in order for marsh habitat to reestablish. Perhaps the most serious and complex problem in the study area is the rate of land and habitat loss. The Louisiana coastal plain contains one of the largest expanses of coastal wetlands in the contiguous United States and accounts for 90 percent of the total coastal marsh loss in the nation (USACE 2004). Couvillion et al. (2011) analyses show coastal Louisiana has undergone a net change in land area of about -1,883 square miles from 1932 to 2010. Trend analyses from 1985 to 2010 show a wetland loss rate of about 16.57 square miles per year. Table 1-10 displays land area changes in chenier plain basins from 1932-2010 (Couvillion et al. 2011).

Table 1-10: Land area changes in chenier plain basins between 1932 – 2010 (Couvillion et al. 2011)

Date	Calcasieu/Sabine Basin (square miles)	Mermentau Basin (square miles)	Teche/Vermilion Basin (square miles)	Coastwide (square miles)
1932	824.99	958.27	548.94	7,545.92
2010	611.42	803.09	471.57	5,662.71
Change	-213.57	-155.18	-73.37	-1883.21

The effects of recent hurricanes have accelerated marsh loss. Table 1-11 includes estimates of wetland loss attributed to the major hurricanes of 2004 to 2008 in the Chenier Plain and throughout coastal Louisiana. More recently, Palaseanu-Lovejoy et al. (2013) estimated wetland loss in the Hackberry area located in the southwestern part of the chenier plain that was impacted by Hurricane Rita (2005) and Ike (2008). Persistent land loss in the Hackberry area due to Hurricane Rita was approximately 5.8% and increased by an additional 7.9% due to Hurricane Ike. It is expected that the chenier plain has sustained more persistent land loss with intermediate and brackish marshes experiencing the most land loss, while saline marshes were less impacted and fresh marshes showed evidence of vegetation seasonality change and regrowth, which concealed the hurricane impacts.

Table 1-11: Wetland loss estimates in acres (km²) following hurricanes Katrina and Rita (2005) and Gustav and Ike (2008) by geographic province (Barras 2009).

Period	Storms	Chenier Plain	Marginal Delta Plain	Delta Plain	Coastal Louisiana
2004-2006	Katrina + Rita	-72,154 (-292)	-642 (-2.6)	-56,834 (-230)	-129,730 (-525)
2006-2008	Gustav + Ike	-34,347 (-139)	-14,579 (-59)	-30,641 (-124)	-79,815 (-323)
2004-2008	All storms	-106,750 (-431)	-15,320 (-62)	-87,475 (-354)	-209,545 (-848)

1.4.5 Rare, Unique, and Imperiled Vegetative Communities

The following rare, unique, and imperiled communities, documented by the Louisiana Natural Heritage Program (LNHP), are important in that they contribute to the diversity and stability of the coastal ecosystem. Table 1-12 displays information from the LNHP database identifying rare, unique or imperiled vegetative communities. See Appendix A for more detailed information concerning this important resource.

Table 1-12: LNHP rare, unique, or imperiled vegetative communities.

Vegetative Communities	Basins or Parish
Submergent Vascular Vegetation (Marine & Estuarine)	Waters of northern Gulf of Mexico, Vermilion-Teche, Mermentau, Calcasieu and Sabine
Salt Marsh	Vermilion-Teche, Mermentau, Calcasieu and Sabine
Brackish Marsh	Vermilion-Teche, Mermentau, Calcasieu and Sabine
Intermediate Marsh	Vermilion-Teche, Mermentau, Calcasieu and Sabine
Coastal Prairie	Vermilion-Teche, Mermentau, Calcasieu and Sabine
Flatwoods Ponds	Calcasieu Parish
Western Hillside Seepage Bogs	Calcasieu and Sabine
Scrub/Shrub Swamp	Vermilion-Teche, Mermentau, Calcasieu and Sabine
Cypress Swamp	Vermilion-Teche, Mermentau, Calcasieu and Sabine
Bottomland Hardwood Forest	Vermilion-Teche, Mermentau, Calcasieu and Sabine
Batture	Vermilion-Teche
Live Oak Natural Levee Forest	Vermilion-Teche
Bayhead Swamp/Forested Seep	Calcasieu Parish

Table 1-12: LNHP rare, unique, or imperiled vegetative communities.

Vegetative Communities	Basins or Parish
Pine Flatwoods	Calcasieu Parish
Western Longleaf Pine Savannah	Calcasieu Parish
Small Stream Forest	Calcasieu Parish
Coastal Dune Grassland	Mermentau, Calcasieu, Sabine
Coastal Dune Shrub Thicket	Mermentau, Calcasieu, Sabine
Coastal Live Oak-Hackberry Forest	Vermilion-Teche, Mermentau, Calcasieu and Sabine
Western Upland Longleaf Pine Forest	Calcasieu Parish
Western Xeric Sandhill Woodland	Calcasieu Parish
(source: http://www.wlf.louisiana.gov/wildlife/louisiana-natural-heritage-program; accessed December 14, 2015)	

1.4.6 Wildlife Resources

Coastal and especially estuarine wildlife is taxonomically diverse with distributions shaped by landforms, climate, salinity, tides, vegetation, other animals and human activities (Day et al. 1989). Appendix A shows the status, functions of interest, trends, and projections from 1985 through 2050 for avifauna, furbearers, game mammals, and reptiles as adapted from the Coast 2050 report by the Louisiana Coastal Wetlands Conservation and Restoration Task Force (LCWCRTF) and the Wetlands Conservation and Restoration Authority (WCRA 1999). Area estuarine wetlands, cheniers, and barrier habitats have historically provided many different species of birds and other wildlife with shelter, nesting, feeding, roosting, cover, nursery, and other life requirements. These habitats provide neotropical migrants with essential staging and stopover habitat (after Stoffer and Zoller 2004, Zoller 2004). Cheniers attract thousands of trans-Gulf migrant birds during their peak migratory months of April to May and August through October. The majority of these birds fly to and from parts of Mexico, and the cheniers offer the birds an important stop-over on their migration. Millions of ducks and geese use the area from September through February. Over 300 species of birds have been recorded in the area, making this region a popular destination for visiting birders, wildlife photographers, and hunters. However, climate and seasonal availability of resources affect the ways estuaries are used by birds and other wildlife (Day et al. 1989). Vegetated habitats within urban and suburban areas, such as bottomland hardwood (BLH) and swamp habitats along streams, lakes, and other waterways, provide critical breeding bird habitats (Wakeley and Roberts 1996).

Among the several sources documenting Louisiana birds, Lowery (1974) and the U.S. Forest Service (source: http://www.fs.fed.us/land/pubs/ecoregions/ch21.html accessed December 14, 2015) indicate the area supports shorebirds (e.g., piping plover, sandpipers, gulls, stilts, skimmers, and oystercatchers), ducks and geese (e.g., mottled duck, mallard, fulvous tree-duck, pintail, teal, wood duck, scaup, mergansers, and Canada goose); herons, egrets, ibis and cormorants; hawks and owls (e.g., bald eagle, osprey, and barred owl); belted kingfisher; woodpeckers and sapsuckers; marsh birds (e.g., rails and gallinules); and various songbirds (e.g., wrens, flycatchers, swallows, warblers, and vireos). Waterfowl, seabirds, coots, and rail populations are stable within the Calcasieu-Sabine and Mermentau basins [see Appendix A (LCWCRTF & WCRA 1999)].

The bald eagle and brown pelican have increased in populations resulting in de-listing as endangered species. Colonial nesting waterbird rookeries (e.g., herons, egrets, ibis, night-herons, and roseate spoonbills) are found throughout and generally show stable or increasing populations [see Appendix A (LCWCRTF & WCRA 1999)]. Habitat loss and fragmentation is among the most pervasive threats to the conservation of biological diversity (Rosenberg et al. 1997). Area BLH, swamp, and other riverine habitats provide travel corridors for birds and other wildlife connecting populations which have been effected by habitat loss and fragmentation. The greatest threat to birds throughout not only the area, but the entire North American continent, is habitat loss (American Bird Conservancy 2009).

Most estuarine mammals show distributions or behaviors that are related to salinity patterns (Day et al. 1989). Large herbivores and carnivores include manatee, coyote, red wolf, ringtail, and river otter; smaller herbivores include swamp rabbit, fulvous harvest mouse, eastern wood rat, and nutria (source: http://www.fs.fed.us/land/pubs/ecoregions/ch21.html accessed December 14, 2015). Populations of

furbearers (nutria, muskrat, mink, otter, and raccoon) and game mammals (rabbits, squirrels, and white-tailed deer) have been stable or increasing [see Appendix A (LCWCRTF & WCRA 1999)]. Prior to the introduction of nutria to Louisiana in 1930s (USGS 2000, Baroch et al. 2002), no invasive wildlife species were known to be present. A substantial population increase of nutria is attributed to the decline in the price of pelts in 1989 (USGS 2000, Baroch et al. 2002). Areas of extensive nutria damage, or "eat outs," alter the composition and habitat type of wetland communities (USGS, 2000). Aerial surveys estimated 80,000 acres of marsh in the State of Louisiana were damaged by nutria (Keddy et al. 2007).

Common species of amphibians and reptiles include the Gulf coast salt marsh snake, Gulf coast toad, pig frog, American alligator, diamondback terrapin, Mediterranean gecko, and Texas horned lizard (source: http://www.fs.fed.us/land/pubs/ecoregions/ch21.html accessed December 15, 2015). The LADNR (2009) observed the following reptiles within the cheniers: the American alligator; turtles (e.g., musk turtle, pond slider, and red-eared slider); snakes (e.g., plain-bellied water snake, banded water snake). Various lizards, and skinks (LADNR 2009). Little is known about amphibian or reptile populations with the exception of the American alligator whose population continues to remain stable. (Source: http://www.wlf.louisiana.gov/general-alligator-information; accessed December 15, 2015). Since 1972, over 700,000 wild alligators have been harvested, over 5.2 million alligator eggs have been collected, and over 2.7 million farm raised alligators have been sold, bringing in an estimated $495,000,000 to the state of Louisiana (LDWF, 2006). According to LDWF scientists, the alligator population dropped significantly between 2008 and 2009. In 2008, more than 43,000 alligator nests were found, while in 2009 only 24,500 nests were found, a 43 percent statewide decrease. This drop in alligator nests is probably the result of saltwater intrusion during Hurricanes Gustav and Ike. A similar trend occurred after Hurricanes Katrina and Rita, with alligator nests decreasing between the 2005 and 2006 surveys. However, the number of nests found increased significantly by 2007.

1.4.7 Aquatic and Fisheries Resources

The area contains a variety of aquatic habitats, including rivers, bayous, canals, lakes, ponds, shallow open water areas, the Gulf of Mexico, and estuarine marsh and embayments. Salinity and habitat structure (SAV, marsh, tidal creeks, deep water, oyster reefs, and benthic substrate) are the primary drivers that affect the distribution of fish and macrocrustaceans throughout the area with three general types: freshwater resident, estuarine resident, and transient marine species. Freshwater species, some of which may tolerate low salinities, generally live in the freshwater portions of the more interior and northern-most regions of the area. Resident species are generally smaller and do not commonly migrate very far. Marine transient species spend a portion of their life cycle in the estuary, generally spawning offshore or in high-salinity bays, and use coastal marshes as nursery areas (Herke 1971, 1995). Species typically found in freshwater areas include: spotted gar, bowfin, largemouth bass, channel catfish, crappie, and gizzard shad. Estuarine-dependent species typically include red and black drum, spotted seatrout, Gulf menhaden, and southern flounder. Typical marine species include king and Spanish mackerel, and cobia.

Plankton communities serve several important roles in coastal waters. Bacterioplankton are primarily decomposers; phytoplankton are the primary producers of the water column, and form the base of the estuarine food web; zooplankton provide the trophic link between the phytoplankton and the intermediate level consumers such as aquatic invertebrates, larval fish, and smaller forage fish species (Day et al. 1989; Thompson and Forman 1987). Biological factors such as predation by nekton and ctenophores, duration of the larval stages of meroplankton, and changes in the aquatic environment brought by the zooplankton populations themselves are important biological factors in the regulation of zooplankton densities (Bouchard and Turner 1976; Conner and Day 1987). Bouchard and Turner (1976) found that salinity largely influenced the distribution of zooplankton. Gillespie (1978) found spring zooplankton peaks were related to temperature. Conner and Day (1987) identified the following factors affecting zooplankton populations: tidal flushing, inflow of freshwater carrying organic detritus, river discharge, water depth, tidal changes, turbidity, and dissolved oxygen.

Gosselink et al. (1979) provide an extensive overview of benthic resources in the area. The bottom estuarine substrate or benthic zone regulates or modifies most physical, chemical, geological, and biological processes throughout the entire estuarine system via what is called a benthic effect (Day et al. 1989). Benthic communities do not have a static structure; rather, they provide a residence for many sessile, burrowing, crawling, and even swimming organisms. Benthic animals are directly or indirectly involved in most physical and chemical processes that occur in estuaries and trophic relationships that occur in aquatic ecosystems (Day et al. 1989). Oysters and mussels from the epibenthic community provide commercial and recreational fisheries and create oyster reef habitats used by many marine and estuarine organisms. A discussion on estuarine benthic organisms and primary consumer groups is in Appendix A. A major link in the aquatic food web between plants and predators is formed by the conversion of plant material (formed in primary production) by benthic detritivores and herbivores to animal tissue (Cole 1975). The salt marsh is a major producer of detritus for both the salt marsh system and the adjacent estuary (Mitsch and Gosselink 2000). In some cases, exported marsh detritus is more important than the phytoplankton based production to the estuary. Detritus export and the sheltering marsh edges make salt marshes important nursery areas for many commercially important fish and shellfish.

Gulf of Mexico nearshore benthic habitats have been more thoroughly studied for longer periods of time, and hence our understanding of status and trends in these areas is greater. Within the Gulf of Mexico four benthic habitats have protracted temporal and synoptic data: oyster reefs, seagrasses, mangroves, and coastal wetlands (NOAA 2013). Mangroves are found only in southeastern Louisiana. Although wigeon grass is common along coastal Louisiana, true seagrass meadows, containing turtle grass, manatee grass, shoal grass and star grass currently occur only east of the Mississippi River near the Chandeleur Islands (source: http://pubs.usgs.gov/sir/2006/5287/pdf/StatewideSummaryforLouisiana.pdf; accessed January 6, 2016). Coastal wetland benthics in the area as referenced above are described in Gosselink et al. (1979), Mitsch and Gosselink (2000), and Day et al. (1989). The American oyster is discussed below.

The American oyster is a keystone estuarine species and has been identified as an ecosystem engineer (Dame 1996). Oyster reefs provide major structural components of estuaries and support more animal life than any other portion of the sea bottom (Bahr and Lanier 1981; Meyer and Townsend 2000; Nelson et al. 2004; Tolley and Volety 2005; Tolley et al. 2005; Boudreaux et al. 2006). The total number and densities of fish, invertebrate and algal species greatly increase in areas containing oyster reefs (Bahr & Lanier 1981). More than 300 marine invertebrate species may occupy an oyster reef at one time (Wells 1961). In addition to increasing species richness, the three-dimensional structure of the reef provides other services such as stabilizing and buffering shorelines from high wave energy (Smithsonian 2001). Because oysters are sessile and pump water through their bodies, they are recognized as good ecosystem monitors. Changes in ecosystem health can be noted over time scales varying from hours to years. Because oysters are continually submersed in environmental conditions, they actively contribute to water quality assessments (Smithsonian 2001). In addition, the chemistry of their shell can provide information on global changes in the environment (Surge et al. 2003). Accordingly, oysters have been used as monitors and indicators of stress in marine ecosystems.

Figure 1-5 shows the location of the oyster reefs Sabine Lake. Calcasieu Lake has been designated by the LDWF as a Public Oyster Tonging Area. More information on oysters including locations of oyster reefs in other areas can be found at the Louisiana Department of Wildlife and fisheries website (source: http://www.wlf.louisiana.gov/fishing/oyster-program; accessed December 14, 2015). The Louisiana portion of Sabine Lake has approximately 34,067 water bottom acres. This area was cleared by the Louisiana Department of Health and Hospitals (LDHH) in March of 2011 for harvesting, but LDWF has not opened a season on this area at this time.

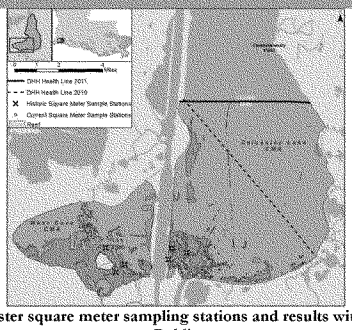


Figure 1-7: The 2011 oyster square meter sampling stations and results within the Calcasieu Lake Public Oyster Area (source: http://www.wlf.louisiana.gov/sites/default/files/pdf/document/37757-stock-assessments/2011_oyster_stock_assessment.pdf; accessed December 16, 2015)

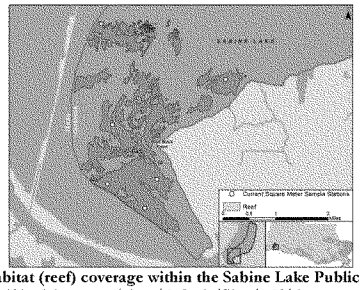


Figure 1-8. Oyster habitat (reef) coverage within the Sabine Lake Public Oyster Area (source: http://www.wlf.louisiana.gov/sites/default/files/pdf/document/37757-stock-assessments/2011_oyster_stock_assessment.pdf; accessed December 16, 2015).

Salinity and submerged vegetation affect the distribution of fish and macrocrustaceans throughout the area with three general types: freshwater, resident, and transient marine species. Freshwater species, some of which may tolerate low salinities, generally live in the freshwater portions of the more interior and northern-most regions of the area. Resident species are generally smaller and do not commonly migrate very far. Marine transient species spend a portion of their life cycle in the estuary, generally spawning offshore or in high-salinity bays, and use coastal marshes as nursery areas (Herke 1971, 1995). See Appendix A for more detailed information concerning fisheries resources including a description of species typically found in freshwater areas.

1.4.8 Essential Fish Habitat (EFH)

Figures displaying EFH for coastal migratory pelagics (king mackerel, Spanish mackerel, and cobia); shrimp (brown, white and pink shrimp); red drum; and stone crab, respectively within the area are provided in Appendix A. Table 1-13 list the EFH for life stages of species.

Table 1-13: EFH life stages in the area (personal communication, NMFS August 29, 2015)

EFH Requirements for Species Managed by the Gulf of Mexico Fishery Management Council: Ecoregion 4, Mississippi River Delta (South Pass) to Freeport, TX.			
Species	**Life Stage**	**System[1]**	**EFH**
Brown shrimp	juvenile	E	<18m; SAV, sand/shell/soft bottom, emergent marsh, oyster reef
White shrimp	larvae/postlarvae	M/E	<82m; pelagi, soft bottom, emergent marsh
	juvenile	E	<30m; soft bottom, emergent marsh
Red drum	larvae/postlarvae	E	all estuaries planktonic, SAV, sand/shell/soft bottom, emergent marsh
	juvenile	M/E	GOM, <5m Vermilion Bay & E; all estuaries SAV, sand/shell/soft/hard bottom, emergent marsh
	adults	M/E	GOM 1-46 m Vermilion Bay & E; SAV, sand/shell/soft/hard bottom, emergent marsh
Lane snapper	larvae	E/M	4-132 m; reefs, SAV
	juvenile	E/M	<20; SAV, mangrove, reefs, sand/shell/soft bottom
	adults	E/M	4-132 m; shoal banks
King mackerel	juvenile	M	<9m; pelagic
Vermilion snapper	juvenile	M	1-25 m; hard bottom
Grey snapper	adult	E/M	0180 m; emergent marsh, soft bottom, hard bottom, sand shell, shoal banks
Cobia	adult/juvenile	M	1-300 m; pelagic
Greater amberjack	adult/juvenile	M	1-360 m; pelagic, drift algae
Atlantic sharpnose shark	neonate/juvenile/adult	M	All nearshore and offshore waters Freeport, TX, to mouth of the Mississippi River
Scalloped hammerhead	neonate	M	All nearshore waters to 30 fathoms; Galveston Bay, Vermilion Bay to West Bay, TX
Bull shark	neonate	M	Estuarine and nearshore waters Freeport to mouth of Sabine River; nearshore waters off west Cameron Parish.
[1]E=Estuarine, M=marine			

1.4.9 Threatened/Endangered Species and Other Protected Species of Concern

There are 10 threatened or endangered species (T&E), and one candidate species known or believed to occur in the area (see Table 1-14) as well as critical wintering habitat for the piping plover and Sargassum critical habitat for loggerhead sea turtles. There are no threatened or endangered plants (personal communication with Ms. Brigette Firmin USFWS, September 20, 2013). A detailed description of T&E species and critical habitats is presented in the supplemental information found in Appendix A and in Appendix A, Annex K.

Table 1-14: Federally listed and candidate species within the area.

Species	Calcasieu Parish	Cameron Parish	Vermilion Parish
*Sprague's pipit (*Anthus spragueii*)	Candidate	Candidate	Candidate
Red-cockaded woodpecker (*Picoides borealis*)	Endangered	NA	NA
Piping plover (*Charadrius melodus*)	NA	Threatened Critical habitat	Threatened Critical habitat
Red knot (*Calidris canutus*)	NA	Threatened	Threatened

Species	Calcasieu Parish	Cameron Parish	Vermilion Parish
**Whooping crane (*Grus americana*)	NA	NA	Threatened
West Indian manatee (*Trichechus manatus*)	NA	Endangered	Endangered
Gulf sturgeon (*Acipenser oxyrinchus desotoi*)	NA	Threatened	Threatened
Green sea turtle (*Chelonia mydas*)	NA	Threatened	Threatened
Kemp's (Atlantic) ridley sea turtle (*Lepidochelys kempii*)	NA	Endangered	Endangered
Leatherback sea turtle (*Dermochelys coriacea*)	NA	Endangered	Endangered
Hawksbill sea turtle (*Eretmochelys imbricata*)	NA	Endangered	Endangered
Loggerhead sea turtle (*Caretta caretta*)	NA	Endangered Critical habitat	Endangered Critical habitat

**Listed as a candidate species until a listing proposal can be prepared by USFWS*
***Designated non-essential experimental population*

Piping plovers winter in Louisiana but do not nest on the coast. Critical wintering habitat encompasses 24,950 acres along 342.5 miles of shoreline, which is most of the coast of Louisiana. Piping plovers arrive from their northern breeding grounds as early as late July and may be present in designated critical wintering habitat for 8 to 10 months of the year. See Appendix A and Annex K for a depiction of piping plover critical habitat in the Project area.

Loggerhead Critical Habitat (*Sargassum* habitat) exists in the southernmost (offshore) portion of the study area. This critical habitat expands the entire length of the project (west to east) with the closest points ranging from approximately four to nine miles offshore. See Appendix A and Annex K, Figure 4-3 for a depiction of Loggerhead sea turtle critical habitat in the Project area.

1.4.10 Cultural and Historic Resources

The cultural history of coastal southwest Louisiana is a very rich one, going back some 10,000 years or more. The general chronological sequence can be summarized as follows: Paleoindian (11,500 - 6,000 B.C.), Archaic (6,000 - 1,500 B.C.), Poverty Point (1,500 - 500 B.C.), Tchula (500 B.C. - A.D. 1), Marksville (A.D. 1 - 400), Baytown (A.D. 400 - 700), Coles Creek (A.D. 700 - 1200), and Mississippian (A.D. 1200 - 1700). The historic period begins at approximately A.D. 1700, and historic perspectives include the Attakapa Indians, first European settlement in Attakapa country, the Acadian migration, the Louisiana Purchase with the western boundary of the United States in dispute until 1819, the Civil War, postbellum period, and the early 20th century.

The study area is located within the Marginal Plain and the Pleistocene Prairie Terrace. Archaeological sites in the southernmost portion of the study area postdate the formation of the Marginal Plain (or Chenier Plain) at the end of the Pleistocene Epoch. Four NRHP listed historic districts, thirty-six NRHP listed standing structures, and seventeen NRHP eligible archeological sites are located within the study area.

An area of potential effects (APE) will be determined for each structure participating in the nonstructural flood risk reduction plan, after which cultural and historic resources, including the preliminarily eligible structures and any additional resources located within the APE, will be identified and assessed for significance and NRHP eligibility. Structures preliminarily eligible for the NED nonstructural flood risk reduction plan are located within the boundaries of two local historic districts as designated by the City of Lake Charles, the Downtown Development District of the Charlestown Cultural District and the Margaret Place Historic District.

An APE will be determined for each of the ecosystem restoration measures recommended for construction, the scope of which would include related project activities. Cultural and historic resources will be identified and assessed for significance and NRHP eligibility. A cultural resources assessment was completed for the

ecosystem restoration measures, and it is estimated that less than 15% of the proposed footprint for the measures has been investigated. Thirty-seven archaeological sites have been recorded in the vicinity of proposed measures. The previously recorded sites include: El Nuevo Constante Shipwreck, which has been determined to be eligible for listing in the NRHP; two prehistoric sites that are potentially eligible for listing in the NRHP; and eight sites, three of which date to the 20th century, that have been determined not eligible for listing in the NRHP. The remaining 26 have not been assessed for eligibility. Seven cemeteries have also been identified in the vicinity of proposed measures. Seventy-two standing structures inventoried in the Louisiana Historic Standing Structures Survey are located in the vicinity of the measures. One is potentially eligible for listing in the NRHP, sixty are not likely to be eligible for listing in the NRHP, and 11 are of undetermined eligibility.

The above information is detailed in the report titled Cultural Resources Assessment and Research Design for the Southwest Coastal Louisiana Project, Calcasieu, Cameron, and Vermilion Parishes, Louisiana on file with the Louisiana Division of Archaeology (Wells and Hill 2016). The USACE has elected to fulfill its obligations under Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, through the execution and implementation of two Programmatic Agreements as provided for in 36 CFR Part 800.14(b) (see Appendix A, Annex F).

1.4.11 Aesthetics and Visual Resources

Based on available aerial photography, the visual conditions have changed significantly over the past 20 years due to the growth of urban development and the loss or conversion of swamps into marsh, or open water areas. Comparisons between the 1992 and 2010 photography show that the same public thoroughfares that are in place today were in place then; however, the scenery has changed from natural to a developed state with residential, commercial, and industrial development dominating US-90, I-10, and the state and parish roads surrounding Sulphur and Lake Charles. The areas in Cameron and Vermillion Parish are still relatively rural, giving the viewer near unobstructed views of a native landscape that has remained aesthetically pleasing. Primary view sheds then, as they are today, were best taken from the local road system. There is one identified Scenic Stream, the Calcasieu River, located in the northeastern corner of Calcasieu Parish. The portion of Calcasieu River that qualifies as scenic stretches from the northeastern corner of Calcasieu Parish northeast into Allen Parish (approximately 34 miles). The Calcasieu River flows through a relatively uniform type of mixed pine-hardwood forest of uneven ages on low, rolling, well drained hills. Much of the timberland is grazed by cattle which tend to lower its value for wildlife. The best habitat can be found immediately adjacent to the stream where the area exhibits high habitat diversity.

Access to the area is in abundance with highways and byways crisscrossing the region along with local streets and neighborhoods in the more developed portions. Scenic Byways include the Creole Nature Trail; which traverses State and Parish Highways 82, 27, 384, 385, and 397. This Scenic Byway is both state and federally designated and also has an "All American Road" status, making it significant in culture, history, recreation, archeology, aesthetics, and tourism. Other Scenic Byways include the Zydeco Cajun Prairie Scenic Byway, located just north of Lafayette and the Jean Lafitte Scenic Byway, located just south of Lafayette. Both of these byways carry a state designation only, but are no less significant in their importance to the region in terms of tourism, scenic vistas, recreation, and the local economy. See Appendix A for additional detail concerning aesthetic and visual resources.

1.4.12 Recreation Resources

Recreational features and opportunities vary throughout the coastal zone, habitat, and culture playing significant roles in the diversity of activities. From the games and competitions of Native Americans, to the influence of diverse immigrant cultures, traditional recreation in Louisiana has been a product of its people. Nearly 10,000 years ago, people began living off the ample resources of Louisiana. The means by which Louisiana's early residents lived, hunting and fishing for food, utilizing high ground for camps, and building vessels for transportation, shaped what is now recognized as traditional recreation in southern Louisiana.

State parks within the *Gulf Coast Prairie and Forested Terraced Uplands* physiographic regions include Palmetto Island and Sam Houston Jones parks. Eight boat launches are located within these regions. Access into the

Wildlife Management Areas (WMAs) and refuges is generally by car or boat. Consumptive recreation includes hunting, fishing for freshwater and saltwater species, and trapping alligators and nutria. Non-consumptive recreation includes bird watching, sightseeing, boating, and environmental education/interpretation. Many of the parks offer hiking/biking trails, camping, and picnic shelters. Federal parks within or adjacent to the *Gulf Coast Marsh* physiographic region provide access to high quality recreational resources. From east to west, the region includes national wildlife refuges (NWR), Louisiana state wildlife refuges (WR) and a state wetland conservation area, including: Cameron Prairie NWR, Lacassine NWR, and the 130,544-acre Sabine NWR; nearly 450,000 people visited the NWRs in 2012. The Louisiana 76,000-acre Rockefeller WR and the 71,544-acre White Lake Wetlands Conservation Area. Outside, but adjacent to the region, is Shell Keys NWR, and Louisiana Marsh Island WR, and Cypremort State Park.

In addition to the high quality recreational fishing and hunting in the parks in the Gulf Coast Marsh region, several lakes and inland marshes offer opportunities for hunting and catching both freshwater and saltwater species. Grand, White, and Calcasieu Lakes, and Vermillion Bay are prime fishing spots for recreational species such as redfish and speckled trout as well as flounder and brown and white shrimp. White Lake is a remote open lake and can only be accessed by the Schooner Bayou Canal, the old Intracoastal Canal north of Pecan Island or via the Superior Canal west of Pecan Island. The Calcasieu Lake area offers 10 of the 35 public or private boat launches in the area.

Bird watching is also an important recreational resource. A global initiative of BirdLife International, implemented by Audubon and local partners in the United States, the Important Bird Areas Program (IBAs) is an effort to identify and conserve areas that are vital to birds and other biodiversity. In the NER area, Audubon lists the entire Chenier Plain as a globally IBA (source: http://netapp.audubon.org/iba, accessed December 14, 2015). Many of the IBAs recognized are located within state or federally operated areas. Federal parks within the Chenier Plain that are globally IBAs include Lacassine NWR, Cameron Prairie NWR, and Sabine NWR. Also in the area is the Baton Rouge Audubon Society 40-acre Peveto Woods Sanctuary located along the Louisiana coast in Cameron Parish. The Peveto Woods Sanctuary site is the most heavily birded locale in Louisiana and was the first chenier sanctuary for migratory birds established in Louisiana. Each spring and fall, Peveto Woods hosts most migratory songbirds native to eastern North America (source: http://www.braudubon.org/peveto-woods-sanctuary.php, accessed December 14, 2015). The State of Louisiana owns and operates the White Lakes Conservation Area, Rockefeller WR, and the State Wildlife Refuge (SWR), all located in the Chenier Plain and all globally IBAs as is the Audubon/Paul J. Rainey Wildlife Sanctuary to the west and the Marsh Island Wildlife Refuge to the east. Finally, Palmetto Island State Park is an IBA just north of the SWR.

Designated within Gulf Marsh region is the Creole Nature Trail National Scenic Byway, a 105- mile driving and walking tour touching four state and NWRs and a bird sanctuary. Finally, public and private boat launches are located throughout the entire region.

1.4.13 Noise

Noise, or unwanted sound, may be objectionable in terms of the nuisance, health, or well-being effects it may have upon humans and the human environment, as well as upon animals and ecological systems (Kryter 1994). Generally, noise is a localized phenomenon. There are many different noise sources throughout the area including commercial and recreational boats, and other recreational vehicles; automobiles and trucks, and all-terrain vehicles; aircraft; machinery and motors; and industry-related noise.

1.5 Need for Action

The processes of sea level rise, subsidence, saltwater intrusion, and erosion of wetlands in southwest coastal Louisiana have caused significant adverse impacts, including increased rates of wetland loss and ecosystem degradation. The loss of wetland and marsh habitat also exacerbates the potential for damages to property and infrastructure caused by hurricane storm surge. As hurricanes make landfall, surge from the Gulf of Mexico is pushed further inland since eroded marshes and wetlands that have converted to open water cannot as

effectively prevent the surge from encroaching. As surge comes ashore, the potential for damages and potential loss of life is increased. Without action, damages from storm surge are expected to increase. Without action, this highly productive coastal ecosystem, composed of diverse habitats and wildlife, is not sustainable. Infrastructure constructed for access into and across the wetlands has modified the hydrology of the coastal zone, thus facilitating and accelerating saltwater intrusion and fragmentation, and conversion of wetlands to open water. Hurricane surge has formed ponds in stable, contiguous marsh areas and expanded existing, small ponds, as well as removed material in degrading marshes (Barras, 2009). Fresh and intermediate marshes appear to be more susceptible to surge impacts, as observed in Barras (2006).

A wetland morphology model developed by Couvillion et al. (2013) and coupled with other predictive models suggests that under a "future-without-action" condition, coastal Louisiana is at risk of losing between 523,369 acres and 115,571 acres of land over the next 50 years. Soil organic carbon storage (to a depth of 1 m) could decrease by between 108 and 250 million metric tons, a loss of 12% to 30% of the total coastwide soil organic carbon. Couvillion et al. (2013) findings suggest that despite the efficacy of restoration projects in mitigating losses in certain areas, net loss of wetlands in coastal Louisiana is likely to continue. Model results also suggest certain areas may eventually be lost regardless of proposed restoration investment, and, as such, other techniques and strategies of adaptation may have to be utilized in these areas.

Land loss and ecosystem degradation threaten the continued productivity of the area's ecosystems, the economic viability of its industries, and the safety of its residents. The following valuable social and economic resources are at risk:

- Residential and non-residential structures, warehouses, and industrial facilities
- Commercial harvest of fishery resources
- Critical infrastructure such as roads and utilities
- Rice, crawfish, and cattle farming
- Recreational saltwater and freshwater fisheries
- Ecotourism
- Oil and gas production
- Petrochemical industries
- Strategic petroleum reserve storage sites
- The buffering effect intact marshes and cheniers provide against storm surge
- Navigation corridors and port facilities for commerce and national defense, and
- Actual and intangible value of land passed down through generations.

During the NEPA scoping process, stakeholders noted the following problems related to saltwater intrusion:

- As the CSC widens and deepens, salinity levels increase after hurricane storm surge events and farmers have greater difficulty operating their rice farms.
- In the 2006 growing season, farmers were unable to plant because of high salinity levels caused by Hurricane Rita which overtopped local levees built in the 1940s or early 1950s.
- As a result of salinity encroachment in Calcasieu Lake, the Sabine Refuge now contains large open water areas.
- Saltwater intrusion is occurring in the Calcasieu and Mermentau Basins and is in turn negatively impacting the seafood industry. Ship channels in the Calcasieu and Sabine Rivers are allowing saltwater movement into the upper estuaries.

From 2002 through 2013, the area has been greatly impacted by hurricane storm surges associated with three Category 2 or higher hurricanes (Lili, Rita, and Ike) which inundated structures and resulted in billions of dollars in damages to southwest coastal Louisiana. Hurricane surge also causes significant damage to wetlands. The breakup of marshes surrounding the towns and communities is allowing hurricane storm surge and associated inundation to more directly impact habitable areas. As a consequence, a smaller hurricane is able to inflict

significant surge-related flooding damages to residential and non-residential structures. As the coastal ecosystem continues to fragment, these losses are expected to increase, thus placing larger populations at risk.

Problems

The people, economy, unique environment, and cultural heritage of southwest Louisiana are at risk due to hurricane storm surge flooding and wave impacts. The area's low elevation, proximity to the Gulf of Mexico, land subsidence, and rising sea level, are expected to exacerbate flooding from hurricane events, shoreline erosion, saltwater intrusion, and loss of wetland and chenier habitats in the future. System-wide problems and opportunities were used to identify and define more geographically specific problems and opportunities.

Problems include the following:

- Flooding from tidal surge and waves associated with hurricanes.
- Increased submergence and inundation of wetlands, resulting in wetland loss.
- Erosion of channel banks and shorelines, resulting in wetland loss.
- Deforestation and mining of chenier ridges.

1.5.1 Significance of Loss of Southwest Coastal Louisiana's "Working Coast"

The first settlers were Native Americans who were present throughout the delta and chenier building processes. These human communities, both prehistoric and modern, have depended on the coastal environment in complex ways. This has always been a working coast. The way of life in coastal Louisiana has evolved over the past 300 years and forms an intricate and vital part of the world's social and natural ecosystems (Gramling and Hagleman 2005). The area is uniquely suited to its current use of sheltering the infrastructure of the navigation, oil and gas, and seafood industries of the region. The 2012 State Master Plan and Coastal Protection and Restoration Authority Board describe the majority of the coast as privately owned. Close working relationships with private landowners are essential, not only for their support, but to gain from their knowledge about private coastal lands (source: http://coastal.la.gov/a-common-vision/master-plan/principles/ accessed December 14, 2015).

- The loss of marsh and wetlands threatens the productivity of the region's coastal ecosystem, the economic viability of industries, and the safety of residents, a marine-resource based economy defined by the interactions of numerous stakeholders engaged in consumptive and non-consumptive uses of coastal resources.
- Southwest Louisiana's "Working Coast" is unique in its scope and scale, with extensive infrastructure needs to serve the navigation, oil and gas, and commercial and recreational fishing industries, which must be balanced and must exist in harmony with each other.
- The loss of marsh and wetlands would threaten nationally significant economic, historical, and cultural and historic resources and have significant negative impacts on the navigation, oil and gas, and seafood industries, and the residents that service these industries.
- The implementation and OMRR&R of the NER RP should be designed so that the users of the resources of the "working coast", may continue use of the resources, including use of the surface, but only to the extent that such uses are practicable and economically justified without impinging upon the purpose, objectives, and sustainability of the features of the NER RP. Impacts of the NER RP on the "working coast" will be more fully addressed in Chapter 3. Chapter 4, and the Real Estate Plan (Appendix E) will address the manner and extent to which the present "working coast" usages of the resources in Southwest Louisiana will be able to continue when the NER features of the RP are implemented.

Navigation

- Wetlands provide protection to several Federal navigation projects, including the GIWW, the Calcasieu River and Pass (providing access to the Ports of Lake Charles and Cameron), Sabine Pass (providing access to Port Arthur, Texas), and Freshwater Bayou (providing access to the Port of Iberia). With the loss of wetlands, the sustainability of the Federal navigation system in the region becomes less reliable and more expensive.

- The Port of Lake Charles is a deepwater seaport, on the U.S. Gulf Coast. The Port is currently the 13th-busiest seaport in the U.S.
- The loss of wetlands would expose Federal navigation channels, and the ports to which they provide access, to increased erosion/shoaling, especially during extreme weather events, and may force the relocation or abandonment of certain channels and port facilities that currently serve the transportation and oil and gas industry requirements of the region and nation.

Oil and Gas (O&G) Infrastructure

- Regional ports serve the area's vast network of offshore oil and gas facilities, including production facilities and an extensive network of pipelines that provide the U.S. with needed energy resources. The area is also home to three of the 11 liquefied natural gas import/export terminals in the U.S.
- The O&G industry encompasses production (active and passive), distribution of products from offshore/near shore sources throughout North America (via vast unseen pipeline distribution network), support service industry, and rig fabrication and service vessel building.
- The area provides O&G to both domestic and international markets through strategically laid pipelines. Even brief interruptions in service have significant impacts to the supply and pricing of gasoline and natural gas throughout the U.S.
- Erosion of wetlands could result in the displacement/damage of the region's strategic O&G industry infrastructure, especially the extensive near-shore pipeline network, resulting in disruption of service and increased repair and maintenance cost. Potential damage to the pipeline network could increase the risk of unintended releases of petroleum products and the resulting ecosystem damage.

Seafood

- Southwest Louisiana has large commercial and recreational fishing industries that are dependent on the region's wetlands.
- The fisheries industry encompasses commercial fishing harvesting, distribution, and processing, fisheries support industry, boat building, and recreation fishing/hunting support (marinas, fishing charter/guide services, camps, bait/tackle shops).

Social

- Developments in the coastal zone are primarily smaller communities that support resource extraction and harvests in the agricultural, energy, and fishing industries.
- While human populations in and near the wetland areas are low, Southwest Coastal Louisiana is a hub of activity supporting the numerous ports, waterways, oil and gas fields, rich fishing grounds, and other elements of a working coast.
- The impact of the loss of wetlands will be felt far beyond the industries directly impacted, with residents that serve these industries, especially the offshore oil and gas industry, being forced to abandon their communities and move further inland.

1.6 Opportunities

Opportunities to address, in part or entirely, the problems include:

- Incorporate structural and nonstructural hurricane and storm surge risk reduction measures solutions to reduce the risk of damages and prevent loss of community cohesion (examples of how this can be accomplished include construction of levees, pump stations, interior drainage, elevating structures, or flood proofing).
- Improve internal system hydrology to restore wetlands (examples of how this can be accomplished include measures such as gates, weirs, or marsh restoration).
- Manage salinity levels to maintain fresh and intermediate marsh (examples of how this can be accomplished include water control structures or modifying hydrology).
- Reduce bank and shoreline erosion (examples of how this can be accomplished include rock armoring or breakwaters).

- Prevent loss of significant cultural and historic resources (examples of how this can be accomplished include levees, marsh restoration, or elevating structures).

1.7 Authorities

The study has both NED and NER components. This stems from two separate authorizations. The NED feature was authorized for the Southwest Coastal Louisiana Feasibility Study by language from the River and Harbor Act of 1962 and from a 2005 House of Representatives Resolution adopted following the impact of Hurricane Rita respectively, as follows:

> *"Surveys of the coastal areas of the United States and its possessions, including the shores of the Great Lakes, in the interest of beach erosion control, hurricane protection and related purposes: Provided, That surveys of particular areas shall be authorized by appropriate resolutions of either the Committee on Public Works of the United States Senate or the Committee on Public Works of the House of Representatives."*
>
> And,
>
> *"Resolved by the Committee on Transportation and Infrastructure of the United States House of Representatives, that, in accordance with Section 110 of the River and Harbor Act of 1962, the Secretary of the Army is requested to survey the coast of Louisiana in Cameron, Calcasieu, and Vermilion Parishes with particular reference to the advisability of providing hurricane protection and storm damage reduction and related purposes to include the feasibility of constructing an armored 12-foot levee along the Gulf Intracoastal Waterway."* (December 7, 2005 – Committee on Transportation and Infrastructure, U.S. House of Representatives, Resolution Docket 2747, Southwest Coastal Louisiana).

Investigation of the NER purpose was recommended in the 2005 Chief's Report for the LCA Ecosystem Restoration Program. The Chenier Plain Freshwater and Sediment Management and Allocation Reassessment Study was one of six large-scale restoration concepts that were purported to have the ability to "significantly restore environmental conditions that existed prior to large-scale alteration of the natural ecosystem" upon construction. The LCA program was authorized in Title VII of the Water Resources Development Act (WRDA) of 2007.

> *"SEC. 7003. LOUISIANA COASTAL AREA.*
> *(a) IN GENERAL. The Secretary may carry out a program for ecosystem restoration, Louisiana Coastal Area, Louisiana, substantially in accordance with the report of the Chief of Engineers, dated January 31, 2005."*

Additional guidance is identified in Section 5007 of WRDA of 2007: Expedited Completion of Reports and Construction for Certain Projects. Guidance provided by the Director of Civil Works on December 19, 2008 states that "*the coastal restoration components proposed as part of the LCA Chenier Plain study will be evaluated as part of the Southwest Coastal Louisiana feasibility study.*"

1.8 Future Without Project Conditions (No Action Alternative)

The second step in the Civil Works Planning process is to develop an inventory of the critical resources (physical, demographic, economic, social, natural etc.) relevant to the problems and opportunities under consideration in the planning area. Then a forecast of the inventory's condition at the future date of the period of analysis (2075) is performed. Those changes in conditions are determined by the impact of all on-going actions, manmade or natural, upon the resources if no alternatives are implemented as part of this evaluation. Section 1.1 described the existing conditions of the affected environment; this section forecasts and reflects the future conditions expected during the 50-year period of analysis if no action is taken. NEPA requires an analysis of the environmental effects from taking no action. The No Action Alternative is the future condition without action and is considered the "future without project" (FWOP) conditions. However, under the future without project conditions that alternative of taking no action is not without impacts from preexisting on-going forces that affect the study area. Therefore, to be consistent with NEPA the following sections reflect the "impacts

of taking no action", which for purposes of alternative analysis are compared with the effects of implementing the proposed action alternatives. The difference between the impacts of taking an action and the no-action provides the basis from which alternative plans are evaluated. This analysis provides a benchmark, enabling decision makers to compare the magnitude of environmental effects of implementing an action alternative.

This section presents the future without project conditions for implementing the No Action Alternative. For aesthetic visual resources and noise there would be no direct, indirect, or cumulative impacts resulting from taking no action. As such, these resources are not discussed further.

1.8.1 Human Environment

1.8.1.1 Population and Housing

Changes in population, households, and housing are expected to follow the growth in employment within the area. Recent trend analysis (Moody's Analytics 2008) indicates an increase of 15,000 residents and approximately 5,600 residential structures projected for the area which would impact estimates of employment, as described in the next section. Generally, the overall population is projected to increase. However, the Cameron Parish population is projected to continue its trend of decreasing since 2000 (Table 1-15). It is probable that refined building requirements and updated FEMA base flood delineation following the series of storms between 2000 and 2010 produced a more permanent effect on development in predominantly coastal Cameron Parish. Significant elevation requirements in order to achieve FEMA compliance likely place a significant constraint on future development.

Table 1-15: Projected parish population (in thousands).

Parish	Population		
	2020	2030	2080
Calcasieu	195.0	200	236.7
Cameron	6.6	6.6	3.9
Vermillion	59.9	63	76.8
Total	261.4	269.6	317.4

A single or multiple catastrophic hurricane storm surge event could result in significant damage to economic assets including primarily residential, commercial, and industrial structures. Additionally, property owners could potentially incur higher insurance premiums offered by the NFIP should Flood Insurance Rate Maps (FIRMs) be updated to reflect an increase in risk over time due to RSLR. The Biggert-Waters Flood Insurance Reform Act of 2012 puts in place a process to adjust flood insurance rates for primary residencies to be consistent with flood risk. Under the new legislation, rates for these properties will increase by 25% per year until premiums meet the full actuarial cost, attempting to move the NFIP toward risk-based pricing. The law also phases out subsidies for vacation and second homes, as well as businesses, severe repetitive loss properties, or substantially improved/damaged properties. Properties not currently insured by the NFIP or any lapsed policy also would be subject to full actuarial rates. The subsequent Homeowner Flood Insurance Affordability Act (HFIAA) of 2014 sets aside the immediate implementation of the Biggert-Waters Act provisions for currently insured property owners and also lengthens the period over which insurance rates would ultimately be adjusted. However, all properties covered by the Biggert-Waters Act will be subject to the appropriate conditions of the act, as amended by the HFIAA, upon a change in ownership. Since a significant portion of the study area lies within a Federal Emergency Management Agency (FEMA) designated floodplain these statutory provisions have potential significant ramifications with regard to the relative value, and affordability, of the housing stock in the area, as well as the long-term individual wealth of the population.

FWOP conditions include an increased potential for flood damage to economic assets due to relative sea level rise. As a consequence of this increased flood risk, property owners and the NFIP (if insured) over time would together incur increased costs to repair flood-damaged property. Additional costs to implement appropriate risk reduction measures to address potential increased flood risk from sea level rise would also be incurred. Such actions could include the migration (or displacement) of affected populations from areas exposed to high flood risk to areas with relatively lower flood risk. Migration out of the area could also result from the temporary or permanent relocation of businesses and employment opportunities.

1.8.1.2 Employment, Business, and Industrial Activity (including Agriculture)

FWOP conditions would include a higher potential for temporary interruption or permanent displacement of employment, business, and industrial activity as businesses temporarily or permanently relocate to areas with less hurricane storm surge damage risk. Growth in employment, business and industrial activity is expected to follow national economic trends to the extent that economic growth is dependent upon macroeconomic variables such as inflation, interest rates, and the business cycle. However, employment in this region is also partially dependent on the petroleum exploration, production, and refining industries, which do not necessarily correlate with national economic trends. Employment trends (Moody's Analytics 2008) suggests growth from 2012 to 2038 with an additional 6,880 jobs projected by the year 2038 (Table 1-16). Cameron Parish, employment is expected to stabilize at 2012 levels (Moody's Analytics 2008).

Table 1-16: Projected non-farm employment (in thousands).

Parish	2012	2020	2030	2038
Calcasieu	91.89	96.5	95.5	95.4
Cameron	2.69	2.8	2.7	2.7
Vermilion	16.54	17.7	18.4	19.9
Total	111.12	116.9	116.5	118.0
Source: Moody's Analytics				

One or more series of catastrophic hurricane storm surge events in the future could result in significant disruption to business and industrial activity that could adversely affect employment and population. Such catastrophic events causing significant damage to non-residential, commercial, and industrial structures would likely increase over time as a result of multiple factors such as RSLR and climate change (source: http://www.climatehotmap.org/global-warming-effects/economy.html accessed December 14, 2015). Additionally, business owners in these communities could potentially incur higher flood insurance premiums should the FIRMs be updated to reflect an increase in flood risk over time.

1.8.1.3 Public Facilities and Services

FWOP conditions would include a greater potential for permanent displacement of public facilities and services due to hurricane storm surge events. Public facilities and services are expected to grow with the needs of the population and would follow population growth trends. In addition to the existing 603 public and quasi-public buildings, an additional 193 such facilities are projected by 2080. These projected facilities are expected to be placed at elevations above the 100-year floodplain. Over time, all facilities would be more susceptible to damages resulting from future hurricane storm surge events as RSLR occurs. The increased risk of damage to public facilities and the resulting temporary or potentially permanent relocation of these facilities would have a negative impact on services which would no longer be available either temporarily or permanently.

1.8.1.4 Transportation

Transportation infrastructure would be more susceptible to damages resulting from hurricane storm surge events due to expected RSLR. There would also be reduced access to infrastructure due to hurricane storm surge. For example, LA 82 in Cameron Parish is being eroded by Gulf waves (source: http://www.coast2050.gov/reports/Chap6.pdf; accessed January 7, 2016). A 5-mile-long segment of Louisiana Highway 27 almost totally blocks drainage from the western portion of the Lakes Subbasin of the Mermentau Basin into adjacent wetlands of the Calcasieu/Sabine Basin. Similarly, along the southern boundary of the Lakes Subbasin, LA 82 blocks drainage across 17 miles of marsh. The Freshwater Bayou navigation channel has altered the historic drainage pattern in the eastern portion of the Lakes Subbasin. These numerous blockages of drainage outlets significantly increase ponding in the subbasin (source: https://lacoast.gov/new/About/Basin_data/me/Default.aspx; accessed January 7, 2016).

1.8.1.5 Community and Regional Growth

Income growth and associated community and regional growth are expected to follow trends in national income, local employment, household formation, and the demand for public facilities and services. There would

also be a higher potential for unstable or disrupted community and regional growth due to increasing risk of damage from storm surge events.

1.8.1.6 Tax Revenues and Property Values

FWOP conditions would include lower tax revenues as property values decline due to higher risk of damage from hurricane storm surge events over time. The real estate market cycle is the primary factor in establishing existing and future property values at any point in time. However, over the period of analysis (50 years) changes in property values would be primarily reflective of the growth in income. As risk of damage grows over time due to higher hurricane storm surge events as a feature of RSLR, the effects of the higher risk of damage from hurricane storm surge would continue to suppress real estate market values for residential and non-residential properties. As in other coastal regions, higher risk of damage from hurricane storm surge would manifest itself in higher premiums for flood insurance under the NFIP: higher premiums are expected to increase the cost of property ownership and result in correspondingly lower market values. In extreme cases, such premiums are expected to rise to such high levels that the cost of flood insurance would become prohibitively expensive to some property owners. As a result, some properties would not be marketable and their values could be reduced to an extremely low level. To the extent that government assessments of these properties accurately reflect the diminished fair market values, the tax base could be reduced and property tax revenues could decline.

Some property owners would choose to reduce higher expected future risk of damage from hurricane storm surge through activities to mitigate or reduce the potential for those damages to occur. These activities would primarily include, but are not limited to, structure elevation, flood-proofing of commercial structures, and relocation to less risky portions of the study area. Each of these mitigation efforts require substantial financial resources to implement, whether these costs are borne by the property owner or are supplemented, in whole or in part, by public assistance.

1.8.1.7 Community Cohesion

The area would become more susceptible to damage caused by hurricane storm surge events that are projected to increase over the period of analysis. The increased risk of damage from hurricane storm surge to residential and non-residential structures and the resulting temporary and/or permanent relocation of populations would negatively affect the community cohesion in many communities. Additionally there would be a greater potential for reducing community cohesion if the civic infrastructure continues to be damaged as a result of hurricane storm surge events. Community cohesion may also be reduced if residents and businesses relocate to lower-risk areas.

1.8.1.8 Other Social Effects (OSE)

The area's social vulnerability is expected to increase over time if subsidence and sea level rise continue to increase, and the population increases as it is projected to do. The absolute number of socially vulnerable people (e.g., low-income, minority, less-educated, and over the age of 65) at risk for damage from hurricane storm surge events will increase. This, in turn, may lead to an increased burden placed on local, state, and Federal agencies to ensure that the most socially vulnerable populations have access to resources before, during, and after hurricane storm surge events.

1.8.2 Water Environment

1.8.2.1 Relative Sea Level Rise

Sea level rise (SLR) conditions were simulated by incorporating the predicted subsidence levels into the initial water elevation parameter to capture the combined effects of subsidence and local SLR into a single RSLR value. For the 2025 and 2075 hydrologic simulations, RSLR values specific to each gage were added to the 2013 initial water surface elevations (WSE) to calculate the initial WSE appropriate for each year and SLR rate. SLR and RSLR data are shown in Figure 1-6 and listed in Table 1-17. Four gages were used for the entire RSLR analysis (Calcasieu Lock West, Catfish Point, Schooner Bayou, and Leland Bowman Lock East), however only the gage closest to the main area with potential benefits is shown here as an example.

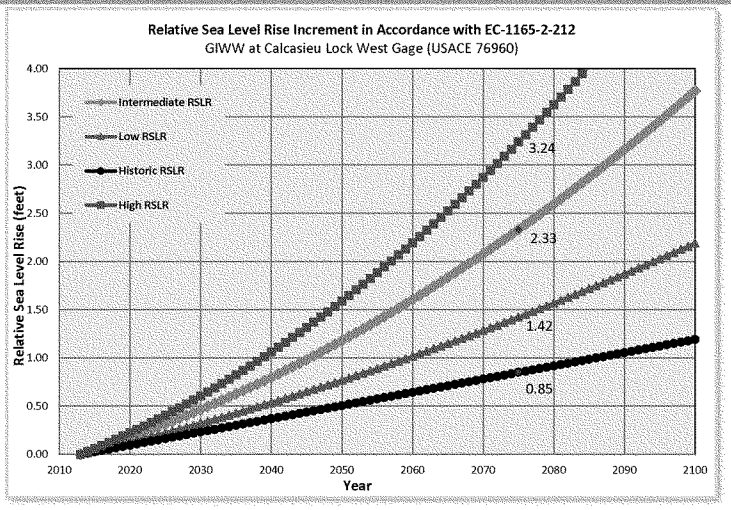


Figure 1-6: Relative sea level rise in the study area.
Historic RSLR rate is based hind cast of the local gauge data

Table 1-17: Predicted RSLR rise rates for the gage on the GIWW west of Calcasieu Lock.

Year and SLR Scenario	Calcasieu West RSLR increment (in feet)	Calcasieu West gage elevations (NAVD88 feet)
2025 Low SLR	0.125	0.222
2025 Intermediate SLR	0.216	0.313
2025 High SLR	0.307	0.405
2075 Low SLR	0.919	1.424
2075 Intermediate SLR	1.827	2.331
2075 High SLR	2.736	3.241

1.8.2.2 Hydrology and Hydraulics

Using the "intermediate" rate of RSLR as a plan formulation assumption is a technique to consider the impacts RSLR could have on the study area both in consideration of NED damages as well as NER ecosystem effects. The intermediate rate was chosen because it offers a balance between potentially unlikely scenarios (i.e. the current trend of RSLR continuing indefinitely and the high rate that could be disastrous for the study area). In the immediate area of Lake Charles, 100-year [1% Annual Chance Exceedance (ACE)] frequency event water levels are estimated to rise between 0.47 ft and 1.19 ft between 2013 and 2075 (see data shown in tables in the Engineering Report - Southwest Coastal Louisiana Explanation of FWOP Results at Appendix B.) In the surrounding marsh areas for all parishes, water levels are estimated to rise between 1.30 ft and 7.40 ft. For the areas along I-10 such as Welsh, Jennings, and Crowley that are far away from any water source connected to the Gulf of Mexico, there is no estimated rise in water surface elevations. This analysis is based upon the

intermediate rate of relative sea level rise. Adding marsh accretion raises water levels slightly in the marsh areas, while not impacting any NED areas. More information about the potential effects of RSLR can be found in Appendix O.

1.8.2.3 Flow and Water Levels

Under the FWOP condition there would be the continuation of the existing water flow and water level trends. As existing marsh fragments and is eventually converted to open water, the rainfall runoff from the north and the increasing RSLR would result in the area converting to greater expanses of fragmented marsh and open water. As sea levels rise, existing locks and control structures used for salinity control would be closed on a more frequent basis over time until they would be closed all the time to prevent saltwater intrusion. Natural drainage pattern flow paths would remain unchanged; however, as sea levels rise, drainage times would increase.

1.8.2.4 Water Quality and Salinity

There would be no direct impacts from implementing the No Action Alternative. Indirect impacts would include the continuation of existing water quality trends as described in Section 1.3.6. Without implementing an action alternative there would be an increased risk of damages resulting from flooding of structures within the study area, with drainage of floodwaters containing elevated nutrients, metals, and organics into water bodies connected to the Calcasieu, Mermentau, and Tech-Vermillion river basins. Into the future the area would be affected by existing and proposed restoration measures, chenier geomorphologic processes, development (in particular, oil and gas development in the Calcasieu River basin and agriculture in the Mermentau River basin), and climate patterns (Mousavi et al., 2011).

1.8.3 Natural Environment

1.8.3.1 Sedimentation and Erosion

FWOP conditions would include persistence of current sedimentation and erosion patterns. Existing hydrologic alterations would continue to affect water levels and salinities and continue influencing land loss at similar or increased rates. RSLR would expose additional shoreline areas to erosive forces into the foreseeable future. Couvillion et al. (2013) predict coastal Louisiana is potentially at risk of losing between 2,118 and 4,677 km^2 of land over the next 50 years. This would be a potential loss of between 14.6% and 32.3% of the remaining coastal wetlands in the state over the next 50 years (exclude Atchafalaya Basin). The uncertainty range for wetland change projections represents anywhere from a 32.2% reduction to a 49.6% increase in the average wetland loss rates experienced from 1932–2010 (Couvillion et al., 2011). These results suggest that a net wetland loss in coastal Louisiana over the next 50 years would likely occur regardless of uncertainties in parameters that influence coastal wetland loss.

Table 1-18: Net land area change (km^2) projections by basins in the study area (source: Couvillion et al. 2013)

Basin	Land Area 2010 (km^2)	Land Area 2060 (km^2)	Net change 2010-2060 (km^2)
Calcasieu/Sabine	1495.0	1348.5	-146.5
Mermentau	1914.1	1706.0	-208.5
Teche/Vermilion	1239.4	1172.4	-67.0
Total Louisiana Coast	16,793.8	14693.0	-2100.8

1.8.3.2 Soils, Water Bottoms, and Prime and Unique Farmlands

The FWOP conditions would be the continuation of existing conditions with coastal shoreline recession, subsidence and land loss continuing at similar or increasing rates of change with concomitant increase in shallow open waterbottoms. As RSLR increases and areas become inundated by salt water, prime farmlands could be lost. As human populations and development increase, prime farmlands could be converted to suburban, urban, and industrial uses and areas available for agricultural use would decrease. Gulf shoreline recession rates, varying between +8 ft to -52.9 ft per year, would result in Gulf shoreline rollover onto interior marshes, the loss of cheniers throughout the study area due to subsidence, and change in land use patterns from forested areas to

agriculture and grazing pasture. Soils identified as prime farmlands on chenier ridge tops would also be susceptible to flooding events and subsidence and could be lost as RSLR increases.

1.8.3.3 Gulf Coastal Shorelines

The FWOP conditions would be the continuation of existing conditions with coastal shoreline recession, subsidence and land loss continuing at similar or increasing rates of change. For example, from 1984 to 2010 the Rockefeller WR shoreline change rate was -43.4 acres per year or 0.056% per year; and Freshwater Bayou/North Pecan Island change rate was -111 acres per year or -0.308% (Appendix A, Annex W), Hypertemporal Subunit Change Rate and Map). The loss of these coastal shorelines would adversely affect the extraordinary scenic, scientific, recreational, natural, historical, archeological, cultural, and economic importance of the coastal shorelines. The continued loss of coastal shorelines would result in the reduction and eventual loss of the natural protective storm buffering. Without the protective buffer provided by the coastal shorelines, interior estuarine wetlands would be at an increased risk to severe damage from hurricane storm events. Continued shoreline recession, subsidence and land loss resulting in the movement of unstable sediments would undermine man-made structures, especially the extensive oil and gas pipelines and related structures in this "working coastline."

1.8.3.4 Vegetation Resources

The FWOP conditions would be the continuation of existing conditions and factors driving trajectories of ecological change to area vegetation zones. Without an extensive ecosystem restoration plan, marsh habitat may continue to be restored through other restoration projects and programs such as those authorized for construction through the CWPPRA, the Coastal Impact Assistance Program (CIAP), and LCA, but not on a large and broad enough scale to completely restore natural processes and features vital to the long-term sustainability of the watershed. (Note, however, that the CWPPRA project authority, absent Congressional amendment, will end in 2019. However, recent approval for the trust fund that funds projects has been approved for an additional five years (personal communication, Brad Inman USACE CWPPRA Lead Manager, January 28, 2016). Additionally, funding approved for construction of CWPPRA projects may be reduced in the intervening years before the expiration of the CWPPRA authorization as the Task Force addresses funding requirements to OMRR&R constructed CWPPRA projects for the remainder of their project life. Finally, some LCA projects, such as the LCA BUDMAT project authority is presently subject to a Federal cost cap; therefore, unless that project authority is amended, construction of future LCA BUDMAT projects will be limited by the existing cap on Federal expenditure.) Without action, the coastal vegetated resources would continue to decline, including bankline erosion and sloughing of the shoreline, and continued fragmentation and conversion of existing brackish and saline marsh to shallow open water habitats. Both human-induced impacts and natural processes would contribute to the continued loss of vegetated habitats, including continued shoreline erosion and subsidence, increased saltwater intrusion, increased water velocities, and increased herbivory. Table 1-19 displays the predicted acreage loss of different wetland types in southwest coastal Louisiana by the year 2050. Net marsh loss by 2050 is expected to be 97,505 acres (Coast 2050 Report, 1999).

Table 1-19: Predicted acreage loss of different wetland types in study area (Coast 2050 Report 1999).

SOUTHWEST COASTAL LOUISIANA	Fresh Marsh lost by 2050 (acres)	Intermediate Marsh lost by 2050 (acres)	Brackish Marsh lost by 2050 (acres)	Saline Marsh lost by 2050 (acres)	Net Marsh loss by 2050 (acres)
Mermentau Basin	34,885	9,080	14,620	525	59,110
Calcasieu/Sabine Basin	2,640	11,555	23,770	430	38,395
Totals	37,525	20,635	38,390	955	97,505

Gulf Coast Prairie and Forested Terraced Uplands:

- Some unknown extent of existing riverine BLH and associated swamp habitats would be converted to more efficient water conveyance channels as human populations and development increase.
- Some unknown extent of existing pasture and rangelands would be converted to rural, suburban and urban human habitats, generally in the order presented, as human populations and development increase.

Gulf Coast Marshes

- Habitat switching would occur due to increasing sea level rise, subsidence, shoreline erosion and other land loss drivers.
- Gulf shoreline recession rates, varying between +8 ft to -52.9 ft per year, would result in Gulf shoreline rollover onto interior marshes thereby converting these existing habitats to barrier shorelines.
- Chenier ridge habitat has been lost throughout the southwest coastal area due to subsidence and change in land use patterns from forested areas to agriculture and grazing pasture. Other anthropogenic activities have affected the extent of chenier habitat such as sand mining though much of this activity has decreased significantly. The open areas on the chenier ridges would continue to be maintained as agricultural or pasture land hence native or invasive scrub shrub habitat would be limited.
- Inland ponds and lakes shoreline loss rates, varying between 3.6 ft and 9.3 ft, would result in conversion of existing salt, brackish, and intermediate/fresh marsh to shallow open water habitats.
- Habitat switching of interior marsh could result from saline intolerant dominant species to species that can tolerate higher salinities.
- SAVs could become lost due to erosive forces and increased sedimentation due to land loss.

1.8.3.5 Rare, Unique, and Imperiled Vegetative Communities

Existing conditions and trends of land loss are expected to continue resulting over time in the loss of these valuable vegetative communities. For example, without action, saltwater intrusion and drainage problems would continue, resulting in the conversion of freshwater marsh to intermediate and brackish marsh and eventual open water.

1.8.3.6 Wildlife Resources

Existing conditions and changes caused by ecosystem drivers would persist. RSLR, human encroachment and development, and other factors would result in loss of existing wildlife estuarine, chenier, riverine, and oak-pine forest habitats. Increases in RSLR would increase saltwater intrusion and exacerbate ongoing conversion of estuarine wetlands to shallow open water. As habitat loss continues, migratory Neotropical avian species would have less suitable stopover habitat forcing them to fly further to suitable habitat. Flying longer distances to find suitable stopover habitat could result in an increase in mortality resulting in a corresponding reduction in overall species diversity and abundance. Most mammalian, amphibian, and reptilian species would migrate to more suitable habitats. Subject to the above described limitations of the CWPPRA and LCA programs, wildlife would benefit from restoration activities implemented by other programs such as CIAP, CWPPRA, LCA and the beneficial use of dredged material; however these activities are not enough to keep up with the current trends in habitat loss and RSLR.

1.8.3.7 Aquatic and Fisheries Resources

Existing conditions and associated changes due to ecosystem drivers, as described in Section 1.4.7, would persist into the future. Increases in RSLR would increase saltwater intrusion and exacerbate ongoing conversion of estuarine wetlands to shallow open water and loss of existing estuarine fish habitats. Increases in RSLR could exacerbate ongoing conversion of existing aquatic organism distributions from an estuarine-dependent to more marine-dependent distribution. As habitat loss continues, there would be a corresponding reduction in overall species diversity and abundance as well as loss of estuarine nursery, foraging, refugia, and other estuarine aquatic habitats. Subject to the above described limitations of the CWPPRA and LCA programs, aquatic and fisheries would benefit from restoration activities implemented by other programs such as CIAP, CWPPRA, beneficial use of dredged material; however these activities are not enough to keep up with the current trends in habitat loss and RSLR.

1.8.3.8 Essential Fish Habitat (EFH)

Existing trends and continued shoreline erosion, subsidence, and land loss, as described in Section 1.4.8 and Appendix A, Annex W would continue to convert existing estuarine EFH to marine and open water EFH types resulting in the loss of existing estuarine EFH but an increase in the open water and marine EFH.

1.8.3.9 Threatened/Endangered Species and Other Protected or Species of Concern

Land loss would directly reduce the availability of habitat for threatened and endangered species. Sprague's pipit populations could decline due to habitat conversion to seeded pasture, hayfield, and cropland, as well as overgrazing by livestock. Moreover, management favoring intensive cattle grazing and reduced fire frequency may lead to the degradation of remaining suitable grassland tracts over much of their range. Without proper fire intervals, shrubs and excessive vegetation litter may reduce habitat quality; in addition, grasslands may eventually succeed to shrubland or savannah (source: http://www.fws.gov/mountain-prairie/species/birds/spraguespipit/SpraguesJS2010r4.pdf; accessed December 17, 2015). Red-cockaded woodpeckers require open pinelands and savannahs with large old pines for nesting and roosting habitat. Foremost among the limiting factors for the red-cockaded woodpecker is suitable nesting habitat and lack of cavity trees, habitat fragmentation, and degradation of foraging habitat through fire suppression. Continued and extensive coastal land loss would continue to reduce the availability of transitional estuarine marsh and chenier forest habitats for use by threatened and endangered species. Piping plover would lose access to some forage and roosting habitat as it shifts to shallow open water. As interior marshes are lost, shoreline retreat rates increase. The coastal habitat utilized by sea turtles would continue to be impacted from this accelerated shoreline retreat rate. The continued erosion of the Gulf coast shoreline would result in additional salt water intrusion into the interior wetlands area resulting in additional marsh loss. Conversely, the recently delisted brown pelicans would gain access to more shallow water foraging areas, resulting from the shoreline retreat. Indirect effects would be the continued reduction of piping plover critical wintering habitat due to coastal erosion. Without action there would be the continued degradation and loss of emergent wetland habitats used by many different fish and wildlife species for shelter, nesting, feeding, roosting, cover, nursery, and other life requirements. The loss and deterioration of transitional wetland habitats over time could continue to indirectly affect, to an undetermined degree, all listed species that may potentially utilize the area including: Gulf sturgeon, piping plovers, red knots, green sea turtles, Kemp's Ridley sea turtles, loggerhead sea turtles, hawksbill sea turtles, leatherback sea turtles, and the West Indian manatee. The recovery of some sensitive/delisted species such as brown pelican, bald eagle, and colonial nesting birds could be indirectly impacted if habitat loss goes unabated.

1.8.3.10 Cultural and Historic Resources

Impacts to cultural and historic resources in southwest Louisiana have resulted from both natural processes, such as erosion and reworking of archaeological deposits, and human activities, such as land development, dredging, agriculture, and vandalism. Coastal environments are dynamic, and impacts to cultural and historic resources in the area would continue as a result of both natural processes and anthropogenic modifications of the landscape.

1.8.3.11 Recreation Resources

Recreational resources in the Louisiana coastal zone that would be most affected are those related to loss of wetlands/marshes and habitat diversity. Many recreational activities are based on aquatic resources and directly related to the habitat and species in an area.

Gulf Coast Prairie and Forested Terraced Uplands: Indirectly, recreational infrastructure would remain vulnerable to surges. Another major consequence of hurricane storm surge is land loss and the possible loss of facilities and infrastructure that support or are supported by recreational activities. Land loss can result in the loss of park land, boat launches, parking areas, access roads, as well as marinas and supply shops. In general, without continued comprehensive ecosystem restoration efforts across the study area, further degradation of area marshes would continue and its associated negative effects on recreational activities will increase. Additionally,

saltwater intrusion and predicted RSLR will continue to cause land loss. As existing freshwater wetland/marsh areas convert to saltwater marsh, then to open water, the recreational opportunities will change accordingly.

Gulf Coast Marshes: Indirectly, the continued loss of wetlands/marshes and habitat diversity affects recreational opportunities. Storm surge and saltwater could influence freshwater forests and habitats and could reduce recreational resources (e.g., fishing, hunting, bird watching, and other). In general, further degradation of area marshes would continue and its associated negative effects on recreation activities would increase. As existing freshwater wetland/marsh areas convert to saltwater marsh, then to open water, the recreational opportunities would change accordingly. For example, freshwater fishing opportunities may be expected to become saltwater opportunities. If the expected peak and then decline of fishery production occurs in these open waters, then the associated marine-fishery recreational opportunities would also decline. As populations of migratory birds and other animals dependent on marsh and swamp decrease, again associated recreational opportunities, such as hunting and wildlife viewing, would decrease. There may be an economic loss felt by marinas and other shops, which may be two-fold. One is losing the actual facility or access to the facility, the other is change in opportunities. Habitat change and resulting changing recreation opportunities (i.e., fresh to marine) may, for example, severely impact a marina specializing in services to particular types of recreation (i.e., loss of freshwater opportunities).

1.8.3.12 Noise

There would be no direct, indirect, or cumulative effects to noise.

1.9 Cumulative Impacts for Future Without Project Conditions (No Action Alternative)

Cumulative impacts would be the incremental direct and indirect effects of not taking action to address hurricane storm surge damage risk reduction or ecosystem restoration on the human, water and natural environment resources, in addition to the direct and indirect impacts of other past, present and reasonably foreseeable future actions (40 CFR § 1508.7) on these important resources. In the FWOP conditions, the following human, water and natural environmental important resources would continue to be at risk.

Human Environment

- An estimated population increase of 225,000 and 15,000 residential structures in the study area in the year 2075 would remain at risk of hurricane storm surge damage;
- Employment of 106,000 workers in the three-parish area in the year 2010; 1,580 non-residential structures in the study area by 2075; 808,414 acres of agricultural land within the three-parish area in 2009; projected 603 public and quasi-public buildings, and an additional 193 such facilities projected by 2080 would remain at risk of hurricane storm surge damage;
- Transportation infrastructure would be more susceptible to damages resulting from hurricane storm surge events due to expected RSLR and loss of coastal wetlands;
- Infrastructure would remain at risk and continue to experience reduced access due to hurricane storm surge damage and loss of coastal wetlands;
- Community and regional growth would remain at risk of continued hurricane storm surge damage;
- Tax revenues and property values would remain at risk due to continued hurricane storm surge damage and continued erosion, fragmentation and eventual loss of coastal wetlands;
- Expected higher flood insurance premiums would be expected to increase the cost of property ownership and result in correspondingly lower market values;
- Continued or increased risk of damage to residential and non-residential structures resulting in temporary and/or permanent relocation of populations would negatively affect the community cohesion in many communities;
- Continued temporary displacement of minority and/or low-income populations because residents within the area would remain vulnerable to flooding from hurricane storm surge and may be forced to relocate to areas with risk reduction measures in place;

- Continued higher risks of damage from hurricane storm surge would manifest itself in higher premiums for flood insurance under the NFIP;
- Continued shoreline recession, subsidence, and land loss would result in the movement of unstable sediments and would undermine man-made structures, especially the extensive oil and gas pipelines and related structures in this "working coastline."

Water Environment

- Existing hydrologic alterations would continue to impact water levels and salinities and continue influencing land loss at similar or increased rates;
- As sea levels rise, natural drainage pattern flow paths would remain unchanged but drainage times would increase;
- Continued salt water intrusion and inundation during hurricane storm surge events;
- Continued erosion by wave and current action resulting in continued shoreline erosion of most channels, lakes, and the Gulf.

Natural Environment

- Degradation, fragmentation and continued loss of soil resources, especially coastal wetlands would continue into the FWOP condition. The LCA Study (USACE, 2004) estimated coastal Louisiana would continue to lose land at a rate of approximately 6,600 acres per year over the next 50 years. It is estimated that an additional net loss of 328,000 acres may occur by 2050, which is almost 10 percent of Louisiana's remaining coastal wetlands. More recently, Couvillion et al (2013) estimated that between 2010-2060 coastal Louisiana would show a net change of -519,119 acres with the Calcasieu/Sabine basin showing a net change of -36,201 acres, Mermentau basin a net change of -51,521 acres and the Teche/Vermilion basin with a net change of -16,556 acres. However, wetland soil losses would be offset to some extent by restoration projects implemented through other programs;
- Continued increases in RSLR could increase saltwater intrusion and exacerbate ongoing conversion of existing estuarine wetlands to shallow open water;
- Impacts to cultural and historic resources in coastal Louisiana would continue as a result of both natural processes and cultural modifications of the landscape;
- Recreational infrastructure and consumptive recreational opportunities would remain vulnerable to damage from hurricane storm surges;
- Continued conversion of existing vegetated wetlands used as foraging, nesting, and over-wintering habitat to open water habitats;
- Reduction in overall species diversity and abundance as well as loss of estuarine nursery, foraging, refugia, and other estuarine aquatic habitats;
- Continued bankline erosion with sloughing, fragmentation and continued degradation of shorelines;
- Continued encroachment of salinity into fresher areas of brackish and freshwaters;
- Continued habitat switching by organisms due to continued fragmentation, degradation and loss of transitional estuarine habitats due to increasing RSLR, subsidence, shoreline erosion, and other land loss drivers; and
- Loss of existing transitional estuarine and chenier habitats would further stress species that are dependent on these habitats for all or a part of their life cycle.

The future without project risks to the important resources in the human, water and natural environment could be offset, to some undetermined degree, by other hurricane storm damage risk reduction projects and ecosystem restoration efforts. The Future Without Conditions are the same as described in Chapter 3, Section 3.4, *Reasonably Foreseeable Actions* subsections.

2.0 PLAN FORMULATION

Plan formulation supports USACE water resources development missions. A systematic and repeatable planning approach ensures sound decision making. The Principles and Guidelines describe the process for Federal water resource studies requiring formulation of alternative plans contributing to Federal objectives. This chapter describes the process to identify the TSP and shows work performed after public and agency comments on the revised draft report released in March 2015.

Plans or alternatives are composed of measures. Measures consist of features which are structural elements that require construction or assembly and/or activities which are nonstructural actions implemented to address planning objectives. Each feature and/or activity represents a measure that can be implemented to address planning objectives at a specific geographic site.

This study considered measures consistent with NED and NER objectives. All measures were evaluated and screened for capability to meet objectives and avoid constraints, for engineering and economic feasibility, and to maximize benefits provided over the 50-year period of analysis from 2025-2075. Measures that warranted continued consideration and met the success thresholds were assembled into alternative plans. In the evaluation process, each alternative plan was required to meet study-specific minimum standards and qualifying criteria in order to merit further consideration. Each plan was evaluated individually to determine whether it qualified for additional consideration.

Note: This chapter describes the alternative development, formulation, and evaluation process that led to the identification of the NED and NER TSPs. The information contained herein was presented in the 2015 Revised Draft Report that was released for public review in March 2015. Changes to the NED and NER TSPs have occurred since that public review which are briefly described at the end of the NED and NER sections in this chapter. The changes to the TSPs resulted in the Recommended Plan presented in this final report. Descriptions of these plans appear in Chapter 4.

Risk Reduction

The term "100-year level (1% ACE) of risk reduction," refers to a level of reduced risk of hurricane and storm surge wave driven flooding that the project area has a 1 percent chance of experiencing each year. The 1 percent chance is based on the combined chances of a storm of a certain size and intensity following a certain track. Different combinations of size, intensity, and track could result in a 100-year surge event. The 50-year level (2% ACE) of risk reduction refers to a level of reduced risk of hurricane and storm surge wave driven flooding that the project area has a 2 percent chance of experiencing each year. The 200-year level (0.5% ACE) of risk reduction refers to a level of reduced risk of hurricane and storm surge wave driven flooding that the project area has a 0.5 percent chance of experiencing each year.

2.1 Goals and Objectives

Generally, the planning goals of the NED Plan are to reduce damages associated with hurricane and coastal storm surge flooding. The NED storm damage risk reduction plans were formulated to achieve NED principles and objectives. Contributions to NED are increases in the net value of the national output of goods and services, expressed in monetary units, and are the direct net benefits that accrue in the planning area and the rest of the Nation.

The general planning goals of the NER Plan are to significantly and sustainably reduce land loss and coastal erosion, restore environmental conditions for the Chenier Plain ecosystem, and evaluate a range of coastal restoration components to address a multitude of ecosystem problems. Plans were formulated to achieve NER principles and objectives. Contributions to NER are increases in the net quantity and/or quality of desired ecosystem resources, and are measured in the study area and nationwide.

The Project Delivery Team (PDT) developed the following planning objectives to apply to the entire study area over the 50-year planning horizon (2025-2075):

- NED Objective 1. Reduce the risk of damages and losses from hurricane and storm surge flooding.
- NER Objective 2. Manage tidal flows to improve drainage, and prevent salinity from exceeding 2 parts per thousand (ppt) for fresh marsh and 6 ppt for intermediate marsh.
- NER Objective 3. Increase wetland productivity in fresh and intermediate marshes to maintain function by reducing the time water levels exceed marsh surfaces.
- NER Objective 4. Reduce shoreline erosion and stabilize canal banks to protect adjacent wetlands.
- NER Objective 5. Restore landscapes, including marsh, shoreline, and cheniers to maintain their function as wildlife habitat and improve their ability to serve as protective barriers.

2.2 Constraints

The NED and NER plans are limited by the following constraints that are to be avoided or minimized:

- **Commercial navigation.** The Calcasieu and Sabine Ship Channels and the GIWW carry significant commercial navigation traffic. Measures that would cause shipping delays would result in negative NED impacts. In addition, the ability of authorized navigation projects to fulfill their purpose, such as the operation of locks along the GIWW, may be impacted by project features.
- **Federally listed threatened and endangered species and their critical habitats.** Construction schedules may be restricted due to T&E species including, but not limited to piping plover, Gulf sturgeon, red-cockaded woodpecker, red knot, whooping crane, West Indian manatee, and several species of sea turtles.
- **Essential fish habitat (EFH), especially intertidal wetlands.** Conversion of one EFH type to another should be done without adversely impacting various fish species.
- **Cultural and historic resources.** Prehistoric and historic archeological sites, buildings, structures, districts, and properties that may be of religious and cultural significance to Indian tribes are located in the study area, including properties included in or eligible for inclusion in the NRHP.

2.3 Study Authorizations

2.3.1 NED Study Authorization

A survey of the coast of Louisiana in Cameron, Calcasieu, and Vermilion Parishes, with particular reference to the advisability of providing hurricane and storm damage risk reduction and related purposes, including the feasibility of constructing an armored 12-foot levee along the Gulf Intracoastal Waterway was authorized by a Resolution of the Committee on Transportation and Infrastructure, U.S. House of Representatives, Docket 2747, on December 7, 2005.

The U.S. Army Corps of Engineers, Mississippi Valley Division, New Orleans District (CEMVN) initiated a Section 905(b) reconnaissance study in April 2006. NED alternatives to reduce hurricane-induced damages within Calcasieu, Cameron, and Vermilion Parishes were formulated through a series of planning meetings with the State of Louisiana, local parishes, and other stakeholders. The following three structural alternatives were initially determined to be sufficiently economically justified with a benefit-to-cost ratio (BCR) greater than 1.0, which would warrant further Federal investigation:

- Armored 12-foot earthen levee that allows for overtopping constructed along the GIWW alignment on the south side across Calcasieu, Cameron, and Vermilion parishes (height and alignment specified in the study resolution), with control structures constructed across waterways.
- Non-armored 12-foot earthen levee that allows for overtopping constructed along the north side of the GIWW providing storm damage risk reduction to the Lake Charles area.
- Non-armored 12-foot earthen levee that allows for overtopping constructed along the north side of the GIWW providing storm damage risk reduction to the Abbeville area.

2.3.2 NER Study Authorization

The 2004 LCA Restoration Study Report and Programmatic Environmental Impact Statement (2004 LCA Study) was developed to identify cost-effective, near-term (ten year implementation period) restoration features to reverse the degradation trend of the coastal ecosystem of Louisiana. The Near-Term Plan that resulted from the 2004 LCA Study focused on restoration strategies that would reintroduce historical flows of river water, nutrients, and sediments; restore hydrology to minimize saltwater intrusion and maintain structural integrity of coastal ecosystems. The 2004 LCA Study identified critical projects, multiple programmatic authorizations, and ten additional required feasibility studies. The Report of the Chief of Engineers dated 31 January 2005 (2005 Chief's Report) approved the Near-Term Plan substantially in accordance with the 2004 LCA Study. Title VII of the Water Resources Development Act of 2007 (WRDA 2007) (Public Law 110-114) authorized an ecosystem restoration Program for the Louisiana Coastal Area substantially in accordance with the Near-Term Plan.

The Chenier Plain Freshwater Management and Allocation Reassessment Study (Chenier Plain Study), recommended in the 2005 Chief's Report was one of six large-scale restoration concepts that were purported to have the ability to "significantly restore environmental conditions that existed prior to large-scale alteration of the natural ecosystem" upon construction. WRDA 2007 authorizes fifteen near-term features to address critical restoration needs of coastal Louisiana, demonstration projects, a beneficial use of dredged material program, project modifications, and a science and technology program. Guidance provided by the Director of Civil Works on December 19, 2008 states that *"the coastal restoration components proposed as part of the LCA Chenier Plain study will be evaluated as part of the Southwest Coastal Louisiana feasibility study"*.

A Feasibility Cost Share Agreement between USACE and the CPRAB, as the non-Federal Sponsor, was executed on January 14, 2009 for the study and analysis of the NED and NER study alternatives.

2.4 Prior Studies

Table 2-1 lists relevant reports and studies that were considered in the development of the NED and NER plans.

Table 2-1: Relevant prior studies, reports, programs, and projects for the SWC Louisiana feasibility study.

Prior Studies, Reports, Programs, and Water Projects	Parish	Potential Data Source	Consistency	Source of Measures
Planning Studies				
Coast 2050 Plan, 1999	All	✓	✓	
LCA, Louisiana Ecosystem Restoration Study, 2004	All	✓	✓	✓
Louisiana's Comprehensive Master Plan for a Sustainable Coast,-2012	All	✓	✓	✓
Louisiana Coastal Protection and Restoration (LACPR) Technical Report, 2009	All	✓	✓	✓
Calcasieu River Basin Feasibility Study (Draft)	Calcasieu	✓		
Calcasieu River and Pass, Louisiana, Dredged Material Management Plan and Supplemental EIS	Calcasieu, Cameron	✓	✓	✓
Federal Laws and Programs				
CWPPRA 1990	All	✓	✓	✓
USACE Continuing Authorities Program (WRDA Sec. 204), 1996	All			✓
CIAP, 2001 & 2005	All	✓		✓
Second Emergency Supplemental Appropriations Act to Meet the Immediate Needs Arising from the Consequences of Hurricane Katrina, 2005 (Public Law 109-062)	N/A	✓	✓	

Prior Studies, Reports, Programs, and Water Projects	Parish	Potential Data Source	Consistency	Source of Measures
Department of Defense, Emergency Supplemental Appropriations to Address Hurricanes in the Gulf of Mexico, and Pandemic Influenza Act, 2006 (Public Law 109-148)	N/A	✓	✓	
State Laws and Programs				
Louisiana Coastal Wetlands Conservation, Restoration and Management Act, 1989	All		✓	
Act 8 of the Louisiana Legislature First Extraordinary Session of 2005	All	✓	✓	
Parish Coastal Wetlands Restoration Program (Christmas Tree Program)	All	✓		
Vegetation Planting Program	All	✓		
Ecosystem Restoration Projects By Funding Source				
CWPPRA Projects	All	✓	✓	
CIAP Projects	All	✓	✓	
State Projects	All	✓	✓	
WRDA Section 204/1135 Projects	All	✓	✓	
Federal Emergency Management Agency Projects	All	✓	✓	
Federal Navigation Projects				
Bayou Teche and Vermilion River	Vermilion		✓	
Freshwater Bayou and Freshwater Bayou Lock	Vermilion	✓	✓	
GIWW	All	✓	✓	
Calcasieu River, Pass and Bar Channel	Calcasieu, Cameron	✓	✓	
Mermentau River	Cameron	✓	✓	
Sabine-Neches Waterway	Calcasieu, Cameron	✓	✓	

2.5 NED Alternative Formulation

A broader description of the process used to formulate the initial array is captured in Table C-3 in Appendix C. Early modeling was performed to determine where hurricane storm surge damage potential exists in the study area. Figure 2-1 depicts red dots that represent structures within the structure inventory that are included within the 100-year floodplain and thus, are at risk of hurricane or storm surge-induced flood damages. At-risk structures are concentrated in several areas where levee systems could potentially reduce risk. The remainder of the study area (outside of Lake Charles, Delcambre, Abbeville, and Erath) is less densely populated and at-risk structures are dispersed over large areas. Therefore, nonstructural measures were considered for these less populated areas.

To assess the benefits of any structural or nonstructural alternative, measure, or feature, the preventable physical damages to existing residential, commercial, industrial, and public buildings and facilities were considered. There are other physical damages, and/or disruptions, associated with broadly dispersed physical infrastructure and natural resources, that may be integral to economic sectors, such as oil and gas production (e.g., pipelines, production facilities, etc.) or agriculture (e.g., livestock, field crops, etc.). However, because no assurance of reduction in damage or associated loss of productivity can be determined through a dedicated, site-specific application of the measures and features available, these damages could not be included.

The structure inventory was supplemented with additional residential and non-residential properties that are expected to be placed in service in FWOP conditions. These supplemental properties generically represent "future growth" with respect to economic assets. Flood plain regulations, mandated by the NFIP (managed by FEMA) and executed through local government ordinances, building codes and permits, require that the first

floor elevation of any new structure be placed at or above the base flood elevation as indicated by the corresponding FIRM. Therefore, while structures that are expected to be placed into service in the future are included in the structure inventory, their exposure to the risk of flooding from hurricane storm surge is significantly less than many structures found in the inventory under existing conditions.

The reduction in expected future damages to the physical facilities and industrial facilities, including oil and gas facilities, was considered as an NED benefit for BCR computations. To achieve this, direct telephone contact was initiated to all 71 owners/operators of industrial facilities in the area requesting information relating to the replacement cost of at-risk facility components and associated depth-percent-damage relationships. Of these 71 inquiries, 44 provided data that is required in the economic analysis. However, no information was provided by the remaining 27 owners/operators. Lacking these data, no speculative estimation of depth-damage relationships to these facilities was made and as a result, the structure inventory used to evaluate damages and benefits for levee plans does not include these facilities.

Plan Development Strategies. Prior to developing specific measures and features for alternative formulation, the PDT identified two broad categories to address study goals: a comprehensive levee plan and a comprehensive nonstructural plan. The reconnaissance report recommendation (12-foot levee along the GIWW) was also used as a starting point to achieve study objectives.

- **Armored 12-foot levee along the GIWW (Reconnaissance Report Recommendation).** Study authority requires assessing the "feasibility of constructing an armored 12-foot levee along the Gulf Intracoastal Waterway." This 122-mile levee was determined to be marginally justified for further Federal investigation in the 2007 reconnaissance report. Nonstructural measures would be applied to communities south of the GIWW, including Cameron, Hackberry, Holly Beach, Creole, Grand Chenier, Pecan Island, and Intracoastal City. This plan is not included in the 2012 State of Louisiana Comprehensive Master Plan for a Sustainable Coast (State Master Plan).

- **Comprehensive Levee Plan.** Individual levees would be built around the largest population centers, and nonstructural measures would be applied in all other areas. Levees could be located around the areas of Lake Charles, Abbeville (including Erath and Delcambre), Kaplan, and Gueydan. The Lake Charles metropolitan area is the largest urban center with a population of approximately 194,000 (U.S. Census, 2009). From west to east, the communities of Gueydan, Kaplan, Abbeville, Erath, and Delcambre are located in northern Vermilion Parish along Highway (Hwy) 14 and have estimated populations of 1,600, 5,200, 12,300, 2,200, and 2,200, respectively (U.S. Census, 2010). The State Master Plan includes plans for levees in the greater Lake Charles and Abbeville areas. Plans for levees around Kaplan and Gueydan are included in the Louisiana Coastal Protection and Restoration (LACPR) study.

- **Comprehensive Nonstructural Plan.** Nonstructural measures were considered as alternatives that could be implemented in the entire study area. Owners of eligible residential and commercial structures (including public buildings but excluding warehouses and industrial facilities) would participate in implementing measures such as structure elevating, flood proofing, and localized storm surge risk reduction measures. Property acquisition may also be considered if circumstances warrant.

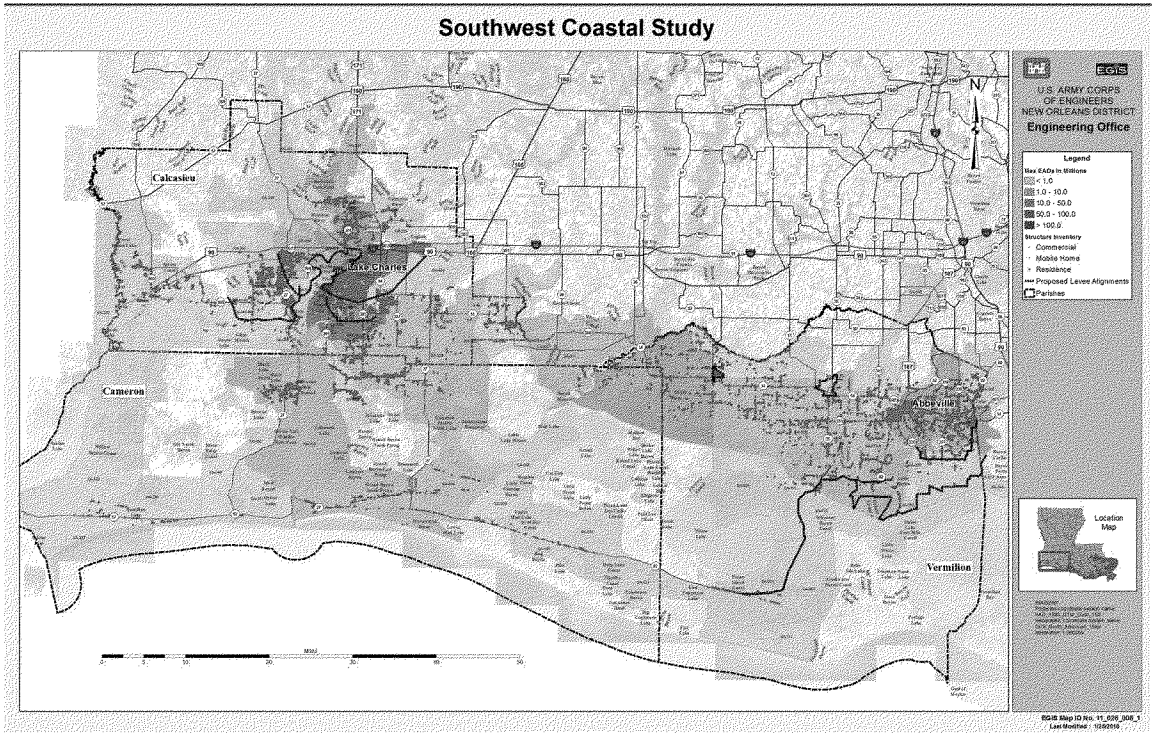


Figure 2-1: Structure inventory and density.

JA 37-899 10/04/2019

2.5.1 NED Measures (*NEPA Required)

Ten NED measures were developed from various sources including the PDT and the State Master Plan.

Table 2-2: Potential NED measures.

Earthen Levees	Elevation-in-Place
Floodgates	Property Acquisition
Floodwalls	Flood proofing
Pumps	Localized Storm Surge Risk Reduction Measures
Highway Armoring	Floodplain Management Plans, Public Information Campaigns, local government building and zoning code requirements, developmental controls, restrictive covenants, etc.

Measures were evaluated to form comprehensive risk reduction alternatives for the entire study area. North of the GIWW, combinations of structural and nonstructural measures were based on existing Federal, State, and local plans (i.e., Southwest Coastal Reconnaissance Study, LACPR, State Master Plan, and the Vermilion Parish Hurricane Protection Plan). South of the GIWW, structural plans were determined to be technically unfeasible because of broadly dispersed (rural) populations.

2.5.2 Initial Array of NED Alternative Plans (*NEPA Required)

Fifteen HSDRR alternatives were identified for further analysis (Table 2-3):

Table 2-3: NED initial array of alternatives.

Independent Variations	
Armored 12-Foot Levee Along the Length of the GIWW	
Gueydan Ring Levee	
Kaplan Ring Levee	
Louisiana Hwy 333/82 Armoring	
Nonstructural Measures	
Lake Charles Levee Variations	**Abbeville Levee Variations**
Lake Charles – Southern (east and west)	Abbeville Marsh/Upland Interface
Lake Charles – Southern/Eastern only	Abbeville along GIWW
Lake Charles – Southern/Western only	Abbeville along LA Hwy 330
Lake Charles – Northern (east and west)	Abbeville (shortened variation) – Excludes Erath and Delcambre
Lake Charles – Northern (east only)	
Lake Charles – Northern (west only)	

The following assumptions were used in a screening process for the initial array of the 15 NED alternatives.

- Ninety hydrologic reaches characterized by unique relationships between storm surge elevations and frequencies were identified. Of these 90 reaches, only 63 were shown to include economic assets that were subject to inundation damages.
- An inventory of structure values, types, and first floor elevations was compiled for all residential and non-residential structures which totaled approximately of 52,000 structures. These included industrial structures for which owners/operators provided information with respect to the vulnerability of damageable property. Warehouses were considered at this stage for the structural plans only, but were included in a subsequent detailed analysis of nonstructural plans.
- A range of low and high costs were developed for the structural features considered.
- Without-action damage estimates were developed and multiplied by a rule of thumb based on the reciprocal of interest and amortization (in this case 20) and used as a surrogate for potential benefits. These values

were then used to determine the level of construction costs that could be supported. Stage-probability curves were calculated using Hydrologic Engineering Center-River Analysis System (HEC-RAS) (for rainfall) and Advanced Circulation (ADCIRC) (surge) model results. They represent 2012 existing conditions.

- An estimating approach was used to determine the potential first construction cost that could be supported by the potential project benefits expressed as an expected annual value. The amortization factor for a Federal discount rate of 3.5 percent is 0.04263. The inverse of that number (23.5) was used as a multiplying factor to develop the initial estimate. However, this figure is a rough estimate of total project costs that could be supported, rather than project first costs. The PDT rounded the factor to 20.0 to account for additional non-construction components of total project costs [interest during construction, operations and maintenance (O&M), engineering and design, and supervision and administration costs].
- The difference between the benefits and costs represents net benefits.
- Simplifying assumptions were made that allowed the PDT to more easily compare alternatives:
  - No induced damages from hurricane storm surge induced flooding outside of levees. No damages from hurricane storm surge induced waves.
  - Though this study was not authorized to address damages from rainfall events, an assumption was made that structural alternatives would reduce risk for all potential hurricane storm surge or rainfall damages for events between 25 and 200 years, which represent events dominated by storm rather than predominantly rainfall flooding. Net benefits less than zero were used to screen alignments.
- Intermediate RSLR was used for future conditions.
- Under without-project conditions, structures at or below the 10-year stage are considered to be repetitively-flooded properties in the evaluation of both structural and nonstructural plans. Therefore, the structure inventory used in the economic analysis (for both structural and nonstructural plans) reset these properties to an elevation beyond the limits of the 100-year floodplain.
- For levee plans that provide hurricane storm surge risk reduction up to the base flood elevation for a 100-year event (1% ACE), few if any benefits would accrue to these structures. Therefore, their addition to the structure inventory has a minor impact on BCR estimates.

2.5.2.1 Initial NED Alternative Plan Screening Considerations

Results of how the 15 initial NED alternatives were assessed and eliminated are presented in Table 2-4. The complete set of structural plans evaluated at this level of screening is described in Table C-4 of Appendix C.

Table 2-4: NED initial screening.

Feature Name (ID)	Levee Length (miles)	Best Estimate Benefits x 20 in mil $1	"Low Cost Scenario" Levee + Pumps in mil $2, 3	"High Cost Scenario" Levee + Pumps in mil $4	Are best estimate benefits x 20 greater than "Low" costs?	Are best estimate benefits x 20 greater than "High" costs?	Screening Decision
Armored 12-ft Levee along the GIWW (per study authority and Recon Alternative S-1)	122	1,835	3,372	4,714	No	No	Eliminated; not enough benefits (once repetitive damages removed) to justify structural solution cost.
Gueydan Ring Levee	6	8	120	180	No	No	Eliminated; damages would have to increase by orders of magnitude to justify structural solution cost.

Kaplan Ring Levee	11	0.7	215	325	No	No	Eliminated; damages would have to increase by orders of magnitude to justify structural solution cost.
Louisiana Hwy 333/82 Armoring	29	N/A	551	841	N/A	N/A	Eliminated; not enough damages to justify structural solution cost
Abbeville Levee along the Marsh/Upland Interface	33	441	990	1,320	No	No	Eliminated; not enough damages to justify structural solution cost5
Abbeville Levee along Hwy 330	13	336	275	405	Yes	No	Although benefits are less than high cost estimates, they are within a margin of error. Consider further for reformulation.

1: Multiplication by "20" represents the amortization factor over 50 years based on existing and future-without project expected annual damage (EAD) from floods. First screening used unadjusted inventory; rainfall, and frequent and repetitive damages were not removed. Damages didn't account for industrial structures or future RSLR. Second screening refined the damages to eliminate frequent, repetitive damages. Based on the results from the Morganza to the Gulf of Mexico study, adjustment for RSLR estimated that damages would increase by 50% over existing damages.

2: "Low" levee cost used $21,000,000/mile armored and $19,000,000/mile unarmored (grass only). The unarmored cost is based on indexing the LACPR estimates to current levels. Assuming the existing ground elevation is +5-feet, a 12-foot levee elevation equals +17-feet; with contingency, the cost per mile would be about $15,500,000 for the levee only. It would be around $18,600,000 including engineering and design, and supervision and administration (rounded to $19,000,000 per mile). Additional cost of $2,000,000 per mile for armoring.

3: Pumping costs for the alternatives based on what was developed for LACPR. Pumping costs for GIWW alignment based on the sum of the largest Lake Charles and Abbeville ring levees.

Other studies: Morganza 35-yr levees cost over $60,000,000 per mile for 10- to 20-ft levees (total cost including structures, mitigation, E&D, S&A, etc.). Morganza to the Gulf of Mexico 100-yr levees costs over $100,000,000 per mile for 15- to 26.5-ft levees (total cost including structures, mitigation, E&D, S&A, etc.). Southwest Coastal Reconnaissance Study used $14,000,000 to $20,000,000 per mile but these values were considered extremely low. After initial screening, 10 hurricane and storm surge damage risk reduction alternatives remained.

4: "High" levee cost used $32,000,000 per mile armored; $29,000,000 per mile un-armored (grass only). High costs based on 50% increase over Low costs rounded up to nearest million.

5: Although this particular alternative was screened, its value as a set of smaller individual levees was evaluated for Abbeville and Delcambre. The incrementalized alternatives were made a part of the focused array.

The initial screening removed all alternatives with net benefits of less than zero including the following:

- **Armored 12-foot levee along the GIWW:** Eliminated from further consideration because potential benefits do not justify estimated costs.
- **Kaplan and Gueydan ring levees:** Eliminated from further consideration. Benefits were an order of magnitude less than the costs and as a result only nonstructural measures were evaluated.
- **Louisiana Hwy 333/82 armoring:** Eliminated from further consideration. Since NED benefits are unclear and the highway is maintained by the Louisiana Department of Transportation and Development (LADOTD), it may be more cost effective for the State to construct this measure.
- **Abbeville Levee along the Marsh/Upland Interface:** Eliminated from further consideration because potential benefits do not justify estimated costs.

2.5.3 Focused Array of NED Alternative Plans (*NEPA Required)

The initial screening left 10 alternatives (the focused array) that warranted additional evaluation (see Table 2-5). A full description of all features and screening is available in Appendix C.

Table 2-5: Initial alternatives that comprise the NED focused array

Independent Variations
Nonstructural Measures
Abbeville Levee Variations
Abbeville along GIWW
Abbeville along LA Hwy 330
Abbeville (shortened variation) – Excludes Erath and Delcambre
Lake Charles Levee Variations
Lake Charles – Southern (east and west)
Lake Charles – Southern/Eastern only
Lake Charles – Southern/Western only
Lake Charles – Northern (east and west)
Lake Charles – Northern (east only)
Lake Charles – Northern (west only)

2.5.3.1 Evaluation and Refinement of Focused Array

The PDT assessed the focused array of alternatives and as a result, some levee alignments were incrementalized and formulated into new alternatives. Although some Abbeville structural alternatives have little to zero marginal benefits, the PDT considered whether a set of smaller individual levees for Abbeville and Delcambre could provide a more cost-effective solution. Since levees around rural areas tend to drive down benefits significantly, the PDT developed smaller, incrementalized alternatives that showed the potential for higher benefits and lower costs for the more densely populated areas. Additionally, since a structural solution for Abbeville is included in the State Master Plan, new configurations of the Abbeville levee were developed for additional analysis.

Benefits outweigh costs for the east Lake Charles levees, but for the western Lake Charles levees, costs outweigh benefits. As a combined set of structural features, the east and west Lake Charles levees had marginal benefits to justify costs, however, reconfigured Lake Charles west levees were carried forward since the PDT felt new levee alignments could be drawn to better focus on more densely populated areas and since a 500-year structural solution for Lake Charles is included in the State Master Plan.

These steps allowed the PDT to identify levee alignments that would more precisely target populated areas adjacent to Lake Charles and Abbeville because only the largest population centers had the potential BCR to support structural measures. Three alignments were drawn at a small scale, using existing USACE maps and Google Maps, to protect major residential neighborhoods, while minimizing crossings that would result in major real estate, relocation, and other costs such as pipelines, major roadways, and industrial areas. The alignments depicted in the graphics below comprise the focused array (along with no action and the nonstructural plan) and were carried forward for additional analysis. Figures 2-2, 2-3, and 2-4 show the locations of the proposed alignments with respect to Lake Charles, Abbeville, Delcambre, and Erath.

The focused array consists of the alternative plans listed below. Each structural plan was evaluated at three levels of risk reduction [50-year (2% ACE), 100-year (1% ACE), and 200-year (0.5% ACE) levels] along the same alignment during these comparisons.

Plan 0: No Action
Plan 1: Lake Charles Eastbank Levee
Plan 2: Lake Charles Westbank/Sulphur Extended Levee
Plan 3: Lake Charles Westbank/Sulphur South Levee
Plan 4: Delcambre/Erath Levee
Plan 5: Abbeville Levee
Plan 6: Abbeville to Delcambre Along Hwy 330 Levee
Plan 7: Nonstructural Measures

2.5.4 Evaluation of the NED Structural Alternative Plans

Ninety hydrologic reaches throughout the study area were developed and characterized by unique relationships between storm surge elevations and frequency. With-project damages were developed for the base and future conditions utilizing existing data, current and future without-project damages, and parametric costs. The alternatives were screened based on the 50 year (2% ACE), 100 year (1% ACE), and 200 year (0.5% ACE) levels of risk reduction.

Using the damage probability relationship from the Hydrologic Engineering Center-Flood Damage Analysis (HEC-FDA) model for the six structural alternatives in the reaches receiving damage, it was estimated that a 50 year (2% ACE) project, would eliminate damages for the 25 and 50 year events. The 100 year (1% ACE) project would eliminate damages for the 25, 50 and 100 year events and the 200 year (0.5% ACE) project would eliminate damages for the 25, 50, 100 and 200 year events. The six alternatives would not eliminate damages from rainfall for more frequent events (1 and 10 year events) because limited topographic relief results in rainfall driven flooding that structural risk reduction measures cannot prevent at higher frequency events.

A percentage was applied to the overall benefits by reach for each of the remaining six structural alternatives to reflect the estimated percentage of the total structures in a reach that are receiving risk reduction from each alternative. For example, approximately 40 percent of the residential and non-residential structures in reach XA-305 lie behind the proposed levee alignment. Therefore, the estimated total benefits calculated for that reach are multiplied by 40 percent to determine the benefits for the Abbeville to Delcambre alternative for reach XA-305. This methodology was applied to all proposed alternatives.

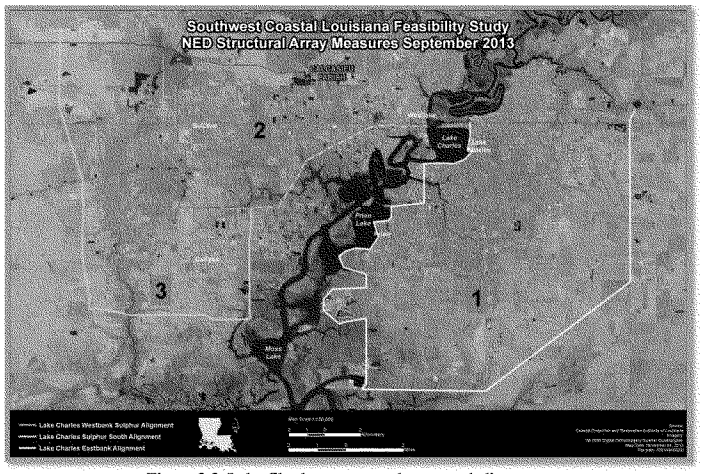


Figure 2-2: Lake Charles conceptual structural alignments.



Figure 2-3: Abbeville, Delcambre, and Erath conceptual structural alignments.



Figure 2-4: Abbeville to Delcambre combined conceptual structural alignment.

2.5.4.1 Economic Analysis of NED Structural Alternative Plans

A benefit/cost analysis was conducted to evaluate the economic feasibility of each of the structural plans. Expected annual benefits for 2025 and 2075 were converted to an equivalent annual value using the previous FY14 Federal interest rate, 3.5 percent, and a 50-year period of analysis. Total cost and estimated annual costs for the project alternatives included the construction costs, and O&M costs for the three levels of risk reduction. Construction costs, along with the schedule of expenditures, were used to determine the interest during construction and gross investment cost at the end of the installation period. For the purposes of this study, construction was assumed to begin in 2017 and continue through 2024 with additional levee lifts (to maintain levee height due to sinking and subsidence) beginning in 2067 and construction ending six to seven years later. The first levee lifts would be overbuilt and allowed to settle for several years before the latter levee lift is added for each alternative. Later levee lifts would account for the RSLR and subsidence that is projected to occur throughout the period of analysis.

Tables 2-6 through 2-8 show the first construction costs, average annual costs, average annual benefits, BCR, and net benefits for each alternative in the focused array. As shown in the tables, the Lake Charles Eastbank alternative was the only one with a justified BCR (value >1.0). The Lake Charles Eastbank alternative was justified at each level of risk reduction. The highest net benefits were for the Lake Charles Eastbank alternative at the 100 year (1% ACE) level of risk reduction.

Table 2-6: Economic analysis of alternatives with 50-year (2% ACE) level risk reduction.

Alternatives	First Costs (in Mil $)	Average Annual Costs (in Mil $)	Average Annual Benefits (in Mil $)	Benefit/Cost Ratio	Net Benefits (in Mil $)
Plan 1: Lake Charles Eastbank*	779.4	35.8	37.6	1.05	1.9
Plan 2: Lake Charles Westbank - Sulphur Extended	142.8	6.5	1.4	0.22	-5.0
Plan 3: Lake Charles Westbank - Sulphur South	456.3	20.7	3.0	0.14	-17.7
Plan 4: Delcambre/Erath	359.4	15.5	11.1	0.72	-4.4
Plan 5: Abbeville	286.0	12.9	2.6	0.20	-10.3
Plan 6: Abbeville to Delcambre Along Hwy 330	628.5	27.8	19.4	0.70	-8.4

Table 2-7: Economic analysis of alternatives with 100-year (1% ACE) level risk reduction.

Alternatives	First Costs (Mil $)	Average Annual Costs (Mil $)	Average Annual Benefits (Mil $)	Benefit/Cost Ratio	Net Benefits (Mil $)
Plan 1: Lake Charles Eastbank*	979.1	43.9	50.7	1.16	6.8
Plan 2: Lake Charles Westbank Sulphur Extended	199.3	8.6	3.3	0.39	-5.2
Plan 3: Lake Charles Westbank Sulphur South	629.1	27.6	7.2	0.26	-20.4
Plan 4: Delcambre/Erath	470.8	20.3	14.5	0.72	-5.8
Plan 5: Abbeville	344.1	15.4	7.2	0.47	-8.2
Plan 6: Abbeville to Delcambre Along Hwy 330	784.2	34.4	27.1	0.79	-7.3

Table 2-8: Economic analysis of alternatives with 200-year (0.5% ACE) level risk reduction.

Alternatives	First Costs (Mil $)	Average Annual Costs (Mil $)	Average Annual Benefits (Mil $)	Benefit/Cost Ratio	Net Benefits (Mil $)
Plan 1: Lake Charles Eastbank*	1,224.1	54.2	61.1	1.13	6.9
Plan 2: Lake Charles Westbank Sulphur Extended	327.1	13.9	5.5	0.39	-8.4
Plan 3: Lake Charles Westbank Sulphur South	883.9	38	12.5	0.33	-25.5
Plan 4: Delcambre/Erath	589.5	25.4	17	0.67	-8.5
Plan 5: Abbeville	447.7	19.9	9.7	0.49	-10.2
Plan 6: Abbeville to Delcambre Along Hwy 330	1,000	43.6	32.5	0.75	-11.1

* Although preliminary assessments identified a positive BCR for this alignment, further analysis revealed a negative BCR.

Refinement of the Levee Alternative

The assessment of economic feasibility for six independent structural measures was conducted in the focused array analysis. Initial results of the structural assessment showed that only one alternative was economically justified: the Lake Charles Eastbank Levee Alternative, Plan 1. However, additional economic assessments were conducted to refine costs for this alignment. Mitigation costs (costs any structural alternative must account for due to unavoidable habitat impacts) were calculated for the levee alternative. The USFWS and USACE determined programmatic costs for proposed structural alternatives based upon visual inspection of habitat types potentially impacted along proposed structural alternative routes, professional judgment, and experience with similar hurricane storm surge risk reduction structural systems, and based on engineering assumptions of right-of-way footprints. With mitigation costs of approximately $100,000,000 included for each risk reduction level, the 100-year (1% ACE) level of risk reduction yielded a revised BCR of 1.01 and the 200-year (0.5% ACE) level of risk reduction yielded a revised BCR of 1.04 (adding the mitigation costs made the 50-year (2% ACE) level of risk reduction not economically justified).

In addition, a review of the largest economic drivers of damages and benefits for the Lake Charles Eastbank Levee was conducted. The structure inventory used to calculate data for this alternative was modified to adjust the first-floor elevation (FFE) for a large commercial structure that was capturing a large share of benefits but was also not represented correctly within the 100-year (1% ACE) floodplain. This structure accounted for an unusually high percentage of damages and benefits in initial evaluations. Once this adjustment was completed, the BCR for Plan 1 fell to 0.61 for the 100-year (1% ACE) level of risk reduction and to 0.30 for the 200-year (0.5% ACE) level of risk reduction. As a result of this additional evaluation, none of the structural levee alignments were found to be economically justified and none were carried into the final array of alternatives.

2.5.5 Nonstructural Plan Evaluation

The following nonstructural measures were evaluated:

- Elevation of residential structures to predicted 2075, 100-year base flood elevation (BFE) unless the required elevation is greater than a maximum of 13 ft above ground level*.
- Acquisition/relocation of residential structures that would require elevation over 13 ft above ground level. Property owners would receive fair market value for the property acquired and relocation benefits.
- Flood proofing of non-residential and public structures (excluding industrial buildings and warehouses) for flood depths not greater than 3 ft above the adjacent ground.

**- Raising structures greater than 13 ft above ground level introduces damage risks from winds during tropical events as a new condition. This height generally serves as a differentiator for insurance rates for wind/hail coverage as well and is therefore used as the upper limit for elevating structures.*

2.5.6 Economic Analysis of NED Nonstructural Alternative Plans

The total number of structures inventoried in 2012 (defined by the footprint of the 2075, 500-year (0.05% ACE) floodplain) is approximately 52,000. The number of expected at-risk structures in the 100-year (1% ACE) floodplain, in the base-year 2025, total approximately 16,000 residential, commercial, and public buildings (but excluding warehouses and industrial buildings).

Nonstructural plans were initially evaluated using 90 hydrologic reaches within the study area as the unit of analysis. Structures were included in the inventory if their FFE fell below the expected 2075, 100-year (1% ACE) floodplain and evaluated for potential damages over the 50-year period of analysis. Benefits and costs were calculated on a reach-by-reach basis. Economic justification of each reach was determined by a comparison of average annual benefits to average annual costs. Reaches with a BCR greater than 1.0 were carried forward for additional consideration. Justification was determined by comparing expected annual benefits to expected annual costs. Net benefits were calculated by subtracting the expected annual costs from expected annual benefits. The initial analysis found that 11 of 90 reaches were economically justified. The data extracted from the justified reaches demonstrates the Federal interest in a nonstructural plan and provides definition of the potential magnitude of the plan.

Analysis found that 11 of the 90 hydrologic reaches had a BCR of 1.0 or greater and were economically justified. Ratios for the other 79 reaches fall at or below unity. The combined expected annual benefits for the justified reaches, hereafter referred to as the **Nonstructural - Justified Reaches Plan (Plan 7)**, was estimated at $20.67 million assuming 100% property owner participation, the total cost for implementing a nonstructural alternative based solely on the justified reaches is approximately $388 million. The corresponding average annual cost is approximately $16.5 million; with net benefits of $4.17 million resulting in a BCR of 1.25. As a result, benefits and costs were calculated on a reach-by-reach basis. The results of this analysis demonstrated that there is a Federal interest in implementing nonstructural alternatives which warranted a more focused analysis to consider only those structures within the 2075, 100-year floodplain. Continuing the economic analysis and improving upon the benefits of Plan 7 led the PDT to further refine the nonstructural project. From this effort, Plan 8 evolved.

This more focused evaluation of the economic feasibility of nonstructural measures was also conducted for all structures within the 2075, 100-year (1% ACE) floodplain, irrespective of their location within a reach. This assessment is referred to as the **Nonstructural - 100-year Floodplain Plan (Plan 8)**. The total expected annual benefits for addressing all of the structures within the 2075, 100-year (1% ACE) floodplain are $74.6 million. The total cost for implementing the nonstructural alternative throughout the 2075, 100-year (1% ACE) floodplain is approximately $3.2 billion. The corresponding average annual cost is approximately $138.2 million. After evaluating the entire 90 reach study area, (Plan 8), it was determined that the BCR for addressing all structures within the 2075 100-year floodplain was 0.54.

Two nonstructural plans, Plan 7 and Plan 8, were carried into the final array of alternatives for evaluation.

2.5.7 Summary of Accounts & Comparison of Alternative Plans in the Initial Draft Report

To facilitate alternatives evaluation and comparison of the alternatives, the 1983 Principles and Guidelines lay out four Federal Accounts that are used to assess the effects of alternatives. The accounts are National Economic Development (NED), Environmental Quality (EQ), Other Social Effects (OSE), and Regional Economic Development (RED).

- The NED account displays changes in the economic value of the national output of goods and services. The 1983 Principles and Guidelines require the identification of an NED plan from among the alternatives.
- The EQ account displays non-monetary effects on significant natural and cultural resources.
- The RED account registers changes in the distribution of economic activity that result from each alternative plan. Evaluations of regional effects are to be carried out using nationally consistent projections of income, employment, output, and population.

- The OSE account registers plan effects from perspectives that are relevant to the planning process, but are not reflected in the other three accounts.

2.5.8 Final Array of NED Plans

Plan 0: **No Action.** There would be no NED benefits associated with the No Action alternative. There would continue to be adverse impacts to the EQ account as salinity levels increase in the area and existing wetlands continue to degrade and disappear. These impacts would also continue to affect residents and infrastructure through the encroachment of open water exacerbating potential storm damage risk and increasing life/safety risk (OSE). Reducing the protective wetlands in the area could have negative effects to RED by impacting major oil refineries, shipping channels, and industrial uses in the study area.

Plan 7: **Nonstructural - Justified Reaches Plan.** This plan provides positive net NED benefits and has a BCR greater than or equal to 1.0. Impacts to EQ would be minimal as no significant features would be constructed and structures to be elevated, acquired, or flood proofed already exist. Effects to RED would be beneficial due to the implementation of risk reduction features and the resulting reduction in risk of hurricane storm-surge related damages to those structures located within the identified reaches which ultimately benefit by the risk reduction measures. Regarding OSE, depending on the manner in which the nonstructural measures would be implemented, there could be an improvement in the area of social vulnerability for populations benefiting from the nonstructural measures. That notwithstanding, the potential for inundation and other storm surge related damages will continue unabated for structures that are not addressed under this alternative. Implementing this alternative would not address the most populated communities.

Plan 8: **Nonstructural - 100-Year Floodplain Plan.** This plan provides negative net NED benefits and has a BCR less than 1.0. However, it is recognized that there are significant individual increments of positive net benefit throughout the study area. Impacts to EQ would be minimal as no significant features would be built and structures to be elevated, acquired, or flood proofed already exist. Effects to RED would be beneficial due to the implementation of risk reduction features and the resulting reduction in risk of hurricane storm-surge related damages to those structures benefiting by the risk reduction measures. Regarding OSE, depending on the manner in which the nonstructural measures would be implemented, there could be an improvement in the area of social vulnerability for the larger population that would benefit from the nonstructural measures. That notwithstanding, the potential for inundation and other storm surge related damages would continue unabated for structures that are not addressed under this alternative. This alternative does address the most populated communities.

2.6 2013 Draft Report TSP

The NED TSP identified in the 2013 Initial Draft Report was Plan 7 (See Appendix M). Technical and policy comments received during the concurrent review phase of the 2013 report suggested more economic work could be completed that would yield a more efficient plan than on a reach-by-reach basis. Plan 7 and Plan 8 were both based on structures located within the 2075, 100-year (1% ACE) floodplain and were carried forward, however only Plan 7 was economically justified. Plan 7 applied nonstructural measures (i.e. structure raising, flood proofing, and property buy-outs) to structures within the 11 justified reaches and consisted of elevation of existing residential structures or acquisition of properties that require significant elevation, and flood proofing measures for non-residential structures for at-risk properties within the 2075, 100-year (1% ACE) floodplain. The preliminary estimated cost of Plan 7 as presented in the initial draft report was $388,000,000 for nonstructural measures benefiting a total of 3,915 structures.

2.7 Nonstructural Plan Optimization

The nonstructural evaluation indicated promising results that warranted further investigation. All structural alternatives were eliminated from further consideration, leaving only nonstructural alternatives as the preferred method for reducing hurricane storm surge risk across the study area. Plan 8 represents a different methodology

from Plan 7 for assessing how the study area, structure inventory, floodplain, and evaluation criteria could be partitioned to identify the most effective hurricane storm surge damage risk reduction solution. Plan 8 offered the greatest flexibility for further evaluation and hence was used as the starting point for optimization. Structures in the 0-10-year floodplain were added to the structure inventory and additional economic calculations were performed to determine whether the addition of these repetitive hurricane storm surge damage risk structures resulted in positive net NED benefits and a BCR greater than or equal to 1.0. This additional assessment consisted of evaluating every structure in the updated inventory with a FFE below the 100-year stage for WSEs prevailing in the year 2025 rather than the year 2075. Warehouses were also added to the structure inventory for benefit evaluation where localized storm surge risk reduction measures represented the most appropriate nonstructural measure to reduce the risk of damage from hurricane storm surge. While RSLR is expected to raise the 100-year stage throughout the 50-year period of analysis and bring the FFEs for other structures that are not in the 100-year floodplain in the 2025 base year into the 100-year floodplain by the year 2075, economic benefits for implementing such plans for these additional structures were found to be small and heavily discounted; relative costs were high given the significant fixed costs for structure elevation, and were therefore found to lack economic justification.

Next, using the inventory of structures with FFEs identified within the 2025 100-year floodplain, the nonstructural analysis was stratified on the basis of flood zones. Structures located in between the 0-25-year flood zones were deemed to be exposed to the highest level of risk from hurricane storm surge and were considered the first increment. The second increment consists of structures with FFEs higher than the 25-year stage, but lower than or equal to the 50-year stage. The third increment encompasses all remaining structures located within the 100-year floodplain. This analysis created refined incremental variations of the previously assessed Plan 8 which was now divided into separate flood zone benefit categories. These increments differentiated structures between the 0-25-year; 25-50-year; and 50-100-year floodplains.

Table 2-9 shows the results of this analysis. Net benefits remain positive for the first two increments (0-25 year and 25-50 year) and support the Federal interest for subsequent implementation. In contrast, net benefits for the 50-100-year increment are negative due to the fact that properties within these flood plains do not suffer the same magnitude of inundation as structures grouped into the 0-25 and 25-50-year increments. Given the high fixed costs of elevating a structure, the accrued benefits were insufficient to compensate for the high mobilization costs.

The economic appendix (Appendix D) describes the specific methodology used to evaluate increments of the new nonstructural plan ("Modified Plan 8") within the separate 100-year floodplain increments so that net benefits could be optimized.

Table 2-9: Optimized Net NED benefits.

Optimized Net Benefit Analysis FY15 Price Level; 3.375% Discount Rate ($1,000s)			
Floodplain Increment	0–25-Year	25–50-Year	50–100-Year
First Cost	$824,025.22	$581,538.88	$915,876.78
Equivalent Annual Project Benefits	$265,963.65	$24,976.54	$17,239.18
Average Annual Cost	$34,342.49	$24,236.68	$38,171.09
Annual Net Benefits	$231,621.16	$739.86	$(20,931.92)
B/C Ratio	7.74	1.03	0.45

2.8 2015 Revised Draft Report TSP and EIS

The additional work completed since release of the 2013 Initial Draft Report and EIS led to the identification of a new TSP in the 2015 Revised Draft Report and EIS. The optimization of net benefits based on increments of the 100-year floodplain led to a **new TSP** (**Modified Plan 8**). In sum, the highest level of net benefits are associated with the 0-25-year floodplain increment of Modified Plan 8. This plan implements nonstructural measures to only those structures with FFEs between the 0-25-year flood stage predicted to occur in year 2025 and is the NED TSP. While it is possible that an additional recommendation could be made to add in the 25-50-year increment since it does have positive net benefits, the recommendation for the Nonstructural 0-25 Year Floodplain Plan focuses the Federal investment on the most at-risk properties in the study area. It also indicates a clean break between increments due to the large disparity between the BCRs. As described in the 2015 Revised Draft Report, Modified Plan 8 offers the greatest net benefits and best BCR of all nonstructural alternatives and increments evaluated in this study.

A brief summary of the components of the revised NED TSP includes:

1. Acquisition and demolition (involuntary component). Structures that meet certain criteria would be acquired and demolished. Owners of these structures would receive just compensation for the structure, would be provided with a similarly sized structure, and would be provided relocation benefits.
2. Elevation of remaining eligible residential structures (voluntary component). This measure would provide eligible owners with the opportunity to lift the entire structure or the habitable area to the predicted 2075, 100-year BFE unless the required elevation is greater than a maximum of 13 ft above ground level.
3. Dry flood proofing of eligible non-residential structures (excluding large warehouses and industrial complexes). Dry flood proofing consists of sealing all areas below the hurricane storm surge damage risk reduction level of a structure to make it watertight and ensure that hurricane storm surge cannot get inside by making walls, doors, windows, and other openings impermeable to water penetration as a result of hurricane storm surge.
4. Construction of localized storm surge risk reduction measures less than six feet in height around non-residential structures (primarily industrial complexes and warehouses). These measures are intended to reduce the frequency of flooding from hurricane storm surge but not eliminate floodplain management and flood insurance requirements.
5. Floodplain Management Plans. The Non-Federal Sponsor (NFS) would be required to prepare a Floodplain Management Plan in coordination with USACE to maintain the integrity of the project. The NFS will be obligated to ensure that governing bodies within the three parishes enact local development plans and building codes, land use and zoning regulations that are compliant with the requirements of the floodplain management plan and that they enforce those regulations and the prevent encroachment upon the requirements of the floodplain management plan and the project's goals and objectives.
6. Adoption and enforcement of more stringent local floodplain regulations. Although communities within the study area cannot change the minimum NFIP standards, the NFS should work with the local governments to adopt local standards that achieve higher levels of hurricane storm surge risk reduction, such as replacing elevation requirements based on the 100-year to the 500-year; implementing a zero rise floodway; and adopting cumulative damages as the trigger for substantial damage determination.
7. Adoption of more restrictive parish and municipal building codes, land use and zoning regulations and other developmental controls. Local governments within the floodplain would be encouraged to adopt and implement and enforce stricter building and housing code requirements, and land use and zoning regulations and other developmental controls aimed at reducing hurricane storm surge damage risk.

2.8.1 2015 Revised Draft Report TSP and EIS – Updated Analyses

Once again, concurrent review phase technical and policy comments led the PDT to refine the NED TSP. This time, two economic adjustments were made for each structure in the 25-year floodplain increment since that was the TSP. The structure inventory was adjusted to account for future severe damage mitigation under FWOP conditions and each structure was evaluated for individual economic justification. This analysis considered likely nonstructural measure costs as applied to a particular structure against the damages avoided over the 50-year period of analysis. If nonstructural measure costs were lower than predicted incurred damages, the structure was individually justified. Not all structures identified as eligible in the 2015 Revised Draft Report and EIS met this criteria and approximately 950 structures initially deemed eligible fell out of the updated TSP. However, even with this economic adjustment, the 0-25-year floodplain increment still represents the highest net benefits and best BCR for all increments evaluated.

The NED TSP would provide reduced hurricane storm surge damage risk for all eligible structures in the study area with a FFE at or below the 25-year stage based on predicted year 2025 hydrologic conditions. The TSP identifies a total of 3,961 impacted structures comprised of 3,462 residential structures, 342 commercial structures and public buildings, and 157 warehouses. Table 2-10 displays the costs and benefits of the TSP and maps of eligible structures can be found in Appendix N. Figure 2-5 displays the location and type of preliminarily eligible structures.

Table 2-10: Net NED benefits for the updated TSP

Optimized Net Benefit Analysis FY15 Price Level; 3.375% Discount Rate	
Floodplain Increment	0–25-Year
First Cost	$678,126,000
Equivalent Annual Project Benefits	$200,100,000
Average Annual Cost	$28,262,000
Annual Net Benefits	$171,838,000
B/C Ratio	7.1

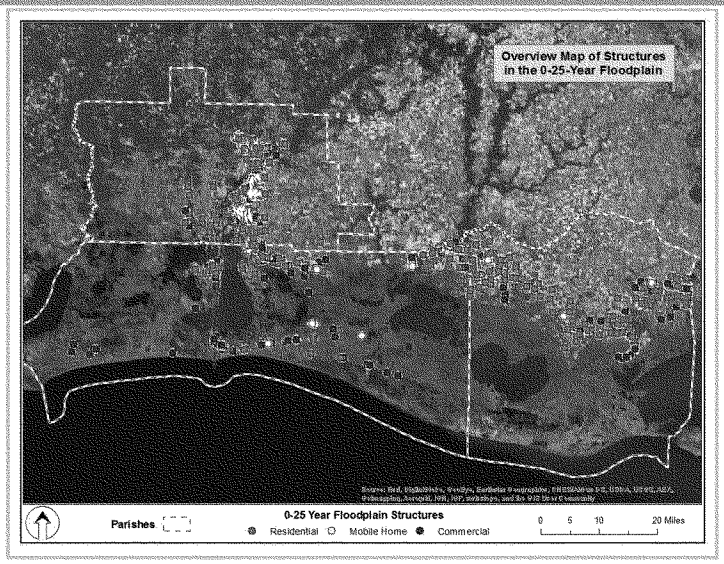


Figure 2-5: TSP Eligible structures in the 0-25-year floodplain.

Additional updates and changes to the TSP occurred after release of the 2015 Revised Draft Report for public review. The most noteworthy change consists of elimination of the involuntary component from the nonstructural plan and making any structure requiring elevation greater than 13 feet above ground level ineligible for participation in the NED RP due to engineering and risk related factors. The entire project is now 100% voluntary. Other changes to the plan consist of updating costs and benefits. These updates and a summary of comments received are described in Chapter 4 and in Appendix L.

2.9 NER Alternative Plan Formulation

The Louisiana Chenier Plain extends from the western bank of Freshwater Bayou westward to the Louisiana-Texas border in Sabine lake, and from the marsh areas just north of the GIWW south to the Gulf of Mexico in Calcasieu, Cameron, and Vermilion parishes. Coastal erosion in the Chenier Plain accounts for approximately 20 percent of the land loss in Louisiana. The January 31, 2005 Chief's Report for the ecosystem restoration of the LCA suggested reducing wetlands losses by 50 percent as a possible desirable outcome from restoration efforts, including the development of a comprehensive restoration plan for the Chenier Plain ecosystem. The entire study area was considered for NER plan formulation. Although a significant portion of the area within the Coastal Zone Management Area has already received funding from other sources to address coastal land loss (Figure 2-6), this study does consider overlapping features in those areas.



Figure 2-6: Restoration projects in the study area.

JA 37-899 10/04/2019 74

The principle areas of focus for the LCA plan formulation are the Calcasieu-Sabine Basin located between the GIWW and the Gulf of Mexico, primarily in the vicinity of Calcasieu and Sabine Lake and the Mermentau/Teche-Vermilion Basins between the GIWW and Gulf of Mexico, Vermilion Bay, and LA-27 to the west.

As part of the adaptive management and project planning process, a conceptual ecological model ("CEM") (Appendix A; Annex L) was developed to help explain the general functional relationships among the essential components of the Southwest Coastal Louisiana area. CEMs are a means of:

(1) Simplifying complex ecological relationships by organizing information and clearly depicting system components and interactions;
(2) Integrating to more comprehensively implicit ecosystem dynamics;
(3) Aiding in identifying which species will show ecosystem response;
(4) Interpreting and tracking changes in restoration/management targets; and
(5) Communicating these findings in multiple formats.

This CEM assists with identifying those aspects where the project can effect change. Specifically, the CEM identifies those major stressors, ecosystem drivers, and critical thresholds of ecological processes and attributes of the natural system likely to respond to restoration features. The project CEM was used to assist in identifying problems and opportunities, refining project objectives and restoration management actions, selecting those attributes to be used as performance measures, modeling for alternative analysis, and monitoring for project success. The project CEM represents the current understanding of these factors and will be updated and modified, as necessary, as new information becomes available to assist with developing adaptive management and monitoring during project planning and implementation.

The CEM (Figure 2-7) was developed in conjunction with the USACE Engineering Research and Development Center (ERDC) and identified five drivers, seven ecological stressors, and four ecological effects. The most serious problem is the rate of land and habitat loss.

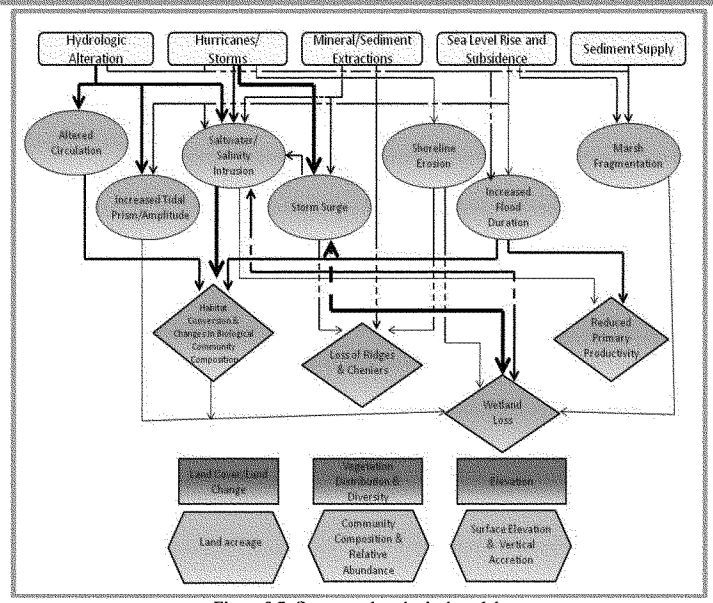


Figure 2-7: Conceptual ecological model.

2.9.1 NER Measures (*NEPA Required)

The PDT used a number of prior studies and reports to identify potential measures and screening criteria, including Federal projects authorized or constructed by the CWPPRA program; the USACE Continuing Authorities Program; the LCA Ecosystem Restoration Study (USACE 2004); and the LACPR Study (USACE 2009); 2012 State Master Plan (SMP), and the U.S. Department of Interior's CIAP.

The PDT recommended five measures to meet the NER goals and objectives:

1. **Marsh restoration.** Consists of marsh restoration and/or nourishment to increase land coverage in the area, and improve terrestrial wildlife habitat, hydrology, water quality, and fish nurseries. Vegetative plantings and herbivory control were deemed unnecessary for this feature.
2. **Bank and shoreline protection/stabilization.** Protection/stabilization features to reduce the rate of erosion at canal banks and shorelines in critical areas and to improve hydrology.
3. **Hydrologic and salinity control structures.** Control structures to manage water flow and minimize saltwater intrusion into marshes.
4. **Chenier reforestation.** Reforestation to restore native trees to the Chenier ecosystem, and reduce land loss rates and control for invasive plant and animal species.
5. **Oyster reef preservation.** To restore and preserve these native features, and reduce shoreline erosion rates.

2.9.1.1 Initial Screening of NER Measures

Initial data collection included over 200 features which were mostly basin and/or location specific, but some applied to the overall study area. The first screening removed features that did not address project goals and objectives. The marsh restoration and shoreline protection/stabilization features were evaluated with the Wetland Value Assessment (WVA) model, and compared to costs to evaluate cost-effectiveness. Measures that were not cost-effective were eliminated unless the location served a critical geomorphologic function.

Measures were screened using the following criteria:

- **Constraints and Goals.** Measures that were not expected to be sustainable were eliminated such as marsh restoration measures located in currently open water areas where water depth is greater than 2 ft or in high subsidence areas along with chenier reforestation in locations with elevations less than 5 ft and areas with high shoreline erosion rates.

- **Objectives.** These criteria were used to ensure that the measures being considered for inclusion were applicable to at least one study objective. Each of the measures was found to support a particular objective. Although an evaluation of each measure against the objectives took place, no measures were eliminated due to their lack of meeting objectives.

- **Effectiveness.** Measures which were more effective in meeting the objectives were carried forward. In areas where marsh is deteriorating and shoreline protection, marsh restoration, or hydrologic and salinity control measures could potentially benefit the areas, the measure that would most benefit the area was retained, and the others were screened. Oyster reef preservation measures were all considered to be effective measures. These thresholds were qualitatively developed by the PDT to establish a minimum criterion for success, to eliminate features that were not worth the Federal investment, and to avoid creating a grossly over-manipulated system.

- **Efficiency.** The final criteria compared cost per acre within the measure categories. If two measures produced the same benefits but one was less expensive to construct, the cheaper option was carried forward. For example, the West Cove marsh restoration measures were eliminated because the Mud Lake measure would provide restoration at a cheaper cost. Additionally, marsh restoration measures that benefitted more than 100 acres were more cost-effective (efficient) than those with a benefit of less than 100 acres, due to economies of scale with the costs of mobilization and demobilization.

The results of the NER screening evaluation are presented in Table 2-11.

Table 2-11: NER screening evaluation.

Screening Criteria		Application to Each NER Measure Category				
		Marsh Restoration	Bank and Shoreline Protection/ Stabilization	Chenier Reforestation	Hydrologic & Salinity Control	Oyster Reef Preservation
Constraints and Goals	Measure violates one of the study planning constraints or goals.	Features that are not sustainable do not meet the sustainability goal and were eliminated e.g. marsh areas where water depth is > 2 ft or local subsidence is high.	None of the shoreline stabilization features were eliminated.	Features that did not meet the sustainability goal were eliminated. Elevations < 5 ft NAVD88 and areas exposed to high rates of shoreline erosion were screened.	None of the hydrologic or salinity control features were eliminated.	None of these features were eliminated.
Objectives	Measure does not address one or more of the study planning objectives.	All marsh restoration measures meet Objective 5. No marsh restoration features were eliminated.	All shoreline protection/stabilization measures meet Objective 4. No shoreline stabilization features were eliminated.	All chenier reforestation measures meet Objective 5. No Chenier features were eliminated.	All hydrologic and salinity control measures meet Objective 2. No control features were eliminated.	All measures meet Objective 5. No oyster reef preservation features were eliminated.
Effectiveness	Measure found to be ineffective.	Marsh restoration features were more effective in areas with severe marsh degradation. Shoreline protection features were more effective in areas with existing marsh that was subjected to erosion from adjacent waterways.		Features were eliminated where existing canopy coverage deemed substantially intact (i.e., >50%) or if the presence of development would prohibit reforestation.	A small number of hydrologic and salinity control features were eliminated as ineffective because they did not exhibit large-scale hydrologic benefits to wetlands in the Chenier Plain.	None of the oyster reef preservation features were eliminated. Reef restoration is an effective method of using natural barriers against storm surges and saltwater intrusion.
Efficiency	Measure found to have below average efficiency.	The average cost of all marsh and shoreline features based on the initial evaluation was approximately $125,000/net acre. Features were considered inefficient and eliminated if they had greater than average cost/net acre. Features that are considered critical components of the system were not eliminated Features that are located adjacent to significant resources, such as cheniers and wildlife refuges were also not eliminated. Marsh restoration or shoreline protection/ stabilization measures producing or protecting less than 100 net acres were considered to be inefficient.		All chenier reforestation features were found to be relatively cost efficient in comparison to each other.	All control features were found to be relatively cost efficient in comparison to each other.	All reef preservation features were found to be relatively cost efficient in comparison to each other.

After the initial screening there were too many potential combinations of features for the PDT to effectively assess and evaluate, therefore, the PDT developed an additional methodology through plan development strategies (ways to classify and combine NER features according to a predefined strategy) to further screen features and develop an initial array of alternatives.

2.9.2 Initial Array of NER Alternative Plans categorized by measure type (*NEPA Required)

Individual features were developed for each of the five NER measures and formed into five separate plan development strategies. Each was based on the measure type and the associated features for that particular

measure. In keeping with the overall study purpose of addressing ecosystem degradation in the entire Chenier Plain, one integrated restoration plan was developed that integrated all of the measure types across all basins. Because the coastal zone is the area in greatest need of environmental restoration, the locations for the implementation of all of the five measures types being considered are located south of the GIWW.

- **Hydrologic and Salinity Control Plan.** This plan contains 49 hydrologic and salinity control features.
- **Marsh Restoration Plan.** This plan contains 52 marsh restoration and/or nourishment features.
- **Shoreline Protection/Stabilization Plan**. This plan contains 50 bank and shoreline protection features.
- **Chenier Reforestation Plan**. This plan contains 35 reforestation features (with invasive species control).
- **Oyster Reef Preservation Plan.** This plan contains 10 oyster reef preservation features.
- **Integrated Restoration Across Basins Plan**. This plan consists of features from all five measure categories. It contains a variety of basin-specific and study area-wide features.

2.9.2.1 Screening of the Initial Array of NER Alternative Plans

Another screening (outlined below and more fully explained in Appendix C) was conducted and more features were removed from further consideration. Land loss analyses were conducted by the USGS to assess whether an area is experiencing high land loss and in critical need of ecosystem restoration.

The following additional screening criteria were applied to the remaining features:

- **Reinforcement of Critical Landscape Features**. Features on or adjacent to a landscape feature designated as critical.
- **Reinforcement of Critical Infrastructure**. Features that restore wetlands from open water and that protect the continuity and function of critical infrastructure.
- **Synergy with Other Projects**. Features that protect or contribute to the benefits of other projects.
- **Scarcity/Diversity**. Features that reduce the loss of freshwater marsh (considered imperiled by the LNHP).
- **Robustness/Sustainability**. Features that are attached to land that will persist through the period of analysis.
- **Implementability Issues**. Features with no serious impediment precluding its timely implementation.

Features were subjected to more detailed analysis and WVAs were conducted using all available data (such as SMP analyses) and assumptions based on professional experience and knowledge. The results of the WVAs (see Appendix A) were combined with cost estimates to select cost-effective features. The following plan features were screened (with more information available in Appendix C):

- **Marsh Restoration.** Marshes that reinforce critical geomorphic land forms (i.e., lake rims, navigation banklines, gulf shoreline), which would protect interior reaches, were given greater priority than interior marshes.
- **Bank and Shoreline Protection/Stabilization.** A single shoreline protection/stabilization feature consisting of a foreshore rock dike along the toe of the Cameron-Creole levee was eliminated due to lack of marsh between the proposed rock dike and the levee. Stabilization at this location did not supply many NER benefits and therefore the feature was removed from further consideration.
- **Hydrologic and Salinity Control.** A WVA analysis was not completed under initial screening because the WVA model cannot adequately describe the benefits of these features across such a large area using preliminary information. In general, the features that were carried forward were those that had larger-scale benefits, such as those that helped maintain greater than 500 net acres as determined by the SMP models. Eight features that met these criteria were carried forward into the final array.
- **Chenier Reforestation.** Although strategic project areas to reforest cheniers were identified and evaluated, due to the relative affordability of this measure type no specific features were screened. It was decided that

all chenier reforestation features would move forward as part of a consolidated chenier reforestation program.

- **Sabine Lake Oyster Reef Preservation.** Several oyster reef projects were removed from further consideration due to very modest benefits and existing or planned funding through other programs. The PDT determined that the Sabine Lake Oyster Reef should be preserved because its 3-dimensional structure provides valuable habitat for various fisheries species and it also provides some hydrologic benefits to the remainder of Sabine Lake. The feature carried forward consists of protecting and preserving the Sabine Lake Oyster Reef by prohibiting the harvesting of oysters from the reef.

NER Alternative Plan Evaluation. The NER features that were eliminated in the secondary screening reduced the overall size of the initial array of alternative plans. The comprehensive effects of these alternatives (including the "No Action" alternative) were estimated using the SMP models (i.e., Wetland Morphology, Eco-Hydrology, Vegetation, and various land loss analysis and hydrodynamic models). The outputs of these models supply the data for subsequent analysis using the WVA model. Hydrodynamic modeling using the MIKE FLOOD model was used concurrently to evaluate the restoration alternatives and help refine the features included in the alternatives (specifically the type, size, and operation of the hydrologic and salinity control features). Results from the additional models indicated that the NER objectives could not be met through the implementation of single-measure alternative plans and as a result, the single measure plans were eliminated. The Integrated Restoration Across Basins alternative was the only plan capable of meeting the study goals and objectives and was carried forward. Variations of the Integrated Restoration Across Basins alternative were developed in the formulation of the focused array to more thoroughly address study area problems. See Appendix A for more information on the modeling for restoration alternatives.

2.9.3 Focused Array of NER Alternative Plans

Using seven restoration strategies (set forth below) developed from the findings from the initial array, plus the "No Action" alternative, a focused array of 27 alternative plans (Table 2-13) was developed containing different combinations of the features. The restoration strategies were applied both comprehensively across basins and individually to the Calcasieu-Sabine Basin and Mermentau/Teche-Vermilion Basin. Plans that were derived from the SMP are identified as such. The PDT also determined that a Calcasieu Ship Channel (CSC) Salinity Control Structure was worth evaluating as a stand-alone strategy/alternative.

The locations of the NER focused array of alternative plans are: (1) the Calcasieu-Sabine Basin between the GIWW and the Gulf of Mexico and primarily in the vicinity of Calcasieu Lake and (2) the Mermentau/Teche-Vermilion Basins which are primarily clustered south of Grand and White Lakes, and in the area surrounding Freshwater Bayou.

For analysis purposes, each alternative plan was divided into two geographic parts. Plans denoted with a "C" contain features located in the Calcasieu-Sabine Basin. Plans denoted with an "M" contain features located in the Mermentau and Teche-Vermilion Basins. The CSC Salinity Control Structure is the sole component of the seventh restoration strategy and a standalone alternative designated as Plan "A". The CSC Salinity Control Structure (Plan "A") is also combinable with any plan containing a Calcasieu-Sabine Basin, or "C" component. Collectively, all of the features for each basin that comprise a restoration strategy are considered unique alternatives. Descriptions of each restoration strategy are presented below.

A listing of the specific features that are contained within each restoration strategy can be found in Table 2-12. Unique alternatives were generated based on restoration strategy and basin location.

NER Strategies

Strategy 0: **No Action Plan.**

Strategy 1: **Large Integrated Restoration (SMP).** The results of the State Master Plan Models were used to select only those hydrologic and salinity control features that showed the greatest benefits. For marsh restoration, features were selected that would best reinforce critical landscape features, with particular emphasis on areas that are exposed to saltwater, tidal, and wave action. Bank and shoreline protection/stabilization features were retained that protected the areas of greatest erosion. Strategy 1 is composed of 6 hydrologic and salinity control features, 19 marsh restoration features, 7 bank and shoreline protection/stabilization features, and all chenier reforestation features.

Strategy 2: **Moderate Integrated Restoration (Hydrologic Emphasis) (SMP).** This restoration strategy has less investment in marsh restoration and bank and shoreline protection/stabilization features, but retains the same level of hydrologic and salinity control features as Strategy 1 due to the philosophy that hydrologic restoration is of great importance to the Chenier Plain. Marsh restoration features were focused on areas of critical importance for restoration. Bank and shoreline protection/stabilization features that protected the areas of greatest erosion were retained. Strategy 2 is composed of 6 hydrologic and salinity control features, 13 marsh restoration features, 4 bank and shoreline protection/stabilization features, and all chenier reforestation features.

Strategy 3: **Moderate Integrated Restoration, Including Gum Cove (SMP).** This Strategy is identical to Strategy 2 except it includes the Gum Cove Lock feature. Strategy 3 was formulated to investigate the hydrologic restoration benefits and cost-effectiveness of the Gum Cove Lock combined with the Calcasieu Ship Channel Salinity Control Structure. Strategy 3 is composed of 6 hydrologic and salinity control features, 13 marsh restoration features, 4 bank and shoreline protection/stabilization features, and all chenier reforestation features.

Strategy 4: **Small Integrated Restoration (SMP).** The focus of Strategy 4 is to use a minimal range of features focused at stabilizing perimeter geomorphology. This Strategy includes marsh restoration and bank and shoreline protection/stabilization features that could reinforce perimeters. Strategy 4 is composed of 2 hydrologic and salinity control features, 9 marsh restoration features, 2 bank and shoreline protection/stabilization features, and all chenier reforestation features.

Strategy 5: **Interior Perimeter Salinity Control.** The focus of Strategy 5 is the control of salinity levels within the interior areas of the Calcasieu-Sabine basin and the Cameron-Creole Watershed. There are no hydrologic and salinity control structures at the main passes, with the expectation that salinity control around the perimeter of Calcasieu Lake and the GIWW could result in lower salinities in the interior marshes at a lower cost than entry salinity control. Strategy 5 includes those marsh restoration and bank and shoreline protection/stabilization features that could reinforce perimeters. Strategy 5 is composed of 6 hydrologic and salinity control features, 9 marsh restoration features, 2 bank and shoreline protection/stabilization features, and all chenier reforestation features.

Strategy 6: **Marsh and Shoreline (Minimal Hydrologic & Salinity Control).** Strategy 6 includes minimal hydrologic and salinity control features and focuses on restoring marsh and protecting/stabilizing shorelines. Strategy 6 was formulated to evaluate the effectiveness of ecosystem restoration with the existing salinity regime and is composed of 5 hydrologic and salinity control features, 18 marsh restoration features, 5 bank and shoreline protection/stabilization features, and all chenier reforestation features.

Strategy 7: **Entry Salinity Control (Stand-alone measure).** Strategy 7 would manage salinity introduced through the CSC into Calcasieu Lake and surrounding wetlands through a CSC Salinity Control Structure (Plan "A"). It is combinable with Calcasieu alternatives and is also evaluated as a stand-alone plan.

Table 2-12: Features within each Restoration Strategy

Feature Location: Mermentau Basin / Calcasieu Basin			Strategy 1/1A	Strategy 2/2A	Strategy 3/3A	Strategy 4/4A	Strategy 5	Strategy 6	Strategy 7 (or A)
Measure	Feature	No Action	Large Integrated Restoration across Basins	Moderate Integrated Restoration across Basins	Moderate Integrated Restoration + Gum Cove	Small Integrated Restoration	Interior Perimeter Salinity Control	Marsh & Shoreline Focus	Entry Salinity Control
Hydrologic & Salinity Control									
	7#	0	0/X	0/X	0/X	0/X	0	0	X
	13*	0	0	0	0	0	0	0	0
	17a-c*	0	0	0	0	0	0	0	0
	48	0	0	0	0	0	0	0	0
	74a	0	X	X	X	X	X	X	0
	407	0	0	0	X	0	X	0	0
Marsh Restoration									
	3a1	0	0	0	0	X	X	0	0
	3c1	0	X	X	X	X	X	X	0
	3c2	0	X	X	X	0	0	X	0
	3c3	0	X	X	X	0	0	X	0
	3c4	0	X	X	X	0	0	X	0
	3c5	0	X	X	X	0	0	X	0
	47a1	0	X	X	X	X	X	X	0
	47a2	0	X	X	X	X	X	X	0
	47c1	0	X	X	X	X	X	X	0
	47c2	0	X	0	0	0	0	X	0
	124a	0	X	0	0	0	0	X	0
	124b	0	X	0	0	0	0	X	0
	124c	0	X	X	X	X	X	X	0
	124d	0	X	X	X	X	X	X	0
	127c1	0	X	0	0	0	0	X	0
	127c2	0	X	X	X	0	0	X	0
	127c3	0	X	X	X	X	X	X	0
	306a1	0	X	X	X	X	X	X	0
	306a2	0	X	0	0	0	0	X	0
Shoreline Protection/Stabilization									
	5a	0	X	X	X	X	X	X	0
	6b1	0	X	X	X	X	X	X	0
	6b2	0	X	X	X	X	X	X	0
	6b3	0	X	X	X	X	X	X	0
	16b	0	X	0	0	X	X	0	0
	99a	0	X	0	0	0	0	X	0
	113b2	0	X	0	0	0	0	0	0
Chenier Reforestation (both basins)									
	CR	0	X	X	X	X	X	X	0

#Feature 7 functions both as a stand-alone Strategy/Alternative and an additive feature. *Following refinement of the benefit assessment as a result of technical comments, these features were found to lack positive outputs and were dropped from all plans. Note: Green cells denote features found in the Calcasieu Basin. Blue cells denote features in the Mermentau Basin. An 'X' in a cell indicates the feature is a component of the strategy while a '0' indicates it is not a component of the strategy.

2.9.4 Comparison of the Focused Array of NER Alternative Plans

The calculated WVA benefits are measured in average annual habitat units (net AAHUs) and cost estimates were examined using the Institute for Water Resources Planning Suite (IWR Plan), the results of which helped guide the identification of a TSP. The SMP Models were used to compare benefits among alternatives in acres and AAHUs, and compared them to the FWOP conditions or "No Action" Alternative. The WVA analysis used to generate the benefits in AAHUs has six variables that must be projected into the future for the FWOP and Future With Project (FWP) condition or "Action" alternatives.

The focused array of alternatives consists of alternative plans that align with a restoration strategy and contain the features the PDT identified as most supportive of achieving the goals of that restoration strategy. For the focused array of alternatives, the SMP modeling effort was used with input from the Eco-hydrology module to estimate land and water changes. The alternatives were run under the intermediate RSLR scenario to predict salinity, water levels, and flows. The results of this modeling effort were input into the Vegetation and Wetland Morphology modules of the SMP modeling system to predict wetland loss and other trends over time. The SMP model included accretion and subsidence projections. For marsh restoration and shoreline protection/stabilization projects, the WVA analysis process used inputs from these models, and was performed using basic assumptions from the CWPPRA program (see Appendix A).

Table 2-13: NER Focused array of Alternative Plans

AlternativePlan/ Strategy#	IWR label	ALTERNATIVE PLAN NAME
A	A	Entry Salinity Control
C-1	C1	Calcasieu Large Integrated Restoration
M-1	M1	Mermentau Large Integrated Restoration
CA-1	C1A	Calcasieu Large Integrated Restoration w/ Entry Salinity Control
CM-1	C1+M1	Comprehensive Large Integrated Restoration
CMA-1	C1A+M1	Comprehensive Large Integrated Restoration w/ Entry Salinity Control
C-2	C2	Calcasieu Moderate Integrated Restoration
M-2	M2	Mermentau Moderate Integrated Restoration
CA-2	C2A	Calcasieu Moderate Integrated Restoration w/ Entry Salinity Control
CM-2	C2+M2	Comprehensive Moderate Integrated Restoration
CMA-2	C2A+M2	Comprehensive Moderate Integrated Restoration w/ Entry Salinity Control
C-3	C3	Calcasieu Moderate Integrated Restoration
M-3	M3	Mermentau Moderate Integrated Restoration
CA-3	C3A	Calcasieu Moderate Integrated Restoration w/ Gum Cove & Entry Salinity Control
CM-3	C3+M3	Comprehensive Moderate Integrated Restoration
CMA-3	C3A+M3	Comprehensive Moderate Integrated Restoration w/ Gum Cove & Entry Salinity Control
C-4	C4	Calcasieu Small Integrated Restoration
M-4	M4	Mermentau Small Integrated Restoration
CA-4	C4A	Calcasieu Small Integrated Restoration w/ Entry Salinity Control
CM-4	C4+M4	Comprehensive Small Integrated Restoration
CMA-4	C4A+M4	Comprehensive Small Integrated Restoration w/ Entry Salinity Control
C-5	C5	Calcasieu Interior Perimeter Salinity Control
M-5	M5	Mermentau Interior Perimeter Salinity Control
CM-5	C5+M5	Comprehensive Interior Perimeter Salinity Control
C-6	C6	Calcasieu Marsh & Shoreline
M-6	M6	Mermentau Marsh & Shoreline
CM-6	C6+M6	Comprehensive Marsh & Shoreline

Alternative plans are delineated by Strategy, geographic location (C=Calcasieu, M= Mermentau), and the potential inclusion of the CSC Salinity Control Structure (Plan "A").

2.9.4.1 Cost Estimates

The construction cost and schedule estimates were developed from similar projects in the study area (such as through the CWPPRA program), with input as needed from other recent projects coast-wide. This includes mobilization and demobilization costs, price per cubic yard of dredged material or per ton of rock, depending on the measure type, and other line items as appropriate. The maintenance schedule for shoreline protection/stabilization was based on anticipated settlement rates calculated from the existing nearby geotechnical data, as available, and similar projects in the vicinity. The renourishment schedule for the marsh restoration features was developed through an optimization process by which the total costs and benefits for different maintenance schedules were considered at five-year intervals. This process determined that a 30-year renourishment cycle optimized costs per unit benefit [in average annual acres (AAA)]. Costs for hydrologic and salinity control features were calculated, along with the features from the SMP. The costs of alternative plans are the sums of the costs of the individual features (see Table 2-14). While some cost-savings may be realized through synergistic execution of adjacent or nearby project features, for a conservative cost estimate this synergy was not assumed. Since the NER plan is intended to reasonably maximize environmental benefits, and since NER planning promotes the avoidance of environmental features that require mitigation, any features that would require mitigation were screened from further consideration and no costs for unavoidable wetland impacts have been factored into the preliminary cost estimates. All restoration features in the various alternatives have been designed to not require mitigation. Preliminary high and low cost estimates for plans that contain Plan "A" (CSC Salinity Control Structure) were developed as starting points to account for potential navigation impacts.

Table 2-14: NER Cost Estimates and Benefits

Plan #	Cost $ Low Nav	Cost $ High Nav	AAA
CMA-1	$3,049,836,909	$3,104,429,860	29,070
CM-1	$2,465,675,681	$2,465,675,681	23,101
CA-1	$1,591,668,028	$1,646,260,979	12,844
C-1	$1,007,506,800	$1,007,506,800	6,875
M-1	$1,458,168,881	$1,458,168,881	16,226
CMA-2	$2,390,030,484	$2,444,623,435	25,187
CM-2	$1,901,658,190	$1,901,658,190	19,218
CA-2	$1,495,879,094	$1,550,472,045	13,898
C-2	$1,007,506,800	$1,007,506,800	7,929
M-2	$894,151,390	$894,151,390	11,289
CMA-3	$2,697,850,484	$2,752,443,435	18,959
CM-3	$2,113,689,256	$2,113,689,256	12,990
CA-3	$1,803,699,094	$1,858,292,045	7,982
C-3	$1,219,537,866	$1,219,537,866	2,013
M-3	$894,151,390	$894,151,390	10,977
CMA-4	$1,903,984,167	$1,958,577,118	22,508
CM-4	$1,319,822,939	$1,319,822,939	16,539
CA-4	$1,041,573,707	$1,096,166,658	11,005
C-4	$457,412,479	$457,412,479	5,036
M-4	$862,410,460	$862,410,460	11,503
CM-5	$1,664,058,939	$1,664,058,939	15,537
C-5	$801,648,479	$801,648,479	4,457
M-5	$862,410,460	$862,410,460	11,080
CM-6	$2,321,547,245	$2,321,547,245	23,026
C-6	$1,005,766,800	$1,005,766,800	9,240
M-6	$1,315,780,445	$1,315,780,445	13,786
A	$584,161,228	$638,754,179	5,969

Price level for feature costs – June 2013 and Discount rate of 3.5% (FY 2014) for navigation delays

2.9.4.2 CE/ICA Results

The focused array of alternative NER plans were compared considering Cost Effectiveness and Incremental Cost Analysis (CE/ICA) to inform environmental investment decision making. Cost effectiveness is determined based upon a finding that no other plan provides a higher output level of acres restored for the same or less cost. Incremental cost analysis is the determination of the greatest increase in output (acres restored) for the least increase in cost. Use of these tools helps decision makers determine the most desirable level of outputs (restored acres) compared to costs.

In the CE/ICA analysis shown in Figure 2-8, a Rough Order of Magnitude (ROM) average annual cost of $10,000,000 was added to plans that include CSC Salinity Control Structure (Plan "A") to represent the potentially high navigation impact cost resulting from the operable closure structure. The cost in this analysis represents traffic delays to all 2011 deep draft traffic in the CSC. All alternatives with Plan "A" were run through CE/ICA both with and without the structure in place in order to isolate the relative performance of the structure. Plans in blue are cost-effective (no other plan produces more benefits for the same or less cost as another plan) and plans in red are best-buys (subset of cost-effective plans that offer the lowest incremental cost per benefit).

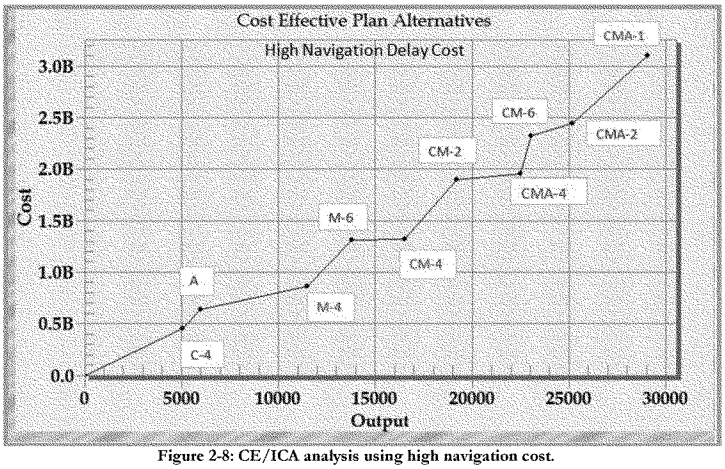


Figure 2-8: CE/ICA analysis using high navigation cost.

The second CE/ICA analysis is shown in Figure 2-9. Identical sets of plans were run, but they used a lower ROM average annual cost of $7,672,500 to represent navigation delay costs caused by the CSC Salinity Control Structure. The lower cost accounts for delays to vessels that transited on the CSC in 2011 with drafts between 15 and 35 ft. The purpose of using this lower cost estimate is to represent an operating scheme that would allow the CSC Salinity Control Structure to remain open during high tide, which is when the deepest draft vessels transit. Thus, a minimum representation of the impact of the structure closure is to add traffic delays for only non-deep-draft vessels. The cost does not include tug assistance costs or any other ancillary impacts of a closure of the CSC Salinity Control Structure. In both analyses, in order to be consistent with the cost

provided for the measures, the average annual cost was converted to a present value of $179,963,228. This present value cost was added to the cost of the plans that contain the CSC Salinity Control Structure, which includes any Plan with an "A" designation.

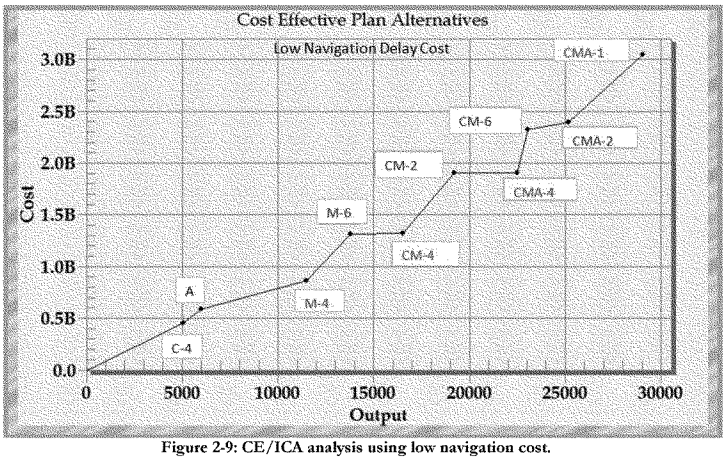


Figure 2-9: CE/ICA analysis using low navigation cost.

For all focused array alternatives, the number of hydrologic and salinity control structures, marsh restoration features, and bank and shoreline protection/stabilization features varied depending on the plan scale and restoration strategy. The plans were estimated to produce between 5,000 and 29,000 AAA, and their costs range from $500,000,000 to over $3,000,000,000.

The CSC Salinity Control Structure (Plan "A") Considerations

As part of the evaluation, plans with and without the CSC Salinity Control Structure were compared. The salinity control structure could potentially provide significant environmental benefits (5,700 AAA) even as a stand-alone plan (Plan "A"). The applications of both low and high preliminary rough order of magnitude estimates of navigation impacts indicated the salinity control structure to be potentially cost-effective. However, Best-Buy plans that contain the CSC Salinity Control Structure, (which includes any Plan with an "A" designation), are significantly more expensive than plans without the CSC structure. Other cost-effective and Best-Buy comprehensive plans containing the CSC structure exist only on the upper most portion of the cost efficient frontier.

When the CSC structure is evaluated as a stand-alone plan, it is anticipated that a more detailed level of analysis would reveal higher navigation impact costs. As a result, the CSC structure as a stand-alone alternative, does not indicate that it could be a Best-Buy plan or be selected as part of a TSP and may in fact fall completely out of consideration should costs be found to be higher than what was estimated by the PDT and fed into the IWR planning suite.

However, if additional benefits are desired, alternatives that include the CSC structure are worth considering. In the long-term there is a good chance that the addition of the CSC structure could provide the next best increment of benefit, even if costs are found to be higher. In the end, the only Best Buy plans that produces greater benefits than comprehensive plans are those which include the CSC salinity control structure as a component.

2.9.5 Final Array of NER Alternative Plans (*NEPA Required)

The final array of alternatives is comprised of the No Action Plan, Plan M-4, and Plan CM-4. The IWR analysis indicates that the only Best Buy plans that do not contain the CSC Salinity Control Structure are plans M-4 and CM-4. Since the negative effects of the CSC structure to navigation are a study constraint and due to the significant cost of the CSC structure, those Best Buy plans on the upper portion of the cost-efficient frontier were dropped from the final array. The components of the final array plans are presented in the table below. Plan M-4 features are those that are located in the Mermentau/Teche-Vermilion basin. Plan CM-4 consists of all the features listed in Table 2-15.

Table 2-15: Features of the NER Final Array Alternative Plans

Basin (Final Array Plan Name)	Category	Feature	Description
Mermentau/Teche-Vermilion (Plan M-4)	Hydrologic/ Salinity Control	13	Little Pecan Bayou Saltwater Sill. Construction of a rock weir with a crest (top) elevation of -3.1 ft and an opening of 60 ft at a bottom invert of -11.1 ft.
	Marsh Restoration*	47a1	Marsh restoration using dredged material south of Hwy 82 about 4.5 miles west of Grand Chenier. 933 marsh acres would be restored and 88 acres would be nourished from 3M cubic yards of dredged material with one future renourishment cycle.
		47a2	Marsh restoration using dredged material south of Hwy 82 about 4.5 miles west of Grand Chenier. 1,297 marsh acres would be restored and 126 acres would be nourished from 8.8M cubic yards of dredged material with one future renourishment cycle.
		47c1	Marsh restoration using dredged material south of Hwy 82 about 4.5 miles west of Grand Chenier. 1,304 marsh acres would be restored and 4 acres would be nourished from 8.6M cubic yards of dredged material with one future renourishment cycle.
		127c3	Marsh restoration at Pecan Island west of the Freshwater Bayou Canal and about 5 miles north of the Freshwater Bayou locks. 832 marsh acres would be restored and 62 acres would be nourished from 7.3M cubic yards of dredged material with one future renourishment cycle.
		306a1	Rainey marsh restoration at Christian Marsh east of the Freshwater Bayou Canal and about 5 miles north of the Freshwater Bayou locks. 627 marsh acres would be restored and 1,269 acres would be nourished from 8.1M cubic yards of dredged material with one future renourishment cycle.
	Shoreline Protection/ Stabilization*	6b1	Gulf shoreline protection/stabilization from Calcasieu River to Freshwater Bayou. 11.1 miles of shore protection consisting of a reef breakwater with a lightweight aggregate core. Located ~150 ft offshore with geotextile fabric and stone built to an 18 ft crest width. The breakwater would protect 2,140 acres of existing marsh.
		6b2	Gulf shoreline protection/stabilization from Calcasieu River to Freshwater Bayou. 8.1 miles of shore protection consisting of a reef breakwater with a lightweight aggregate core. Located ~150 ft offshore with geotextile fabric and stone built to an 18 ft crest width. The breakwater would protect 1,583 acres of existing marsh.

		6b3	Gulf shoreline protection/stabilization from Calcasieu River to Freshwater Bayou. 6.3 miles of shore protection consisting of a reef breakwater with a lightweight aggregate core. Located ~150 ft offshore with geotextile fabric and stone built to an 18 ft crest width. The breakwater would protect 1,098 acres of existing marsh.
		16b	Fortify Freshwater Bayou with 13.4 miles of rock revetment at three critical spots to prevent breaching. Revetment would be built to +4 ft with a 4 ft crown. Two maintenance lifts will be required. The breakwater would protect 1,288 acres of existing marsh.
	Chenier Reforestation	CR	Replant 13 chenier locations. Approximately 435 seedlings per acre, at 10 ft x 10 ft spacing, with invasive species control incorporated.
Calcasieu/ Sabine (Plan CM-4) (Includes all features in Plan M-4)	Hydrologic/ Salinity Control	74a	Cameron-Creole Spillway. Located at the breach in the levee south of Lambert Bayou. The canal would act as a drainage manifold. The outfall channel into Calcasieu Lake would be rock-lined for scour protection and built to +4 ft.
	Marsh Restoration*	3a1	Beneficial use of dredged material from the Calcasieu Ship Channel. Adjacent to the south shore of the GIWW west of the ship channel near Black Lake. 599 marsh acres would be restored from 5.3M cubic yards of dredged material with one future renourishment cycle.
		3c1	Beneficial use of dredged material from the Calcasieu Ship Channel. Adjacent to the east rim of Calcasieu Lake within the Cameron-Creole Watershed. 1,765 marsh acres would be restored and 450 acres would be nourished from 10.2M cubic yards of dredged material with one future renourishment cycle.
		124c	Marsh restoration at Mud Lake. Located adjacent and north of Highway 82 and east of Mud Lake. 1,908 marsh acres would be restored and 734 acres would be nourished from 11.1M cubic yards of dredged material with one future renourishment cycle.
		124d	Beneficial use of dredged material from the Calcasieu Ship Channel for marsh restoration at Mud Lake. Located west of the Calcasieu Ship Channel and adjacent to the southern rim of West Cove. 159 marsh acres would be restored and 448 acres would be nourished from 1.4M cubic yards of dredged material with one future renourishment cycle.
	Shoreline Protection/ Stabilization*	5a	Holly Beach Shoreline Stabilization Breakwaters. Construction of approximately 8.7 miles of rock and low action breakwaters and is a continuation of existing breakwaters. Crown elevation of +1.5 ft with a crown width of 30 ft. Two maintenance lifts will be required. The breakwater would protect 26 acres of beach and dune habitat.
	Chenier Reforestation	CR	Replant 22 chenier locations. Approximately 435 seedlings per acre, at 10 ft x 10 ft spacing, with invasive species control incorporated.
	Oyster Reef Preservation	ORP	Preservation of a large oyster reef in Sabine Lake through the enforcement of oyster dredging restrictions.

**- Renourishment and maintenance lifts are considered an Operations and Maintenance (O&M) cost and are a 100% NFS responsibility.*

2.10 Summary of Accounts and Comparison of Alternatives

To facilitate alternatives evaluation and comparison, the 1983 Principles and Guidelines set up four Federal Accounts to assess the effects of alternatives. The accounts are National Economic Development (NED), Environmental Quality (EQ), Other Social Effects (OSE), and Regional Economic Development (RED).

All NER alternative plans provide positive net EQ benefits that contribute to the regional ecosystem outputs and functions, and provide coastal sustainability. All plans considered provide synergy with NED objectives by providing resilience to key elements of regional geomorphic structure that facilitate storm risk management. The alternative plans also support RED benefits in maintaining the regional geomorphic structure that in turn maintains an existing hydrology which supports a regional agricultural economy. The plans also support RED objectives by providing resiliency to natural risk reduction features. Regarding OSE, all alternative plans address the southern-most portion of the study, which is comprised largely of coastal wetlands and ridges. The populations of this portion of the study area has a long and rich history of utilizing the natural landscape as the

source of their economy. All the plans considered facilitated that continued use and history and provide the possibility of social as well as physical resiliency for the area.

NER TSP

The Corps objective in ecosystem restoration planning is to contribute to NER. Contributions to NER (NER outputs) are increases in the net quantity and/or quality of desired ecosystem resources. The TSP must be shown to be preferable to taking no action (if no action is not recommended) or implementing any of the other alternatives considered during the planning process. For ecosystem restoration projects, a plan that reasonably maximizes ecosystem restoration benefits compared to costs, consistent with the Federal objective, shall be selected. The TSP must be shown to be cost-effective and justified to achieve the desired level of output.

Plan 0: **No Action.** As detailed in Chapter 1, under this alternative, no ecosystem restoration would take place. Coastal wetlands would continue to degrade and disappear, further weakening the coastal landscape resulting in significant impacts to important habitats. Infrastructure, populations, industry, and businesses would continue to become vulnerable to the increased effects of storm surge and RSLR through the loss of a protective wetland buffer. Ecosystem restoration projects would take place under CWPPRA, SMP, RESTORE Act, and Parish plans but at a smaller scale.

Plan M4: **Mermentau Small Integrated Restoration.** This alternative was formulated for NER so specific NED or RED benefits were not calculated. Effects to EQ are increased but only for the Mermentau Basin. These include benefits to the flora and fauna of the study area through the restoration and protection of important imperiled habitat. Aquatic, terrestrial, and bird species would benefit from the restored ecosystem. Positive effects to OSE are expected through the restoration of wetland habitat and its associated benefits to plant and wildlife species, salinity reduction, and improvement to the coastal landscape. Restoring the ecosystem also has positive benefits for surrounding communities through a preservation of cultural values, community cohesion, economic vitality, and leisure and recreation.

Plan CM-4: **Comprehensive Small Integrated Restoration (TSP).** This alternative was formulated for NER so specific NED or RED benefits were not calculated. Effects to EQ increase in the Calcasieu and Mermentau Basins. Effects of restoring the ecosystem would be similar to Plan M4, but would be on a much larger scale. Positive effects to OSE are expected through the restoration of wetland habitat and its associated benefits to plant and wildlife species, salinity reduction, and improvement to the coastal landscape. Additional benefits to OSE, such as those described for Plan M4, would occur but on a much larger scale. This alternative provides the most cost-effective and comprehensive benefit.

2.11 Additional Evaluation of the Final Array of Alternatives

Both the 2013 Initial Draft Report and the 2015 Revised Draft Report identified Plan CM-4 as the TSP. However, during technical reviews and based on new information from the feasibility level design phase of the study, additional work and other assessments were completed for several of the features in each alternative. These efforts required a reevaluation of each alternative against one another to confirm Plan CM-4 remained the TSP.

In order to use the best available data and models, alternative plan feature benefits (AAHUs) were updated with the certified version of the WVA model. Refined annualized costs were also developed and input into the IWR Planning Suite model with the new AAHU calculations. The PDT completed a new analysis of the NER focused array of alternatives based on the refinements in benefits and costs for all features in each alternative. This effort helped identify features that fell short of initial benefits projections. For example, the Little Pecan Bayou Saltwater Sill (Feature 13) had significantly fewer benefits than originally projected and was therefore removed as a component from all alternatives. Other features that comprised the alternative plans were also evaluated. The Sabine Lake Oyster Reef Preservation feature was removed from further consideration since there is no cost for its implementation, it lacks quantifiable benefits, and it can be handled administratively by the agency in charge of its management. The PDT also determined that the CSC Salinity Control Structure and

the Cameron-Creole Spillway (feature 74a) should be assessed through additional studies because there are too many uncertainties about potential effects on salinity, habitat, and navigation. These features also need complex and detailed hydrodynamic and navigation economics modeling that this study effort is not scoped to support at this time. Given these adjustments, the focused array of alternatives was re-run to calculate the CE/ICA without these features and based on the updated annualized benefits and costs. The outputs from these adjustments are presented below (see Table 2-16 and Figure 2-10).

Table 2-16: NER cost efficient alternative plan comparison.

Plan Name	Total Cost x 1,000	Annual Cost	AAHUs	Cost/AAHU	Annual Cost/AAHU	Cost Effective Status
CM-1	$2,159,512	$85,933,395	8,623	$250,430	$9,965	Best Buy
CM-6	$2,032,615	$80,883,760	8,285	$245,324	$9,762	Best Buy
CM-3	$1,874,080	$74,575,197	7,170	$261,388	$10,401	Yes
CM-2	$1,588,626	$63,216,127	6,990	$227,278	$9,044	Best Buy
CM-5	$1,460,681	$58,124,842	5,156	$283,297	$11,273	Yes
CM-4	$1,175,227	$46,765,771	4,976	$236,176	$9,398	Yes
C-1	$826,903	$32,904,915	4,129	$200,289	$7,970	Best Buy
C-2	$740,684	$29,474,025	3,688	$200,821	$7,991	Yes
C-5	$671,458	$26,719,300	1,980	$339,172	$13,497	Yes
C-4	$386,003	$15,360,229	1,800	$214,475	$8,535	Yes
No Action Plan	$0	$0	0	$0	$0	Best Buy

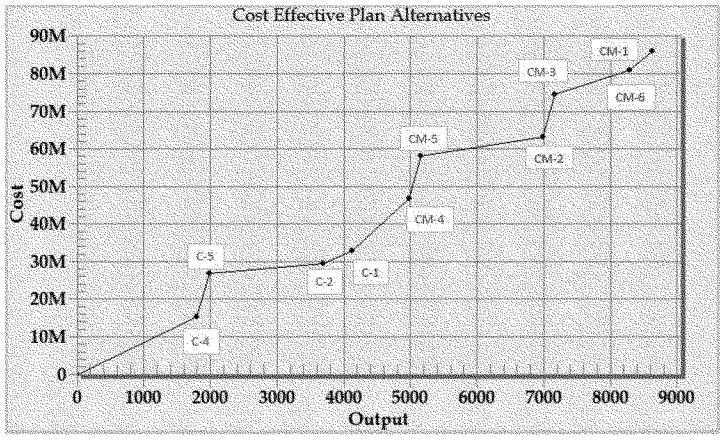


Figure 2-10: CE/ICA analysis using updated annualized costs and benefits.

2.12 Confirmation of the NER TSP

The relative ranking of alternatives to one another as expressed in the first IWR runs was altered with the updated set of outputs. Plan A did not perform as a cost efficient plan in the refined CE/ICA despite continuing

to demonstrate the potential to deliver a relatively significant magnitude of benefits (975 AAHUs). Note that for CE/ICA runs after the initial alternative screening process AAHUs were used in lieu of AAAs in the benefits calculations.

Several features included in the TSP appear, on an individual basis, to lack adequate restoration performance to justify their inclusion. The basis/rationale for the inclusion of those features, specifically 124d, 5a, & 306a1, in various alternative plans including the TSP is important. These features, as well as all of the features in the TSP, titled Small Integrated Restoration, represent the minimum critical components necessary for providing restoration in a manner that protects the geomorphic integrity and resiliency of the larger Chenier Plain system. While the features of the TSP were assessed for their individual outputs and are not interdependent, they do support a holistic objective. That is to provide long-term resilience to the overall ecosystem structure of the Chenier Plain. Each feature, in addition to restoring valuable habitat, enhances the resilience to a structural element of the larger ecosystem.

In the case of features 124d and 5a, these features are anchor pieces that also work with feature 124c to prevent the long-term failure of a heavily deteriorated land bridge in the vicinity of Mud Lake, which lies between the Gulf of Mexico and the western extent of Calcasieu Lake. Feature 5a is particularly critical to this area since the beach and dune ridge represents the sole contiguous chenier crossing the area. The breakdown of this land bridge would ultimately result in the establishment of an open estuary reaching approximately 20 or more miles inland from the coast and elevating salinities and coastal storm effects throughout the area. Feature 306a1, in addition to creating valuable marsh, stabilizes the eastern ridge associated with the Freshwater Bayou channel. Feature 127c3 provides similar support for the western side of this ridge. Loss of one, or both sides of this ridge would result in a rapidly expanding embayment that could threaten the remainder of the Mermentau Basin.

Plan CM-4 is the plan that reasonably maximizes ecosystem restoration benefits compared to costs, and consistent with the Federal objective. CM-4 is the TSP because it is cost-effective, it contains restoration features in both hydrologic basins, and it is the least cost alternative that contains an integrated suite of restoration types including chenier reforestation, marsh restoration, and shoreline protection/stabilization. While there are larger-scale alternatives that would cost more and would contain more features, implementation of alternative CM-4 would achieve all study objectives with the exception of NER Objective 2 ("Manage tidal flows to improve drainage and prevent salinity from exceeding 2 ppt for fresh marsh and 6 ppt for intermediate marsh."). NER Objective 2 would be partially achieved because the CSC Salinity Control Structure and the Cameron-Creole Spillway, the only features that would manage tidal flows and prevent salinities from increasing, are recommended for additional study. CM-4 achieves most of the study objectives for the least cost. This makes it the NER plan.

Based on the data presented in Table 2-16, the financial investment required to select the first comprehensive Best Buy plan, CM-2, represents an additional cost of over $400M. Additionally, in direct comparison with the Best Buy plan CM-2, CM-4 produces 71.2 percent of those benefits at 74.0 percent of the cost. This proportionality demonstrates that the two plans are virtually identical in efficiency. For these reasons, the PDT maintains that the lower cost plan, Plan CM-4 is the TSP.

Description of the NER TSP:

- **Marsh Restoration.** Nine marsh restoration and nourishment features consist of delivering sediments to former marsh areas and eroding marsh areas (minimum of 100 acres efficiency criteria) that have water levels of less than two ft and that have been optimized to preserve or restore critical geomorphologic features to restore vegetated wetlands. This involves excavation of significant quantities and delivery of borrow material to restoration sites through designated access corridors. Some restoration sites may require containment to hold sediments in place. The marsh restoration locations include: (a) three areas on the south side of LA-82 approximately 4.5 miles west of Grand Chenier; (b) Pecan Island west of the Freshwater Bayou Canal approximately 5 miles north of the Freshwater Bayou locks; (c) Christian Marsh

located east of Freshwater Bayou Canal and approximately 5 miles north of Freshwater Bayou locks; (d) southern shoreline of GIWW west of the CSC near Black Lake; (e) eastern rim of Calcasieu Lake within the Cameron-Creole Watershed (to be constructed by the USFWS); (f) east of Mud Lake and north of Highway 82; (g) Mud Lake west of the CSC adjacent to southern rim of West Cove (to be constructed by the USFWS). Dredged material sources would be the CSC (both beneficial use and dedicated dredging) and the Gulf of Mexico.

A table summarizing details of these features is included at Table 2-17a. Construction of marsh restoration features would typically involve placement of dedicated borrow material by hydraulic dredging. Placement would generally involve over-placement of material to achieve a typical marsh elevation of approximately +1.5 ft NAVD88 (or as dictated by adjacent marsh elevation) following post construction settlement. As necessary earthen containment dikes would be employed to efficiently achieve the desired initial construction elevation. Dikes would be breached following construction to allow dewatering and settlement to the final target marsh elevation. All marsh restoration locations would have one future renourishment cycle (as part of O&M and a 100% NFS responsibility). Subsequent marsh renourishment would employ similar techniques and specifications as developed for the initial construction. For a detailed description of each of the proposed marsh restoration projects see Appendix K. See also Appendix A, Annex V for information concerning corresponding marsh restoration project borrow sources.

- **Shoreline Protection/Stabilization.** The five Gulf shoreline protection/stabilization features span approximately 252,000 linear ft and would be used to reduce erosion of canal banks and shorelines in critical areas in order to protect adjacent wetlands and critical geomorphic features. Multiple locations of Gulf of Mexico shoreline from the Calcasieu River to Freshwater Bayou consist of reef breakwaters with a lightweight aggregate core that would be located approximately 150 ft offshore with geotextile fabric and stone built to an 18 foot crest width. In addition, approximately 13.4 miles of rock revetment built to +3 ft NAVD88 with a 4 foot crown would be placed at three locations to fortify spoil banks of the GIWW and Freshwater Bayou. Two future maintenance lifts would be required (as part of O&M and a 100% NFS responsibility). Rock and breakwaters would also be placed at Holly Beach as a continuation of existing breakwaters; two future maintenance lifts would be required (as part of O&M and a 100% NFS responsibility). Details of these features are included in Table 2-17b.
- **Chenier Reforestation.** Chenier restoration consists of replanting of 435 seedlings per acre at 10 foot x 10 foot spacing, in 35 Chenier locations on 1,400 acres in Cameron and Vermilion parishes. Invasive species control and eradication are also included. Details of these features are included in Table 2-17c.
- **Hydrologic and Salinity Control.** The Cameron-Creole Spillway salinity control structure south of Lambert Bayou is recommended for additional study. It would serve as a drainage manifold and the outfall channel into Calcasieu Lake would be rock-lined for scour protection The SMP model used to evaluate this feature needs additional refinement to properly evaluate the benefits over the 6,600-acre area of influence. The modeling indicated a slight decrease in acreage under the FWP condition (0.8% reduction), but indicated a positive benefit in habitat quality (267 AAHUs). Nevertheless, the modeling performed for this feature would not be able to adequately measure the potential benefits of this feature because it would only operate in extreme conditions (e.g., after a high storm surge). Therefore it would be prudent to examine this measure in more detail under a new study effort.
- The **CSC Salinity Control Structure** is recommended as an additional long-range study feature to adequately account for potential environmental benefits, navigation impacts, and engineering.
- O&M costs for all NER features (a NFS responsibility) are estimated at approximately $311,573,000.
- First construction costs only are estimated at $1,175,227,000.
- **Changes and updates to the NER TSP since release of the 2015 Revised Draft Report are minor and consist of providing more details about each feature in the fact sheets (Appendix K), and updating costs and benefits. These changes can be found in Chapter 4.**

2.13 NER TSP Feature Details

Table 2-17a. Details of the marsh restoration features of the TSP (See Appendix K for fact sheets and maps detailing each NER TSP marsh restoration feature).

Measure Number	Measure Name	Basin	Marsh Type	Acres Restored	Acres Nourished	Total Acres	Net Benefits (acres)	Average Annual Habitat Units (AAHU)	Borrow Volume (cy)	Borrow Area (acres)	Renourishment Volume (cy)	Initial Construction Costs (US $)	TY 30 Renourishment (US $)
3a1	Beneficial Use of Dredged Material from Calcasieu Ship Channel	Calcasieu	Brackish	599	-	599	454	191	5,339,286	139	1,000,000	$66,593,748	$17,759,470
3c1	Beneficial Use of Dredged Material from Calcasieu Ship Channel	Calcasieu	Brackish	1,347	734	2,081	1,324	607	9,458,313	314	3,651,841	$168,194,346	$70,984,253
47a1	Marsh Restoration Using Dredged Material South of Highway 82	Mermentau	Brackish	933	88	1,021	895	272	3,022,782	1,716[1]	1,500,000	$105,234,982	$21,239,680
47a2	Marsh Restoration Using Dredged Material South of Highway 82	Mermentau	Brackish	1,297	126	1,423	1,218	381	8,831,084	1,716[1]	1,500,000	$97,348,440	$17,585,890
47c1	Marsh Restoration Using Dredged Material South of Highway 82	Mermentau	Brackish	1,304	4	1,308	1,135	353	8,557,120	1,716[1]	1,800,000	$95,372,834	$14,981,607
124c	Marsh Restoration at Mud Lake	Calcasieu	Saline	1,077	708	1,785	1,228	500	10,369,956	531	2,001,611	$112,219,520	$24,680,885
124d	Marsh Restoration at Mud Lake	Calcasieu	Brackish	159	448	607	168	4	1,420,943	378	1,200,000	$28,882,160	$17,636,205
127c3	Marsh Restoration at Pecan Island	Mermentau	Brackish	832	62	894	735	241	7,301,057	3,950[2]	781,000	$61,662,041	$15,683,451
306a1	Rainey Marsh Restoration Southwest Portion (Christian Marsh)	Mermentau	Brackish	627	1,269	1,896	743	151	8,128,181	3,950[2]	3,500,000	$75,885,692	$37,551,555
	Totals			8,175	3,439	11,614	7,900	2,700	62,428,722	7,028	16,934,452	$811,393,763	$238,102,996

1- This borrow source provides the sediment for all three restoration features but the full amount of available material will not be dredged each cycle. Therefore this total acreage is only counted once in the column total.

2- This borrow source provides the sediment for both restoration features but the full amount of available material will not be dredged each cycle. Therefore this total acreage is only counted once in the column total.

JA
37-899
93
10/04/2019

(Table 2-17a continued)

Measure Number	Measure Name	Impact to State Water Bottoms permanent (acres)	Floatation Footprint (acres)	Disposal Footprint (acres)	Dike Footprint (feet)	Dike Footprint (acres)	Impact to State Water Bottoms (temporary)	Dredge Pipeline Route (feet)	Dredge Pipeline Route (acres)	Piping Plover Critical Habitat (temporary impact acres)	Construction Period
3a1	Beneficial Use of Dredged Material from Calcasieu Ship Channel	139	132	-	44,700	30.8	-	43,942	30	-	16 months
3c1	Beneficial Use of Dredged Material from Calcasieu Ship Channel	314	182	-	97,250	51.4	-	61,497	42	-	33 months
47a1	Marsh Restoration Using Dredged Material South of Highway 82	1,716[1]	47	-	68,300	47.0	-	35,519	24	0.14	23 months
47a2	Marsh Restoration Using Dredged Material South of Highway 82	1,716[1]	47	-	41,000	28.2	-	30,898	21	0.14	24 months
47c1	Marsh Restoration Using Dredged Material South of Highway 82	1,716[1]	47	-	35,200	24.2	-	29,858	21	0.14	23 months
124c	Marsh Restoration at Mud Lake	531	28	-	78,100	31.5	-	9,485	7	1.8	27 months
124d	Marsh Restoration at Mud Lake	314	182	-	32,500	22.4	-	21,452	15	-	9 months
127c3	Marsh Restoration at Pecan Island	3,950[2]	110	-	46,000	31.7	-	37,074	26	-	12 months
306a1	Rainey Marsh Restoration Southwest Portion (Christian Marsh)	3,950[2]	178	-	108,000	74.4	-	59,731	41	-	17 months
	Totals	6,964	953		551,050	341.6		329,456	227	2.2	---

1- This borrow source provides the sediment for all three restoration features but the full amount of available material will not be dredged each cycle. Therefore this total acreage is only counted once in the column total.

2- This borrow source provides the sediment for both restoration features but the full amount of available material will not be dredged each cycle. Therefore this total acreage is only counted once in the column total.

JA
37-899
64
10/04/2019

Table 2-17b. Details of the shoreline protection features of the TSP (See Appendix K for fact sheets and maps detailing each NER TSP shoreline protection feature).

Measure Number	Measure Name	Basin	Marsh Type	Net Benefits (acres)	Average annual habitat units (AAHU)	Shoreline Feature Length (ft)	Rock (tons)	Grade Rock (lbs)	Geotextile Fabric (sq yds)	Lightweight Aggregate (tons)	1st Maintenance Lift (tons)	2nd Maintenance Lift (tons)	Initial Construction Costs (US $)	TY15 Maintenance (US $)
5a	Holly Beach Shoreline Stabilization – Breakwaters	Calcasieu	Saline	26	56	46,014	860,540	250	386,460	0	129,081	86,054	$144,044,021	$16,786,222
6b1	Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou	Mermentau	Brackish	2,140	625	58,293	868,480	250	447,830	479,150	86,848	0	$198,480,921	NA
6b2	Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou	Mermentau	Brackish	1,583	466	42,883	687,140	250	363,270	357,010	68,714	0	$145,876,561	NA
6b3	Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou	Mermentau	Brackish	1,098	312	33,355	561,530	250	244,205	279,030	56,153	0	$115,270,890	NA
16b	Fortify Spoil Banks of the GIWW and Freshwater Bayou	Mermentau	Brackish	1,288	279	70,983	617,640	250	516,860	0	92,646	61,764	$36,018,600	$5,695,468
	Totals			6,135	1,738	251,528	3,595,330		1,958,625	1,115,190	433,442	147,818	$639,690,993	$22,481,690

JA 37-899 95 10/04/2019

(Table 2-17b continued)

Measure Number	Measure Name	TY 25 Maintenance (US $)	Impacts to State Water Bottoms (permanent)	Breakwater Footprint (feet)	Flotation Footprint* (acres)	Temporary Disposal Footprint* (acres)	Impact to State Water Bottoms (temporary acres)	Critical Habitat (acres)	Temporary Staging Area (acres)	Crown Elevation (feet NAVD88)	Crown Width (feet)	Slopes	Aprons (feet)	Construction Period
5a	Holly Beach Shoreline Stabilization – Breakwaters	$11,247,740	57.4	57.4	479	462	941	-	-	3.50	24	2:1	10-ft front & 6-ft back	19 months
6b1	Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou	$15,389,345	65.9	65.9	725	711	1436	-	21	3.25	18	2:1	10-ft front & 6-ft back	31 months
6b2	Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou	$11,343,672	40.2	40.2	507	497	1004	-	21	3.25	18	2:1	10-ft front & 6-ft back	23 months
6b3	Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou	$9,041,421	37.8	37.8	372	289	661	-	21	3.25	18	2:1	10-ft front & 6-ft back	18 months
16b	Fortify Spoil Banks of the GIWW and Freshwater Bayou	$3,966,404	77.1	77.1	358	-	-	-	-	3.00	4	4:1	none	13 months
	Totals	$50,988,582	278.4	278.4	2,441	1,959	4,042	-	63	-	-	-	-	---

**- Access for heavy equipment to construct shoreline stabilization features consists of dredging a channel in open water to allow construction equipment to reach shoreline areas and placing the dredged material alongside the channel so the necessary channel depth is maintained. This material stored adjacent to the channel will be returned to the access channel after construction. These impacts are temporary and will naturally revert to existing conditions over time.*

(Table 2-17b continued)

Linear Feet for Access and Temporary Disposal							
Measure	**5a**	**6b1**	**6b2**	**6b3**	**16b***	**Total Feet**	**Miles**
Disposal	159,741	239,001	168,533	98,683	0	665,958	126.1
Equipment Access	161,957	244,857	173,050	126,542	0	706,406	133.8

**- No dredging or temporary disposal is anticipated for Feature 16b since Freshwater Bayou has adequate water depths to allow the necessary construction equipment access.*

JA 37-899 96 10/04/2019

Table 2-17c. Details of the chenier reforestation features of the TSP (see Appendix K for fact sheets and maps detailing the NER TSP chenier reforestation features).

Measure Name	Net Benefits (acres)	Benefits (AAHU)	Species	Total Fence Length (feet)	Fence Height (feet)	Planting Density (#/acre)	Spacing (feet)	Min. Survival % at Year 4*	Equip-ment Access Corridor (feet)	Equip-ment Access Corridor (acres)	State Water Bottoms (permanent)	State Water Bottoms (tempor-ary)	Critical Habitat (acres)	Staging Area (acres)
Chenier Reforestation (CR)	1,413	538	Live Oak; Hackberry	150,000	7.5	435	10 x 10	57%	13,867	10	0	0	0	0

**. For a given planting, a minimum of 250 seedlings/ saplings per acre must be present (with a 60 to 40 hard mast to soft mast ratio) at the end of the fourth year (i.e., Year 5) following successful attainment of the one-year survivorship criteria. Costs to ensure the minimum survival percent are considered 'construction' and will be cost-shared accordingly.*

JA
37-899
97
10/04/2019

2.14 Views of the Non-Federal Sponsor

CPRAB recognizes the importance of hurricane and storm surge risk reduction and ecosystem restoration as evidenced by the fact that the 2012 State Master Plan includes this study. Implementation of the NED Plan would provide hurricane and storm surge risk reduction to eligible properties. The NER Plan would help to restore and protect the critical Chenier Plain providing multiple environmental benefits to southwest coastal Louisiana. CPRAB and numerous local stakeholders participated with CEMVN in the PDT process and have given input to develop the various measures and alternatives to formulate the plans. CPRAB currently has expressed no objection to the features of the NER and NED plans, and both plans are consistent with the State Master Plan. However, CPRAB continues to support construction of structural risk reduction features like levees across the study area as the most efficient way to reduce flood damage risks to residents of the study area.

3.0 ENVIRONMENTAL CONSEQUENCES (*NEPA REQUIRED)

This chapter describes the environmental consequences associated with implementing the alternatives for the nonstructural hurricane storm surge damage risk reduction (HSDRR) NED plans and the ecosystem restoration NER plans. The impacts of the NED and NER plan measures described herein and in Appendix A are assessed at a full feasibility level and are recommended for construction. Fact sheets describing the NER measures in more detail can be found in Appendix K. The Alternatives carried forward, as described in Chapter 2, for comparative analysis include the following:

NED Alternatives:

(A) Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain is the recommended plan consisting of approximately 3,961 structures that meet the eligibility criteria broken down as follows:
   a. 3,462 residential
   b. 342 non-residential
   c. 157 warehouses

(B) Plan 8 Alternative – Nonstructural 100-Year Floodplain includes 15,667 total eligible structures broken down as follows:
   a. 13,934 residential
   b. 1,003 non-residential
   c. 730 warehouses

NER Alternatives: Table 2-13 includes a listing of measures included in the final array of alternatives and tables at 2-17 includes a listing of measures that make up the NER RP alternative.

(A) Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan is the RP. It includes 22 features in the Mermentau Basin and 27 measures in the Calcasieu/Sabine Basin for a total of 49 features. The hydrologic/salinity control measures are recommended for further study, and the oyster reef preservation measure was removed from further consideration. The features comprising the recommended plan are broken out as follows:
   a. 9 marsh restoration measures restoring/nourishing 11,614 acres of wetlands.
   b. 35 Chenier reforestation locations.
   c. 5 shoreline protection measures totaling approximately 47.6 miles.

(B) Plan M4 Alternative - This alternative totals 22 measures in the Mermentau Basin only. The measures comprising the alternatives include:
   a. 5 marsh restoration features restoring/nourishing 6,542 acres of wetlands.
   b. 13 Chenier reforestation locations
   c. 4 shoreline protection measures totaling approximately 38.9 miles.

The CM-4 Alternative would restore approximately 50% more marsh or 6,063 more acres; reforest approximately 60% more (22 more) Chenier reforestation locations; and protect approximately 22% or 8.7 miles more of shoreline through shoreline protection measures.

Two marsh restoration features (124d - Marsh Restoration at Mud Lake and 3c1 - Beneficial Use of Dredged Material from the Calcasieu Ship Channel) are partially located on USFWS refuge lands. The USACE recommends that USFWS independently seek authorization and appropriation to construct these projects.

3.1 The Human Environment (Socioeconomics)

Consideration of public and policy comments on the Southwest Coastal Louisiana, Integrated Draft Feasibility Report and Programmatic Environmental Impact Statement released on December 13, 2013 and the Revised Integrated Draft Feasibility Report and Environmental Impact Statement released on March 20, 2015 regarding the NED TSP resulted in removal of the mandatory component of the plan which called for the acquisition and demolition of structures located within the FEMA Regulatory Floodway. Consequently, implementation

of the nonstructural NED Alternative would be performed on an entirely voluntary basis, which lessens the potential adverse impacts on the human environment.

3.1.1 Population and Housing

HSDRR (NED) Plan

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)

Direct impacts include the potential for damage to structures, landscaping and driveways while the structure is being elevated. There could be potential inconvenience to residents having to move and store their personal possessions and relocate to a temporary residence while their residences are being elevated. Additionally, access to the residence would be impeded during the time the residence is being elevated. Temporary relocation of individuals and families could entail different travel routes through unfamiliar areas, longer commute times to work, school, and other destinations for typical life activities (e.g., shopping, doctor and dentist visits, etc.). The change in commute times could be a positive or negative impact, since the relocation could temporarily move individuals and families either closer or farther away from their destinations.

Indirect impacts would include reduced risk of damages from hurricane storm surge events for population and housing located in the 25-year floodplain. This risk reduction would lead to greater stability and sustainability of population and housing resources. However, if a residence is elevated, access to the elevated residences could be more difficult, especially for the elderly and physically handicapped, even if retrofitted with an elevator and other special access improvements. Additional indirect impacts would be the different visual appearance of neighborhoods and communities with a few elevated structures located within a community of nearby structures that are not elevated. There could also be potential drainage issues, especially related to construction of localized storm surge risk reduction measures. However, any such Project-induced impacts would be avoided or corrected to pre-construction conditions. There is a potential that existing landscaping around residential structures could be damaged and require restoration.

Direct and indirect impacts associated with residential and commercial properties that are located in the 25-year floodplain but that do not undergo nonstructural risk reduction measures (either by choice or due to ineligibility) or that are located in the study area but do not fall within the 25-year floodplain are similar to those impacts described in Chapter 1 under the FWOP condition. This is generally true for each of the below resources and as such, will not be repeated throughout this analysis.

Plan 8 Alternative – Nonstructural 100-Year Floodplain

The impacts from this alternative are similar to the impacts identified in connection with the Modified Plan 8 Nonstructural 0-25-Year Floodplain Plan (RP) alternative but greater in scale because of the larger numbers of structures that would be included in the Project under this alternative as compared to the RP, as described in paragraph 3.0 above This will be generally true for all resources below. Hence a discussion of impacts associated with the Plan 8 alternative will not be detailed for each of the following resources unless there is a significant reason for it to be addressed in connection with a specific resource. The scale of the differences would vary by resource but the general rule remains: impacts would be similar in nature but greater in scale for the Plan 8 alternative as compared to the RP.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

NER RP measures would have no direct impacts on population and housing. Indirect impacts would include decreasing the rate of shoreline erosion, thereby protecting the temporary population of the Holly Beach camp community located along the shoreline of the Gulf of Mexico in the Calcasieu Basin.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan

The impacts of Plan M-4 are the same as the impacts identified for the Mermentau Basin component of Plan CM-4 alternative (NER RP) but overall lesser in scale due to the size of the RP by comparison, as described in paragraph 3.0 above (i.e., 49 measures in the RP as compared to 22 measures for the Plan M-4 alternative). This will be generally true for all resources below. Hence a discussion of impacts associated with the Plan M-4

alternative will not be detailed for each of the following resources unless there is a significant reason for it to be addressed in connection with a specific resource. The scale of the differences in impacts between Plan M-4 compared to the Plan CM-4 would be approximately 50% less for marsh restoration measures as there would be approximately 6,063 less acres restored; there would be 22 less chenier reforestation locations and therefore approximately 60% less impacts; miles of shoreline protected would be 8.7 miles less resulting in approximately 22% less impacts.

3.1.2 Employment, Business, and Industrial Activity (Including Agriculture)

HSDRR (NED) Plans

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)

There would be direct impacts associated with the flood proofing of businesses and the construction of localized storm surge risk reduction measures in the nonstructural plan. If commercial structures are flood proofed, businesses could potentially either shut down or relocate temporarily while the measure is being applied, which could lead to a loss of revenue, change in business clients to other more available businesses, as well as a loss of wages to employees. The construction of localized storm surge risk reduction measures around warehouses could temporarily and intermittently impede access to the warehouses during construction and cause drainage issues for adjacent areas and structures. There is a potential that existing landscaping around businesses and warehouses could be damaged and require restoration. Also, if a business relocates outside of the community, it could face the inconvenience of having to establish itself in a new area as well as longer travel distances and increased transportation costs to move the business products to markets.

Indirect impacts would include reduced risk of hurricane storm surge- related damage for employment, business, and industrial activity in the 25-year floodplain of the study area which translates into greater stability of productivity in the region.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

Restoration measures would have no direct impacts on employment, business, and industrial activity. Indirect effects would include the prevention of further land loss, which could result in localized positive effects of maintaining employment and businesses (e.g., recreational and commercial fishing), and industrial activity. Cumulative impacts would be beneficial and would result from improved sustainability of southwest Louisiana with similar restoration efforts, making a more stable environment for employment, business, and industrial activity.

Plan M-4 Alternative - Mermentau Small Integrated Restoration Plan

The impacts for this alternative are similar to the impacts identified for the CM-4 Alternative RP but lesser in scale. For example there are 6,063 less acres of marsh restoration, 22 less Chenier reforestation locations and 8.7 miles less shoreline protection. Impacts are the same as the Mermentau Basin component of the RP.

3.1.3 Public Facilities and Services

HSDRR (NED) Plans

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)

Direct impacts associated with flood proofing to public facilities in the area would be the interruption and temporary unavailability of public services if these facilities are forced to close or are relocated to temporary locations during implementation of the nonstructural risk reduction measures.

Indirect impacts include reduced risk of hurricane storm surge-related damages for public facilities and services in the area thereby reducing the number of days a structure is unavailable for use and minimizing the inconvenience to the general public. Indirect impacts to public facilities and services not included in the plan would be the same as identified under the no-action alternative. Other direct and indirect impacts would be similar to those described in sections 3.1.1 and 3.1.2.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

Restoration measures would have no direct, indirect, or cumulative impacts on public facilities or services.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan

Impacts are the same as MB component of the RP.

3.1.4 Transportation

HSDRR (NED) Plans

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)

Direct impacts associated with the NED RP for transportation would include temporary and intermittent delays, disruption of traffic movement, congestion of roads, and re-routing of vehicles and pedestrians during the construction of the various risk reduction measures. Local parking access to businesses could also be affected by construction vehicles and crews and construction of the localized storm surge risk reduction measures around the warehouses.

Indirect impacts would include the additional wear and tear on roads, especially local roads, caused by large trucks transporting construction materials including borrow material transported for construction of local risk reduction measures at warehouses, as well as reduced parking. There would also be greater noise and dust generated by construction vehicles. However, best construction management practices would be utilized to limit dust emissions and to ensure the safety of construction workers, residents, and employees during construction of the nonstructural measures. There could be minor indirect short term impact to transportation due to construction related activities related to both structural elevations and commercial /warehouse flood proofing measures. These impacts will vary depending on the number and location of structures undergoing improvements at a given time and the timing and duration of the construction-related activities. There would be no long term impact.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

No direct impacts on transportation. Dredging for borrow material from the Calcasieu Ship Channel would be conducted in a manner to avoid impacting navigation. Indirect impacts would include the additional wear and tear on roads, especially local roads, caused by large trucks transporting construction materials. Additional indirect impacts to transportation includes reducing the intensity of damages to the following transportation structures:

- Marsh restoration measures 124c and 47a1 would reduce the intensity of almost daily wind-generated wave action which erodes areas adjacent to Highway 82;
- Marsh restoration measure 3c1 would reduce the wave action which erodes the southern spoil bank along the GIWW from the south (This impact would only apply if USFWS obtains authorization and funding and independently implements measure 3c1.);
- Shoreline protection measure 16b would protect the shoreline of Freshwater Bayou through the placement of foreshore rock dikes;

Plan M-4 Alternative - Mermentau Small Integrated Restoration Plan

Impacts are the same as the MB component of the RP.

3.1.5 Community and Regional Growth

HSDRR (NED) Plans

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)

Direct impacts would include a temporary monetary stimulus to the region due to spending associated with the construction activities in the area. This stimulus would be an increase the region's income for as long as the

spending continued. For the study area as a whole, temporary relocations would likely take place within the overall study area during implementation of the nonstructural measures, resulting in little if any change.

Indirect impacts would include reduced risk of hurricane storm surge-related damages for those low-lying structures located in the 25 year floodplain thus reducing overall social vulnerability and preserving growth opportunities for communities in the region and enhancing the potential for long-term growth and sustainability.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

Restoration measures of this alternative would have no direct or indirect impacts on community and regional growth other than the temporary monetary stimulus associated with construction activities, as described above in connection with the NED RP.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan

Impacts are the same as MB component of the RP.

3.1.6 Tax Revenues and Property Values

HSDRR (NED) Plans

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)

For the nonstructural plan, Parish sales tax revenue would likely increase during the implementation of nonstructural measures as a result of an expected influx of workers and construction expenditures from outside of the area. Construction activities associated with the NED RP would provide jobs and could increase the level of spending, labor, and capital expenditures in the area.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

No direct effects to tax revenues and property values. Indirect effects could include following:

- fee lands acquired by the State would be removed from the ad valorem tax base of local government and no property taxes could be collected on those lands.
- the prevention of land loss could result in localized positive effects of maintaining tax revenues and property values.

Plan M-4 Alternative - Mermentau Small Integrated Restoration Plan

Impacts are the same as the MB component of the RP. Two marsh restoration features (124d - Marsh Restoration at Mud Lake and 3c1 - Beneficial Use of Dredged Material from the Calcasieu Ship Channel) are partially located on USFWS refuge lands. The USACE recommends that USFWS independently seek authorization and appropriation to construct these projects.

3.1.7 Other Social Effects (OSE)

HSDRR (NED) Plans

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)

A summary of OSEs is presented in the Table 3-1. These include reduction in risks associated with damages from hurricane storm surge events to housing units, public facilities, and commercial structures located within areas where the RP is implemented, as well as improvement in the health and safety of those residents living within these and surrounding areas. Depending on participation rates, the overall social vulnerability of all three parishes could be reduced, and thus, the potential for long-term growth and sustainability could be enhanced. These areas could be at a reduced risk of incurring costs associated with clean-up, debris removal, and building and infrastructure repair associated with damage from a hurricane storm surge event.

Table 3-1: Summary of other social effects.

OSE Alternative Evaluation				
Social Factors and Metrics	**Nonstructural Measures**	**CM-4**	**M-4**	**No Action**
	DL / FE	DL / FE	DL / FE	DL / FE
Physical Health/Safety	1/2	1/1	0/0	-1/-2
Regional Healthcare	1/2	1/1	0/0	0/-2
Employment Opportunities	1/3	0/0	0/0	-1/-3
Community Cohesion	1/2	0/0	0/0	-1/-1
Vulnerable Groups	1/1	1/1	0/0	-1/-2
Residents of Study Area	1/1	1/1	0/0	-1/-2
Recreational Activities	1/2	1/2	0/1	-1/-2
Impacts are in comparison to the Without Project Condition DL = impacts to daily life when there is no storm/flooding FE = impacts during a storm/flood event Scores range from -3 (significant negative impact) to +3 (significant positive impact)				

Under the NED RP, tenants would be eligible for certain relocation assistance benefits. While structure owners would not be responsible for eligible costs associated with the nonstructural measures, (see Appendix L for a description of eligible costs), they would be responsible for ineligible costs associated with the structure elevation, including temporary relocation costs and any costs for moving out of the eligible structure during construction of the nonstructural measure. (See Chapter 4 and Appendix L for more information about the benefits of and the eligible and ineligible costs associated with the nonstructural plan.) The ability of lower income groups to participate in the Project could be impacted by these out of pocket expenses including the costs associated with temporary relocation during structure elevation, and any additional costs that would be required in order to meet the Project eligibility criteria, (i.e., costs associated with any necessary structural repair or asbestos abatement). This could potentially offset, to some degree, the reduction in overall social vulnerability at least in lower income communities.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

This alternative would reduce the adverse impacts to OSE associated with continued land loss, habitat fragmentation and degradation, especially with regard to the vulnerability of existing transportation (navigation and roads), oil and gas infrastructure, and recreational and commercial fishing opportunities. In the short-term the area's social vulnerability would be reduced, to some extent, by increasing wetland EFH habitat for aquatic species associated with recreational and commercial fishing. In addition, the proposed action would increase marsh-related leisure and recreational and commercial fishing opportunities thereby having a positive localized economic impact. The long-term benefits of marsh restoration, shoreline protection, bank stabilization, and chenier reforestation would improve wetland and chenier habitats which would subsequently improve or slow the loss of leisure and recreation opportunities and contribute to regional economic growth and sustainability.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan

Impacts are the same as the MB component of the RP.

3.1.8 Community Cohesion

HSDRR (NED) Plan

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)

Direct impacts that would disrupt community cohesion, temporarily, include the noise and fugitive dust from construction activities, the temporary displacement and relocation of residents during construction, and

disruption of businesses during construction. Furthermore, non-residential structures that serve as meeting places for the community could become temporarily unavailable during Project implementation.

Indirect impacts for the nonstructural plan would include reduced risk of hurricane storm surge-related damages for lower-lying structures within communities, thus preserving community cohesion in the region. Other indirect impacts include improvements to pedestrian and handicap access not only to homes, but also to community facilities benefiting from nonstructural measures.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

There would be no direct impacts on community cohesion. Indirect impacts would include maintaining the integrity of the coastal landscape that supports ecosystem services that in turn supports human population and activities.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan

Impacts are the same as the MB component of the RP.

3.1.9 Environmental Justice

HSDRR (NED) Plans

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)

An EJ analysis was conducted which focused on the potential for disproportionately high and adverse impacts to minority and low-income populations during the construction and normal operation of the proposed nonstructural risk-reduction measures. EJ communities, as defined by minority composition and percent of population existing at or below the federal poverty level, have been identified within the Project area.

As discussed in greater detail in Appendix A, Annex O, low-income and minority populations within the Project area were assessed using up-to-date economic statistics, aerial photographs and U.S. Census Bureau 2007-2011 ACS estimates. Based on the analysis described in Appendix A, Annex O, the NED RP would not cause any disproportionate adverse impacts to minority or low-income residents within the Project or study area.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

Many of the areas in which these activities will occur are sparsely populated or devoid of permanent structures and/or population. Access to some areas due to marsh restoration and nourishment activities may be temporarily interrupted. Impacts due to shoreline protection construction would also be temporary. Temporary impacts from construction activities due to increased turbidity, noise, and access interruption are compensated for by the opportunity for long-term positive cumulative impacts as other restoration programs improve the habitat and sustainability of coastal Louisiana. The long-term benefits of marsh restoration, shoreline protection, bank stabilization, and chenier reforestation would improve wetland habitat which would subsequently improve leisure and recreation opportunities to all residents of the area. The proposed action would have no disproportionate adverse impacts on minority and low-income populations.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan

The proposed action would have no disproportionate adverse impacts on minority and low-income populations.

3.2 Water Environment (Hydrology and Hydraulics)

3.2.1 Flow and Water Levels

HSDRR (NED) Plan

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)

The total level of impact would be relatively minor and would be dependent on the combination of nonstructural methods used and the participation rate in the Project. Potential direct and indirect impacts to flow and water depend on the method used. For example:

- Raising structures with pilings could increase storage capacity and lower surge elevations for those structures not elevated.
- Localized storm surge risk reduction measures could decrease storage capacity and raise the surge elevations for those nearby structures that are not elevated.
- Raising structures with a cinderblock chain wall would have similar impacts as existing conditions on storage capacity and surge elevations since it would mimic existing conditions of the structure.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

Marsh Restoration: Existing fragmented marsh and shallow open water areas would be restored to marsh habitat. Temporary containment/exclusion dikes would temporarily prevent local flows from coming into and over marsh restoration site during construction activities. However, temporary containment/exclusion dikes would naturally degrade or would be degraded to provide hydrologic exchange following dewatering and consolidation of dredge sediment slurry. Consequently, these changes would not cause water levels in adjacent lakes to permanently alter flows or water levels.

Shoreline Protection: Segmented breakwaters along the Gulf would dissipate the high energy Gulf waves without changing water levels or flows. Rather, these structures would provide conditions conducive to land building behind them. Interior shoreline protection measures will not alter flows or water levels. Rather, these structures will reduce erosion caused by waves.

Chenier Reforestation: No direct or indirect impacts.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan

Impacts are the same as MB component of RP.

3.2.2 Water Quality and Salinity

HSDRR (NED) Plans

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)

No direct impacts to water quality or salinity by implementing any of the nonstructural risk reduction measures. Construction would use the best practical techniques and BMPs to avoid potential adverse impacts. Construction impacts to runoff would be minimized through implementation of a Stormwater Pollution Prevention Plan (SWPPP) (USEPA 2012).

Indirect Impacts: Elevating and flood proofing structures, as well as protecting warehouses with localized storm surge risk reduction measures, would prevent them from being flooded, which would reduce water quality impacts associated with flooding from storm surge events that exists under the FWOP conditions.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

Marsh Restoration and Shoreline Protection: Direct impacts of marsh restoration and shoreline protection measures would include protection and restoration of existing open water, fragmented and degrading wetlands to transitional estuarine marsh and shoreline protection. Construction activities, hydraulic dredging and placement of dredged sediments and other fill materials could result in the following localized and temporary impacts to water quality including: reduction of water clarity; change in color; reduction in the pH of receiving area waters toward more acidic conditions; emission of reduced sulfur compounds including hydrogen sulfide often characterized as an objectionable rotten-egg smell; release of organic material with varying quantities of ammonia, nitrogen, and phosphorus compounds which could stimulate growth of algae and other aquatic plants. The factors responsible include increased turbidity, increased suspended sediments, and organic enrichment, chemical leaching, reduced dissolved oxygen, and elevated carbon dioxide levels, among others. Tidal currents present in the Project measure areas would serve to disperse and thereby dilute localized changes. Following construction, pH levels, water clarity, color, emissions of sulfur compounds, and release of organic material, ammonia, nitrogen, phosphorus compounds, turbidity, organic enrichment, dissolved oxygen, and

carbon dioxide levels in the area would return to those observed prior to measure construction. Any such impacts would be minimized and controlled by the use of the best available practical techniques and BMPs. The proposed action would have no significant long-term adverse impacts to water chemistry. Because rock, fill, and construction materials for proposed shoreline protection measures are anticipated to be free of contaminants, discharge of these materials into existing adjacent waters is not expected to result in adverse effects to aquatic organisms. During marsh restoration, effluent from the dredge discharge pipe would be directed to adjacent fragmented marsh for nourishment. Material proposed for construction of marsh restoration and shoreline protection has been evaluated to determine suitability for placement in the aquatic environment in accordance with Clean Water Act Section 404(b)(1). Dredging borrow from the CSC would occur during regularly scheduled maintenance events. Hence, water quality and salinity impacts at the CSC borrow sites would be the same as those described under future without Project conditions. The depths of borrow pits in the Gulf would be limited to the area of wave penetration. There is no expectation of low dissolved oxygen in the borrow pits due to designs that will control depth, shape and location in the existing wave/wind climate. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts.

Indirect impacts of marsh restoration and shoreline protection include water quality improvements as restored and nourished marsh would trap sediments and nutrients helping to maintain or improve local water quality. Sediments and dredge effluent taken from off-shore borrow areas (see Appendix K Fact Sheets) and placed at interior marsh restoration (disposal) areas may have higher salinities compared to the saline marsh restoration sites. However, any differences would likely be minimal and the dredged effluent and higher saline borrow sediments would rapidly desalinate to those ambient salinity conditions following dewatering and consolidation of sediments. Borrow areas would be configured so that stratification would be minimized by orienting the long axis of each borrow area parallel to the Gulf shoreline and with side slopes no steeper than 4(H):1(V). Borrow material has been evaluated to determine suitability for placement in the aquatic environment in accordance with Clean Water Act Sections 401 and 404(b)(1) and are anticipated to be free of contaminants. Discharge of these materials into waters would not be expected to result in adverse contamination effects to aquatic organisms. Indirect impacts regarding ecosystem restoration measures could lead to water quality improvements through the restoration and protection of wetland and chenier habitats.

Chenier Reforestation: Water quality impacts of these measures would be minimal, if at all, as these features are located on chenier ridges and removed from nearby waters.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan
Impacts are the same as the MB component of the NER RP.

3.3 Natural Environment
3.3.1 Sedimentation and Erosion
HSDRR (NED) Plans
Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)
There would be no direct or indirect impacts.

Ecosystem Restoration (NER) Plans
Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)
Marsh Restoration: Increased marsh surface area would increase sediment entrapment when marshes are flooded (e.g., tidal and storm surge). Restored marsh would reduce fetch over open water areas thereby reducing wind generated waves and subsequent erosion. Previous STWAVE modeling performed in 2012 for the Louisiana Coastal Area – Stabilize Shoreline at Point Au Fer Island Project indicated that offshore borrow areas and access channels would not be expected to significantly increase wave energy or erosion processes. Detailed modeling of specific borrow areas proposed for this study would be conducted during the PED phase.

Shoreline Protection: Sedimentation patterns in the vicinity of the measures would be altered. Sediment deposition and/or erosion would occur depending on the hydrodynamics at the site. For example, the location and

orientation of individual measures could cause erosion and/or sediment accretion. Shoreline erosion adjacent to the measures would likely be reduced. Longshore sediment transport in the vicinity of the shoreline protection measures in the Gulf of Mexico may result in the accumulation of sediment behind breakwater measures, creating salients or tombolos. No detrimental changes in longshore sediment transport processes are anticipated to occur from the construction of the four offshore breakwater measures (5a, 6b1, 6b2, and 6b3). Edwards (2006) examined breakwaters at Holly Beach that have caused sediment deposition, specifically low tide tombolos. Analysis of survey data and tracer data indicated that the beach/breakwater system is in a state of dynamic equilibrium at high tide, and static equilibrium at low tide. Measure 5a would extend from the western CSC jetty to the existing breakwaters of the Holly Beach Sand Management (CS-31) project. The introduction of sands for the Cameron Parish Shoreline Restoration (CS-33) project increased the sediment budget for this area, so that downstream (longshore) sediment starvation is not expected to be a problem. Additionally, the existing jetty and shipping channel already disrupt the littoral sediment transport in this area from the east. The area immediately west of the CSC jetty has been used as a single point discharge for maintenance dredging sediment from the jetty channel. Its probable continued use as such in the future should also help to further offset down current sediment starvation caused by the jetty. Measures 6b1, 6b2, and 6b3 would be constructed offshore from the Gulf of Mexico shoreline of Rockefeller Refuge, which is fine-grained marsh sediment, with a veneer of shell hash. The fine-grained sediment does not contribute to the littoral sediment transport. All offshore breakwater measures are expected to reduce shoreline erosion rates by approximately 50% based on previous experiences with this type of structure at Holly Beach and other nearby areas.

Chenier Reforestation: Tree roots bind sediments together and would likely reduce erosion of cheniers if the Cheniers are overtopped during storm events or by rising sea levels. Trees would likely reduce storm surge and subsequent erosion of adjacent marshes.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan
Impacts are the same as the MB component of the RP.

3.3.2 Soils, Water Bottoms, and Prime and Unique Farmlands

HSDRR (NED) Plans

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)
Although there could be some minor direct and or indirect impacts on soils due to nonstructural elevation, flood proofing and construction of small localized storm surge risk reduction measures, nonstructural measures would be implemented in residential and non-residential commercial areas where soils have been previously disturbed and the best available practical techniques and BMPs would be used during construction to avoid, minimize and reduce potential direct and indirect impacts to soils, water bottoms and prime and unique farmlands. There would be no direct or indirect impacts associated with nonstructural measures on prime and unique farmlands or water bottoms.

The PDT anticipates that only a small amount of borrow would be needed for construction of the localized storm surge risk reduction measures for each warehouse being accomplished by separate task order. Based on this conclusion, it is foreseeable that commercial borrow sites would be used. As of the date of this Report, there are several commercial borrow sites within the project area that are readily available. Real Estate regulations (ER. 405-1-12, paragraph 12-9d(3)) allow for small quantities of borrow material to be supplied by the construction contractor through the use of readily available commercial sites, if supported by an analysis conducted by the Government and the NFS, and if no other constraints exist. Since it has been determined that each IDIQ task order will address a single warehouse, for purposes of this Final Report, it has been assumed that the analysis performed pursuant to the above cited ER 405-1-12 will determine that the required borrow quantities constitute a small quantity that can be obtained through a commercial site that meets the Project requirements. Prior to issuing a construction task order, the Government will conduct the necessary analysis in accordance with ER 405-1-12. Contractors would be required to demonstrate that any proposed commercial borrow site is environmentally cleared and contains geotechnically suitable borrow material. In evaluating the suitability of the proposed commercial borrow site, impacts to wetlands or bottomland

hardwoods would be prohibited. Costs of utilizing a commercial borrow site would be considered an item of construction cost, and not an item of LERRD cost.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

Marsh Restoration: Marsh restoration measures would include the use of dredged material from the Calcasieu Ship Channel and the Gulf of Mexico (Gulf) for the restoration and nourishment of marsh. Hydric soils in the marsh restoration areas consist primarily of Bancker muck, Creole mucky clay, Scatlake mucky clay, Larose mucky clay; and less frequently Allemands mucky peat, Clovelly muck, and Mermentau clay (Table 3-2).

Table 3-2: Hydric soils in marsh restoration areas.

Soil Association	Acres
Allemands mucky peat (AE)	40
Bancker muck (BA)	4,747
Clovelly muck (CO)	142
Creole mucky clay (CR)	3,481
Larose mucky clay (LR)	503
Mermentau clay (MM and ME)	24
Scatlake mucky clay (SC)	1,327

Impacts to hydric soils from the restoration and nourishment of marsh would be beneficial. As marsh is restored, hydric soils would increase and become more stable. Direct impacts to water bottoms in the marsh restoration footprints in Calcasieu and Mermentau Basins would result in the restoration of existing water bottom habitat to marsh habitat. The containment dikes would naturally degrade over time, resulting in the restoration of water bottom habitat to marsh habitat. Borrow areas to provide sediment for the restoration and nourishment of the marsh areas would result in direct impacts to water bottom habitat topography. Soils associated with prime and unique farmlands are most common on chenier ridges, and none of these soils were identified in the marsh restoration areas. There would be no direct impacts to prime and unique farmlands as a result of the restoration and nourishment of marsh areas. The restoration and nourishment of marsh could result in an indirect impact that could be beneficial to soils identified as prime and unique farmlands. The restoration of marsh could contribute to flood attenuation from small storm events and could prevent future loss of prime and unique farmland soils that may be present on nearby chenier ridges. See Table 2-17 (Chapter 2) for a listing of each marsh restoration measure with total acres of temporary and permanent impacts to water bottom habitat.

Shoreline Protection: The Holly Beach Shoreline Stabilization - Breakwaters measure (5a) would include placement of rock breakwaters, resulting in direct impacts to water bottoms in the Gulf of Mexico. The Gulf shoreline restoration Calcasieu River to Freshwater Bayou measures would be constructed in three segments (6b1, 6b2, and 6b3), resulting in direct impacts to water bottoms in the Gulf of Mexico. Measure 16b (Fortify Spoil Banks of GIWW and Freshwater Bayou) would consist of bankline protection with rock dikes along three separate reaches of Freshwater Bayou, resulting in direct impacts to water bottoms in Freshwater Bayou. The potential for unintended adverse consequences, such as alteration of sedimentation patterns, associated with shoreline protection measures has been determined not to be significant. In addition, all shoreline protection measures would include construction of "fish dips" to allow for ingress and egress of aquatic organisms. In all shoreline protection measures, soft surface water bottoms would be replaced with rock resulting in indirect impacts to aquatic habitat along the shorelines. Additionally, the dredging of floatation canals and associated disposal areas would result in temporary direct impacts to 4,042 acres of water bottom habitat. Hydric soils could be directly impacted during the placement of stone breakwaters and rock dikes, but long term indirect impacts would include the prevention of further erosion and loss of these soils, and potentially an increase in hydric soils along the Gulf shoreline. See Table 2-17 (Chapter 2) for a listing of each shoreline protection measure with total acres of temporary and permanent impacts to water bottom habitat.

Soils associated with prime and unique farmlands are most common on chenier ridges, and none of these soils were identified in the vicinity of the Gulf shoreline restoration or Freshwater Bayou measures. Approximately 549 acres of Hackberry loamy fine sand, classified as a prime farmland soil, is located along the shoreline adjacent to the Holly Beach shoreline stabilization measure. The 549 acres of prime farmland soils along the shoreline at Holly Beach would not be directly impacted by the placement of the rock breakwaters, nor would any other prime and unique farmlands be directly impacted or removed from agriculture use by the shoreline protection measure of the RP. Indirect impacts to this area of prime farmland soil would include a reduction in erosion and loss of the prime farmlands. Over time, tomobolo or sandbars could form between the breakwaters and existing beach resulting in the direct conversion of water bottom habitat. Edwards (2006) examined breakwaters at Holly Beach that have caused sediment deposition, specifically low tide tombolos. Analysis of survey data and tracer data indicated that the beach/breakwater system is in a state of dynamic equilibrium at high tide, and static equilibrium at low tide.

Chenier Reforestation: A total of 578 acres of hydric soils were identified along the cheniers. Reforestation of the cheniers would stabilize soils and could prevent future erosion and loss of hydric soils. Therefore, the direct and indirect impacts to hydric soils on the cheniers would be beneficial. No water bottoms were identified on the cheniers, so there would be no direct or indirect impacts to water bottoms as a result of chenier reforestation. Soils that are suitable for agriculture and pastureland in the Chenier Plains are most commonly located on the chenier ridges. Approximately 514 acres of soils classified as prime farmlands, consisting entirely of Hackberry loamy fine sand, are present along the chenier ridges that are proposed for reforestation under this alternative. The reforestation of the chenier ridges would remove these areas and identified prime farmlands from future agricultural use. In compliance with the Farmland Protection Policy Act (FPPA), the USACE consulted with the Department of Agriculture NRCS to determine the precise acreage of prime and unique farmlands that would be impacted. It was determined that the proposed activities would not irreversibly impact prime farmlands and is exempt from the rules and regulations of the FPPA, Subtitle I of Title XV, Section 1539 – 1549 (NRCS letter dated December 13, 2013). (See Appendix A, Annex E).

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan
Impacts are the same as the MB component of the RP.

3.3.3 Coastal Shorelines

HSDRR (NED) Plans

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)
No impacts as the NED areas are far removed from the Gulf coastal shoreline.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)
Marsh Restoration: Only measure 124c (Marsh Restoration at Mud Lake) would occur in proximity to the Gulf shoreline. Construction of this measure would require temporary placement of dredge pipeline so that dredged material may be pumped from the Gulf borrow site to the marsh restoration sites. This would result in temporary and minor disturbance to the shoreline resources such as the nearshore, beach and dune as a designated pathway for placement of the dredge pipeline resulting in the temporary unavailability of this small area until this construction activity is completed. Following construction, the best available practical techniques and best management practices (BMPs) would be used to restore the shoreline to pre-construction conditions.

Shoreline Protection: Proposed segmented breakwaters are expected to eliminate or substantially reduce erosion of the gulf shoreline, but would not directly affect hydrology or salinity levels since the openings between the breakwater segments would allow free passage of water. The potential for unintended adverse consequences, such as alteration of sedimentation patterns, associated with shoreline protection measures has been assessed and determined not to be significant. In addition, all shoreline protection measures would include construction of "fish dips" to allow for ingress and egress of aquatic organisms. Edwards (2006) examined breakwaters at Holly Beach that have caused sediment deposition, specifically low tide tombolos. Analysis of survey data and tracer data indicated that the beach/breakwater system is in a state of dynamic equilibrium at high tide, and

static equilibrium at low tide. Indirectly, the breakwaters would help to maintain existing salinity and hydrology in the marshes and water bodies behind the shoreline, which could otherwise be altered by continued erosion. In the MB there are numerous canals and natural bayous and ponds that lie inland of the Gulf shoreline. The Gulf shoreline restoration measures Calcasieu River to Freshwater Bayou Measures (6b1, 6b2, and 6b3) would prevent new openings from forming between the Gulf and these inland water bodies.

Chenier Reforestation: Several of the chenier restoration projects would occur in close proximity to the Gulf shoreline. It is possible that some construction equipment may be delivered by barge from the Gulf to access the chenier ridges to perform restoration activities. In such cases, there would be minor, localized, temporary adverse impacts, including loss of vegetation cover and displacement of shoreline sediments. Following reforestation efforts, the best available practical techniques and best management practices (BMPs) would be used to restore the shoreline to pre-construction conditions.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan
Direct and indirect impacts are the same as MB impacts of RP.

3.3.4 Vegetation Resources

HSDRR (NED) Plans

Modified Plan 8 Alternative – Nonstructural 0-25-Year Floodplain Plan (RP)
Implementation of the NED RP takes place at residential and commercial sites that have been previously disturbed. There could be some direct or indirect impacts to existing vegetation resources, such as landscaping vegetation, during construction of nonstructural measures. Best available practical techniques and BMPs would be used to avoid impacts vegetation resources.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative – Comprehensive Small Integrated Restoration Plan (RP)
The RP would restore/nourish/protect acreage in the CSB and the MB.

Marsh Restoration: These measures would restore and/or nourish saline marsh and brackish marsh in both the CSB and the MB. Of these totals, saline marsh and brackish marsh would be temporarily impacted in the CSB and the MB from access required for borrow deposition. See Table 2-17 (chapter 2) for linear feet and acres of dredge pipeline access and flotation channels. These areas would be restored to pre-construction conditions following completion of the restoration activities. Restored/nourished marsh would regenerate and revegetate naturally from seed sources and vegetative sources in the area and contribute to reducing the overall habitat fragmentation in the area as well as provide many different species of fish and wildlife with shelter, nesting, feeding, roosting, cover, nursery, and other life requirements habitat. These marsh habitats would also provide neotropical migrants with essential staging and stopover habitat (Stoffer and Zoller 2004, Zoller 2004). Based on previous coastal restoration actions, it is expected that invasive species would not occur on restored coastal marsh platforms unless the elevation of the marsh platform is too high (i.e., upland-like conditions when tallow trees could invade). See table 2-17 (Chapter 2) for quantities of acres of marsh restored and nourished.

Coastal Restoration Projects Impacted by NER RP Measures: The NER RP measures would be constructed in the immediate vicinity of existing coastal restoration projects See Figure 3-1 for a depiction of existing coastal restoration projects listed in Table 3-4. Specific NER RP marsh restoration measures that could impact existing restoration projects include:

- Marsh Restoration Measure 3c1 (Figure 3-2) is immediately adjacent to Project CS-54 (Cameron-Creole Watershed Grand Bayou Marsh Creation).
- Marsh Restoration Measure 124c (Figure 3-3) would is immediately adjacent to Project CS-59 (Oyster Bayou Marsh Creation and Terracing).

Due to the close proximity of construction, the proposed NER RP measures would be constructed to avoid existing coastal restoration projects by construction of temporary containment/exclusion dikes that would

contain dredged borrow sediments used for construction of the NER RP measure and also prevent dredged effluents from entering the existing coastal restoration project sites. Temporary containment/exclusion dikes would be allowed to degrade naturally to restore connectivity with surrounding areas or they would be degraded by this Project's non-Federal Sponsor in the third year following completion of construction, whichever first occurs. Following completion of marsh restoration, the NER RP measures and existing restoration projects would synergistically interact to provide higher quality transitional marsh habitats in the area

Mitigation Projects Impacted by the NER RP Measures: Mitigation projects (e.g., the creation of marsh and marsh terraces) are designed and constructed to offset anticipated losses from permitted activities. In some instances, NER RP measures would overlap and impact existing mitigation projects. When overlap occurs, NER measures would not be constructed until the mitigation projects satisfy their permitted obligations (see Chapter 4 for NER measure implementation details). Mitigation Manger Kelley Templet with the LADNR, Office of Coastal Management, identified for the PDT existing mitigation projects in the study area constructed by various companies (e.g., oil and gas, Union Pacific, and others) and are designed and constructed to offset unavoidable anticipated losses to wetlands from permitted activities. Figure 3-4 depicts the location of mitigation projects in the area. In most instances, these mitigation projects were developed to provide a sustainable buffer from wave action and storm surge generated by tropical storm and hurricane events. Where overlap occurs, proposed NER RP measures would not be constructed until the mitigation projects satisfy their permit obligations. The permitted mitigation projects, the anticipated expiration date of the mitigation permit, and the specific NER RP measure that would overlap some portion of the permitted mitigation project is provided in Table 3-5. Impacts to the mitigation projects would be avoided by tiering construction of NER RP features until after the mitigation permit obligations have been satisfied.

Shoreline Protection: These measures would protect barrier island habitat in the CSB and saline and brackish marsh in the MB. These shoreline protection measures would restore an important geomorphic framework for preventing further fragmentation and loss of interior wetlands used as habitat by many different species of fish and wildlife. See table 2-17 (Chapter 2) for quantities of length and project details associated with each shoreline protection measure. The NER RP shoreline protection measure 5a (Holly Beach Shoreline Stabilization-Breakwaters) would be located immediately offshore of the projects CS-31 (Holly Beach Sand Management) and CS 33 (Cameron Parish Shoreline). Construction of Measure 5a would work synergistically with these existing restoration projects by providing additional protection to inland marsh resources.

Chenier Reforestation: Measures would reforest chenier forests in the CSB and MB. Measure CR is a series of chenier ridge reforestation features located along existing chenier ridges situated within Cameron and Vermilion Parishes (see NER Fact Sheets Appendix K). Reforestation would help ensure the viability of the cheniers into the future thereby offering continued natural protection to sensitive chenier areas. The measure would consist of invasive species control and planting native species seedlings to achieve a 50 percent canopy cover. Prior to planting, an application of 64 ounces of Clearcast® would be sprayed over the top of hardwoods to control invasive species, primarily Chinese tallow (*Triadica sebifera*), if needed. Typical invasive plants that may be eliminated or controlled but are not limited to this list are Chinese tallow, Chinese privet, cogon grass, Johnsongrass, Japanese privet, Japanese honeysuckle, common ragweed, rescuegrass, sticky chickweed, purple nutsedge, and mimosa trees. However, invasive species are presently limited on the cheniers due to ongoing farming activities. It is not anticipated that the use of the herbicide would result in any adverse impacts to water quality resources.

Up to 50 percent of the measure acreage would be planted with live oak (*Quercus virginiana*) and hackberry (*Celtis occidentalis*). Bare-root seedlings would be planted on 10x10-foot spacing (435 trees per acre), which assumes 57% survival. For a given planting, a minimum of 250 seedlings/saplings per acre must be present (with a 60 to 40 hard mast to soft mast ratio) at the end of the fourth year (i.e., Year 5) following successful attainment of the one year survivorship criteria. Trees established through natural recruitment may be included in this tally; however, no less that 125 hard mast-producing seedlings per acre must be present. Surviving hard mast seedlings must be representative of the species composition and percentage identified in this Plan. Exotic/invasive species may not be included in this tally. By Year 5 (four years following successful attainment

of the one-year survivorship criteria) the perimeter would be virtually free (approximately 5% or less on an acre-by-acre basis) of exotic/invasive vegetative species.

Fencing would be installed to exclude cattle and reduce deer herbivory. Fencing would be 7.5 feet tall, and fence posts would be installed in concrete with a small tractor using an auger bit and portable cement mixer. Approximately 150,000 linear feet of fencing would be required, however fencing would not be required for the CR-509c and CR-509d measures, since they are located in a remote area along the coast where there is currently no cattle grazing.

The developing plant community must exhibit characteristics and diversity indicative of a viable native forested chenier. The proposed reforestation would provide critical stopover habitat for migratory neotropical birds. See table 2-17 (Chapter 2) for planting details associated with the chenier reforestation feature. The proposed reforestation would provide critical stopover habitat for migratory neotropic birds. Typical invasive plants that may be eliminated or controlled but are not limited to this list are Chinese tallow, Chinese privet, cogon grass, Johnsongrass, Japanese privet, Japanese honeysuckle, common ragweed, rescuegrass, sticky chickweed, purple nutsedge, and mimosa trees. However, invasive species are presently limited on the cheniers due to ongoing farming activities.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan
Impacts are the same as the MB component of the RP.

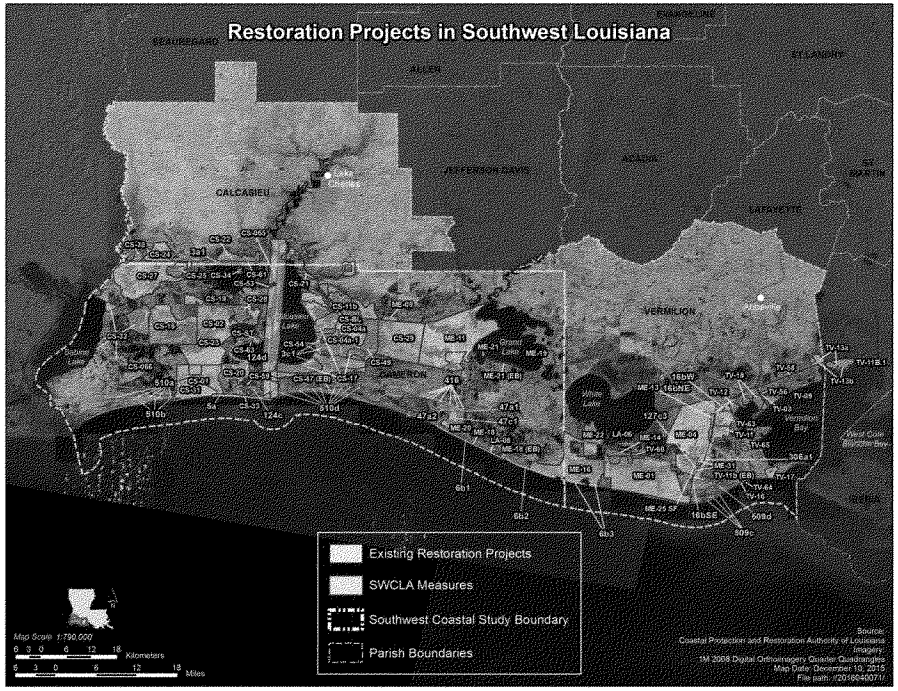


Figure 3-1. Ecosystem Restoration Activities and proposed NER RP Projects in Southwest Coastal Louisiana Project Area.

JA 37-899 10/04/2019 114

Table 3-4. List of Ecosystem Projects Displayed in Figure 3-1. (*projects would be impacted/benefitted by the NER RP measures)

CS-01 Holly Beach Breakwaters Project CS-02 Rycade Canal Marsh Management CS-04a Cameron-Creole Maintenance CS-04a-1 Cameron-Creole Structure Automation CS-11b Sweet Lake/Willow Lake Hydrologic Restoration CS-17 Cameron Creole Plugs CS-18 Sabine National Wildlife Refuge Erosion Protection CS-19 West Hackberry Vegetative Planting Demo CS-20 East Mud Lake Marsh Management CS-21 Highway 384 Hydrologic Restoration CS-22 Clear Marais Bank Protection CS-23 Replace Sabine Refuge Water Control Structures CS-24 Perry Ridge Shore Protection CS-25 Plowed Terraces Demonstration CS-27 Black Bayou Hydrologic Restoration CS-28-1 Sabine Refuge Marsh Creation, Cycle 1 CS-28-2 Sabine Refuge Marsh Creation, Cycle 2 CS-28-3 Sabine Refuge Marsh Creation, Cycle 3 CS-28-4-5 Sabine Refuge Marsh Creation, Cycles 4-5 CS-29 Black Bayou Culverts Hydrologic Restoration CS-30 GIWW - Perry Ridge West Bank Stabilization *CS-31 Holly Beach Sand Management (impacted by NER RP Measure 5a) CS-32 East Sabine Lake Hydrologic Restoration *CS-33 Cameron Parish Shoreline Restoration (impacted by NER RP Measure 5a) CS-34 Marcantel Supplemental Beneficial Use Disposal Area CS-47 Trosclair Road Repairs CS-49 Cameron-Creole Freshwater Introduction CS-53 Kelso Bayou Marsh Creation	CS-53 Kelso Bayou Marsh Creation *CS-54 Cameron-Creole Watershed Grand Bayou Marsh Creation (impacted by NER RP Measure 3c1) *CS-59 Oyster Bayou Marsh Creation and Terracing (impacted by NER RP Measure 124c) CS-61 Brannon Ditch CS-63 Sabine Shellbank Stabilization CS-65 Calcasieu Ship Channel Salinity Controls CS-66 Cameron Meadows Marsh Creation and Nourishment CS-BL Blind Lake CS-ST Sabine Terraces LA-06 SP Foundation Improvements Demo LA-08 Bio-Engineered Oyster Reef Demo ME-01 Pecan Island Freshwater Introduction ME-04 Freshwater Bayou Wetland Protection ME-09 Cameron Prairie National Wildlife Refuge Shoreline Protection ME-11 Humble Canal Hydrologic Restoration ME-13 Freshwater Bayou Bank Stabilization ME-14 Pecan Island Terracing ME-16 Freshwater Introduction South of Highway 82 ME-18 Rockefeller Refuge Gulf Shoreline Stabilization ME-19 Grand-White Lakes Landbridge Protection ME-20 South Grand Chenier Marsh Creation ME-21 Grand Lake Shoreline Protection ME-22 South White Lake Shoreline Protection ME-25 Marsh Creation Near Freshwater Bayou ME-31 Freshwater Bayou Marsh Creation	TV-03 Vermilion River Cutoff Bank Protection TV-09 Boston Canal/Vermilion Bay Bank Protection TV-11 Freshwater Bayou Bank Protection TV-11b Freshwater Bayou Bank Stabilization TV-11b.1 Acadiana Gulf of Mexico Access Channel TV-12 Little Vermilion Bay Sediment Trapping TV-13a Oaks/Avery Canal Hydrologic Restoration, Increment 1 TV-13b Oaks/Avery Structures TV-16 Cheniere Au Tigre Sediment Trapping Demonstration TV-17 Lake Portage Land Bridge TV-18 Four Mile Canal Terracing and Sediment Trapping TV-56 Four-Mile Canal Storm Surge Reduction Construction TV-58 Boston Canal TV-60 Front Ridge Chenier Terracing/Protection TV-63 Cole's Bayou Restoration TV-64 Cheniere au Tigre TV-65 Rainey Audubon Wildlife Sanctuary Earthen Terraces

JA 37-899 10/04/2019 115

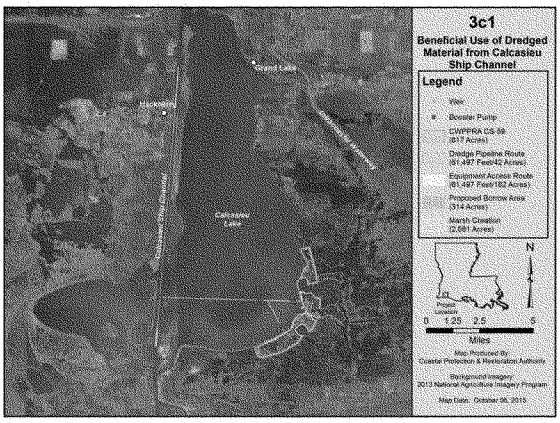


Figure 3-2. NER RP Measure 3c1 Adjacent to CWPPRA Project CS-54 Cameron Creole Watershed

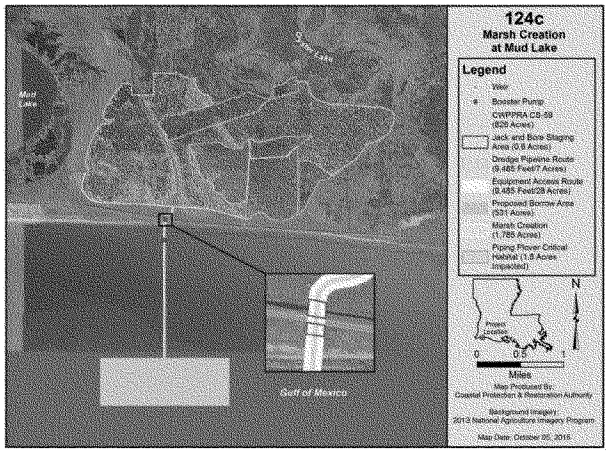


Figure 3-3. NER RP Measure 124c Adjacent to CWPPRA CS-59 Oyster Bayou Restoration

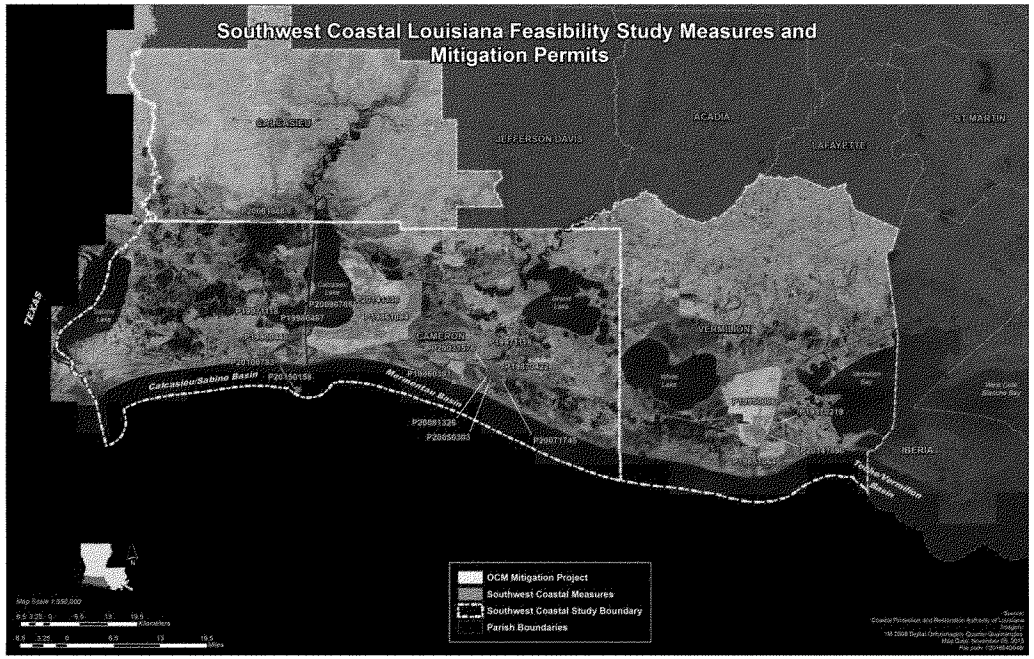


Figure 3-4. Permitted Mitigation Projects and Southwest Coastal Louisiana Study Measures

JA 37-899 10/04/2019 117

Table 3-5. Existing Mitigation Projects Impacted by NER RP Measures

Permit #	Description	NER RP Feature	Permittee or Owner	Expiration Date (permit completion date + 20 years)*	Mitigation Project Description
Tier I Features					
P20061888	Terraces at GIWW N of Black Lake	3a1	Gulfport Energy Corporation	11/30/2032	Proposed construction of 5,358 linear ft of terraces south of the GIWW and north of Black Lake.
P19900448	Marsh Management Plan area	124d	Apache Louisiana Minerals	11/13/2016	Install and maintain water control structures for CTU 1 and 2. In CTU 1, 64,000 linear ft of smooth cordgrass plantings. In CTU 2, 32,470 linear ft of boundary levee are to be repaired. Various water control structures are to be repaired or replaced.
P19971118	West Cove Planting Project	124d	Union Pacific Resources	7/28/2022	West Cove Planting Project; 5,000 ft of plantings of *Spartina alterniflora.*
P19950086	Marsh Management Plan area	127c3	Vermilion Corporation	4/1/2021	Eight water control structures will be installed; a riprap levee will be constructed; five double flapgated culverts and one earthen plug will be installed; two earthen plugs will be constructed.
Tier II Features					
P20141590	Spoil Placement	306a1	Hilcorp Energy Company	4/8/2040	Dredging of 15,430 cubic yards of native material to construct slip for the purpose of installing a drill rig, well protector and pilings. The dredged material will be pumped into a shallow pond adjacent to the proposed drill site using a temporary discharge pipe. An additional 301 cubic yards of material will be displaced to construct containment berms.
Tier III Features					
P20141138	Rip-rap Grand Bayou	3c1	CPRA	1/29/2040	Installation of 21,000 tons of riprap along the Calcasieu Lake Shoreline near the Peconi, Mangrove and Grand Bayou water control structures.
P19870422	Marsh Management Plan area	47a2	T. Bonsall	2/3/2023	Construction of a levee and multiple water control structures (South of Upper Mud Lake).
P20031576	Mitigation for P20031304	47a2	Kash Oil & Gas, Inc.	3/31/2029	Constructed 4,803 linear feet of terraces and planted with *Spartina alterniflora.*
P20081326	Mitigation for P20080132	47a2	PetroQuest Energy, L.L.C.	11/25/2033	Construct and plant 2,897 linear ft of wave dampening terraces that will capture re-suspended sediments and protect fragile shorelines by planting plugs of smooth cordgrass on both sides of constructed terraces.
P20071745	Mitigation for 20070883	47c1	Manti Operating Company	3/5/2025	Construction of ten 500-foot terraces, eight 300-foot terraces, two 200-foot terraces and eight 400-foot terraces (6.1 acres). Plantings of *Spartina alterniflora* rows on each side of the terraces.

*Expiration Date: if permit completion date is greater than 20 years, then implementation of measure would be similarly delayed.

3.3.5 Wildlife Resources

HSDRR (NED) Plans

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)

No significant impacts to most wildlife resources except commensal vermin (e.g., rats, mice, pigeons, etc.) that thrive in association with human habitations and, which, typically disrupt the natural habitats

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

Marsh Restoration: Shallow open water would be restored to brackish marsh and saline marsh in the CSB, and open water would be restored to brackish marsh in the MB. Additional nourishment could occur adjacent to the marsh restoration sites. The CEMVN has determined that the proposed action "may affect but will not likely adversely affect" the Sprague's pipit and would have no effect on the red-cockaded woodpecker or critical habitats and would not adversely impact other species of concern that could potentially be found in the Project area. See table 2-17b (Chapter 2) for feature details associated with each marsh restoration measure.

The proposed restoration/nourishment in these basins would result in improved habitat conditions for several species of wildlife including migratory and resident waterfowl, shorebirds, wading birds, and furbearers. Migratory waterfowl utilizing the area would benefit from a greater food supply resulting from the increased abundance and diversity of emergent and submerged species. Habitat for the resident mottled duck would also improve considerably as the marsh platform would provide more desirable nesting habitat. Intertidal marsh and marsh edge would also provide increased foraging opportunities for shorebirds and wading birds. Small fishes and crustaceans are often found in greater densities along vegetated marsh edge (Castellanos /and Rozas 2001, Rozas and Minello 2001), and many of those species are important prey items for wading birds such as the great blue heron, little blue heron, great egret, black-crowned night-heron, and snowy egret. Mudflats and shallow water habitat restored by the deposition of dredged material would provide increased foraging opportunities for shorebirds such as least sandpipers, killdeer, and the American avocet. Those species feed on tiny invertebrates and crustaceans found on mudflats which are exposed at low tide and in shallow-water areas of the appropriate depth. Furbearers (such as nutria and muskrat) which feed on vegetation would benefit from the increased marsh acreage in the Project area. Representative furbearers such as the mink, river otter, and raccoon have a diverse diet and feed on many different species of fishes and crustaceans. Those species often feed along vegetated shorelines which provide cover for many of their prey species. The loss of open water habitat with construction of these measures would not be expected to adversely affect species that currently utilize these habitats as there is ample open water habitat in the basins. Wildlife species currently utilizing the shallow open water and vegetated shorelines in the Project area are highly mobile and/or suited to semi-aquatic life and should not be affected during construction.

Shoreline Protection: The installation of segmented offshore breakwaters and shoreline rock revetment would work to protect the marshes behind these structures from wave induced erosion and help maintain wildlife populations dependent on this habitat type. The potential for unintended adverse consequences, such as alteration of sedimentation patterns, associated with shoreline protection measures has been assessed and determined not significant. Some existing habitat would be converted to rock revetment thereby reducing the available wetland habitat for wildlife species and resulting in the demise of more immobile wildlife species. However, these impacts would result in a minimal overall impact to wildlife populations in the area and would work to protect the adjacent habitat these species depend on for survival that could be lost in the future if the revetment was not installed. See table 2-17b (Chapter 2) for specific feature details associated with each shoreline protection measure.

Chenier Reforestation: Existing chenier habitat in the CSB and the MB would undergo invasive species control and reforestation with construction of the proposed action. See table 2-17b (Chapter 2) for specific feature details associated with chenier reforestation features. Implementation of these measures would increase the diversity of the existing habitat and the quality of the available foraging, resting and nesting habitat necessary for numerous terrestrial and avian wildlife species and essential for neotropical migrants. Construction would

be minimally invasive (no earthwork is required) and some species may temporarily avoid these Project measures during construction, but would quickly return once construction is complete.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan
Impacts to wildlife resources would be similar to those discussed for the NER RP except to a lesser extent.

3.3.6 Fisheries and Aquatic Resources

HSDRR (NED) Plans

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan)
The nonstructural measures should have no direct, indirect, or cumulative impacts to these resources.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)
Marsh Restoration: Impacts in the construction footprint, and construction activities using earthen materials to restore and nourish marsh would directly impact fisheries and aquatic resources by the elimination of benthic, oyster, and fishery habitat or the conversion of shallow open water habitats to less valuable deep water borrow areas. Additionally, direct mortality or injury of fisheries and benthic species could occur due to burial or increased turbidity. Borrow areas are identified from Calcasieu Ship Channel, and the Gulf of Mexico. See table 2-17b (Chapter 2) for borrow quantities associated with each marsh restoration measure. Improved marsh habitats and increased SAV could have positive indirect impacts on juvenile fishes, shrimp, crabs, and other species by increasing food and cover if they are able to access the area. The two main limiting factors in SAV colonization are depth and turbidity, not seed source. When marshes are restored the shallow open water that is left is more conducive for SAV colonization due to the shallower depth. Also due to the marsh the fetch is reduced so turbidity is reduced thus improving the likelihood of SAV colonization. The conversion of open water to marsh is generally considered a benefit to aquatic species.

During marsh restoration, effluent from the dredge discharge pipe would be directed to adjacent fragmented marsh for nourishment. Dredging and construction activities would smother sessile and slow-moving benthic and suspension/filter feeders and force more mobile fish and aquatic organisms to move from the dredging, disposal and construction areas. It is expected that benthic and suspension/filter feeders would re-colonize the newly deposited dredged material at marsh restoration sites within 1-3 years due to its similarity with the existing substrate in the disposal areas. The conversion of shallow open-water to marsh habitat would prevent some larger fishery and aquatic organisms from immediately re-entering the disposal area (marsh restoration/nourishment sites). Following dredging and construction activities, larger fishery and aquatic organisms would gain access to the newly restored marsh and tidal pools during normal water flows and tides. Marsh is considered to have a higher ecological value than shallow open-water in this coastal ecosystem that is presently experiencing widespread coastal land loss.

Benthic, plankton, suspension/filter-feeding species, visual predators and other fishery and aquatic organisms could have short-term and localized adverse indirect effects caused by increased turbidity, total suspended sediments, and water temperatures and lower dissolved oxygen levels from dredging and construction. Benthic organisms could be smothered. Suspension/filter feeding organisms could be impacted due to clogging of the gills and feeding mechanisms which could either cause death or reduce growth and reproduction. Visual predators would have a reduced success rate at catching prey due to lower visibility levels. Mobile species would be forced to relocate away from the dredging and construction area. Following dredging and construction activities, turbidity and suspended sediment levels, water temperature, and dissolved oxygen levels would return to pre-construction conditions. These temporary and localized impacts would be minimized and controlled by utilizing the best available practical techniques and BMPs during construction.

Waterbottoms used for borrow could cause the conversion of shallow open water habitats to less valuable deeper water borrow areas. Depending on the depth of the borrow area, this deeper water habitat could over the long term provide a refuge during extreme water temperature spikes. It is not anticipated that dredged borrow sites would cause hypoxic conditions. In addition there would be a short term direct adverse impact to

benthic species as well as the habitat of other aquatic species as 953 acres of water bottom is deepened and then refilled for the temporary floatation access channels. There could be direct mortality or injury of fisheries and benthic species due to both the digging and relocating of the material and burial of species that have colonized the area during the work. Restored transitional estuarine marsh habitats and increased SAV could have positive indirect impacts on juvenile fishes, shrimp, crabs, and other species by increasing EFH which provides food and cover to the area. The conversion of open water to marsh is generally considered a benefit to aquatic species. See table 2-17b (Chapter 2) for specific feature details associated with each marsh restoration measure. The best available practical techniques and BMPs would be utilized during construction to avoid, minimize and reduce potential adverse impacts to fishery and aquatic organisms.

Shoreline Protection: Impacts in the construction footprint would include the elimination of benthic and fishery habitat and the conversion of existing sandy shallow open water habitats to rock habitat which will only partially be submerged. Additionally, shallow mud bottoms would be converted to rock with the MB components in Fortify Spoil Banks of the GIWW and Freshwater Bayou measure. There would be a short-term direct adverse impact to benthic species as well as the habitat of other aquatic species as water bottoms are deepened and then refilled for the temporary floatation access channels. There could be direct mortality or injury of fisheries and benthic species due to both the digging and relocating of the material and burial of species that have colonized the temporary flotation access area during the construction. There could also be short-term indirect adverse impacts to plankton, benthic populations, suspension/filter-feeders and other fisheries caused by increased turbidity, total suspended sediments, and water temperatures and lower dissolved oxygen levels from construction activities. Benthic organisms could be smothered. Suspension/filter feeding organisms could be impacted due to clogging of the gills and feeding mechanisms which could either cause death or reduce growth and reproduction. Visual predators would have a reduced success rate due to lower visibility levels. Mobile species would be forced to relocate away from the dredging and construction area. Following construction, turbidity and suspended sediment levels, water temperature, and dissolved oxygen levels would return to pre-construction conditions. These temporary and localized impacts would be minimized and controlled by utilizing the best available practical techniques and BMPs during construction. Rock substrate is known to provide benefits to some aquatic species by providing them a refuge from predation. They also provide a hard substrate for oyster spat to settle on. See table 2-17b (Chapter 2) for specific feature details associated with each shoreline protection measure.

Chenier Reforestation: There would be no direct, indirect, or cumulative impacts on these resources.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan
Impacts are the same as the MB component of the RP.

3.3.7 Essential Fish Habitat (EFH)

HSDRR (NED) Plans

Modified Plan 8 - Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)
No direct, indirect, or cumulative impacts are expected to this resource from implementation of this action.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)
Marsh Restoration: Both the CSB and MB components would convert open water and degraded marsh (combination of estuarine marsh and estuarine mud bottoms EFHs) to transitional, intertidal, estuarine marsh (marsh edge, SAV, marsh ponds, and inner marsh EFHs). See table 2-17b (Chapter 2) for specific feature details associated with each marsh restoration measure. Construction activities using earthen materials to create marsh could bury EFH substrates or temporarily change environmental conditions, including turbidity and salinity, in the water column. The Project would increase SAV and adjacent intertidal marsh vegetation (marsh restoration areas) in some areas. However, increases in SAV colonization would be limited by depth and turbidity, not seed source. When marshes are restored the shallow open water that is left is more conducive for SAV colonization due to the shallower depth. Also due to the marsh the fetch is reduced so turbidity is reduced thus the likelihood of SAV colonization. In addition, there would be a short term direct adverse impact to estuarine mud bottoms

as water bottoms are deepened and then refilled for the temporary floatation access channels. The floatation access for measure 3c1 would temporarily traverse the Calcasieu Lake Public Oyster Area with the dredge pipeline floated over the public oyster area, but no oyster reef EFH would be impacted by the measure. Any identified oyster reefs would be avoided. Dredging and construction activities to restore and nourish marsh would bury existing EFH substrates and temporarily change environmental conditions, including: short-term and localized increased turbidity, total suspended sediments, and water temperatures and lower dissolved oxygen levels in the water column. However, these effects would be short-term and localized and the area would return to pre-construction conditions following completion of dredging and construction activities. The proposed action would provide indirect positive effects by increasing SAV and estuarine marsh EFH. The CSB components and MB components would also nourish existing marsh and terraces in areas adjacent to the marsh restoration sites. There would be long term indirect positive impacts to marsh (marsh edge, SAV, marsh ponds, and inner marsh EFH). Waterbottoms identified for borrow include areas within the CSC and the Gulf of Mexico for the CSB. If the dredged material from the CSC is obtained during maintenance events there would be no additional EFH impacts. Borrow in the Gulf would convert Gulf water EFH to deeper Gulf water EFH. High-energy offshore Gulf borrow areas could naturally refill with material over time.

Shoreline Protection: Both the CSB and MB components would convert open water (combination of estuarine mud bottoms, Gulf waters, marsh edge, offshore, beach, coastal, and sand EFH) to rock which is not considered EFH in coastal Louisiana. In addition there would be a short term direct adverse impact to the aforementioned EFH as water bottoms are deepened and then refilled for the floatation channels. See table 2-17b (Chapter 2) for specific feature details associated with each shoreline protection measure.
Chenier Reforestations: Reforesting chenier ridges would have no direct, indirect, or cumulative impacts on EFH as these areas are far removed from waters with EFH. In addition, reforestation would use the best practical techniques and BMPs to avoid potential adverse impacts associated with non-point source storm water runoff associated with construction into adjacent marsh and water areas.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan
Impacts would be same as the MB component of RP.

3.3.8 Threatened and Endangered Species, and Other Protected or Species of Concern HSDRR (NED) Plans

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)
The CEMVN has determined that the proposed action "may affect but will not likely adversely affect" the Sprague's pipit and would have no effect on the red-cockaded woodpecker or critical habitats and would not adversely impact other species of concern that could potentially be found in the Project area. However, the presence, as define by the guidelines provided by USFWS, of threatened or endangered species would render that structure ineligible to participate in the project. Furthermore, direct impacts to species of concern would be avoided in accordance with the Bald and Golden Eagle Protection Act (BGEPA), MBTA, and the Marine Mammal Protection Act (MMPA) by implementing recommendations from USFWS and the National Marine Fisheries Service (NMFS) and utilizing the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to threatened and endangered species. Further consultation would occur as measures are implemented if construction has not been conducted within one year of signing the Record of Decision (ROD). Adverse direct and indirect impacts would be avoided in accordance with the Endangered Species Act (ESA), Bald and Golden Eagle Protection Act, the BGEPA, the MBT and MBTA and the use of best management practices (BMPs) (see also Appendix A) and recommendations from USFWS (see Appendix A, Annex G for final USFWS CAR). Potential minimal indirect impacts could occur to the candidate species, Sprague's pipit, including the temporary displacement of any birds that may be present during construction activity and noise. However, the best practical techniques and BMPs would be utilized during construction to avoid, minimize and reduce potential adverse impacts to this species. However, the presence of candidate species would render that structure ineligible to participate in the project.

Species of Concern: Depending on the final designs of the NED RP, there could be a potential for minimal indirect impacts to colonial nesting water birds. These impacts could include the temporary displacement of

any birds that may be present due to construction activity and noise. It is assumed the birds would relocate to adjacent foraging/roosting grounds. Nesting birds would not be impacted as no work would take place within a rookery. Additionally, during nesting season, work would be required to take place outside of the USFWS and LDWF-declared buffer zones (Appendix A, Annex K). Work within the buffer zones may only take place during non-nesting season (September 1 to February 15). There would be no impacts to the bald eagle as no known nests are located near any Project measures. If an eagle's nest is found within the Project area, a no-work zone would be implemented (Appendix A, Annex K).

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

The CEMVN has determined that the proposed action "may affect but will not likely adversely affect" the piping plover or it's critical habitat, red knot, Sprague's pipit, West Indian manatee, Gulf sturgeon, loggerhead and Kemps Ridley sea turtles; would have no effect on the red-cockaded woodpecker, green, leatherback, and hawksbill sea turtles or loggerhead critical habitat and would not adversely impact other species of concern that could potentially be found in the Project area. Furthermore, direct impacts to species of concern would be avoided in accordance with the BGEPA, MBTA, and the MMPA by utilizing the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to threatened and endangered species (see Appendix A, Annex K for information on T&E species in the Project area and Annex G for recommendations from USFWS and the National Marine Fisheries Service (NMFS). Further consultation would occur as measures are implemented if construction has not been conducted within one year of signing the ROD.

Marsh Restoration: Potential temporary and minimal indirect impacts to the West Indian manatee, Gulf sturgeon and all sea turtles identified in Appendix A, Annex K. Temporary dredging and construction-related impacts would result, primarily from noise, water turbulence, increased turbidity, suspended total sediments, and water and the presence of workers in the marsh restoration sites, access routes and borrow sites. However, these typically mobile species would temporarily avoid the area where construction-related activity is taking place. Critical habitat for piping plover will be temporarily impacted by placement of the dredge pipeline coming from the Gulf borrow sites and crossing the beach as it is moved to more interior marsh restoration sites (measures 47a1, 47a2, 47c1 and 124c. See table 2-17b (Chapter 2) for impacts to critical habitat in acres associated with each marsh restoration measure. Timing of dredge pipeline placement and removal will be coordinated with USFWS. Loggerhead critical habitat would not be impacted as the borrow sites are within approximately three miles offshore. Beneficial impacts would be the increase in wetland habitat which is utilized by the whooping crane.

Shoreline Protection: Potential indirect impacts to the West Indian manatee, Gulf sturgeon and all sea turtles listed in Appendix A, Annex K would be temporary and minimal. Temporary construction related impacts would be due to noise, turbulence, and mere presence of workers in the marsh restoration sites, access routes, and borrow sites and would likely result in the species avoiding the area temporarily. Permanent impacts would be the hindrance of access by sea turtles, to thousands of linear feet of shoreline. However, sea turtles do not typically use the beaches of Louisiana and it is assumed that they could easily go around the breakwater as it would not be contiguous. Loggerhead critical habitat would not be impacted as the shoreline protection measures are approximately 150 feet from the shore. Indirect beneficial impacts would be the protection of thousands of linear feet of shoreline which is designated piping plover critical habitat and also used by the Red knot. See table 2-17b (Chapter 2) for flotation footprint of associated with each shoreline protection measure.

Chenier Reforestation: There could be potential minimal indirect impacts to Sprague's pipit if reforestation of grasslands occurred. It is assumed that the birds would relocate to adjacent or nearby suitable foraging/roosting area.

Species of Concern: There is the potential for minimal indirect impacts to colonial nesting water birds. Impacts could include disturbance of roosting or foraging birds due to construction activity and noise. It is anticipated nesting birds would not be impacted as no work would take place within a rookery. Additionally, during nesting

season, work would be required to take place outside of the USFWS and LDWF declared buffer zones (Appendix A, Annexes K & Q). Work within buffer zones may only take place during non-nesting season (September 1 to February 15). In addition to these potential adverse impacts, marsh restoration would beneficially impact colonial nesting water birds by providing additional foraging grounds. No impacts to the bald eagle, as no known nests are located near any Project measures. If an eagle's nest is found within the Project area, a no-work zone must be implemented. Bottlenose dolphins could be found in the vicinity of shoreline protection measures, but with the utilization of the best management practices for reducing entrapment of this species (see Appendix A, Annex K), no indirect impacts are anticipated.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan
Impacts to T&E resources would be similar to those discussed for the NER RP except to a lesser extent.

3.3.9 Cultural and Historic Resources

The following alternatives have the potential to impact cultural and historic resources, and the CEMVN has elected to fulfill its obligations under Section 106 of the NHPA of 1966, as amended, through the execution and implementation of two Programmatic Agreements as provided for in 36 CFR Part 800.14(b). (See Appendix A, Annex F). Cultural resources investigations and consultation would be required prior to implementing the recommended plans in order to identify cultural and historic resources, including historic properties, and assess potential impacts and/or adverse effects to historic properties. The CEMVN will seek ways to avoid, minimize, or mitigate any adverse effects on historic properties. The information provided below is detailed in the report titled *Cultural Resources Assessment and Research Design for the Southwest Coastal Louisiana Project, Calcasieu, Cameron, and Vermilion Parishes, Louisiana* (Wells and Hill 2016) on file with the Louisiana Division of Archaeology.

HSDRR (NED) Plan

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)
There is the potential for direct and indirect impacts to previously recorded archaeological sites, buildings, structures, districts, and properties that may be of religious and cultural significance to Indian tribes, as well as any unrecorded cultural and historic resources that may be identified during subsequent cultural resource investigations.

The designated eligible NED RP structures have not been assessed for significance and NRHP eligibility. These structures and any additional resources located within an Area of Potential Effect (APE) will be identified and assessed following the determination of the APE for each participating NED RP structure. It is possible that some of the structures and other resources identified within an APE shall be considered eligible for listing in the NRHP. Four historic districts within the study area are listed in the NRHP, although none of the preliminarily eligible NED RP structures are located within the boundaries of an NRHP historic district. Thirty-six NRHP listed standing structures are located within the study area, most of which are located within a mile of one or more preliminarily eligible NED RP structures. Sixteen of the preliminarily eligible NED RP structures are located within the boundaries of a local historic district, 14 within the Downtown Development District of the Charlestown Cultural District and two within the Margaret Place Historic District, as designated by the City of Lake Charles.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)
CSB - There is the potential for direct and indirect impacts to previously recorded archaeological sites, buildings, structures, and properties that may be of religious and cultural significance to Indian tribes, including 15 previously recorded archaeological sites and 39 previously inventoried standing structures, as well as any unrecorded cultural and historic resources that may be identified during the cultural resources investigations. Five historic cemeteries have also been documented in the vicinity of the proposed features. The previously recorded sites include one potentially eligible for listing in the NRHP, four not eligible for listing in the NRHP, and ten of undetermined eligibility. Of the 15 previously recorded sites, eight have prehistoric components, and seven have historic components.

Marsh Restoration: Eight sites have been recorded and 27 structures inventoried within a mile of the proposed features 3a1, 3c1, 124c, and 124d. Three prehistoric sites (two undetermined and one ineligible) are located within a mile of 3c1, and one ineligible prehistoric and four historic sites (three undetermined and one ineligible) are located within a mile of 124d. No resources have been recorded within the proposed borrow areas. High probability areas have been identified located within the boundaries of the marsh restoration features, and there is the potential that archaeological sites could be altered or destroyed by Project activities. If the USFWS obtains authorization and funding, then impacts of these measures to cultural resources would be the responsibility of the USFWS.

Shoreline Protection: One ineligible historic site has been recorded within a mile of the proposed feature 5a. There is the potential that archaeological sites could be altered or destroyed by Project activities.

Chenier Reforestation: Nine sites have been recorded and 11 structures inventoried within a mile of the proposed features 510a, 510b, and 510d. Two of the sites, one structure, and one cemetery are within or immediately adjacent to 510a, and three of the sites are within or immediately adjacent to 510d. Two prehistoric sites (one potentially eligible and one undetermined) and two historic sites (one undetermined and one ineligible) are located within a mile of 510a. Two prehistoric sites (one potentially eligible and one undetermined) and one ineligible historic site are located within a mile of 510b. Two prehistoric sites and three historic site of undetermined eligibility are located within a mile of 510d. Cheniers are high probability areas, and there is the potential that archaeological sites could be altered or destroyed by Project activities.

MB - There is the potential for direct and indirect impacts to previously recorded archaeological sites, buildings, structures, and properties that may be of religious and cultural significance to Indian tribes, including 22 previously recorded archaeological sites and 33 previously inventoried standing structures, as well as any unrecorded cultural and historic resources that may be identified during the cultural resources investigations. Two historic cemeteries have also been documented in the vicinity of the proposed features. The previously recorded sites include one eligible for listing in the NRHP, one potentially eligible for listing in the NRHP, four not eligible for listing in the NRHP, and 16 of undetermined eligibility. Of the 22 previously recorded sites, 20 have prehistoric components, and three have historic components.

Marsh Restoration: Nine prehistoric sites have been recorded and 17 structures inventoried within a mile of the proposed features 47a1, 47a2, 47c1, 127c3, and 306a1. Two of the sites are within or immediately adjacent to 306a1. Six prehistoric sites (one potentially eligible and five undetermined) are located within a mile of 47a1, and three prehistoric sites (one potentially eligible and two undetermined) are located within a mile of 47a2. Three prehistoric sites of undetermined eligibility are located within a mile of 306a1. No resources have been recorded within the proposed borrow areas. High probability areas have been identified within the boundaries of the marsh restoration features, and there is the potential that archaeological sites could be altered or destroyed by Project activities.

Shoreline Protection: Nine sites have been recorded within a mile of the proposed features 16b, 6b1, 6b2, and 6b3. Five of the sites are within or immediately adjacent to 6b2, including an NRHP listed site, and one site is within or immediately adjacent to 6b3. Three prehistoric sites of undetermined eligibility are located within a mile of 16b. Four prehistoric sites (one undetermined and three ineligible) and one NRHP listed historic site are located within a mile of 6b2. One prehistoric site of undetermined eligibility is located within a mile of 6b3. There is the potential that archaeological sites could be altered or destroyed by Project activities.

Chenier Reforestation: Eleven sites have been recorded and 39 structures inventoried within a mile of the proposed features 416, 509c, and 509d. Three of the sites, ten structures, one of which is potentially eligible for listing in the NRHP, and one cemetery are within or immediately adjacent to 416, and two sites are within or immediately adjacent to 509d. Eight prehistoric sites, one with a historic component (one potentially eligible and seven undetermined) and one ineligible historic site are located within a mile of 416. Two prehistoric sites of undetermined eligibility are located within a mile of 509d. Cheniers are high probability areas, and there is the potential that archaeological sites could be altered or destroyed by Project activities.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan
Impacts would be the same as those described for the MB component of the RP.

3.3.10 Aesthetics (Visual Resources)

HSDRR (NED) Plans

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)
There would be minimal impacts on visual resources due to elevating residential structures. Most viewsheds would not significantly change when individual or small groups of residential structures are elevated. However, in those viewsheds with relatively homogenous low-elevated residential structures, elevating residential structures up to 13 feet may disrupt the symmetry of the existing viewshed. Under Louisiana Civil Code Art 701, the Servitude of View, the owner of the dominate estate has the right to prevent the raising of constructions on the servient estate that would obstruct the existing view.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)
Marsh Restoration: Construction of the marsh restoration measures would not adversely impact the Visual Resources. The primary difference is in how the marsh is restored. With the use of dredge material from the CSC, where impacts would be minimal, visual resources would be greatly and positively impacted. Those areas along the Creole Nature Trail would positively impact the byway creating enhanced view sheds for travelers. Other areas, such as those located along the Intracoastal Waterway and Freshwater Bayou Canal have less visual significance because those areas are remote with limited access. Construction of marsh habitat may have temporary negative impact to the Aesthetic resources in the Project area. Initial construction of the marsh would temporarily alter open water to bare mud flats, which may be considered aesthetically unpleasant. With dewatering and natural colonization of marsh plants, based on previous experience with beneficial use of dredged material and marsh restoration, it will take approximately one to three years before the marsh becomes fully established with vegetation.

Shoreline Protection: These elements do have public visual significance and their protection and restoration would add an element of form, line and color to the shoreline of Louisiana. Visually, manmade measures like breakwaters would not have positive effects on the viewscape of undeveloped and natural beach. Measures such as this are necessary to ensure that the beach remains as it is. Many of these areas are remote and public access is very limited.

Chenier Reforestation: Visually, these measures are the most significant of any other in the study area. Cheniers aid in the form and function of developing the design elements of the landscape. As small hillocks or ridges, they offer the variation in terrain that makes the viewshed interesting and memorable. They offer islands of oasis for different plant materials to develop and add texture and color to the land. In most cases, they allow taller trees to grow in a region which adds the necessary framing elements to the landscape to give it artistic quality and character. Most of the designated chenier restoration measures are located directly adjacent to the Creole Nature Trail and would considerably and positively add to existing design elements already described under marsh restoration.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan
Impacts would be the same as those described for the MB component of the RP.

3.3.11 Recreation

HSDRR (NED) Plans

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)
There are no direct impacts from structure elevation on recreational resources. A direct impact from flood proofing park buildings is the recreational use would be temporarily unavailable during flood proofing work. An indirect impact of elevating structures on building costs of future recreational camps could result in fewer camps being constructed.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

Marsh Restoration: Any direct impacts to recreational fishing, hunting, and other recreational resources would be temporary and occur during construction. Recreationalists may have to circumvent a marsh restoration Project area when traveling to a destination due to construction limiting or delaying access. In general, measures that create marsh habitat and improve hydrology of wetlands are more likely to improve recreational fishing opportunities by enhancing the sustainability of productive nursery habitats.

Shoreline Protection: Any direct impacts to recreational fishing and hunting would be temporary and occur during construction activities. Shoreline protection Projects should help protect recreational resource lands from effects of coastal storm surge and minimize the loss of valuable fishery habitat.

Chenier Reforestation: Restoration of natural ridges would improve bank stabilization and potentially provide additional habitat for deer, small game and birds, which could be beneficial for hunting and bird watching. Restored ridges would also enhance protection of adjacent swamps and marshes during coastal storms, which could also potentially benefit recreational resources and infrastructure such as boat launches.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan

Impacts would be the same as those described for MB component of the RP. Appendix A (Annex N: Recreation) provides more details on direct, indirect, and cumulative impacts of the RP and the Mermentau Small Integrated Restoration Alternative on these resources.

3.4 Cumulative Impacts

The historic and existing conditions for the significant resources involving both the NED and NER plans are presented in Chapter 1. The direct and indirect impacts of the No Action Alternative (Future Without Project Conditions) on significant resources is also presented in Chapter 1. The direct and indirect impacts for each of the NED and NER Plans, as compared to the No Action Alternative, is presented in Chapter 3 (sections 3-1 to 3-3). Cumulative impacts are the effects on the environment that result from the incremental direct and indirect impacts of the proposed action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such actions. Cumulative impacts can result from actions that individually are minor, but collectively result in significant actions taking place over time (Section 1508.7 40 CFR Parts 1500-1508). For example, the incremental impacts of the proposed NER RP measures when added to other past, present and reasonably foreseeable future wetland restoration projects throughout the study area could significantly modify an entire basin's habitat diversity. The Council on Environmental Quality's (CEQ) "Considering Cumulative Effects Under the National Environmental Policy Act" (CEQ 1997) provides an 11-step framework for cumulative effects analysis (CEA) that was utilized to conduct the cumulative impact assessment for this study.

The following describes the cumulative effects or impacts for each alternative NED and NER plan by describing both the spatial (United States, Louisiana, and Study Area) and the temporal (past, present and reasonably foreseeable future (50-year period of analysis) actions of other nonstructural flood risk reduction and ecosystem restoration projects as compared to the impacts of the proposed actions presented in Chapter 3 (sections 3-1 to 3-3). The action detailed in this section are limited to those of the Federal, State and Local governments as there are no relevant private or pulic actions related to either the NED or NER actions.

3.4.1 HSDRR (NED) Plans

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (NED RP)

As described in detail in Chapter 4, the NED RP proposes implementing nonstructural measures across the 4,700 square mile study area to reduce coastal storm surge damages to 3,462 residential structures, 342 commercial structures and public buildings, and 157 warehouses through the combined voluntary elevation of residential structures, dry flood proofing of non-residential structures, and construction of localized storm surge risk reduction measures around warehouses. To assess the cumulative impacts for the NED RP, the incremental direct and indirect impacts of implementing the NED RP, as detailed in Chapter 3 above, are considered

together with other past, present and reasonably foreseeable future nonstructural risk reduction projects which are identified and described below. The cumulative impacts are summarized in Table 3-6.[1]

Nonstructural Risk Reduction Measures throughout the United States:

Contributions to national economic development (NED outputs) are increases in the net value of the national output of goods and services, expressed in monetary units, and are the direct net benefits that accrue in the planning area and the rest of the Nation. Contributions to NED include increases in the net value of those goods and services that are marketed and also of those that may not be marketed. For any storm surge risk reduction plan, the NED outputs can be used to measure the cumulative effect to the Nation's economy. To that end, the cumulative effects can be seen in the thousands of miles of levees, nonstructural measures and hazard mitigation programs in place throughout the nation and the region. The measure of NED outputs within the study area would also contribute to the measure at the National level. Therefore there is no reason to perform computations of outputs beyond the study area.

Evaluations of the study alternatives eliminated all structural alternatives which could have had local, regional, or National environmental impacts. The remaining nonstructural alternatives developed eligibility criteria which eliminated any structure for which implementation of the nonstructural measure would have resulted in an impact to wetlands, threatened and endangered species, or the deposition of fill materials into the waters of the United States. For these reasons the evaluations of cumulative impacts is confined to the study area.

Reasonably foreseeable ongoing programs:

It is reasonably foreseeable that the FEMA Hazard Mitigation Assistance (HMA) (http://www.fema.gov/hazard-mitigation-assistance) grants programs would continue to provide funding for eligible mitigation activities that reduce disaster losses and protect life and property from future disaster damages. Currently, FEMA administers the following HMA grant programs:

- Hazard Mitigation Grant Program (HMGP) assists in implementing long-term hazard mitigation measures following Presidential disaster declarations. Funding is available to implement projects in accordance with State, Tribal, and local priorities.
- Pre-Disaster Mitigation (PDM) provides funds for hazard mitigation planning and to implement mitigation projects before disasters. The program goal is to reduce overall risk to the population and structures, while at the same time, also reducing reliance on Federal funding from disaster declarations.
- Flood Mitigation Assistance (FMA) provides annual funds so that measures can be taken to reduce or eliminate risk of flood damage to buildings insured under the NFIP.

Nonstructural Risk Reduction Measures throughout Louisiana:

The conceptual 2012 State Master Plan recommends a comprehensive nonstructural program as part of its strategy to reduce the flood risk for Louisiana citizens. The 2012 State Master Plan's appendix F2 Nonstructural Implementation Strategy includes the following nonstructural strategies: 1) flood proofing of residential and commercial properties, 2) elevation of residential properties, and 3) voluntary Acquisitions of residential properties. In addition, programmatic measures such as land use planning, building codes, and education that can reduce risk to future buildings within communities will be integral to the nonstructural program (source: http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&ved=0ahUKEwi_msil0ovLAhVCWT4KHcrSD-sQFggqMAE&url=http%3A%2F%2Fcoastal.la.gov%2Fwp-

[1] The cumulative impacts of the Plan 8 Alternative – Nonstructural 100-Year Floodplain are similar to, but greater in scale, to the cumulative impacts identified in connection with the NED RP alternative because of the larger numbers of structures that would be included in the Plan 8 Alternative. Hence a discussion of the cumulative impacts associated with the Plan 8 alternative will not be further detailed.

content%2Fuploads%2F2014%2F03%2FAppendix_F2_NonstructuralStrategyFINAL.pdf&usg=AFQjCNE3WYY2tiNH924gwCffvwwbH8uLNA; accessed February 22, 2016).

Past and Present Actions:

Following Hurricanes Katrina, Lili, Rita, Gustav, Ike, and Issac many residents were required to meet certain building requirements to meet floodplain management ordinances. Some individuals met these building requirements at personal expense. Many others utilized the FEMA Hazard Mitigation Assistance (HMA) (http://www.fema.gov/hazard-mitigation-assistance) grants programs (including: HMGP, PDM and FMA programs) to provide funding for eligible mitigation activities that reduce disaster losses and protect life and property from past, present and future disaster damages in Louisiana.

Nonstructural Risk Reduction Measures throughout the Study Area:

Past and Present Actions:

Within the study area the only known Federal program addressing reduction in damages from hurricane storm surge events is FEMA's Hazard Mitigation Assistance (HMA), as expressed in the FEMA Federal Insurance and Mitigation Administration (FIMA) policy guidance. The key purpose of Hazard Mitigation Grant Program (HMGP) is to ensure that the opportunity to take critical mitigation measures to reduce the risk of loss of life and property from future disasters is not lost during the reconstruction process following a disaster. HMGP funding is available, when authorized under a Presidential major disaster declaration, in the areas of the State requested by the Governor. Federally-recognized tribes may also submit a request for a Presidential major disaster declaration within their impacted areas (see http://www.fema.gov/media-library/assets/documents/85146). The amount of HMGP funding available to the Applicant is based on the estimated total Federal assistance, subject to the sliding scale formula outlined in Title 44 of the Code of Federal Regulations (CFR) Section 206.432(b) that FEMA provides for disaster recovery under Presidential major disaster declarations. As described in greater detail at the above referenced website, the following project types are eligible under the HMA programs:

- Property Acquisition and Structure Demolition;
- Property Acquisition and Structure Relocation;
- Structure Elevation;
- Mitigation Reconstruction; and
- Dry Flood proofing.

Table 40 in the Economic Appendix D indicates a total of 51,857 structures in the study area. Of these, 46,860 residential structures, 3,432 non-residential structures, and 1,565 warehouses are within the 100-year floodplain. Above the 100-year floodplain are 36,190 residential structures, 2,429 non-residential structures, and 835 warehouses that are above the 100-year floodplain. Many of these structures are located on naturally higher elevations. However, based on personal communications, some of the structures in the study area that are above the 100-year floodplain have already been elevated or subjected to other nonstructural risk reduction via FEMA grants or at personal expense. Personal communications with many different residents in the study area's Parishes of Calcasieu, Cameron and Vermilion during public meetings and hearings for the Draft and Revised Draft Integrated Feasibility Report and EIS revealed many of residents (total numbers unknown) have previously or are in the process of elevating their structures at personal expense or through grant assistance programs such as FEMA's Hazard Mitigation Assistance following Hurricanes Katrina, Rita, Gustave, and Ike. It is reasonably foreseeable that many of these self-proclaimed self-reliant residents would continue to stay in the area and raise their structures or take other measures to reduce hurricane storm surge damages. For example, in Calcasieu Parish 61 structures received residential mitigation grants in various forms, including: 24 structures were acquired; 22 structures were elevated; 5 structures were pilot reconstruction; 5 structures were wind retrofitted; 3 structures were provided shutters; 1 structure was provided drainage, and 1 structure was

provided roof repair (personal communication Laurie T. Cormier, Calcasieu Parish Police Jury, February 23, 2016).

Reasonably foreseeable ongoing programs:

There are ongoing programs within the region that may be implemented during the period of analysis, however, at the time of this report construction specific information is not available. A brief discussion of these programs follows.

As referenced above as an ongoing program throughout Louisiana, the conceptual 2012 State Master Plan recommends a comprehensive nonstructural program as part of its strategy to reduce the flood risk for Louisiana citizens. The 2012 State Master Plan's appendix F2 Nonstructural Implementation Strategy includes the following nonstructural strategies: 1) flood proofing of residential and commercial properties, 2) elevation of residential properties, and 3) voluntary Acquisitions of residential properties. In addition, programmatic measures such as land use planning, building codes, and education that can reduce risk to future buildings within communities will be integral to the nonstructural program (source: http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&ved=0ahUKEwi_msiI0ovLAhVCWT4KHcrSD-sQFggqMAE&url=http%3A%2F%2Fcoastal.la.gov%2Fwp-content%2Fuploads%2F2014%2F03%2FAppendix_F2_NonstructuralStrategyFINAL.pdf&usg=AFQjCNE3WYY2tiNJH924gwCffvwwbH8uLNA; accessed February 22, 2016).

Reasonably Foreseeable Actions:

There are no reasonably foreseeable nonstrucutral risk reduction projects/actions identified within the study area.

CEQ's recommends 11 Steps for Cumulative Effects Analysis. These steps are the end of this section. Some considerations specific to NED analysis are as follows:

- Regulatory thresholds have been identified (e.g., air quality and water quality standards) including the factors for managing and identifying cultural resources and the requirements (including age of the structure (50 years) that could trigger eligibility for listing on the national register of historic structures. This latter example is of particular importance considering the 50-year period of analysis due to the numerous structures in the area that could potentially qualify as a historic or national register structure over the course of the period of analysis.
- Generally, current trends in the human environment such as employment, business and industrial activity, and community and regional growth tend to mirror the increases demonstrated in populations and housing. Only Cameron Parish has had a population decline.
- During plan formulation the alternatives were modified, removed and new alternatives added to avoid, minimize and reduce potential significant Project-induced effects. For example several structural levees were considered but were later screened out due to a failure of benefits to exceed costs.
- For the NED RP, a notice of construction completion (NCC) for a participating structure would be provided to the non-Federal sponsor upon completion of the flood proofing measure for that structure. Although the non-Federal sponsor will have certain OMRR&R obligations, among other things, to inspect and to ensure no encroachment upon the Project purpose or functionality, there is no post construction monitoring or adaptive management for the NED RP. It is the responsibility of the owner to OMRR&R the flood proofing improvements to his/her property.

3.4.2 Ecosystem Restoration (NER) Plans

Coastal Ecosystem Restoration in Study Area:

The processes of coastal wetland loss in the Study Area can result from the gradual decline of marsh vegetation due to inundation and saltwater intrusion, as well as from storm surge events; both of which can eventually

lead to complete loss of marsh vegetation. As marsh vegetation is lost, underlying soils are more susceptible to erosion and are typically lost as well, leading to deeper water and precluding marsh regeneration. Significant accretion of sediments is then required in order for marsh habitat to reestablish. Perhaps the most serious and complex problem in the study area is the rate of land and habitat loss. Table 1-10 displays land area changes in chenier plain basins from 1932-2010 (Couvillion et al. 2011). The effects of recent hurricanes have accelerated marsh loss. Table 1-11 includes estimates of wetland loss attributed to the major hurricanes of 2004 to 2008 in the Chenier Plain and throughout coastal Louisiana. More recently, Palaseanu-Lovejoy et al. (2013) estimated wetland loss in the Hackberry area located in the southwestern part of the chenier plain that was impacted by Hurricane Rita (2005) and Ike (2008). Persistent land loss in the Hackberry area due to Hurricane Rita was approximately 5.8% and increased by an additional 7.9% due to Hurricane Ike. It is expected that the chenier plain has sustained more persistent land loss with intermediate and brackish marshes experiencing the most land loss, while saline marshes were less impacted and fresh marshes showed evidence of vegetation seasonality change and regrowth, which concealed the hurricane impacts.

According to the Louisiana Recovery Authority's 2006 "The Rita Report", the devastation Hurricane Rita left behind made it the third most expensive natural disaster in US history (source: http://lra.louisiana.gov/assets/docs/searchable/reports/RitaReportFinal091806.pdf). The Rita Report estimated almost $600 million dollars of damage to agriculture, forestry and fishing. More than 200,000 acres of fresh water and intermediate marshland was inundated with saltwater threatening native species on already-threatened environmentally sensitive wetlands. Hence, the southwest coastal Louisiana area, like the remainder of coastal Louisiana has been and will continue to be subjected to stresses which will continue the decline of environmental resources.

It is anticipated that future conditions in the Study Area would include persistence of current sedimentation and erosion patterns. Existing hydrologic alterations would continue to affect water levels and salinities and continue influencing land loss at similar or increased rates. RSLR would expose additional shoreline areas to erosive forces into the foreseeable future. Table 1-18 displays net land area change projections by basins in the study area (Couvillion et al. 2013). The Study Area basins would experience the following net changes between 2010-2060: -146.5 km2 for Calcasieu/Sabine Basin, -146.5 km^2 for Mermentau Basin, and -67.0 km^2 for Teche/Vermilion Basin. These results suggest that a net wetland loss in coastal Louisiana as well as the Study Area over the next 50 years would likely occur regardless of uncertainties in parameters that influence coastal wetland loss.

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (NER RP)

Cumulative impacts for the NER RP would be the incremental direct and indirect impacts of implementing the NER RP marsh restoration, shoreline protection and chenier reforestation measures (summarized below) in addition to other past, present and reasonably foreseeable future coastal and other ecosystem restoration projects described below. Alternative Plan: M-4– Mermentau Small Integrated Restoration Plan is a separable increment of the NER RP so impacts would be the same as described for the Mermentau Basin component of the NER RP. Therefore Plan M-4 is no longer discussed. Following presentation of other present and reasonably foreseeable ecosystem restoration programs and projects, the cumulative impacts are summarized in Table 3-6.

Over the 50-year period of analysis, the NER RP would protect, restore, and nourish a net total of 14,035 net acres of emergent marsh (including 7,900 net acres from the nine marsh restoration measures and 6,135 net acres from the five shoreline protection measures). At the end of the 50 year period of analysis, the marsh restoration and shoreline protection measures together would achieve a total net ecological benefit of 4,430 AAHUs; with 2,700 AAHUs from the nine marsh restoration measures, and 1,738 AAHUs from the five shoreline protection measures. Whereas the chenier restoration measures would restore a total of 1,413 net acres with 538 AAHUs. The positive cumulative impacts of implementing the NER RP would be the additive and, in some instances. the synergistic effects of restoring and nourishing sites over the 50-year period of analysis, an estimated 7,900 net acres and 2,700 AAHUs. The five shoreline protection measures would span approximately 251,528 linear feet, and are anticipated to protect/stabilize approximately 6,135 net acres and

1,738 AAHUs. Although not impacting waters of the United States, the approximately 1,413 net acres from 35 reforestation sites in Cameron and Vermilion Parishes would be reforested over the 50 year period of analysis, resulting in 538 AAHUs. The only significant long-term adverse cumulative impact of implementing the NER RP measures is the conversion of existing degraded marsh and shallow open water to transitional estuarine marsh habitat, breakwaters, and rocked shoreline protection habitats.

Coastal Ecosystem Restoration in the United States:

Dahl and Stedman (2013) reporting on the status and trends of wetlands in conterminous United States coastal watersheds from 2004 to 2009 indicate that in 2009, there were an estimated 41.1 million acres of wetlands in the coastal watersheds of the United States. This area represented 37.3 percent of total wetland area in the conterminous United States. Between 2004 and 2009, wetland area in the coastal watersheds of the United States declined by an estimated 360,720 acres. The average annual rate of change was an estimated loss of 80,160 acres, a 25 percent increase in the rate of wetland loss from the previous reporting period. The increase in the rate of coastal wetland loss was statistically significant ($p = 0.007$) when results from this study were compared to the coastal wetland loss estimates from the 1998 to 2004. Erosion and/or inundation are the primary causes of saltwater wetland losses in the Gulf of Mexico. In addition, saltwater impacts have been adversely affected by the cumulative effects of oil and gas development, hurricanes and other coastal storm events.

While the Coastal wetlands loss is occurring across the nation, and is significant as a national resource, the connections between other national coastal restoration projects and those occurring within the region is limited or nonexistent. For this reason, the resources of concern and the remainder of this analysis will focus on those resources within the study area and those that are transient to or affected by this study area.

Past and Present Actions: Regional, Louisiana, and Study Area

The below list is not exhaustive, but provides a representative sample of coastal ecosystem restoration efforts that cumulatively effect coastal wetland loss within the region. The EPA, reporting on the Nation, states the number of restoration projects grows yearly. Current Federal initiatives call for a wide range of restoration actions, including improving or restoring 25,000 miles of stream corridor; which contributes to the success of neo-tropical migratory species (sources: http://www.nwd-mr.usace.army.mil/rcc/MRFTF/docs/USACE-NFPC%20Nonstructural%20Measures%20Definitions.pdf; and http://water.epa.gov/type/wetlands/restore/principles.cfm; accessed January 22, 2016).

- Coastal Impact Assistance Program (CIAP) is authorized by the Outer Continental Shelf (OCS) Lands Act, as amended; 31 U.S.C. 6301-6305. The intent of the program is to disburse funding to eligible producing states and coastal political subdivisions for the purpose of conservation, protection, or restoration of coastal areas including wetlands; mitigation of damage to fish, wildlife, or natural resources; planning assistance and the administrative costs of complying with these objectives; implementation of a federally-approved marine, coastal, or comprehensive conservation management plan; and mitigation of the impact of outer Continental Shelf activities through funding of onshore infrastructure projects and public service needs. Louisiana's CIAP Program, administered by the Department of Interior, provides approximately $500 million dollars to Louisiana and includes a total of 103 projects state-wide, with 11 state projects, 17 state/parish projects and 75 parish projects. Examples of CIAP projects recently completed or under construction are presented below.
    - East Grand Terre Island Barrier Island Restoration
    - Barataria Land Bridge Dedicated Dredging created more than 2,000 acres of marsh
    - Marcantel Beneficial Use created 440 acres of marsh
- CWPPRA Program – There are currently 149 active CWPPRA projects throughout coastal Louisiana. In September 2015, 101 projects had been completed, benefiting over 97,401 acres. 21 projects are currently

under active construction with 22 additional projects approved and in the engineering and design phase of development (source: https://lacoast.gov/new/About/FAQs.aspx; accessed November 23, 2015).

- CS-04a Cameron-Creole Maintenance
- CS-11b Sweet Lake/Willow Lake Hydrologic Restoration
- CS-17 Cameron Creole Plugs
- CS-18 Sabine National Wildlife Refuge Erosion Protection
- CS-19 West Hackberry Vegetative Planting Demonstration
- CS-20 East Mud Lake Marsh Management
- CS-21 Highway 384 Hydrologic Restoration
- CS-22 Clear Marais Bank Protection
- CS-23 Replace Sabine Refuge Water Control Structures at Headquarters Canal, West Cove Canal, and Hog Island Gully
- CS-24 Perry Ridge Shore Protection
- CS-25 Plowed Terraces Demonstration
- CS-27 Black Bayou Hydrologic Restoration
- CS-28-1 Sabine Refuge Marsh Creation, Cycle 1
- CS-28-2 Sabine Refuge Marsh Creation, Cycle 2
- CS-28-3 Sabine Refuge Marsh Creation, Cycle 3
- CS-28-4-5 Sabine Refuge Marsh Creation, Cycles 4 and 5
- CS-29 Black Bayou Culverts Hydrologic Restoration
- CS-30 GIWW - Perry Ridge West Bank Stabilization
- CS-31 Holly Beach Sand Management
- CS-32 East Sabine Lake Hydrologic Restoration
- CS-054 Cameron-Creole Watershed Grand Bayou Marsh Creation
- CS-59 Oyster Bayou Marsh Creation and Terracing
- ME-04 Freshwater Bayou Wetland Protection
- ME-09 Cameron Prairie National Wildlife Refuge Shoreline Protection
- ME-11 Humble Canal Hydrologic Restoration
- ME-13 Freshwater Bayou Bank Stabilization
- ME-14 Pecan Island Terracing NMFS Sediment and Nutrient Trapping
- ME-16 Freshwater Introduction South of Highway 82
- ME-18 Rockefeller Refuge Gulf Shoreline Stabilization
- ME-19 Grand-White Lakes Landbridge Protection
- ME-20 South Grand Chenier Marsh Creation
- ME-21 Grand Lake Shoreline Protection
- ME-22 South White Lake Shoreline Protection
- TV-03 Vermilion River Cutoff Bank Protection COE Shoreline Protection
- TV-04 Cote Blanche Hydrologic Restoration
- TV-09 Boston Canal/Vermilion Bay Bank Protection
- TV-12 Little Vermilion Bay Sediment Trapping
- TV-13a Oaks/Avery Canal Hydrologic Restoration, Increment 1
- TV-14 Marsh Island Hydrologic Restoration
- TV-15 Sediment Trapping at "The Jaws
- TV-16 Cheniere Au Tigre Sediment Trapping Demonstration
- TV-17 Lake Portage Land Bridge
- TV-18 Four Mile Canal Terracing and Sediment Trapping
- TV-21 East Marsh Island Marsh Creation

- Louisiana Coastal Area (LCA), Ecosystem Restoration Study (USACE 2004) recommends 15 near-term measures aimed at addressing the critical restoration needs. The components recommended for authorization include five critical near-term ecosystem restoration measures, a demonstration program consisting of a series of demonstration projects, a beneficial use of dredged material (BUDMAT) program,

and a science and technology program. The five critical near-term ecosystem restoration measures, demonstration projects, and BUDMAT projects are all subject to the approval of feasibility level of detail decision documents by the Secretary of the Army. The January 31, 2005 Chief's Report approved the Near-Term Plan substantially in accordance with the 2004 LCA Study. Title VII of the Water Resources Development Act of 2007 (WRDA 2007) (Public Law 110-114) authorized an ecosystem restoration Program for the Louisiana Coastal Area substantially in accordance with the Near-Term Plan. Some of the LCA projects have not yet been authorized for construction, and some of those that have been authorized for construction but no longer have a local non-federal sponsor. LCA projects that are completed or are currently under construction include:

- LCA West Bay Marsh Creation Tier 1 project, which is part of the LCA's Beneficial Use of Dredged Material (BUDMAT) Program
- LCA Barataria Basin Barrier Shoreline Caminada
- LCA Barataria Basin Barrier Shoreline Shell Island
- LCA Terrebonne Basin Barrier Shoreline Whisky Island
- LCA Amite Diversion Canal modification

- The 2012 Louisiana's Comprehensive Master Plan for a Sustainable Coast, (source: http://issuu.com/coastalmasterplan/docs/coastal_master_plan-v2?e=3722998/2447530; accessed November 23, 2015) indicates that the CPRAB has, since 2007:
  - Benefited 19,405 acres of coastal habitat
  - Moved over 150 projects into design and construction
  - Constructed projects in 20 parishes
  - Constructed 32 miles of barrier islands/berms
- USACE Navigation projects, Beneficial Use of Dredged Material Program

The CEMVN removes, on average, about 75 million cubic yards (CY) of shoal material from Federal navigation channels every year. Of this annual total, about 19 million CY is removed from projects located too far from potential beneficial use disposal sites to be economically feasible. The Mississippi River Deep Draft Crossings account for about 18 million CY of this total of this annual total, about 16 million CY consists of "fluff" material that is not usable/suitable for marsh restoration the Atchafalaya River and Calcasieu River bar channels account for this "fluff" material. Thus, of the 75 million CY that the CEMVN dredges every year, only about 40 million CY are actually available for beneficial use placement.

On average, about 16.0 million CY of dredged material is beneficially used on an annual basis. This equals about 40 percent of all dredged material removed annually in CEMVN that is actually available and suitable for beneficial use placement. The majority of this beneficial use is funded by the O&M budget. The remainder is paid for by CWPPRA, LCA BUDMAT, Continuing Authorities Program - Section 204, or by Contributed Funds depending on availability. To date (1976-2015), the CEMVN has used dredged material to create/restore:

a. Approximately 61 square miles of coastal habitat in Louisiana.
b. Approximately 32,623 acres of wetland habitat.
c. Approximately 3,495 acres of bird nesting islands, beach/shoreline, and barrier island habitat.
d. Approximately 3,000 acres of scrub/shrub, maritime forest ridge, grassland habitat (Southwest Pass).

Channel-by-channel breakdown of beneficial acres created/restored by Federal navigation projects:

a. Calcasieu River = 3,320 acres
b. Mermentau River = 242 acres
c. Freshwater Bayou = 344 acres
d. Atchafalaya River = 8,996
e. Houma Navigation Canal = 143 acres
f. Port Fourchon = 309 acres
g. Barataria Bay Waterway = 1,079 acres
h. Tiger Pass = 624 acres
i. Baptiste Collette = 1,828 acres

j. South Pass = 1,971 acres
k. Southwest Pass = 17,591 acres
l. MRGO = 2,591 acres
m. Berwick Bay Harbor = 59 acres
n. Tangipahoa River = 21 acres

- The State of Louisiana, Division of Administration, Office of Community Development, CDBG Program helps communities provide a suitable living environment and expand economic opportunities for their residents, particularly in low to moderate income areas. There are presently 10 different CDBG projects in coastal Louisiana, including levee repairs, water assimilation, bulkhead, flood control, and terracing projects. The scale of this program past and present is such that the cumulative impact in the region is not significant.
- The Mississippi Coastal Improvements Program (MsCIP) consists of structural, nonstructural and environmental project elements, including restoration of 1,280 square miles of Mississippi sound aquatic restoration 30,000 acres coastal habitat restoration. Some of the completed projects include (source: http://www.sam.usace.army.mil/Portals/46/docs/program_management/mscip/images/PlaceMap07Dec2015.jpg; accessed February 22, 2016):
  - Hancock County Beaches
  - Harris County Beaches
  - Hancock County Streams
  - Jackson Marsh
  - Gautier Coastal Streams
  - Franklin Creek Floodway
  - West Ship Island

  Projects with construction underway include:
  - Camille Cut
  - East Ship Island, South
  - Cat Island Restoration
- Houston-Galveston Navigation Channels, Texas (HGNC) project is a collection of beneficial uses sites under one project scope in Galveston Bay, Texas. The Port of Houston Authority and the US Army Corps of Engineers, Galveston District along with 6 local state and federal agencies developed a plan to contain the material dredged from the channel constructing 1,720 hectares (4,250 acres) of intertidal marsh and islands that supported vegetation and bird habitats.

Reasonably foreseeable ongoing programs: Regional, Louisiana, and Study Area

There are ongoing programs within the region that may be implemented during a period of analysis, however, at the time of this report construction specific information is not available. A brief discussion of these programs follows.

- Restoration of injuries to natural resources damaged by the 2010 Deepwater Horizon oil spill is presently under the Natural Resource Damage Assessment (NRDA), a legal process under the Oil Pollution Act of 1990 (OPA) and the Louisiana Oil Spill Prevention and Response Act of 1991 (LOSPRA) whereby designated trustees represent the public to ensure that natural resources injured in an oil spill are restored (source: http://la-dwh.com/AboutNRDA.aspx; accessed November 25, 2015). Both federal and state NRDA regulations provide a step-by-step process for trustees to determine injuries, to assess damages, and to develop and implement restoration projects that compensate the public for injuries to natural resources impacted by an incident. In general, the NRDA process involves three steps: (1) pre-assessment; (2) restoration planning; and (3) restoration implementation. On July 11, 2011, Governor Bobby Jindal unveiled the "Louisiana Plan" which outlines 13 initial proposed early restoration projects (source: http://la-dwh.com/LouisianaPlanProjects.aspx; accessed November 25, 2015). The projects are consistent with Louisiana's Coastal Master Plan and they support the goal of compensating the public for natural resource injuries resulting from the Deepwater Horizon Oil Spill.
  - On October 5, 2015, the Deepwater Horizon Natural Resource Damage Assessment Trustees released the Deepwater Horizon Oil Spill Draft Programmatic Damage Assessment and Restoration Plan and

Programmatic Environmental Impact Statement (PDARP/PEIS) for public review and comment (source: http://la-dwh.com/PDARP_PEIS/Draft_PDARP_PEIS.aspx; accessed November 25, 2015). The Trustees identified Alternative A as their preferred alternative. Alternative A is an integrated restoration portfolio that emphasizes the broad ecosystem benefits that can be realized through coastal habitat restoration in combination with resource-specific restoration in the ecologically interconnected northern Gulf of Mexico ecosystem. The restoration dollars could be used for a variety of restoration approaches. For illustration purposes only, the approximately $4 billion allocated to Louisiana could be sufficient to create 20,000 to 40,000 acres of coastal marsh in Louisiana along hundreds of miles of shoreline, supporting the diversity of fish, birds, and animals that depend on coastal marsh. Although no NRDA sponsored projects have yet been constructed, it is reasonably foreseeable that the nearly Gulf-coast wide damages would be mitigated.

- The Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act (RESTORE Act) represents a portion of the Congressional response to the Deepwater Horizon oil spill. The Act dedicates 80 percent of all Clean Water Act administrative and civil penalties related to the Deepwater Horizon oil spill to the Gulf Coast Restoration Trust Fund (Trust Fund). RESTORE Act funds are allocated between five buckets: the Direct Component (35%), the Council-Selected Restoration Component (30%), the Spill Impact Component (30%), the Gulf Coast Ecosystem Restoration Science Program (2.5%); and Centers of Excellence Research Grants Program (2.5%). In early 2013, Transocean entered into a plea agreement to pay $1 billion to resolve federal Clean Water Act civil penalty claims, of which $800 million will be made available under the RESTORE Act to fund Gulf Coast recovery projects. The process of selecting projects for implementation under the RESTORE Act is anticipated to continue through the period of analysis, until the allocated funds are exhausted. Some projects have been selected and funded for implementation and will be discussed as a part of the reasonably foreseeable actions section below.

Reasonably Foreseeable Actions: Regional, Louisiana, and Study Area

The causes of coastal wetland degradation and loss have been researched extensively and are well documented. Nationwide coastal wetland degradation and loss is expected to continue due to many different, and often interacting factors, including: agriculture, nutrient enrichment, drainage, climate change, human development, silviculture, pollution, invasive species, world-wide eustatic sea level rise, subsidence, navigation channels, oil and gas activities, saltwater intrusion, hurricane and storms, and others. The EPA, reporting on the Nation, states the number of restoration projects grows yearly. Therefore, it is reasonably foreseeable, for this region, that future Federal, state and local initiatives will continue to call for a wide range of restoration actions, including coastal ecosystem restoration.

Couvillion et al. (2013) models for a 2010–2060 simulation period under a "future-without-action" condition, determined that coastal Louisiana is at risk of losing between 2,118 and 4,677 km^2 of land over the next 50 years. With the extensive coastal ecosystem degradation and coastwide land loss, it is anticipated future focus will be on the desire to implement coastal restoration projects designed to help offset these expected future coastal land losses. These projects could potentially be pursued under the CWPPRA Program, CIAP projects within Louisiana, Louisiana's Community Development Block Grant Projects (CDBG), Louisiana Coastal Area (LCA) Program, 2012 State Master Plan, State-sponsored projects, and WRDA. Reasonably foreseeable coastal ecosystem restoration projects in Louisiana include:

- The CIAP authorization is subject to a Federal fiscal cap. Within the limitations of its authorization, CIAP will continue to be implemented under the Outer Continental Shelf (OCS) Lands Act. The purpose of the program is to disburse funding to eligible producing states and coastal political subdivisions for conservation, protection, or restoration of coastal areas including wetlands; mitigation of damage to fish, wildlife, or natural resources; planning assistance and the administrative costs of complying with these objectives; implementation of a federally-approved marine, coastal, or comprehensive conservation management plan; and mitigation of the impact of outer Continental Shelf activities through funding of

onshore infrastructure projects and public service needs (source: http://www.saj.usace.army.mil/Missions/Environmental/EcosystemRestoration.aspx; accessed February 22, 2016).

- PO-73-2 - Central Wetlands – EBSTP to A2
- PO-148 - Living Shoreline
- TE-63 - Falgout Canal Freshwater Enhancement
- BA-0161 - Mississippi River Water Reintroduction into Bayou Lafourche

- The MsCIP will continue with structural, nonstructural and environmental project elements to restore coastal Mississippi. Future study elements that are as yet unfunded but included in Public Law 113-121 and may be reasonably foreseeable include the following (source: http://www.sam.usace.army.mil/Portals/46/docs/program_management/mscip/images/PlaceMap07Dec2015.jpg; accessed February 22, 2016):
  - Coast-wide Beach and Dune Restoration
  - Waveland Residential Flood proofing
  - Turkey Creek Ecosystem Restoration
  - Deer Island Restoration
  - Admiral Island Ecosystem Restoration
- The CWPPRA Program authorization has been extended to 2019. There are 22 projects in the engineering and design phase of development. It is therefore reasonably foreseeable that some CWPPRA projects that are presently in design will be authorized and constructed in the near future (such as).
  - PO-104 - Bayou Bonfouca Marsh Creation
  - ME-20 - South Grand Chenier Marsh Creation Project
  - CS-54 - Cameron-Creole Watershed Grand Bayou Marsh Creation
  - TE-72 - Lost Lake Marsh Creation and Hydrologic Restoration
  - CS-59 - Oyster Bayou Marsh Creation and Terracing
  - ME-21 - Grand Lake Shoreline Protection- Tebo Point
- The State of Louisiana, Division of Administration, Office of Community Development, CDBG Program helps communities provide a suitable living environment and expand economic opportunities for their residents, particularly in low to moderate income areas. There are presently 10 different CDBG projects in coastal Louisiana, including levee repairs, water assimilation, bulkhead, flood control, and terracing projects. The scale of this program past and present is such that the cumulative impact in the region is not significant.
  - TE-78 - Cut-Off/Pointe Aux Chene Levee
  - TV-60 - Front Ridge Chenier Terracing/Protection
  - TV-0067 - Bayou Tigre Flood Control Project
- Louisiana Coastal Area (LCA), Ecosystem Restoration Study (USACE 2004) recommends 15 near-term measures aimed at addressing the critical restoration needs. LCA Program — the USACE and the State will continue to partner to construct the Caminada Headland and Shell Island component of the Barataria Basin Barrier Shoreline project.
  - LCA BUDMAT Tiger Pass
- The Restore Act Council voted on Dec. 9, 2015, to approve the first round of Funded Priorities Lists of projects that it intends to fund with the Council-Selected Restoration Component of funds received from the Transocean settlement. Of the $241.4 million available for the current Council-Selected Restoration Component, the Council is approving approximately $156.6 million for funding this FPL, with approximately $26.6 million reserved for future activities.
  - Jean Lafitte Canal Backfilling
  - West Grand Terre Beach Nourishment and Stabilization
  - Golden Triangle Marsh Creation
  - Biloxi Marsh Living Shoreline
  - Mississippi River Reintroduction into Maurepas Swamp
  - Bayou Dularge Ridge, Marsh & Hydrologic Restoration

- NRDA: The Trustees identified Alternative A as their preferred alternative. Although no NRDA sponsored projects have yet been constructed, it is reasonably foreseeable that the nearly Gulf-coast wide damages would be mitigated. The following project has been selected for construction.
    - TE-100 - NRDA Caillou Lake Headlands

Impacts of the NER RP:

The primary impacts of the NER RP would be related to dredging and construction of the nine marsh restoration measures and the five shoreline protection measures and the reforestation of the 35 chenier reforestation measures. Dredging and construction related impacts are generally temporary and localized and include: increased turbidity and total suspended sediments, organic enrichment, chemical leaching, reduced dissolved oxygen, and elevated carbon dioxide levels. Following construction, these temporary and localized effects would return to pre-construction levels. The only significant long term adverse cumulative effects expected from implementing the NER RP measures would be associated with the conversion of existing fragmented marsh and shallow water bottom habitats to transitional estuarine marsh habitat and rocked shoreline protection habitats. However, conversion of fragmented marsh and shallow water bottoms to these transitional estuarine marsh habitat and shoreline protection habitat would provide greater long-term positive benefits when considered within the context of the ongoing extensive land loss throughout coastal Louisiana and the project area which is converting extensive areas of marsh to shallow open water.

a. Additional long term positive cumulative impacts would be related to restoring and protecting important, essential and in some instances critical habitats (e.g., piping plover) used by various terrestrial and aquatic organisms for shelter, nesting, feeding, roosting, cover, nursery, EFH and other life requirements; as well as local increases in productivity. The NER RP breakwater measures would provide protection to designated critical wintering habitat for piping plover which would work synergistically with other barrier shoreline restoration and protection features (e.g., State of Louisiana Caminada Headland Beach and Dune Restoration, Shell Island restoration; CWPPRA projects TE-27 and TE-50 Whiskey Island restoration and other barrier restoration projects). Increased recreational and commercial fishing opportunities provided by marsh restoration measures that would provide important, critical and essential habitats (e.g., piping plover) as well as protection of recreational marsh lands from wave erosion effects by the shoreline protection measures. The cumulative impacts of the proposed action would be a positive increase in visual resources, especially the viewscape, in the form of providing additional acres of marsh wetlands (and chenier ridge) in an area that is otherwise being degraded, fragmented and lost throughout the southwest coastal basin, coastal Louisiana, and the Nation. Restoration of marsh would convert existing view sheds of open water into marsh wetlands interspersed with large bodies of open water and use the basic design elements of form, line, texture, color, and repetition to create an aesthetically pleasing viewshed.

b. Recreation: Temporary negative impacts of marsh restoration activities due to increased turbidity and possible boating access issues are mediated by the presence of other productive and popular recreation areas throughout the coastal region of Louisiana. Long-term positive cumulative impacts are expected to occur as restoration measures help protect recreational resource lands from effects of coastal storm surge while improving recreational opportunities by enhancing the sustainability of valuable nursery habitats.

c. Visual resources: The continued relative sea level rise could potentially impact the entire area resulting in vast areas of shallow open water as vertical accretion rates fail to keep pace with rising sea levels. Impacts to visual resources would continue throughout not only the project area but coastal Louisiana and the Nation due to the loss of wetlands and conversion of existing habitats to open water habitats. However, wetland restoration efforts such as the CWPPRA, CIAP, and LCA Programs could restore partially the land, would convert existing viewsheds of open water into marsh, wetland, swamp or a variety of landscape types that frame large bodies of open water and use the basic design elements of form, line, texture, color and repetition to create an aesthetically pleasing viewshed.

d. The historic modifications of coastal marshes for agricultural purposes (e.g., draining and filling) and their reclamation for domestic and industrial development have substantially reduced viable wetlands habitat area during the past century (Adam, 1990; Anderson et al., 1992). Longer term, indirect impacts are also

associated with some of these habitat disturbances. For example, the construction of impoundment dikes, water-control embankments, levees, dams for flood control, as well as canals and their associated spoil banks invariably alters the hydrology of these wetland systems, often interfering with normal tidal flooding and drainage, modifying overland water flow, decreasing sediment supply to the marsh surface, and arresting vertical accretion.

e. According to Orson et al. (1985) coastal wetlands can respond to increasing sea level rise in three ways: (1) coastline retreat if the rates of coastal submergence exceed the vertical accretion of the wetland surface; (2) remain stable if sediment input from interior regions equals the rate of coastal submergence so that surface elevations are maintained; or (3) they can expand both vertically and laterally if the rate of coastal submergence is less than the sediment accretion rate. The failure of coastal wetlands to keep pace with sea level rise is generally ascribed to insufficient sediment deposition on the wetland surface leading to accretion deficits (i.e., vertical accretion is less than relative sea level rise). Delaune et al. (1983) and others have documented that, throughout coastal Louisiana wetlands are being replaced at an alarming rate by shallow open water.

CEQ's recommends 11 Steps for Cumulative Effects Analysis. The following describes how the study is consistent with the CEQ's 11-step cumulative effects analysis for both the NED and NER Plans. Some considerations specific to NER analysis are as follows:

- Step 1: This document has identified in previous sections the significant effects and issues associated with implementing the proposed action by documenting the direct and indirect effects of the proposed action on significant environmental resources.
- Step 2: This document has identified the geographic scope of the analysis as the area consisting of Calcasieu, Cameron and Vermilion Parishes including the migratory species frequenting the geographic area.
- Step 3: The time frame of the analysis consisted of the historic, existing, future without project and future with project conditions for the identified significant natural and human environmental resources.
- Step 4: Other actions affecting the significant natural and human resources (the significant resources have been previously described).
- Steps 5 and 6: The responses of each identified significant resource to change has been documented for each identified significant human and natural resource, as have the factors or stressors potentially affecting significant human and natural resources, and if appropriate, their relationship to regulatory thresholds (e.g., air quality standards; threatened and endangered species and their designated critical habitat).
- Step 7: The baseline condition has been documented for each significant human and natural resources including the historic, existing, and future without project conditions (Chapter 1).
- Step 8: The incremental project-induced impacts would be in addition to impacts from other actions such as continued oil and gas exploration/extraction/production/refining, navigation, commercial and recreational fisheries, inhabitation and employment, other coastal protection and restoration activities, and other human activities in the project area.
- Step 9: The magnitude and significance of cumulative effects on identified significant resources are identified for:
  a. Study area influences,
  b. Region-wide influences on significant resources.
- Step 10: Theplan has been evaluated to ensure steps were taken to avoid and minimize impacts to significant resources. During plan formulation steps were taken to remove, modify or add alternatives to avoid, minimize, reduce, or mitigate potential significant effects.
- Step 11: Monitoring effects of the proposed action and adaptation of management are identified and described in the Adaptive Management and Monitoring (AM&M) Plan (see Appendix A Annex L).

This analysis considers known past, present, and reasonably foreseeable future nonstructural hurricane storm damage risk reduction projects and ecosystem restoration projects over a 50-year period of analysis from 2025 to 2075. Table 3-6 provides a summary of this cumulative impacts analysis.

Table 3-6 Summary of Cumulative Impacts
(*NED Plan 8 Alternative – Nonstructural 100-Year Floodplain cumulative impacts would be similar in nature but greater in scale compared to NED RP)
(**Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan cumulative effects are same as impacts identified for the Mermentau Basin component of NER RP)

Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts NED RP: Modified Plan 8 Nonstructural 0-25 year Floodplain Plan*	Cumulative Impacts NER RP: Plan CM-4**
Population and Housing Levels	Risks of hurricane storm surge impacts continue to those not provided risk reduction by structural or nonstructural risk reduction measures. United States (US): Population and households increasing. Louisiana (LA): population in 1970 estimated at 3.645 million. Risks of hurricane storm surge impacts to those not provided risk reduction by structural or nonstructural risk reduction measures. Study Area (SA): 1970 populations and number of households in Calcasieu, Cameron and Vermilion Parishes is 196,680 with 57.2 thousand households	Risks of hurricane storm surge impacts continue to those not provided risk reduction by structural or nonstructural risk reduction measures. US: Population and households increasing. LA: 2015 populations increasing to 4,605 million. Continued coastal land loss and conversion to open water and loss of forested cheniers. SA: 2012 population 259,918 with 96.2 thousand households. Continued coastal land loss and conversion to open water and loss of forested cheniers.	Risks of hurricane storm surge impacts continue to those not provided risk reduction by structural or nonstructural risk reduction measures. US: Population and households increasing. LA: Increasing population and households in Louisiana. Continued coastal land loss and conversion to open water and loss of forested cheniers. SA: Increases population and households in Calcasieu, Cameron and Vermilion Parishes. Households likely continue. Risk of hurricane storm surge damages continue. Continued loss of brackish and saline marsh and forested chenier habitats.	US: Population and households increasing. LA: Increasing populations and households. Risks of hurricane storm surge impacts continue to those not provided risk reduction by structural or nonstructural risk reduction measures. SA: Hurricane storm surge related risks reduced for individual households and people located in the 25-year floodplain and in structures that volunteer to participate in nonstructural risk reduction measures. People and households associated with those structures not included in the proposed voluntary nonstructural risk reduction measures would continue to be at risk from hurricane storm surge risk reduction.	US: Population and households increasing. Continued coastal land loss and conversion to open water especially for coastal states. Offset by nationwide coastal restoration efforts. LA: Continued Louisiana coastal wetland loss and loss of forested cheniers offset by coastal restoration efforts such as CWPPRA, LCA, and others described in Sections 1.9 and 3.4. SA: Cumulative impacts would include incremental impacts of proposed action in the SA in addition to other ecosystem restoration throughout the basin, Louisiana, and the Nation being converted or restored from open water back to land mass. Similar projects include diversion projects, marsh, and swamp restoration and nourishment by CWPPRA, LCA and others described in Sections 1.9 and 3.4.
Employment, Business, and Industrial Activity (Including Agriculture)	The leading employment sectors are education, healthcare, petroleum production, and petrochemical refining. Other significant employment sectors include education, manufacturing, accommodations and social services, and retail trade. Employment for the region as a whole grew from 1970 through 2000.	Employment growth was steady from 1970 to 2012 for Calcasieu and Vermilion parishes, although employment in Cameron parish declined since 2000, and is reflected in the population estimates previously described.	Employment is expected to continue to follow the same trend in the study area. However, businesses would face a higher risk of closing periodically due to damages sustained from hurricane storm-surge.	Would lower the risk that hurricane storm-surge damage would cause the businesses included in the recommended plan. This lower risk could shorten the amount of time businesses would need to close following a hurricane.	Land loss would be stabilized, which could result in localized positive effects of maintaining employment and businesses (e.g., recreational and commercial fishing), and industrial activity.
Public Facilities and Services	The Port of Lake Charles is a key center for international trade, and is among the top 15 busiest ports in the nation. A total of 603 public and quasi-public buildings were specifically inventoried in 2012.	The Port of Lake Charles is a key center for international trade, and is among the top 15 busiest ports in the nation. A total of 603 public and quasi-public buildings were specifically inventoried in 2012.	FWOP conditions would include a greater potential for permanent displacement of public facilities and services due to hurricane storm surge events. Public facilities and services are expected to grow with the needs of the population and would follow population growth trends. In addition to the existing 603 public and quasi-public buildings, an additional 193 such facilities are projected by 2080	Would reduce risk of hurricane storm surge-related damages for public facilities and services in the area thereby reducing the number of days a structure is unavailable for use and minimizing the inconvenience to the general public.	Plan CM-4 would have no cumulative impacts on public facilities or services.

JA 37-899 10/04/2019 140

Table 3-6 Summary of Cumulative Impacts
(*NED Plan 8 Alternative -- Nonstructural 100-Year Floodplain cumulative impacts would be similar in nature but greater in scale compared to NED RP)
(**Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan cumulative effects are same as impacts identified for the Mermentau Basin component of NER RP)

Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts NED RP: Modified Plan 8 Nonstructural 0-25 year Floodplain Plan*	Cumulative Impacts NER RP: Plan CM-4**
Transportation	The transportation infrastructure includes major roads, highways, railroads, and navigable waterways that have developed historically to meet the needs of the public. Interstate 10 (I-10), an east-west bi-coastal thoroughfare that connects Houston and Baton Rouge, crosses the northern part of the area and is a primary route for hurricane evacuation and post-storm emergency response.	The transportation infrastructure includes major roads, highways, railroads, and navigable waterways that have developed historically to meet the needs of the public. Interstate 10 (I-10), an east-west bi-coastal thoroughfare that connects Houston and Baton Rouge, crosses the northern part of the area and is a primary route for hurricane evacuation and post-storm emergency response.	Portions of Interstate 10 and other highways and local roads will continue to be periodically damaged by hurricane storm surge.	Portions of Interstate 10 and other highways and local roads will continue to be periodically damaged by hurricane storm surge.	Would reduce the intensity of almost daily wind-generated wave action which erodes areas adjacent to Highway 82; would reduce the wave action which erodes the southern spoil bank along the GIWW from the south; would protect the shoreline of Freshwater Bayou through the placement of foreshore rock dikes;
Community and Regional Growth	Growth in the study area has been largely steady and follows population trends	Residents currently living in low-lying areas face the prospect of relocating due to the high risk of hurricane storm surge damage.	Income growth and associated community and regional growth are expected to follow trends in national income, local employment, household formation, and the demand for public facilities and services. There would also be a higher potential for unstable or disrupted community and regional growth due to increasing risk of damage from storm surge events.	Would include reduced risk of hurricane storm surge-related damages for those low-lying structures located in the 25 year floodplain thus reducing overall social vulnerability and preserving growth opportunities for communities in the region and enhancing the potential for long-term growth and sustainability.	Plan CM-4 would have no cumulative impacts on Community and Regional Growth.
Tax Revenues and Property Values	Tax revenues from property taxes tend to rise over time with the increase in property values.	Property values in the low-lying areas are likely not rising in value at the same rate as comparable properties facing a lower risk of sustaining hurricane storm-surge damage.	FWOP conditions would include lower tax revenues as property values decline due to higher risk of damage from hurricane storm surge events over time. Higher risk of damage from hurricane storm surge would manifest itself in higher premiums for flood insurance under the NFIP: higher premiums are expected to increase the cost of property ownership and result in correspondingly lower market values	For the properties included in the recommended plan, property values would stabilize as the higher risk of damage from hurricane storm surge is arrested and reduced.	Would facilitate the prevention of land loss, which could result in localized positive effects of maintaining tax revenues and property values

JA 37-899 10/04/2019 141

Table 3-6 Summary of Cumulative Impacts
(*NED Plan 8 Alternative – Nonstructural 100-Year Floodplain cumulative impacts would be similar in nature but greater in scale compared to NED RP)
(**Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan cumulative effects are same as impacts identified for the Mermentau Basin component of NER RP)

Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts NED RP: Modified Plan 8 Nonstructural 0-25 year Floodplain Plan*	Cumulative Impacts NER RP: Plan CM-4**
Other Social Effects	US: Severe storm surge events threaten the health and safety of residents living in coastal areas. Loss of life, injury, and post flood health hazards may occur in the event of catastrophic flooding. LA and SA: The study area was severely impacted by Hurricane Rita in 2006 and Hurricane Ike in 2008. When facilities that provide critical care or emergency services are impacted by storm surge events, residents are at an even greater risk for experiencing negative health outcomes. Hurricanes Rita and Ike reduced the accessibility and availability of health facilities and services and required additional first-responder (fire and police) protection.	US, LA and SA: Other Social Effects that storm surge has on communities include impacts to health and safety, economic vitality, social connectedness, vulnerability and resiliency and leisure and recreation. Many communities along the eastern seaboard and the gulf coast remain vulnerable to these social effects.	US, LA and SA: Social vulnerability is expected to increase over time if subsidence and sea level rise continue to occur, and the population of coastal communities increases as it is projected to do. The absolute number of socially vulnerable people (e.g., low-income, minority, less-educated, and over the age of 65) at risk for storm surge events will increase. This, in turn, may lead to an increased burden placed on local, state, and federal agencies to ensure that the most socially vulnerable populations have access to resources before, during, and after flood events. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane and storm surge damage risk reduction projects as described in more detail in Sections 1.9 and 3.4.	US, LA and SA: Cumulative impacts include reducing the risks associated with damages to housing units, public facilities, and commercial structures during storm events as well as improving the health and safety of residents living within the study area. The study area's social vulnerability would be reduced under this alternative with the possible exception of populations unwilling to participate or unable to participate in the Project due to ineligible Project costs. Reduced social vulnerability leads to the potential for enhanced long-term growth and sustainability. Also, the area would be at a reduced risk of incurring the costs associated with clean-up, debris removal, and building and infrastructure repair as a result of storm surge events. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane and storm surge damage risk reduction projects as described in more detail in Sections 1.9 and 3.4.	US, LA and SA: Restoration projects would reduce the risks associated with habitat damage via saltwater intrusion, shoreline retreat, and loss of geomorphologic infrastructure. The area's social vulnerability would be reduced under this alternative via improved leisure and recreation opportunities, economic vitality, and reduced stress. Thus, the potential for long-term growth and sustainability would be enhanced. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane and storm surge damage risk reduction projects as described in more detail in Sections 1.9 and 3.4.

JA 37-899 10/04/2019 142

Table 3-6 Summary of Cumulative Impacts
(*NED Plan 8 Alternative – Nonstructural 100-Year Floodplain cumulative impacts would be similar in nature but greater in scale compared to NED RP)
(**Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan cumulative effects are same as impacts identified for the Mermentau Basin component of NER RP)

Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts NED RP: Modified Plan 8 Nonstructural 0-25 year Floodplain Plan*	Cumulative Impacts NER RP: Plan CM-4**
Community Cohesion	US, LA and SA: Community cohesion is based on the characteristics that keep the members of the group together long enough to establish meaningful interactions, common institutions, and agreed upon ways of behavior. Many areas across the country, state and in the study area are comprised of communities with a long history and long-established public and social institutions including places of worship, schools, and community associations. In 2005 with Hurricane Rita, and again in 2008 with Hurricane Ike, communities in Calcasieu, Cameron, and Vermilion Parishes were inundated by storm surge and social institutions were impacted which affected community cohesion.	US, LA and SA: Due to the absence of hurricane storm surge risk reduction measures, and the resulting direct impacts to existing structures, local populations are often forced to evacuate and/or relocate for significant time periods, thereby significantly disrupting temporarily, and in some instances, permanently, community cohesion.	US, LA and SA: Due to the absence of hurricane storm surge risk reduction measures, and the resulting direct impacts to existing structures, local coastal populations, which are projected to increase in the future, are often forced to evacuate and/or relocate for significant time periods, thereby significantly disrupting temporarily, and in some instances, permanently, community cohesion. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane and storm surge damage risk reduction projects as described in more detail in Sections 1.9 and 3.4.	US, LA and SA: Storm surge risk reduction measures could temporarily affect community cohesion due to the noise and fugitive dust from construction activities, the temporary displacement and relocation of residents during construction, and disruption of businesses during construction. Furthermore, non-residential structures that serve as meeting places for the community could become temporarily unavailable during Project implementation. The nonstructural plan would provide positive benefits to the community and it's cohesiveness by reducing the risk of storm surge damage resulting in fewer evacuations or permanent displacement. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane and storm surge damage risk reduction projects as described in more detail in Sections 1.9 and 3.4.	US, LA and SA: Restoration impacts would include maintaining the integrity of the coastal landscape that supports ecosystem services that in turn supports human population and activities. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane and storm surge damage risk reduction projects as described in more detail in Sections 1.9 and 3.4.
Environmental Justice	US, LA & SA: Institutional recognition of Environmental Justice because of Executive Order 12898 of 1994 (E.O. 12898) and the Department of Defense's Strategy on Environmental Justice of 1995, which direct Federal agencies to identify and address any disproportionately high adverse human health or environmental effects of Federal actions to minority and/or low-income populations.	US, LA: High poverty rates negatively impact the social welfare of residents and undermine the community's ability to provide assistance to residents in times of need.	US, LA & SA: Institutional recognition of Environmental Justice because of Executive Order 12898 of 1994 (E.O. 12898) and the Department of Defense's Strategy on Environmental Justice of 1995, which direct Federal agencies to identify and address any disproportionately high adverse human health or environmental effects of Federal actions to minority and/or low-income populations.	US, LA: High poverty rates negatively impact the social welfare of residents and undermine the community's ability to provide assistance to residents in times of need.	US, LA & SA: Institutional recognition of Environmental Justice because of Executive Order 12898 of 1994 (E.O. 12898) and the Department of Defense's Strategy on Environmental Justice of 1995, which direct Federal agencies to identify and address any disproportionately high adverse human health or environmental effects of Federal actions to minority and/or low-income populations.

JA 37-899 10/04/2019 143

Table 3-6 Summary of Cumulative Impacts
(*NED Plan 8 Alternative – Nonstructural 100-Year Floodplain cumulative impacts would be similar in nature but greater in scale compared to NED RP)
(**Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan cumulative effects are same as impacts identified for the Mermentau Basin component of NER RP)

Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts NED RP: Modified Plan 8 Nonstructural 0-25 year Floodplain Plan*	Cumulative Impacts NER RP: Plan CM-4**
Flow and Water Levels	US & LA & SA: Flows and water levels respond to and are impacted by natural conditions such as hurricane storm surge and man-made conditions. Subsidence and eustatic sea level rise cause landward movement of marine conditions into estuaries, wetlands and fringing uplands.	US & LA: Increased flows and water levels associated with increased runoff due to increasing urbanization and wetland loss. Rate of RSLR increasing over historic conditions. SA: Water control structures operated both passively and actively. Virtually all hydrologic management focuses on controlling salinity and minimizing tidal fluctuations by constructing and operating levees, weirs, and a variety of gated structures. 1990 inventory identified 174 individual water control structures in the interior and along the perimeter of the Calcasieu-Sabine basin.	US & LA & SA: Increased hurricane storm surges; increased flows and water levels associated with increase urbanization and associated runoff and increased wetland loss. Rate of RSLR increasing over historic conditions. Existing and authorized structural and nonstructural hurricane storm surge damage risk reduction projects provide risk reduction. SA: Continued disjointed and uncoordinated operation of water control structures. There are no identified existing or authorized for construction risk structural or nonstructural risk reduction measures in SA.	US & LA: Increased hurricane storm surges; increased flows and water levels associated with increased urbanization and associated runoff and increased wetland loss. Rate of RSLR increasing over historic conditions. Existing and authorized structural and nonstructural hurricane storm surge damage risk reduction projects provide risk reduction. SA: Total level of project-induced impact would be relatively minor and in addition to other existing and authorized for construction structural and nonstructural hurricane storm surge damage risk reduction projects as described in more detail in Sections 1.9 and 3.4.	US: increased flows and water levels associated with increased urbanization and associated runoff and increased wetland loss, and increased hurricane storm surges. Continued coastal land loss and conversion to open water especially for coastal states. Offset by nationwide coastal restoration efforts. LA: Similar to US and including increasing rate of RSLR over present conditions. Continued Louisiana coastal wetland loss and loss of forested cheniers offset by coastal restoration efforts such as CWPPRA, LCA, and others described in Sections 1.9 and 3.4. SA: Cumulative impacts include incremental impacts of proposed action on flow and water levels in the SA in addition to impacts to flow and water levels by other ecosystem restoration throughout the basin, Louisiana, and the Nation. Similar projects include diversion projects, marsh, and swamp restoration and nourishment by CWPPRA, LCA and others described in Sections 1.9 and 3.4.
Water Quality and Salinity	LA & SA: Clean Water Act of 1977, NEPA of 1969, Coastal Zone Management Act, and Estuary Protection Act and institutional recognition to restore and protect water bodies, especially with respect to point sources. Non-point sources still unregulated. LA & SA: Increasing human development adversely impacts water quality. Salinity levels increase inland due to salt water intrusion, due in part to wetland loss, channelization, and oil and gas exploration canals.	US & LA & SA: Continued institutional recognition. Increasing human development, agriculture and oil & gas exploration and industrialization result in increased potential for water quality problems and saltwater intrusion. SA: coastal wetland loss results in loss of water purification by wetlands. Channels and oil & gas exploration canal continue to provide conduit for saltwater intrusion and coastal land loss.	US & LA & SA: Continued institutional recognition. Increasing human development, agriculture and oil & gas exploration and industrialization result in increased potential for water quality problems and saltwater intrusion. These water quality impacts offset by existing and authorized for construction ecosystem restoration projects. SA: coastal wetland loss results in loss of water purification by wetlands. Channels and oil & gas exploration canal continue to provide conduit for saltwater intrusion and coastal land loss.	US & LA: Continued institutional recognition. Increasing human development, agriculture, channelization and oil & gas exploration and industrialization continue to result in increased potential for water quality problems and saltwater intrusion. These water quality impacts offset by existing and authorized for construction ecosystem restoration projects. SA: The NED RP would reduce water quality impacts associated with flooding from storm surge events. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane storm surge damage risk reduction projects as described in more detail in Sections 1.9 and 3.4.	US & LA: Continued institutional recognition. Increasing coastal land loss, human development, agriculture, channelization and oil & gas exploration and industrialization continue to result in increased potential for water quality problems and saltwater intrusion. These water quality impacts offset by existing and authorized for construction ecosystem restoration projects throughout the US and LA. SA: NER would have short term, localized and generally minor adverse water quality impacts during construction. There would be long term positive water quality improvements as restored, nourished and protected marsh improves local water quality by sequestering and filtering degraded waters. These impacts would be in addition to other national, state and local existing and authorized for construction ecosystem restoration projects as described in more detail in Sections 1.9 and 3.4.

JA 37-899 144 10/04/2019

Table 3-6 Summary of Cumulative Impacts
(*NED Plan 8 Alternative – Nonstructural 100-Year Floodplain cumulative impacts would be similar in nature but greater in scale compared to NED RP)
(**Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan cumulative effects are same as impacts identified for the Mermentau Basin component of NER RP)

Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts NED RP: Modified Plan 8 Nonstructural 0-25 year Floodplain Plan*	Cumulative Impacts NER RP: Plan CM-4**
Sedimentation and Erosion	US & LA & SA: Flood Control Act of 1928 helps reduce sedimentation of rivers and other water bodies caused by erosion associated with agriculture, human development, industrialization and storms. SA: Sediment delivery by Atchafalaya River and other rivers throughout SA.	US & LA: continued sedimentation and erosion associated with agriculture, human development, industrialization, storms, navigation channels and oil and gas canals. LA: 350 miles of sandy barrier shoreline and gulf beaches lost. SA: White Lake average shoreline erosion rate of 15 feet per year; Grand Lake shoreline erosion rate of 11 feet per year to 32 feet per year; and Sabine Lake about 10 feet per year.	US & LA: continued sedimentation and erosion associated with agriculture, human development, industrialization, storms, navigation channels and oil and gas canals. These impacts would be offset by existing and authorized for construction ecosystem restoration projects. SA: continued shoreline erosion and sedimentation.	US & LA: continued sedimentation and erosion associated with agriculture, human development, industrialization, storms, navigation channels and oil and gas canals. These impacts would be offset by existing and authorized for construction ecosystem restoration projects SA: No project-induced impacts of NED RP.	US & LA: continued sedimentation and erosion associated with agriculture, human development, industrialization, storms, navigation channels and oil and gas canals. These impacts would be offset by existing and authorized for construction ecosystem restoration projects SA: Increased marsh surface area would increase sediment entrapment when marshes are flooded (e.g., tidal and storm surge). Restored marsh would reduce fetch over open water areas thereby reducing wind generated waves and subsequent erosion. These impacts would be in addition to other national, state and local existing and authorized for construction ecosystem restoration projects as described in more detail in Sections 1.9 and 3.4.
Soils, Water Bottoms, Prime & Unique Farmlands	US: Institutional recognition of soil and water resources conservation. Prime agricultural land decreases from 1997 to 2012 LA: land area decreases from 1932 to 2010; SA: land area decreases from 1932 to 2010 with concomitant increase in shallow open water area.	US: Institutional recognition of soil and water resources conservation. Prime agricultural land decreases from 1997 to 2012 LA: land area decreases from 1932 to 2010 SA consists primarily of wetland type soils and shorelines prone to frequent flooding and not suitable for agricultural use. Prime farmland consist of 941,196 acres, or 34.3 percent of the soils in SA	US: Institutional recognition of soil and water resources conservation. Prime agricultural land decreases from 1997 to 2012 LA: land area continues to decrease with concomitant increase in shallow open water resulting in greater potential for hurricane storm surge damages to human habitations and loss of estuarine marsh habitats. These impacts offset by beach nourishment and restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: land area continues to decrease with concomitant increase in shallow open water resulting in greater potential for hurricane storm surge damages and loss of estuarine marsh habitats	US: Institutional recognition of soil and water resources conservation. Prime agricultural land decreases from 1997 to 2012 LA: land area continues to decrease with concomitant increase in shallow open water resulting in greater potential for hurricane storm surge damages to human habitations and loss of estuarine marsh habitats. These impacts offset by beach nourishment and restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: no significant impacts of the NED RP on soils, water bottoms or prime and unique wetlands.	US: Institutional recognition of soil and water resources conservation. Prime agricultural land decreases from 1997 to 2012 LA: land area continues to decrease with concomitant increase in shallow open water resulting in greater potential for hurricane storm surge damages to human habitations and loss of estuarine marsh habitats. These impacts offset by beach nourishment and restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: total 15,448 net acres with 4973 AAHUs of brackish and saline marsh and cheniers restored, protected, and reforested. Total 14,635 acres of water bottoms impacted by borrowing sediments for marsh restoration, placement of shoreline protection rock, and restoring water bottoms to marsh. Marsh restoration and shoreline protection would increase and help stabilize hydric soils. Direct impacts to water bottoms in the marsh restoration footprints in Calcasieu and Mermentau Basins would result in the restoration of existing water bottom habitat to marsh habitat. These impacts would be in addition to other national, state and local existing and authorized for construction ecosystem restoration projects as described in more detail in Sections 1.9 and 3.4.

JA
37-899
10/04/2019
145

Table 3-6 Summary of Cumulative Impacts
(*NED Plan 8 Alternative – Nonstructural 100-Year Floodplain cumulative impacts would be similar in nature but greater in scale compared to NED RP)
(**Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan cumulative effects are same as impacts identified for the Mermentau Basin component of NER RP)

Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts NED RP: Modified Plan 8 Nonstructural 0-25 year Floodplain Plan*	Cumulative Impacts NER RP: Plan CM-4**
Coastal Shorelines	US: Institutional recognition of coastal barrier resources. Beach shorelines continue to erode as sea level rises and in many instances subsidence continues. Losses offset by federal, state, and local beach nourishment and restoration projects. LA: Gulf shoreline and interior waterbody shoreline losses continue as sea level rises and subsidence continues. Losses offset by beach nourishment and restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: Gulf coastal shorelines and interior waterbody shorelines continue to erode due to natural and man-induced causes.	US: Institutional recognition of coastal barrier resources continues. Beach shorelines continue to erode as sea level rises and subsidence continues. Losses offset by federal, state, and local beach nourishment and restoration projects. LA: Gulf shoreline and interior waterbody shoreline losses continue as sea level rises and subsidence continues. These impacts offset by beach nourishment and restoration projects such as CWPPRA, LCA, NOAA Fisheries and their state and local efforts LA: beach shorelines continue to erode as sea level rises and subsidence continues. Losses offset by federal, state, and local beach nourishment and restoration projects. LA: Gulf shoreline and interior waterbody shoreline losses continue as sea level rises and subsidence continues. Losses offset by beach nourishment and restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA the average long-term erosion rate at Rockefeller Wildlife Refuge estimated to be 30.9 ft/yr; Gulf shoreline recession rates vary from 4.4 feet per year near Hackberry Beach, 8.7 feet per year at Ocean View Beach, 36.1 feet per year at Mermentau Beach and 52.4 ft/yr at Rockefeller Wildlife Refuge.	US: Institutional recognition of coastal barrier resources continues. Losses offset by federal, state, and local beach nourishment and restoration projects. LA: Gulf shoreline and interior waterbody shoreline losses continue as sea level rises and subsidence continues. These impacts offset by beach nourishment and restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: Gulf shoreline and interior waterbody shoreline losses continue as sea level rises and subsidence continues. Losses offset by beach nourishment and restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts	US: Institutional recognition of coastal barrier resources continues. Beach shorelines continue to erode as sea level rises in many instances subsidence continues. These impacts offset by federal, state and local beach nourishment and restoration projects. LA: Gulf shoreline and interior waterbody shoreline losses continue as sea level rises and subsidence continues. Losses offset by beach nourishment and restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: NED RP has no significant direct, indirect or cumulative impacts on coastal shorelines.	US: Institutional recognition of coastal barrier resources continues. Beach shorelines continue to erode as sea level rises in many instances subsidence continues. These impacts offset by federal, state and local beach nourishment and restoration projects. LA: Gulf shoreline and interior waterbody shoreline losses continue as sea level rises and subsidence continues. These impacts offset by beach nourishment and restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: 251,528 linear feet of shoreline protection would benefit 6,135 net acres marsh with 1,738 AAHUs. These impacts would be in addition to other national, state and local existing and authorized for construction ecosystem restoration projects as described in more detail in Sections 1.9 and 3.4.

JA 37-899 10/04/2019 146

Table 3-6 Summary of Cumulative Impacts
(*NED Plan 8 Alternative – Nonstructural 100-Year Floodplain cumulative impacts would be similar in nature but greater in scale compared to NED RP)
(**Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan cumulative effects are same as impacts identified for the Mermentau Basin component of NER RP)

Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts NED RP: Modified Plan 8 Nonstructural 0-25 year Floodplain Plan*	Cumulative Impacts NER RP: Plan CM-4**
Vegetation Resources	US: Institutional recognition of Natural Resources. Vegetation resources continue to be lost to human encroachment and development LA: from 1985 to 2010 increasing coastal land loss of -16.57 mile^2 per year SA: from 1985 to 2010 increasing coastal land loss of – 0.97 square miles per year Calcasieu Basin; -1.30 mile^2 in Mermentau Basin; -0.45 mile^2 in Teche-Vermilion Basin	US: Institutional recognition of Natural Resources continues. Vegetation resources continue to be lost to human encroachment and development LA: from 1985 to 2010 increasing coastal land loss of -16.57 square miles per year SA: from 1985 to 2010 increasing coastal land loss of – 0.97 mile^2 per year Calcasieu Basin; -1.30 mile^2 in Mermentau Basin; -0.45 mile^2 per year in Teche-Vermilion Basin	US: Institutional recognition of Natural Resources continues. Vegetation resources continue to be lost to human encroachment and development. These impacts would be offset by existing and authorized for construction ecosystem restoration projects. LA: estimated net change between 2010-2060 under moderate sea level rise scenario is -2100 km^2. These impacts offset by restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: estimated net change between 2010-2060 under moderate sea level rise scenario in Calcasieu/Sabine basin is -146.5 km^2; in Mermentau Basin -208 km^2; and in Teche-Vermilion Basin -67 km^2	US: Institutional recognition of Natural Resources continues. Vegetation resources continue to be lost to human encroachment and development. These impacts would be offset by existing and authorized for construction ecosystem restoration projects LA: estimated net change between 2010-2060 under moderate sea level rise scenario is -2100 km^2. These impacts offset by restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts. SA: NED RP has no significant direct, indirect or cumulative impacts on vegetation resources.	US: Institutional recognition of Natural Resources continues. Vegetation resources continue to be lost to human encroachment and development. These impacts would be offset by existing and authorized for construction ecosystem restoration projects LA: estimated net change between 2010-2060 under moderate sea level rise scenario is -2100 km^2. These impacts offset by beach nourishment and restoration projects such as CWPPRA, LCA, NOAA Fisheries, and other state and local efforts. SA: total 15,448 net acres with 4973 AAHUs of brackish and saline marsh and cheniers restored, protected, and reforested. These impacts would be in addition to other national, state and local existing and authorized for construction ecosystem restoration projects as described in more detail in Sections 1.9 and 3.4.
Wildlife Resources	US: Institutional recognition of natural resources and fish and wildlife resources and its habitats. Wetland dependent wildlife populations respond primarily to natural population-regulating mechanisms. Institutional recognition of wildlife and its habitats. Wildlife resources continue to be adversely impacted and lost due to human encroachment and development of wildlife habitats LA: wildlife habitats lost from 1985 to 2010 due to increasing coastal land loss of -16.57 mile^2 per year SA: wildlife habitat losses from 1985 to 2010 increasing coastal land loss of – 0.97 square miles per year Calcasieu Basin; -1.30 mile^2 in Mermentau Basin; -0.45 mile^2 in Teche-Vermilion Basin	US: Institutional recognition of natural resources and fish and wildlife resources and its habitats continues. Continued institutional recognition of wildlife and its habitats. Wildlife resources continue to be adversely impacted and lost due to human encroachment and development of wildlife habitats. LA: wildlife habitats lost from 1985 to 2010 due to increasing coastal land loss of -16.57 square miles per year SA: from 1985 to 2010 increasing coastal land loss of – 0.97 mile^2 per year Calcasieu Basin; -1.30 mile^2 in Mermentau Basin; -0.45 mile^2 per year in Teche-Vermilion Basin	US: Institutional recognition of natural resources and fish and wildlife resources and its habitats continues. Wildlife resources continue to be adversely impacted and lost due to human encroachment and development of wildlife habitats. These impacts would be offset by existing and authorized for construction ecosystem restoration projects LA: continued wildlife habitats lost with estimated net change between 2010-2060 under moderate sea level rise scenario is -2100 km^2. These impacts offset by restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: estimated net change between 2010-2060 under moderate sea level rise scenario in Calcasieu/Sabine basin is -146.5 km^2; in Mermentau Basin -208 km^2; and in Teche-Vermilion Basin -67 km^2	US: Institutional recognition of natural resources and fish and wildlife resources and its habitats continues. Wildlife resources continue to be adversely impacted and lost due to human encroachment and development of wildlife habitats. These impacts would be offset by existing and authorized for construction ecosystem restoration projects LA: continued wildlife habitats lost with estimated net change between 2010-2060 under moderate sea level rise scenario is -2100 km^2. These impacts offset by restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: NED RP has no significant direct, indirect or cumulative impacts on wildlife resources.	US: Institutional recognition of natural resources and fish and wildlife resources and its habitats continues. Wildlife resources continue to be adversely impacted and lost due to human encroachment and development of wildlife habitats. These impacts would be offset by existing and authorized for construction ecosystem restoration projects LA: continued wildlife habitats lost with estimated net change between 2010-2060 under moderate sea level rise scenario is -2100 km^2. These impacts offset by beach nourishment and restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: total 15,448 net acres with 4973 AAHUs of brackish and saline marsh and cheniers restored, protected, and reforested and used by various wildlife species. These impacts would be in addition to other national, state and local existing and authorized for construction ecosystem restoration projects as described in more detail in Sections 1.9 and 3.4.

JA 37-899 10/04/2019 147

Table 3-6 Summary of Cumulative Impacts
(*NED Plan 8 Alternative – Nonstructural 100-Year Floodplain cumulative impacts would be similar in nature but greater in scale compared to NED RP)
(**Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan cumulative effects are same as impacts identified for the Mermentau Basin component of NER RP)

Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts NED RP: Modified Plan 8 Nonstructural 0-25 year Floodplain Plan*	Cumulative Impacts NER RP: Plan CM-4**
Fisheries and Aquatic Resources	US & LA & SA: Institutional recognition of natural resources and fish and aquatic resources and its habitats. Reduction in fisheries habitat, increased catches, gear improvement, catch regulations, Magnuson-Stevens Fishery Conservation and Management Act and amendments, formation of NMFS and LDWF. About 90% of the world's seafood resources have been depleted in the past century; 38% of the depleted species have declined by more than 90%; 7% of the species of fish studied by researchers have become extinct.	US & LA & SA: Institutional recognition of natural resources and fish and aquatic resources and its habitats. LA: from 1985 to 2010 increasing coastal land loss of -16.57 square miles per year results in loss of coastal estuaries used as fish and aquatic organisms nursery and foraging habitat. SA: from 1985 to 2010 increasing coastal land loss of -0.97 mile^2 per year Calcasieu Basin; -1.30 mile^2 in Mermentau Basin; -0.45 mile^2 per year in Teche-Vermilion Basin	US: Institutional recognition of natural resources and fish and aquatic resources and its habitats continues. Fisheries and aquatic resources continue to be adversely impacted due to reduction in fisheries habitat, increased catches, gear improvement, catch regulations. These impacts would be offset by existing and authorized for construction ecosystem restoration projects LA: continued fish and aquatic organisms estuarine habitats lost with estimated net change between 2010-2060 under moderate sea level rise scenario is -2100 km^2. These impacts offset by restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: estimated net change between 2010-2060 under moderate sea level rise scenario in Calcasieu/Sabine basin is -146.5 km^2; in Mermentau Basin -208 km^2; and in Teche-Vermilion Basin -67 km^2	US: Institutional recognition of natural resources and fish and wildlife resources and its habitats continues. Fisheries and aquatic resources continue to be adversely impacted due to reduction in fisheries habitat, increased catches, gear improvement, catch regulations. These impacts would be offset by existing and authorized for construction ecosystem restoration projects LA: continued fish and aquatic organisms estuarine habitats lost with estimated net change between 2010-2060 under moderate sea level rise scenario is -2100 km^2. These impacts offset by restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: NED RP has no significant direct, indirect or cumulative impacts on fisheries or aquatic resources.	US: Institutional recognition of natural resources and fish and wildlife resources and its habitats continues. Fisheries and aquatic resources continue to be adversely impacted due to reduction in fisheries habitat, increased catches, gear improvement, catch regulations. These impacts would be offset by existing and authorized for construction ecosystem restoration projects LA: continued wildlife habitats lost with estimated net change between 2010-2060 under moderate sea level rise scenario is -2100 km^2. These impacts offset by beach nourishment and restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: total 9,313 net acres with 3,239 AAHUs of brackish and saline marsh restored, nourished and protected and available for use by fish and aquatic organisms. These impacts would be in addition to other national, state and local existing and authorized for construction ecosystem restoration projects as described in more detail in Sections 1.9 and 3.4.
Essential Fish Habitat	US & LA & SA: Institutional recognition of decline in EFH quality; passage of Magnuson-Stevens Fishery Conservation and Management Act, as amended, formation of NMFS and LDWF.	US & LA & SA: Institutional recognition of EFH continues. LA: from 1985 to 2010 increasing coastal land loss of -16.57 square miles per year results in loss of coastal estuaries used as transitional estuarine EFH nursery and foraging habitats. SA: from 1985 to 2010 increasing coastal land loss of -0.97 mile^2 per year Calcasieu Basin; -1.30 mile^2 in Mermentau Basin; -0.45 mile^2 per year in Teche-Vermilion Basin results in loss of coastal estuaries used as EFH nursery and foraging habitats.	US: Institutional recognition of EFH continues. LA: continued transitional estuarine EFH lost with estimated net change between 2010-2060 under moderate sea level rise scenario is -2100 km^2. These impacts offset by restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: continued transitional estuarine EFH lost with estimated net change estimated net change between 2010-2060 under moderate sea level rise scenario in Calcasieu/Sabine basin is -146.5 km^2; in Mermentau Basin -208 km^2; and in Teche-Vermilion Basin -67 km^2	US: Institutional recognition of EFH continues. LA: continued transitional estuarine EFH lost with estimated net change with estimated net change between 2010-2060 under moderate sea level rise scenario is -2100 km^2. These impacts offset by restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: NED RP has no significant direct, indirect or cumulative impacts on fisheries or aquatic resources. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane storm surge damage risk reduction projects as described in more detail in Sections 1.9 and 3.4.	US: Institutional recognition of EFH continues. LA: continued transitional estuarine EFH lost with estimated net change with estimated net change between 2010-2060 under moderate sea level rise scenario is -2100 km^2. These impacts offset by restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: total 9,313 net acres with 3,239 AAHUs of brackish and saline marsh restored, nourished and protected and available for use by fish and aquatic organisms. These impacts would be in addition to other national, state and local existing and authorized for construction ecosystem restoration projects as described in more detail in Sections 1.9 and 3.4.

JA 37-899 10/04/2019 148

Table 3-6 Summary of Cumulative Impacts
(*NED Plan 8 Alternative – Nonstructural 100-Year Floodplain cumulative impacts would be similar in nature but greater in scale compared to NED RP)
(**Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan cumulative effects are same as impacts identified for the Mermentau Basin component of NER RP)

Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts NED RP: Modified Plan 8 Nonstructural 0-25 year Floodplain Plan*	Cumulative Impacts NER RP: Plan CM-4**
Threatened & Endangered Species & Other Protected or Species of Concern	US, LA & SA: The Endangered Species Act of 1973 (ESA), Migratory Bird Treaty Act of 1918 as amended (MBTA), Bald and Golden Eagle Protection Act (BGEPA) and Marine Mammal Protection Act of 1972 (MMPA) help protect the existence of certain species listed under each Act. Listed and protected species habitat is impacted by natural conditions such as hurricane storm surge, saltwater intrusion and subsidence, and man-made conditions such as agriculture, human development and industrialization.	US, LA & SA: continued impacts to listed and protected species habitat by natural conditions such as hurricane storm surge, saltwater intrusion and subsidence, and man-made conditions such as agriculture, human development and industrialization.	US, LA & SA: continued impacts to listed and protected species habitat impacts by natural conditions such as hurricane storm surge, saltwater intrusion and subsidence, and man-made conditions such as agriculture, human development and industrialization.	US & LA: continued impacts to listed and protected species habitat impacts associated with agriculture, human development and industrialization. SA: minimum and temporary project-induced impacts such as temporary avoidance of nearby habitat due to noise and construction activity. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane storm surge damage risk reduction projects as described in more detail in Sections 1.9 and 3.4.	US & LA: continued impacts to listed and protected species habitat by natural conditions such as hurricane storm surge, saltwater intrusion and subsidence, and man-made conditions such as agriculture, human development and industrialization. SA: beneficial impacts to listed and protected species habitat associate with shoreline protection and the creation of marsh & chenier habitats. These impacts would be in addition to other national, state and local existing and authorized for construction ecosystem restoration projects.
Cultural and Historic Resources	US, LA, & SA: Institutional recognition via the National Historic Preservation Act (and others). Historic and cultural resources subjected to natural processes and man-made actions.	US, LA, & SA: Continued institutional recognition. Human activities as well as natural processes can potentially destroy historic and natural resources. The loss of land threatens the existence and integrity of these resources.	US, LA, & SA: Continued institutional recognition via the National Historic Preservation Act (and others). Potential loss of historic and cultural resources due to natural and human causes. SA: The continued adverse impacts associated with hurricane storm surge and land loss within the SA threatens the existence and integrity of historic and cultural resources that may exist within the SA.	US & LA: Continued institutional recognition via the National Historic Preservation Act (and others). Potential loss of historic and cultural resources due to natural and human causes. SA: Implementing the NED RP could directly and indirectly affect any recorded or unrecorded cultural resource that may exist within the footprint of the project, the project's borrow source, or within any area identified as an area of potential effects (APE). A programmatic agreement (PA) is in place to govern future investigations and activities. In accordance with the PA, to the extent any adverse effect to identified cultural resources cannot be avoided, such impacts will be mitigated. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane storm surge damage risk reduction projects as described in more detail in Sections 1.9 and 3.4.	US & LA: Institutional recognition via the National Historic Preservation Act (and others). Potential loss of historic and cultural resources due to natural and human causes. SA: Implementing the NER RP has a chance to directly and indirectly affect any recorded or unrecorded cultural resource that may exist within the footprint of the project, the project's borrow source, or within any area identified as an area of potential effects (APE). A programmatic agreement (PA) is in place to govern future investigations and activities. In accordance with the PA, to the extent any adverse effect to identified cultural resources cannot be avoided, such impacts will be mitigated. These impacts would be in addition to other national, state and local existing and authorized for construction ecosystem restoration projects as described in more detail in Sections 1.9 and 3.4.

JA 37-899 10/04/2019 149

Table 3-6 Summary of Cumulative Impacts
(*NED Plan 8 Alternative – Nonstructural 100-Year Floodplain cumulative impacts would be similar in nature but greater in scale compared to NED RP)
(**Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan cumulative effects are same as impacts identified for the Mermentau Basin component of NER RP)

Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts NED RP: Modified Plan 8 Nonstructural 0-25 year Floodplain Plan*	Cumulative Impacts NER RP: Plan CM-4**
Aesthetics (Visual Resources)	US, LA, & SA: Technical recognition via 1988 USACE Visual Resources Assessment Procedure. Institutional recognition via Wild and Scenic Rivers Act, Louisiana Scenic Rivers Act, Scenic Byways and others. LA & SA: Aesthetic resources negatively impacted by hurricanes Katrina, Rita, Gustav, and Ike	US, LA, & SA: Continued institutional recognition. Visual resources have been destroyed, enhanced, or preserved by human activities and natural processes. LA & SA: Continued wetland loss may have an adverse effect on the visual complexity of the bayous and swamps.	US, LA, & SA: Continued institutional recognition. Continued human population growth and development and other human activities have the potential to destroy, enhance or preserve visual resources. SA: Erosion and land loss could result in the loss of vegetation that may provide a visually complex environment and desirable views and reduce opportunities for viewing wildlife.	US, LA, & SA: Generally, there would be no significant effects on the natural environment. Most effects would be on the human environment. This includes incremental risk reduction achieved by elevating 3,665 residential structures, flood proofing 247 non-residential structures and acquiring 3 residential structures. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane storm surge damage risk reduction projects as described in more detail in Sections 1.9 and 3.4.	US, LA, & SA: Replenishment of the land would convert existing view sheds of open water into marsh, wetland, or a variety of landscape types that frame large bodies of open water and use the basic design elements of form, line, texture, color, and repetition to create an aesthetically pleasing view shed. Temporary impacts due to construction activities. These impacts would be in addition to other national, state and local existing and authorized for construction ecosystem restoration projects as described in more detail in Sections 1.9 and 3.4.
Recreation	US, LA and SA: Recreational features and opportunities vary throughout the coastal zone, habitat and culture playing significant roles in the diversity of activities. From the games and competitions of Native Americans, to the influence of diverse immigrant cultures, traditional recreation in Louisiana has been a product of its people.	US, LA and SA: Federal and State agencies are major providers of recreational opportunities throughout the country and State of Louisiana. There are eight Wildlife Refuges and Conservation Areas in the Study Area, and two State parks. In addition to the high quality recreational fishing and hunting in the parks in the region, several lakes and inland marshes offer opportunities for birding, hunting and catching both freshwater and saltwater species.	US, LA and SA: The continued loss of wetlands/marshes and habitat diversity affects recreational opportunities. Storm surge and saltwater could have a negative impact on freshwater forests and habitats and could reduce recreational resources (e.g., fishing, hunting, bird watching, and other). In general, further degradation of area marshes will continue and its associated negative impacts on recreation activities will increase. Additionally, recreational infrastructure would remain vulnerable to surges. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane storm surge damage risk reduction projects as described in more detail in Sections 1.9 and 3.4.	US, LA and SA: By elevating residential recreational structures, such as camps, damage from storm surge is less likely to occur. Additionally, elevated structures should create less debris that must be removed following a storm surge event. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane storm surge damage risk reduction projects as described in more detail in Sections 1.9 and 3.4.	US, LA and SA: The cumulative impacts of other ongoing and planned ecosystem restoration measures are expected to be generally beneficial to recreation as the risk of destruction of recreation resources by storm surge is reduced and habitat areas supporting fish and wildlife resources are enhanced. Temporary negative impacts of restoration activities due to construction activities, increased turbidity and possible boating access issues are mediated by the presence of other productive and popular recreation areas throughout the coastal region of Louisiana. Long-term positive cumulative impacts are expected to occur as restoration enhances the sustainability of valuable nursery habitats. These impacts would be in addition to other national, state and local existing and authorized for construction ecosystem restoration projects as described in more detail in Sections 1.9 and 3.4.

JA
37-899
150
10/04/2019

3.5 Irreversible and Irretrievable Commitments of Resources Involved in the Implementation of the Recommended Plan

NEPA 40 CFR 1502.16 requires that environmental analysis include identification of "any irreversible and irretrievable commitments of resources which would be involved in the tentatively selected plan should it be implemented." Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that the use of these resources have on future generations. Irreversible effects primarily result from use or destruction of a specific resource (e.g., energy and minerals) that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (e.g., extinction of a T&E species or the disturbance of a cultural site).

The NER RP would result in the direct and indirect commitments of resources. These would be related mainly to construction components. Energy typically associated with construction activities would be expended and irretrievably lost under all of the alternatives excluding the no action alternative. Fuels used during the construction and operation of dredging equipment and barges would constitute an irretrievable commitment of fuel resources.

For the NER RP, most resource commitments are neither irreversible nor irretrievable. The dredging of borrow material is considered reversible although it is anticipated that the natural infilling of the borrow pits may take several years. Benthic communities would be removed and lost along with the sediment during dredging operations. Benthic communities would also take several years to recover. Fish and plankton would be entrained in the dredge during the dredging of the borrow areas. These losses would be irretrievable. However, most impacts to fish and plankton are short term and temporary and would only occur during dredging and construction activities. For example, access channels that would be dredged and retention dikes that are constructed would be restored to natural conditions after construction.

Other impacts, including disruption of community cohesion, may have longer effects that can be reduced through appropriate enhancement measures and best management practices. There are no irreversible or irretrievable commitments of resources which would preclude formulation or implementation of reasonable alternatives for this Project.

3.6 Relationship between Local Short-Term uses of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

NEPA Section 102(2)(c)(iv) and 40 CFR 1502.16 requires that an environmental impact statement include a discussion of the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity. This section describes how the RP would affect the short-term use and the long-term productivity of the environment. For the RP, "short-term" refers to the temporary phase of construction of the proposed Project, while "long-term" refers to the operational life of the proposed Project and beyond.

Construction of the NER RP would result in short-term construction-related impacts within parts of the Project area and would include to some extent interference with local traffic, minor limited air emissions, and increases in ambient noise levels, disturbance of fisheries and wildlife, increased turbidity levels, lower DO, and disturbance of recreational and commercial fisheries. These impacts would be temporary and would occur only during construction, and are not expected to alter the long-term productivity of the natural environment.

The NER RP would assist in the long-term productivity of the ecological community in three basins by improving water quality, nutrients, and sediments. This would facilitate the growth and productivity of emergent transitional marsh and the invertebrates, fish, and wildlife that use these habitats. The NER RP would enhance the long-term productivity of natural communities throughout the region. These long-term beneficial effects would outweigh the impacts to the environment resulting primarily from Project construction. With an increase in the wetland habitat quality, fish populations would experience beneficial impacts. These improvements in productivity would beneficially impact long-term commercial and recreational fishing in the study region.

3.7 Mitigation

Mitigation per 40 CFR §1508.20 includes measures to avoid the impact by not taking an action or parts of an action; minimize impacts by limiting the degree or magnitude of the action and its implementation; rectifying the impact by repairing, rehabilitating, or restoring the affected environment; reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and compensating for the impact by replacing or providing substitute resources or environments. The appropriate application of mitigation is to formulate a project that first avoids adverse impacts, then minimizes adverse impacts, and lastly, compensates for unavoidable impacts. No impacts from the NED RP or NER RP have been identified that would require compensatory mitigation. In addition, the CEMVN has determined that the proposed action "may affect but will not likely adversely affect" the piping plover or it's critical habitat, Red knot, Sprague's pipit, West Indian manatee, Gulf sturgeon, loggerhead and Kemps Ridley sea turtles; would have no effect on the Red-cockaded woodpecker, green, leatherback, and hawksbill sea turtles or loggerhead critical habitat and would not adversely impact other species of concern that could potentially be found in the Project area. No unique or valuable habitats would be adversely affected. However, the presence of threatened or endangered species would render that structure ineligible to participate in the Project.

To reduce potential fisheries impacts, any clearing and snagging would adhere to the Stream Obstruction and Removal Guidelines (1983); however, no such actions are anticipated.

The Lake Charles Metropolitan Statistical Area is vulnerable to being designated as non-attainment for ozone and particulate matter (PM) in the next few years (personal communication, EPA April 30, 2015). The Imperial Calcasieu Regional Planning & Development Commission, representing Calcasieu Parish, Cameron Parish, the Cities of Lake Charles, Westlake, Sulphur, Vinton, DeQuincy, the Town of Iowa, the Lake Charles Harbor and Terminal District, the Chennault International Airport, the Lake Area Industrial Alliance, the Southwest Louisiana Economic Development Alliance, and the Chamber SWLA has applied for and been accepted by EPA into the EPA Ozone Advance and PM Advance programs. The Advance programs are collaborative efforts between EPA, states, and local governments to enact expeditious emission reductions to help near non-attainment areas remain in attainment of the National Ambient Air Quality Standards. This reflects the sensitivity of ozone and PM levels in the area, and the need for federally-funded projects in the study area to consider air emissions. In addition to all applicable local, state, or Federal requirements, the mitigation measures for potential air quality impacts for reducing impacts associated with emissions of NOx, CO, PM, $S0_2$, and other pollutants from construction-related activities would include consideration of the following, as appropriate.

Noise vibration and emissions:

- The use of heavy machinery fitted with approved muffling devices that reduce noise, vibration, and emissions.

Fugitive Dust Source Controls:

- Stabilize open storage piles and disturbed areas by covering and/or applying water or chemical/organic dust palliative where appropriate at active and inactive sites during workdays, weekends, holidays, and windy conditions;
- Install wind fencing and phase grading operations where appropriate, and operate water trucks for stabilization of surfaces under windy conditions; and
- Prevent spillage when hauling material and operating non-earthmoving equipment and limit speeds to 15 miles per hour. Limit speed of earth-moving equipment to 10 mph.

Mobile and Stationary Source Controls:

- Plan construction scheduling to minimize vehicle trips;
- Limit idling of heavy equipment to less than five minutes and verify through unscheduled inspections;
- Maintain and tune engines per manufacturer's specifications to perform at EPA certification levels, prevent tampering, and conduct unscheduled inspections to ensure these measures are followed;

- If practicable, utilize new, clean equipment meeting the most stringent of applicable Federal or State Standards. In general, commit to the best available emissions control technology. Tier 4 engines should be used for Project construction equipment to the maximum extent feasible;
- Lacking availability of non-road construction equipment that meets Tier 4 engine standards, the responsible agency should commit to using EPA-verified particulate traps, oxidation catalysts, and other appropriate controls where suitable to reduce emissions of diesel particulate matter and other pollutants at the construction site; and
- Consider alternative fuels and energy sources (e.g., natural gas, electricity and plug-in or battery).

4.0 RECOMMENDED PLAN
(PREVIOUSLY TENTATIVELY SELECTED PLAN) (*NEPA REQUIRED)

The NED RP is the Nonstructural 0-25-Year Floodplain Plan (Modified Plan 8).

The NER RP is Alternative Plan CM-4.

4.1 The National Economic Development (NED) Plan
4.1.1 Description of the NED RP
The NED RP applies nonstructural measures to eligible structures and is a 100% voluntary project. Eligible structures are located in the 0-25-year floodplain and are individually economically justified (i.e. the costs to apply a particular nonstructural measure are less than the hurricane storm surge damages predicted to occur to that structure over the 50-year period of analysis). Eligible structures are those whereby the structure owner would be offered the opportunity to apply nonstructural measures (elevating, dry flood proofing, or localized storm surge risk reduction measures) to the structure if certain eligibility criteria are met. If the structure owner does not want to participate in the Project, USACE and the NFS would defer any further action on that structure until such time as the structure owner elects to participate or until the period of construction ends. However, the Government reserves, at its sole discretion, the right to determine whether or not a structure may participate in the NED RP after a structure owner has declined participation, and if allowed to participate, the timing and scheduling of such participation in the Project. There are 3,961 residential and non-residential structures that meet the initial eligibility criteria (i.e., they are located in the 0-25-year floodplain and are individually economically justified).

The NED RP consists of the following measures (see Appendix L for additional details on the nonstructural plan and methods of implementation):

1. Elevation of eligible residential structures. The term "base flood" is defined by the NFIP as the "flood having a 1% chance of being exceeded in any given year and is also called the 100-year flood." For purposes of this study, the BFE has been forecast into the future based on anticipated hydrologic conditions predicted to occur over the 50-year period of analysis (2025-2075). This measure entails lifting the entire structure or the habitable area to the predicted 2075, 100-year BFE unless the required elevation is greater than a maximum of 13 ft above ground level. Any structure that requires elevating greater than 13 ft above ground level would be ineligible to participate due to engineering and risk related factors. At the time of this Final Report, a structure inventory has been compiled which identifies 3,462 residential structures in the Study Area that have been deemed to be preliminarily eligible to participate in the Project (See Appendix N). The following process to determine final eligibility, which is more fully described in Appendix L, would apply to property owners willing to participate in the elevation Project whose structures meet the initial eligibility criteria (i.e. structure is located in the 0-25-year floodplain and is individually economically justified):
    - Residential property owners would be asked to grant a temporary right-of-entry to USACE and the NFS to enter upon the property to conduct such property and structural investigations deemed necessary to determine final eligibility for participation in the Project.
    - The property owner would submit satisfactory documentation as deemed necessary by USACE to establish proper proof of structure ownership.
    - The NFS would conduct title research to confirm the property has clear title; and any appraisals that may be necessary (i.e., if a structure requires elevation of greater than 13 ft).
    - An ASTM Phase I Environmental Site Assessment (ESA) and asbestos investigation would be conducted to confirm the absence of HTRW and damaged or friable asbestos or asbestos-containing materials. If warranted, additional HTRW investigations may be required.
    - The structure would be evaluated by USACE to ensure that certain eligibility criteria are satisfied including but not limited to: elevation of the structure would not exceed 13 ft above ground level, the structure is in suitable condition for elevation, threatened or endangered species would not be



impacted, no fill would be placed in waters of United States, wetlands would not be impacted, and the property has not previously receive any disaster assistance for structure elevation.

2. Dry flood proofing of eligible non-residential structures (excluding large warehouses). Dry flood proofing consists of sealing all areas below the hurricane storm surge damage risk reduction flood protection level of a non-residential structure to make it resistant to water intrusion from hurricane storm surge and to reduce the risk that hurricane storm surge can get inside by making walls, doors, windows, and other openings resistant to water penetration. Walls are coated with sealants or waterproofing compounds, or plastic sheeting is placed around the walls and covered. Back-flow prevention mechanisms for water and sewer lines such as drain plugs, standpipes, grinder pumps, floor drains, and back-up valves can be installed. This measure is viable for appropriate structures if design hurricane storm surge depths are generally less than 3ft. Hydrodynamic forces would also be a consideration. For structures with crawlspaces, the only effective way to dry flood proof is to make the first floor resistant to the passage of waters from hurricane storm surge.

   While each individual eligible non-residential structures will be evaluated for the most cost effective nonstructural measure, the government reserves the right to determine which measure shall be implemented at each structure location.

   The process of determining eligibility would be substantially similar to the process followed above in connection with the elevation of residential structures. Identification of eligibility criteria and details concerning the process will be developed during PED and provided prior to Project implementation. At the time of this Final Report, a structure inventory has been compiled which identifies 342 preliminarily eligible non-residential structures and public buildings in the Study Area. Eligible property owners who request application of the dry flood proofing measures to their commercial structures or public buildings, must provide temporary right-of-entry, undergo site and structural assessments, present the requisite documentation, and undergo a structure-specific analysis performed during the design phase that is substantially similar to that which is described above in connection with the elevation of residential structures but is designed to ensure that the structure is suitable for this method of flood proofing and that this method of flood proofing is the most cost-effective measure for the structure under consideration.

3. Construction of localized storm surge risk reduction measures less than six feet in height around warehouses. These measures are intended to reduce the frequency of flooding but not eliminate floodplain management and flood insurance requirements. Localized storm surge risk reduction measures can be constructed of earth, concrete, masonry, or steel and placed around a single structure or a contiguous group of structures. It should be noted that some local governments may have adopted floodplain management rules that exceed the minimum requirements of the NFIP, and may limit the ability of certain flood proofing measures to be constructed if effects of the flood proofing measure create the potential for drainage problems by displacing flood storage, elevating buildings on fill, requiring significant tree removal, etc.

   While each individual eligible warehouse will be evaluated for the most cost effective nonstructural measure, the government reserves the right to determine which measure shall be implemented at each warehouse location.

   At the time of this Final Report, a structure inventory has been compiled which identifies 157 preliminarily eligible warehouses in the Study Area. Eligible property owners, who request implementation of the localized storm surge risk reduction measures around their warehouses must provide temporary right-of-entry, undergo site and structural assessments, present the requisite documentation, and undergo a site-specific analysis performed during the design phase that is substantially similar to that which is described above in connection with the elevation of residential structures but is designed to ensure that the structure is suitable for this method of flood proofing and that this method of flood-proofing is the most cost-

effective measure for the structure under consideration. Identification of eligibility criteria and details concerning the process will be developed during PED and provided prior to Project implementation.

4.1.2 Implementing Nonstructural Measures for Eligible Structures

During the Preconstruction Engineering and Design (PED) phase of the Project, the Government, in consultation with the NFS, will develop the Agreement which must be executed by the Owners of each eligible property in advance of the implementation of the non-structural measure determined by the Government to be appropriate for that structure. Appendix L provides an exemplary listing of some of the provisions anticipated to be included within that Agreement and describes the process and requirements for securing that agreement and proceeding with the eligibility determination and non-structural implementation for each structure measure. The agreement will contain restrictive covenants that run with the land in perpetuity. Among other rights, the agreement will include the right for the NFS and the Government to inspect the property during structure elevation. The agreement, as well as any required curative documents, subordination or release agreement(s), shall be recorded by the NFS in the public records of the Parish in which the property is located prior to commencement of the nonstructural improvements on the property. While each individual eligible structure would be evaluated for the most cost effective nonstructural measure, the government reserves the right to determine which measure would be implemented at each structure location. Once the eligibility determination investigations are complete (as described in Appendix L), Appendix L describes the steps that would be completed to initiate the appropriate nonstructural measure at each eligible structure location.

4.1.2.1 Implementation of Nonstructural Improvements

Following eligibility determination, execution of an Agreement between the non-Federal sponsor and the Owner(s), and receipt of proof of recordation of the required documentation, construction of the nonstructural measure would begin. Detailed information regarding the anticipated non-structural measures that would be utilized for each type of structure, eligibility requirements, the process for implementation of the non-structural measures and the eligible and ineligible costs of non-structural measures is contained in Appendix L of this Report.

4.1.2.2 Notice of Construction Completion

Upon completion of the nonstructural improvement of each structure, an inspection would be performed by USACE and upon final approval by the District Engineer, or his designee, a Notice of Construction Completion (NCC) would be issued to the NFS and the individual nonstructural project would be closed out as complete.

4.1.3 NED Implementation Plan

This Final Report recommends a strategy to implement the nonstructural Project for eligible structures. Structures that have been identified as preliminarily eligible as part of the RP are located across the 4,700 mile, three-parish study area. In order to effectively implement the NED RP, clusters of eligible structures that represent the highest risk for hurricane storm surge damages (i.e. those with a FFE below the 10-year stage) would be identified and prioritized for construction. Individual structures would be addressed based on a ranking of risk from highest to lowest within the cluster. The ranking of individual structures would be revisited as elevation work is completed, as additional funding is distributed, and as new clusters are identified. Addressing groups of structures within a small geographic area would be more cost-effective, efficient, and would also allow for a more strategic methodology for applying nonstructural measures to at-risk structures. Additional work on this process would occur during the design phase of the Project. More details on this process can be found in Appendix L.

4.1.4 Hydrologic and Economic Evaluation of the RP

Hydrologic and economic models were run to determine the inundation effects of storms on residential, commercial, and industrial properties. Hydrologic modeling provided the existing and future hydrologic conditions needed to assess storm surge-related damages. The modeling identified 90 hydrologic reaches which

are characterized by unique relationships between storm surge elevations and frequency (Figure 4-1). An inventory of structure values, types, and FFEs was compiled for all structures in the 90 reaches (approximately 52,000 structures). Approximately 16,000 structures are located within the 100-year (1% ACE) floodplain. Based on the results of storm surge modeling, a flood damage analysis model was used to estimate economic damages under the "No-Action" alternative and the potential benefits resulting from the implementation of nonstructural measures.

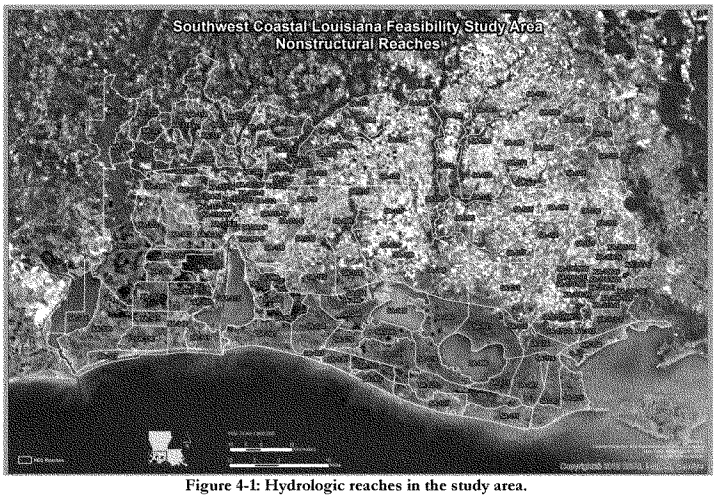


Figure 4-1: Hydrologic reaches in the study area.

The NED RP (Modified Plan 8) assessed benefits using 2025 conditions as the base flood criteria and identified properties in the 0-25-year (0-4% ACE) floodplain as the highest increment of net benefits. The economic evaluation employed several assumptions regarding the nonstructural action to be taken for any given structure. Residential structures with FFEs below the 2025 25-year (4% ACE) WSE were eligible to be raised to the year 2075 100-year (1% ACE) BFE. This evaluation was incrementalized by also evaluating the structures within the 25-50-year (4-2% ACE) floodplain and the 50-100-year (2-1% ACE) floodplain. Project costs and benefits were calculated on the basis of voluntary participation in the nonstructural plan unless certain criteria were met for a given structure. However, should participation be less than 100%, then both benefits and costs are expected to decline in similar proportion such that the BCR would remain unchanged for this plan. In addition, due to the lack of any economically justified structural alternatives there are no viable options to achieve greater positive net benefits. The NED RP addresses study area structures in most immediate need of hurricane storm surge damage risk reduction. Figure 4-2 depicts the eligible structures in the NED RP across the study area. High resolution maps depicting individual eligible structures can be found in Appendix N.

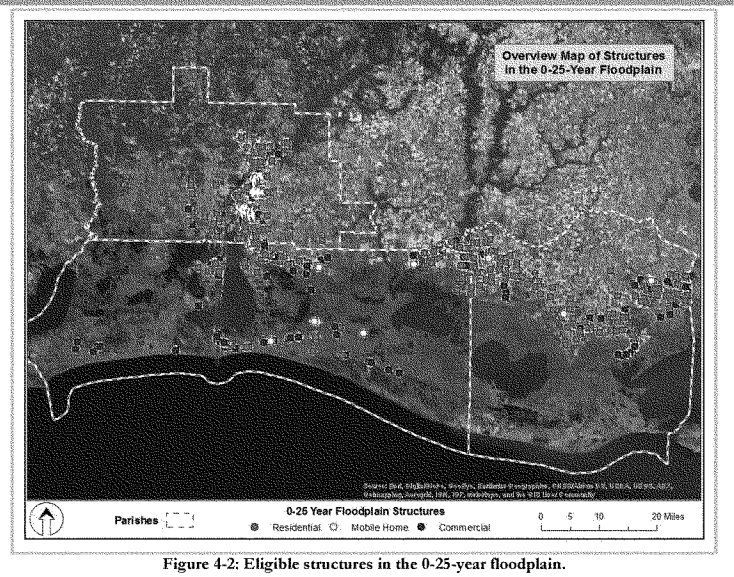


Figure 4-2: Eligible structures in the 0-25-year floodplain.

The expected annual benefits for addressing all the structures within the 0-25 year (0-4% ACE) floodplain are approximately $204 million. The project first cost for implementing the nonstructural Project is $906 million and the corresponding average annual cost is approximately $36 million. The NED RP would have no disproportionate adverse impacts on minority and low-income populations.

4.1.5 Compliance with Executive Order 11988

In implementing Executive Order (EO) 11988, the procedures identified below were followed in the formulation of the NED RP consistent with the 8-step process outlined in ER 1165-2-26, Paragraph 8.

1. While the proposed action is located within the limits of the base floodplain, the recommendation of the NED plan is designed to elevate residential properties that are the most prone to hurricane storm surge damage beyond the limits of the base flood and floodplain values would remain unaffected.

2. Since the study objective is to reduce the risk of damage from hurricane storm surge for the properties at the highest risk of damage specifically within the base floodplain, there are no practicable alternatives to the action that would result in an equivalent level of hurricane storm surge damage risk reduction.

3. The revised draft report was released to the public in February 2015 and a series of public meetings held in April 2015 in the communities of Abbeville, Lake Charles, and Cameron where the public was given the opportunity to express their views on the proposed plan and invited to submit written and electronic comments directly to the Corps during the official public comment period. CEMVN responded to all comments submitted by the public and a number of state and Federal agencies.

4. The proposed action is expected to exclusively have beneficial impacts to natural floodplain values. No losses of natural and beneficial floodplain values are foreseen. The nonstructural nature of the NED RP is designed to avoid adverse impacts to ecosystem or natural resources that are normally associated with structural hurricane storm surge damage risk management alternatives. The nature and extent of flooding within the base floodplain is unaffected by the measures designed to adapt structures to hurricane storm surge damage and/or make them resilient to damages during hurricane storm surge events.

5. The risk of inducement of development within the floodplain is normally associated with structural projects such as levees and floodwalls where vacant parcels are no longer subject to frequent flooding, lowering the cost of potential development and providing economic incentives for the addition of inventory to the floodplain. Even if induced inventory complies with floodplain management regulations such that the primary structure is technically higher than the base flood elevation, the addition of structures to the floodplain still incurs residual risk for hurricane storm surge events that are beyond the design performance of levees and floodwalls. In this case, the NED RP does not induce development since the actions to be taken address structures that are currently within the floodplain. The implementation of the NED RP may make the community more resilient and sustainable in the future, but it does not otherwise lower the cost of developing in the floodplain as a prerequisite to providing economic incentives that may induce development.

The NED RP is not expected to induce development in the base floodplain. Future development is defined as development that is expected, in equal amount, under both without-project and with-project conditions. In contrast, induced development is that which takes place only due to the fact the Federal government has taken action (with-project condition) to reduce hurricane storm surge damage risk in the floodplain. This generally occurs since the cost of development in the floodplain is lowered owing to the lowering or avoidance of future costs associated with hurricane storm surge damage. The NED RP does not reduce hurricane storm surge damage risk for any other structures in the floodplain other than those specifically identified under existing conditions. Therefore, the plan creates no further incentives created to develop in the floodplain. The spatial distribution of target properties in the NED RP is large and diverse. In instances where the application of nonstructural measures are in concentrated areas (neighborhoods or clusters), preservation and an enhanced sustainability of the area may result as a positive project effect. However, given the voluntary nature of plan participation it is too speculative to draw a conclusion of this nature.

Within the study area as a whole, approximately 75% of all hurricane storm surge damage risk, estimated as future without-project expected annual damages, is associated with hurricane storm surge events occurring in the 25-year floodplain. The NED RP effectively reduces risk of damage from the surge event for a majority (80%) of all structures in the 25-year floodplain. Therefore, project performance is exceptionally high and residual risk is correspondingly minimized to a significant degree. The Residual Risk section of the Economic Appendix (Appendix D) details the calculation of residual risk and documents this conclusion.

6. Structure elevation is the primary nonstructural measure comprising the NED RP. Implementation of this measure is not anticipated to extend beyond the footprint of the property boundaries and right-of-way associated with the structure being elevated. There are no identified adverse impacts to ecosystem resources associated with this action, with the possible exception of HTRW-related issues that can only be identified on a structure-by-structure basis through specific site inspection conducted prior to Project implementation. In cases where adverse impacts may occur due to the presence of HTRW, the Government reserves the right to revert to the no-action plan as it relates to that structure, thus avoiding the potential for adverse environmental impacts. This approach applies equally to the other two primary techniques: dry flood proofing and localized storm surge risk reduction measures. Therefore, methods to minimize adverse impacts of the action are not necessary for this NED RP.

7. The public has been notified through the dissemination of the revised draft report and public meetings that there is no practicable alternative to locating the action in the floodplain, particularly since the Project targets properties that are located in the areas within the base floodplain that are most prone to flooding from hurricane storm surge. Moreover, it has been observed that the public is accepting of the action located within the

floodplain since project performance is designed to lower the risk of damage from hurricane storm surge to the community without the adverse impacts normally associated with structural measures.

8. Of all alternatives considered, including those that have been found not to be economically justified and thus not in the Federal interest, the NED RP is the most responsive to the planning objectives established by the study and consistent with EO 11988.

The NED RP consists of applying nonstructural measures to residential and non-residential properties and commercial warehouses. Included among the estimated 342 non-residential structures are public and semi-public buildings, none of which are owned by the Federal government. No critical facilities are included in the plan that would necessitate action to relocate the structure outside of the 0.2% floodplain. Although EO 13690 is under current pubic review, the NED RP does comply with the current tenets of the EO by incorporating sea level rise in project planning. The target level of risk reduction for the elevation of residential structures is the 100-year BFE predicted under 2075 hydrologic conditions, which incorporates the effects of anticipated sea level rise. This approach utilizes data informed by the best available climate science. Moreover, since sea level rise in most reaches in the study area will increase the stage of the 100-year event from 2025 to 2075 by two ft or greater, then elevation to the 100-year stage under 2075 conditions will effectively elevate the structures by two or more ft above the 100-year stage under both 2025 and current (2012) conditions.

There are no practicable alternatives to implementing the Project in the floodplain. This is made evident by the fact that the avoidance of hurricane storm surge damage risk in the floodplain itself is the objective of the study and is positive in its effect on floodplain values.

Floodplain values in population centers primarily relate to conveyance of floodwaters from riverine systems and storage for storm-surge induced and rainfall flooding (tropical and extra-tropical in nature). Flood risk in the study area is dominated by storm-surge and rainfall effects, whereas riverine systems contribute relatively little. In much of the study area, drainage from flood events is characterized by slow gravity drainage past coastal cheniers toward the Gulf of Mexico. Flood durations involving saltwater standing in excess of 1-2 days is typical and accounts for higher than expected economic damage to structures. The NED RP would neither exacerbate nor alleviate this attribute of the floodplain, as nonstructural measures attempt to adapt to floodplain characteristics rather than alter them, as would be expected with structural measures such as levees, floodwalls, and channelization. For the same reason, any other attribute associated with floodplain values, such as water quality, carbon sequestration, fish and wildlife habitat, would be equally unaffected under the RP.

4.1.6 NED Mitigation

Since the application of all nonstructural measures would occur on existing developed properties there are no expected impacts to wetland habitats as a result of implementation of the NED RP and every attempt would be made to avoid impacting wetland habitats. For an eligible structure, if elevating, dry flood proofing, or construction of localized storm surge risk reduction measures results in impacts to wetlands or threatened/endangered species, or if the measure requires the placement of fill in waters of the United States the structure would no longer be eligible as part of the NED RP. Therefore, mitigation for unavoidable impacts from NED plan implementation is not anticipated to be necessary.

4.1.7 NED Adaptive Management and Monitoring

Mitigation is not anticipated to be necessary for the NED RP and as a result adaptive management would not be required.

4.1.8 NED Operations, Maintenance, Repair, Rehabilitation, and Replacement (OMRR&R)

For all structure types (residential, non-residential, and warehouses) OMRR&R costs are expected to be 'de minimus' (works) and will be confined to regular, periodic surveys and site visits of structures where NED measures have been applied in order to determine that the requirements of the OMRR&R Manual are being

met (estimated to be $5,000 annually though this estimate will be revised during the PED phase). Once the NED measures have been implemented and NCC'd, the owner of the property will be responsible for all cost and risk of maintaining, repairing, rehabilitating and replacement the flood proofing measures that were utilized for the subject property. A draft OMRR&R Manual shall be provided to the NFS as early as possible in the period of implementation because USACE will issue a NCC for each flood proofed structure once the flood proofing is complete. At the time of the issuance of an NCC, the NFS's obligations for operation and maintenance for the subject structure or lands commences. Flood proofed structures and acquired tracts shall be considered a separable element and functional portion of the Project. The NFS is responsible for the enforcement of the provisions of the agreement executed by the owners of property benefiting from the NED measures and for enforcement of the requirements of the OMRR&R Manual, including by not limited to, compliance with the requirements of Section 402 of the Water Resources Development Act of 1986, as amended. Upon NCC for NED implementation for a given structure or contract, the USACE will furnish to the NFS a final OMRR&R manual addressing, among other things, the NFS responsibility for enforcement of terms of the flood proofing agreement, as well as other OMRR&R requirements.. The NFS shall conduct periodic inspections at the intervals specified in the OMRR&R Manual to ensure that the owners, their heirs, and assigns, are in compliance with the terms and conditions of the executed agreements and shall provide written certifications to USACE that the structures and lands have been inspected and that no violations have been found. Regarding the elevated residential structures, the inspections will determine among other things, that no part of the structure located below the level of the lowest habitable finished floor has been converted to living area for human habitation, or otherwise altered in any manner which would impede the movement of waters beneath the structure; that the area below the predicted 2075 100-year BFE is being used solely for the parking of vehicles, limited storage, or access to the structure and not for human habitation; that mechanical, electrical or plumbing devices have not been installed below the BFE; that the property is in compliance with all applicable floodplain ordinances and regulations. USACE shall have the right, but not the obligation, to perform its own inspections of the flood proofed structures and lands acquired pursuant to the Project.

Further details regarding the obligations of the NFS for the NED RP are set forth in Chapter 7 of this report.

4.1.9 NED Risk and Uncertainty Analysis

Risk and uncertainty are intrinsic in water resources planning and design. This section describes various categories of risk and uncertainty pertinent to the study.

Environmental Factors

Relative Sea Level Rise: There is uncertainty about how much sea level change would occur in the region. An assessment of RSLR was included in plan formulation. The evaluation of RSLR is documented in the Engineering Report. (Appendix B). Calculations based on Engineering Regulation 1100-2-8162 determined that the low, intermediate, and high rates of RSLR at 2075 would be 1.4 ft, 2.3 ft, and 3.2 ft higher than current levels respectively (Table 4-1). The intermediate rate was used for models and screening alternatives, with the low and high rates then used in a sensitivity analysis on the RP to ensure that no superior alternatives had been accidentally eliminated due to the reliance on a single scenario. This analysis is detailed in Appendix O, the Climate Performance and Resilience Register.

RSLR could impact the benefits achieved by the RP. Because the NED RP was developed using the intermediate RSLR rate, the NED RP would provide fewer benefits than anticipated should the low RSLR rate result and more benefits with the high RSLR rate. With the high RSLR rate, the nonstructural component would be less effective because structures would have to be raised to a height that would increase their risk from wind damage during a storm. This could ultimately lead to a shift in project strategy from elevations to relocations if future sea level is higher than anticipated. Such a shift would occur only after careful consideration of not only sea level, but also community cohesion and the viability of supporting infrastructure such as transportation, water supply, and wastewater. For those structures already raised in a previous round of elevation, actual economic benefits could be lower than anticipated if community cohesion and supporting infrastructure are not maintained. These factors would be considered during the implementation phase of the

Project. The Corps will continue to monitor local conditions and determine if the intermediate scenario of RSLR is occurring. If observed conditions deviate from intermediate to high sea level forecasts during design or construction, reevaluation of the NED and NER will be required.

Table 4-1: Predicted RSLR rise rates for the gage on the GIWW west of Calcasieu Lock.

Year and SLR Scenario	Calcasieu West RSLR increment (in feet)	Calcasieu West gage elevations (NAVD88 feet)
2025 Low SLR	0.125	0.222
2025 Intermediate SLR	0.216	0.313
2025 High SLR	0.307	0.405
2075 Low SLR	0.919	1.424
2075 Intermediate SLR	1.827	2.331
2075 High SLR	2.736	3.241

Storms: Uncertainty with regard to the size and frequency of hurricanes that could result from global meteorological events, such as El Nino and La Nina, cannot be predicted over a set period of time. The storm record is constantly being updated and a large storm such as Hurricane Rita or a slow moving storm such as Hurricane Isaac can alter the expected return period for other storms. To reduce the uncertainties of storm events, storms with varying degrees of size, intensity, and path were included in the modeling. By using a long-term record of different storm scenarios, the effects of such storms were incorporated into the modeling to reduce the uncertainty in the determination of Project benefits (see Appendix B, Engineering Report).

If indicated by monitoring of RLSR and/or climate non-stationarity, the nonstructural Project can be adaptive and make adjustments to design criteria and structures preliminarily recommended for inclusion in the Project. This is achievable because the implementation of a broad regional nonstructural project, as well as evidence of a greater-than-predicted rate of RSLR and/or coastal storm damages, would be distributed over time. As sea level changes and is updated over time, the floodplain definitions would change, design criteria can be adapted, and the predicted 2075 100-year BFE could be adjusted upward. This could require raising structures deemed eligible in the NED RP to a higher elevation than identified at this time. Conversely, some structures that were already elevated would return to the risk pool earlier than forecast. However, this would also be a time-distributed effect and identification of greater than expected RSLR would correspond to a potential reduction of forecast benefits.

Modeling Factors

ADCIRC and HEC-RAS models appear to provide a specific response on the NED RP in any given scenario; however it is only a representative point of reference in a complex system. While the analysis is enhanced by the models, application of the models can introduce error and uncertainty. Calibration and verification efforts are employed so that the models more closely replicate observed changes or at least provide insight into the limitations of the model. Models are limited by basic, underlying assumptions and uncertainties. Some of the simplifying assumptions include the model parameters such as boundary conditions, which are limited by the data available, especially during storm events and the time period selected for analysis. Another model parameter assumption is model geometry. Survey data/LiDAR has good coverage in some areas; other areas require assumptions, interpolations, extrapolations, or known elevation points to get coverage. Another uncertainty is that a limited number of storm scenarios are modeled. It is assumed that various storm scenarios over a number of years would represent a much higher indicator of the ability for nonstructural measures to appropriately avoid or minimize surge related damages from major storm events. Models use available historic data to extrapolate future storm conditions and frequency. The size and frequency of storms included are based on statistical analysis but do not account for meteorological changes that can increase or decrease storms over a period of several years. The models do not account for the potential of increased frequency and intensity of storms due to climate change.

Economic Factors

There is an economic risk in under or overestimating the future benefits associated with the project alternatives. The with-project damages and overall benefits associated with the alternatives were estimated based on the existing and FWOP damages. For structural features, this could potentially result in the feature not being economically justified or preliminary estimates of the BCRs being overstated. However, no structural features are part of the NED RP so this risk is minimized.

The HEC-FDA model (Version 1.2.5b) was used to calculate the damages for the without project existing and future conditions. Economic and engineering inputs were used to calculate damages for without project existing conditions (2012), the Project base year (2025), and the end of the period of analysis (2075). In an evaluation performed on the nonstructural plan, the most significant factor was the use of the base year risk condition rather than the end year condition to determine the eligibility of structures for the application of nonstructural measures. Increases in relative stage elevation for various base year risk conditions result in greater numbers of structures (incurring damages that exceed remediation costs) introduced into the risk pool, both spatially and for any given event probability. For the study end year risk conditions, increased stage conditions translate into an increase in structures in the risk pool. However, the additional damages incurred by those structures over the period of analysis are nominal in comparison to their remediation costs given that a change in the stage associated with the 1% ACE is, on average, only 2 ft. The evaluation of residual risk associated with structures that are not in the 100-year floodplain under 2025 hydrologic conditions, but are under 2075 conditions, is expanded upon in Appendix D – Economics.

For the NED RP, the PDT assumed a 100% participation rate which is intended to serve as an upper limit to the Federal investment in nonstructural measures. It is recognized that likely participation in any nonstructural risk reduction project would not reach 100%. Reasons of locality preference, community-wide participation trends, economic constraints for willing participants, risk tolerance, ability to affordably mitigate or self-mitigate risks, structural eligibility, issues related to insurability, and the nature of future storm events are some of the factors that may influence participation. Conversely, the NED plan should highlight the benefits of participation such as long-term hurricane storm surge damage risk reduction, and beneficial impacts to insurability. If the NED RP is funded on the basis of 100% participation, but the actual participation is less, the uncommitted funds would not be expended. It is expected that a sensitivity analysis of the BCRs for varying levels of participation would result in no significant change in recommendation. For this analysis, non-participating property owners would be randomly selected to reduce the participation rate, the effect of which would be to reduce benefits and costs, on average, by constant degrees. As a result, net benefits for the NED RP remain positive and the BCR unchanged.

The uncertainty surrounding each of the economic and engineering variables and a probability distribution were entered into the model to quantify the uncertainty associated with the key economic variables. The number of years that stages were recorded at a given gage was entered to quantify the hydrologic uncertainty or error surrounding the stage-probability relationships. The plan costs were estimated based on the number of structures within the 25-year (4% ACE) floodplain in the 2025 base year. RSLR prior to the base year significantly affects the determination of the number of structures that would be eligible for application of nonstructural measures. This means that uncertainty in the projected rate of future RSLR translates directly to uncertainty as to how many structures would be included in the NED RP.

The NED RP offers hurricane storm surge damage risk reduction only for those eligible, economically justified structures in the 0-25-year floodplain, which equals 3,961 of a total of 4,952 structures. An additional 10,715 structures are present in the 25-100 year (4% - 1% ACE) floodplain. However, complete implementation of the NED RP has the potential to reduce damages from the design hurricane storm surge within the study area as a whole floodplain by 58%, suggesting a highly effective plan and a significant reduction in residual risk. Most damages occurring within the 100-year floodplain occur in the 0-25-year floodplain increment, thereby accounting for most project benefits. From the standpoint of public safety, the NED RP is not expected to have a large and widespread impact. For those residents that may participate in elevating their residences, the probability is that their degree of risk aversion is not expected to change as a result of this nonstructural measure, and evacuation behavior would be the same under both without- and with-project conditions.

The localized risk reduction measures as applied to single warehouse structures were formulated as a small-scale approach, similar in scale to individual structure elevations and dry floodproofing of commercial structures, but intended to reduce flooding associated with the highest frequency events for a unique type of structure for which this measure is both technically feasible and economically effective. The level of risk reduction for localized risk reduction measures is contingent upon the fixed maximum height of the barrier, which is constrained by the footprint of parcel ownership, and does not necessarily correlate with the 100-year level of risk reduction that is represented by the performance of the structure elevation measure applied to the overwhelming majority of structures comprising the recommended plan. Although, economically justified on an individual basis, localized risk reduction measures still carry potential large residual flood risk. The level of residual risk will vary by location, and not all warehouse operators are guaranteed to voluntarily participate in the recommended plan. Yet, because of the commercial/industrial nature of the occupational use of the structure, life-safety considerations are not as significant as they would be as for plans that address residential structures which may have equivalent high residual risk.

4.1.10 NED Real Estate Requirements

Costs for the nonstructural elevations were included as construction costs and not as separable real estate acquisition costs. In addition, a Chart of Accounts which captures the real estate costs associated with the plan implementation (administrative costs for elevations) is included in the Real Estate Plan (Appendix E). A maximum of 3,961 structures are eligible for inclusion in the NED Project. Additional discussion of the real estate requirements for NED RP features can be found in the Real Estate Plan (Appendix E). The NFS would be responsible for acquiring all necessary real estate interests under established criteria.

4.1.11 Summary of Environmental Consequences of NED Plan

Each non-residential structure will be evaluated to determine the most cost effective method of flood proofing. At the time of this Report, it is anticipated that implementation of localized storm surge risk reduction measures will be through the Federal procurement of Indefinite Deliverable, Indefinite Quantity (IDIQ) contracts that will be implemented by the issuance of individual task orders for the implementation of flood proofing measures at each warehouse. The basis for this assumption is that the PDT has completed an inspection of the warehouse inventory. That inspection indicates that the geographic distribution of these warehouses and the inability to determine the schedule for voluntary participation do not comport with the clustering strategy whereby the rest of the NED RP will be implemented. For these reasons it is anticipated that an individual task order will be limited to a single warehouse to be flood proofed. The PDT anticipates that only a small amount of borrow would be needed for construction of the localized storm surge risk reduction measures for each warehouse being accomplished by separate task order. Based on this conclusion, it is foreseeable that commercial borrow sites would be used. As of the date of this Report, there are several commercial borrow sites within the project area that are readily available.

Real Estate regulations (ER. 405-1-12, paragraph 12-9d(3)) allow for small quantities of borrow material to be supplied by the construction contractor through the use of readily available commercial sites, if supported by an analysis conducted by the Government and the NFS, and if no other constraints exist. Since it has been determined that each IDIQ task order will address a single warehouse, for purposes of this Final Report, it has been assumed that the analysis performed pursuant to the above cited ER 405-1-12 will determine that the required borrow quantities constitute a small quantity that can be obtained through a commercial site that meets the Project requirements. Prior to issuing a construction task order, the Government will conduct the necessary analysis in accordance with ER 405-1-12. Contractors would be required to demonstrate that any proposed commercial borrow site is environmentally cleared and contains geotechnically suitable borrow material. In evaluating the suitability of the proposed commercial borrow site, impacts to wetlands or bottomland hardwoods would be prohibited. Costs of utilizing a commercial borrow site would be considered an item of construction cost, and not an item of LERRD cost.

The NED RP avoids and minimizes negative environmental impacts to the maximum extent. The eligibility criteria for implementation of a plan measure stipulates that implementation cannot impact threatened or

endangered species, that implementation will not require fill in the waters of the United States and would not result in any impact to wetlands. The current impact analysis indicates that no mitigation for the NED RP would be required. This determination would be refined as each eligible structure is evaluated for a particular measure. The more significant changes between the initial TSPs and the NED RP are highlighted in Table 4-2 below.

Table 4-2: NED Plan Changes.

Plan	Recommendation	2013 Draft Report (TSP)	2015 Revised Draft Report (TSP)	Final Report (NED RP)
NED	Eligibility	11 Justified Reaches	Justified Floodplains	Justified Floodplains
	Eligible Floodplain	2075 100-Year	2025 0-25-Year	2025 0-25-Year
	Eligible Structures	3,915	4,952	3,961[1]
	Benefit/Cost Ratio	1.25:1	7.74:1	5.65:1[2]
	Eligibility	Voluntary	Voluntary & Involuntary	Voluntary
	Project First Cost	$388,000,000	$824,000,000	$906,091,000

1- Only economically justified structures are included in the NED RP
2- BCR was updated with certified cost numbers

4.2 National Ecosystem Restoration Recommended Plan (NER RP)

4.2.1 Description of the NER RP (Plan CM-4)

The NER RP (Alternative CM-4) consists of a broad range of ecosystem restoration measures including marsh restoration features (which involves hydraulic dredging and placing of sediments), shoreline protection/stabilization features, and chenier reforestation. The CSC Salinity Control Structure and the Cameron-Creole Spillway Structure are recommended as additional long-range studies to adequately account for potential environmental benefits, economic costs, and engineering. The NER RP features comprise an integrated comprehensive restoration plan that would have synergy with other ecosystem restoration projects and would facilitate hydrologic and geomorphic stability and resilience. Each restoration feature is detailed in a fact sheet which can be found in Appendix K.

The NER RP restoration features (together with their benefits and impacts) are constructible and would move into the preconstruction engineering and design (PED) phase next. The construction acres and habitat benefits for all NER RP features are depicted in Tables 4-3 and 4-4.

Table 4-3: NER RP Feature Construction Benefits.

	Category	ID	Description	Net Acres	Net AAHUs
Mermantau/Teche-Vermilion (Plan M-4)	Marsh Restoration[1]	47a1	Marsh restoration using dredged material south of LA-82, about 4.5 miles west of Grand Chenier. 933 marsh acres would be restored and 88 acres would be nourished from 3M cubic yards of dredged material with one renourishment cycle.	895	272
		47a2	Marsh restoration using dredged material south of LA-82, approximately 4.5 miles west of Grand Chenier. 1,297 marsh acres would be restored and 126 acres would be nourished from 8.8M cubic yards of dredged material with one renourishment cycle.	1,218	381
		47c1	Marsh restoration using dredged material south of LA-82, approximately 4.5 miles west of Grand Chenier. 1,304 marsh acres would be restored and 4 acres would be nourished from 8.6M cubic yards of dredged material with one renourishment cycle.	1,135	353
		127c3	Marsh restoration at Pecan Island, west of the Freshwater Bayou Canal and approximately 5 miles north of the Freshwater Bayou locks. 832 marsh acres would be restored and 62 acres would be nourished from 7.3M cubic yards of dredged material with one renourishment cycle.	735	241
		306a1	Rainey marsh restoration at Christian Marsh, east of the Freshwater Bayou Canal and approximately 5 miles north of the Freshwater Bayou locks. 627 marsh acres would be restored and 1,269 acres would be nourished from 8.1M cubic yards of dredged material with one renourishment cycle.	743	151
	Shoreline Protection/ Stabilization[1]	6b1	Gulf shore protection/stabilization from Calcasieu River to Freshwater Bayou. 11.0 miles of Gulf shore protection consisting of a reef breakwater with a lightweight aggregate core. Located ~150 ft offshore consisting of geotextile fabric and stone built to an 18 ft crest width.	2,140	625
		6b2	Gulf shore protection/stabilization from Calcasieu River to Freshwater Bayou. 8.1 miles of Gulf shoreline protection consisting of a reef breakwater with a lightweight aggregate core. Located ~150 ft offshore using geotextile fabric and stone built to an 18 ft crest width.	1,583	466
		6b3	Gulf shore protection/stabilization from Calcasieu River to Freshwater Bayou. 6.3 miles of Gulf shoreline protection consisting of a reef breakwater with a lightweight aggregate core. Located ~150 ft offshore using geotextile fabric and stone built to an 18 ft crest width.	1,098	312
		16b	Fortify spoil banks of Freshwater Bayou. Approximately 13.4 miles of rock revetment at three critical locations to prevent shoreline breaching. Rock revetment would be built to +3 ft with a 4 ft crown. Two maintenance lifts would be required.	1,288	279
	Chenier Re-forestation	CR	13 separate chenier locations would be replanted. Approximately 435 seedlings per acre, at 10 ft x 10 ft spacing, with invasive species control incorporated[3].	281	96
Calcasieu/ Sabine (CM-	Marsh Restoration[1]	3a1	Beneficial use of dredged material from the Calcasieu Ship Channel. Located adjacent to the south shore of the GIWW west of the Calcasieu Ship Channel near Black Lake. Restore 599 marsh acres with 5.3M cubic yards of dredged material with one renourishment cycle.	454	191

		3c1[2]	Beneficial use of dredged material from the Calcasieu Ship Channel. Located adjacent to the eastern rim of Calcasieu Lake and situated within the Cameron-Creole Watershed area. 1,347 marsh acres would be restored and 734 acres would be nourished from 9.4M cubic yards of dredged material with one renourishment cycle.	1,324	607
		124c	Marsh restoration at Mud Lake. Located adjacent and north of Highway 82 and east of Mud Lake. 1,077 marsh acres would be restored and 708 acres would be nourished from 10.4M cubic yards of dredged material with one renourishment cycle.	1,228	500
		124d[2]	Marsh restoration at Mud Lake. Located west of the Calcasieu Ship Channel and adjacent to the south rim of West Cove. 159 marsh acres would be restored and 448 acres would be nourished from 1.4M cubic yards of dredged material with one renourishment cycle.	168	4
	Shoreline Protection/ Stabilization[1]	5a	Holly Beach Shoreline Stabilization Breakwaters. Construction of 8.7 miles of rock and low action breakwaters and is a continuation of existing breakwaters. Crown elevation of +3.5 ft with a crown width of 24 ft. Two maintenance lifts would be required.	26	56
	Chenier Re-forestation	CR	22 separate chenier locations would be replanted. Approximately 435 seedlings per acre, at 10 ft x 10 ft spacing, with invasive species control incorporated[3].	1,132	442
	TOTALS			15,448	4,976

1-Renourishment and maintenance lifts are considered an OMRR&R cost and are a 100% NFS responsibility. Renourishment material would come from the site of the initial dredging effort.

2- Features 3c1 and 124d are partially located on USFWS property. While USACE believes that these features are worthy of recommendation, USACE has determined that these features would more properly be implemented by USFWS. Therefore, USACE will not seek authorization and funding of these features. Rather USACE will recommend to USFWS that it consider seeking independent Congressional authorization and funding for implementation of these features by USFWS.

3- Costs to ensure the minimum survival percent are considered 'construction' and will be cost-shared accordingly. Following NCC of these features, control of invasive species are considered an OMRR&R cost and are a 100% NFS responsibility.

The full benefits for all feature types in the NER RP are presented below.

Table 4-4: NER Plan Benefits by Measure Type.

Restoration Measure	# of Features	Net Acres	AAHUs	Parishes
Marsh Restoration	9	7,900	2,700	Calcasieu, Cameron, Vermilion
Shoreline Protection/Stabilization	5	6,135	1,738	Cameron, Vermilion
Chenier Reforestation	35	1,413	538	Cameron, Vermilion
Total	**49***	**15,448**	**4,976**	---

**- The Calcasieu Ship Channel Salinity Control Structure and the Cameron-Creole Spillway Structure are recommended for additional feasibility study.*

Each of the marsh restoration features involves delivering sediments to open water or eroding marsh areas (minimum of 100 acres) that have water levels of less than two ft and that have been optimized to preserve or restore critical geomorphologic features to create new vegetated wetlands. The marsh restoration locations include: (a) three areas on the south side of LA-82 approximately 4.5 miles west of Grand Chenier; (b) Pecan Island west of the Freshwater Bayou Canal approximately 5 miles north of the Freshwater Bayou locks; (c)

Christian Marsh located east of Freshwater Bayou Canal and approximately 5 miles north of Freshwater Bayou locks; (d) southern shoreline of GIWW west of Calcasieu Ship Channel near Black Lake; (e) eastern rim of Calcasieu Lake within the Cameron-Creole Watershed; (f) east of Mud Lake and north of Highway 82; (g) Mud Lake west of the CSC adjacent to the southern rim of West Cove. Dredged material sources would be the CSC (through beneficial use of dredged material) and the Gulf of Mexico (through dedicated dredging). All marsh restoration locations would have one future re-nourishment cycle. A 30-year renourishment interval was chosen as the best balance between cost, net acres, and AAHUs. The costs are included in the OMRR&R estimates and would be the responsibility of the NFS (currently estimated at $311,573,000 for all restoration features). Adaptive management techniques would be used to adjust the projected interval, either sooner or later than the 30-years, based on actual loss rates after construction. (See Appendix A for Adaptive Management and Monitoring).

The five shoreline protection/stabilization features, which span approximately 252,000 linear ft, would be used to reduce erosion of canal banks and shorelines in critical areas in order to protect adjacent wetlands and critical geomorphic features.

Chenier restoration consists of planting of 435 seedlings per acre at 10 foot x 10 foot spacing, in 35 chenier locations on over 1,400 acres in Cameron and Vermilion parishes. Cheniers selected for restoration would be greater than five ft in elevation and with low shoreline erosion rates, provided the existing canopy coverage is less than 50% unless nearby development would prevent achieving study objectives.

Figures 4-3a and 4-3b depict the NER RP features. Figure 4-4 depicts active restoration activities in the study area under various programs.

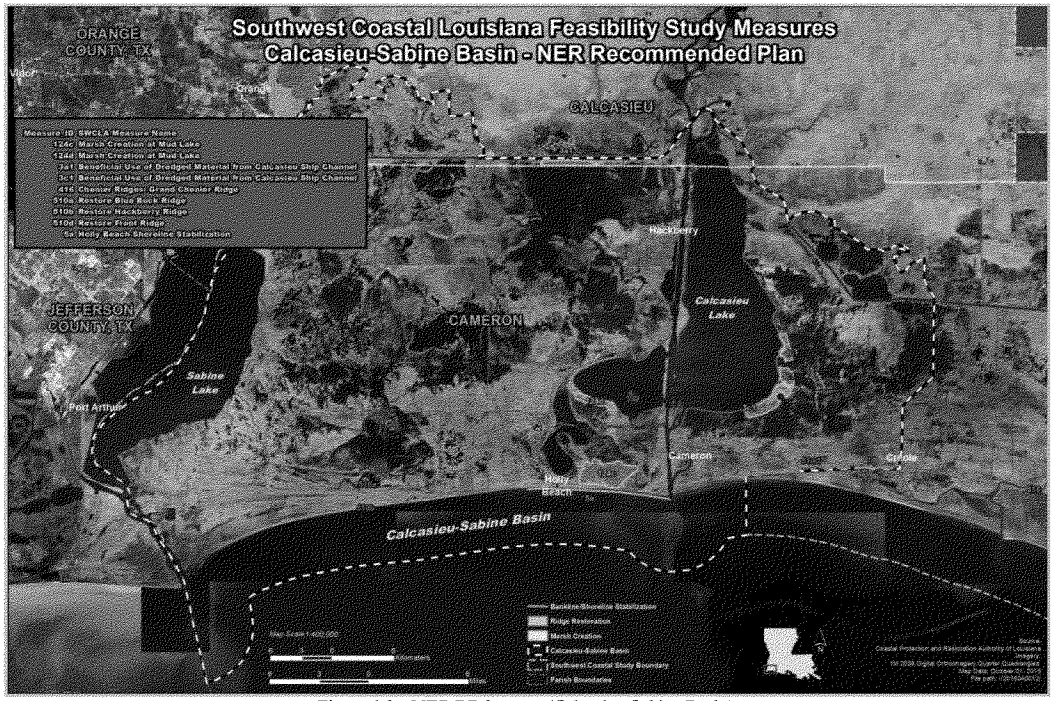


Figure 4-3a: NER RP features (Calcasieu-Sabine Basin).

JA
37-899
169
10/04/2019

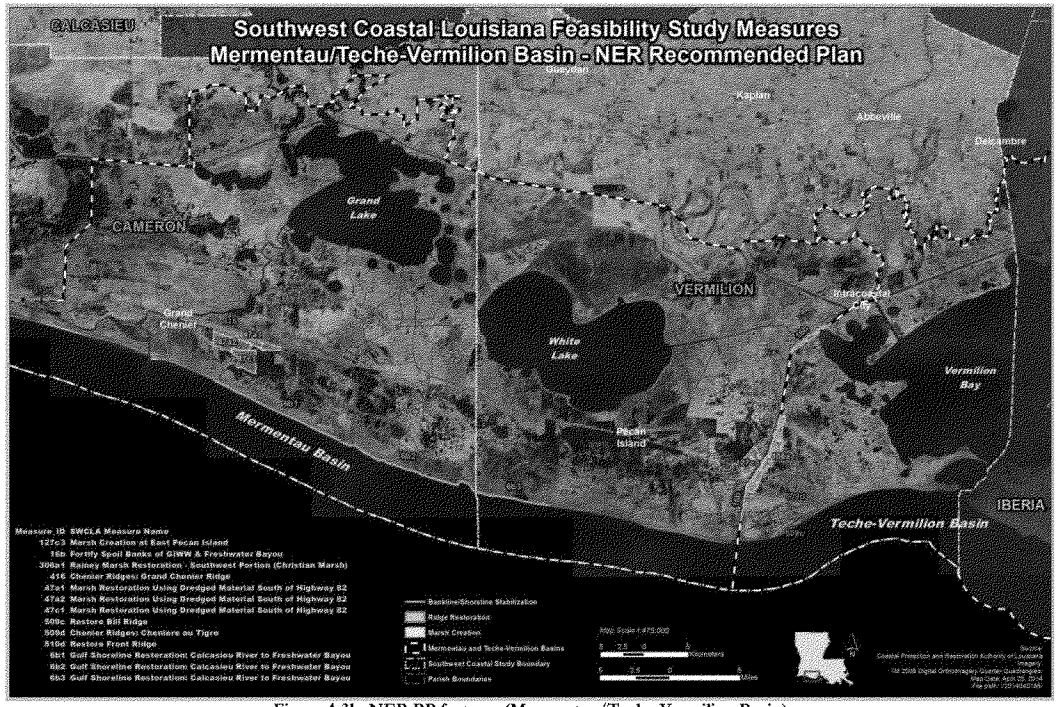


Figure 4-3b: NER RP features (Mermentau/Teche-Vermilion Basin).

JA 37-899 10/04/2019 170

Figure 4-4: Ecosystem restoration activities in the study area

4.2.2 NER RP Implementation

This section describes the sequence in which NER RP features would be constructed. NER RP features were categorized into three tiers whereby Tier I features would be constructed before Tier II, and Tier II features constructed before Tier III. Tier I features may be constructed simultaneously because they would not affect the construction of any nearby Tier I NER RP feature. Shoreline protection features would be constructed prior to marsh restoration features in an effort to better protect the more storm-vulnerable marsh restoration features. This approach contributes to the sustainability of the marsh restoration features. Tier II NER RP features were so categorized because they utilize the same borrow or staging area, and/or construction of these features would potentially interfere with construction of a Tier I NER RP feature. Tier II NER RP features would be constructed contemporaneously as the construction of any one of these features would not affect any other feature within this grouping. Tier III NER RP features were so categorized because they would utilize the same borrow or staging area, and/or interfered with construction of a Tier II feature, and/or interfered with an existing mitigation project. Tier III features would be constructed contemporaneously if they would not affect construction of the other features within this grouping.

In categorizing features, it was assumed that all construction funds would be available, multiple construction contracts could be let at one time, and there is an adequate supply of all materials to facilitate construction. More detailed design and analysis would be undertaken during the PED phase. The initiation of construction for features within each tier was scheduled over ten year intervals. For planning purposes the first construction interval beginning at the base year of 2025 through 2034, the second 2035-2044, and the third 2045 to completion. Actual initiation of construction would be contingent on the date of authorization, and subsequent provision of appropriations, for this recommendation. The individual features are organized, and would be staged, within the tiers based on their systemic criticality and for sequential staging. The tiering and staging of the individual features has been developed to assure several implementation requirements. First, that the features are implemented in the most effective order for long-term ecosystem performance. Second, that no conflicts will occur with common resources required for construction, and finally, that the completion of any existing obligations for mitigation projects that interface with some plan features will be met prior to implementation. General prioritization for staging within the tiers would apply the criteria of addressing shorelines and channel banks, and working from the coastline landward. Features that interface with projects having outstanding mitigation obligations would also be staged later in each tier.

Tier I Projects (projected implementation 2025-2034):

- Holly Beach Shoreline Stabilization – Breakwaters (5a)
- Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou (6b1)
- Fortify Spoil Banks of the GIWW and Freshwater Bayou (16bSE)
- Fortify Spoil Banks of the GIWW and Freshwater Bayou (16bNE)
- Fortify Spoil Banks of the GIWW and Freshwater Bayou (16bW)
- Beneficial Use of Dredged Material from the Calcasieu Ship Channel (3a1)
- Marsh Restoration at Mud Lake (124d)[1]
- Marsh Restoration at Pecan Island (127c3)
- Chenier Ridges: Grand Chenier Ridge (416)[2]
- Restore Bill Ridge (509c)[2]
- Chenier Ridges: Cheniere au Tigre (509d)[2]
- Restore Blue Buck Ridge (510a)[2]
- Restore Hackberry Ridge (510b)[2]
- Restore Front Ridge (510d)[2]

Tier II Projects (projected implementation 2035-2044):

- Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou (6b2)
- Marsh Restoration at Mud Lake (124c)
- Rainey Marsh Restoration Southwest Portion (Christian Marsh) (306a1)

Tier III Projects (projected implementation 2045-completion):

- Beneficial Use of Dredged Material from the Calcasieu Ship Channel (3c1)[1]
- Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou (6b3)
- Marsh Restoration Using Dredged Material South of Highway 82 (47a1)
- Marsh Restoration Using Dredged Material South of Highway 82 (47a2)
- Marsh Restoration Using Dredged Material South of Highway 82 (47c1)

Recommended for Further Study:

- Calcasieu Ship Channel Salinity Control Structure
- Cameron-Creole Spillway Structure

[1]- *Recommended for independent Congressional authorization and appropriation for construction by USFWS*

[2]- *Individual features that comprise the chenier reforestation measure*

Two marsh restoration measures, (Features 124d and 3c1) are partially located on USFWS property (Sabine National Wildlife Refuge and Cameron Prairie National Wildlife Refuge, respectively) and are included in the NER RP. These features are vitally important to help preserve the Calcasieu Lake rim and prevent vast new expanses of open water from forming should the lake rim be breached by erosional forces. All NED and NER RP features (including those recommended for appropriation and construction by USFWS) represent the "Federal Plan". Because USFWS is ultimately responsible for managing its refuge lands, USACE is not seeking authorization and funding for the USFWS Features 124d and 3c1. The NED RP and the subset of NER features that are recommended for authorization and appropriation by USACE [all features minus 124d and 3c1) represent the "Corps Plan"]. Rather, USACE supports USFWS in seeking its own authorization and appropriation to construct the two features and offers USFWS the information that USACE developed under this study effort as a starting point for USFWS efforts to obtain independent authorization and funding for the USFWS features of the Federal Plan. The NER project first cost estimate for the Federal Plan (which includes costs associated with these two features) is $2.485 billion. The total benefits for the Federal NER RP are 15,448 acres and 4,976 AAHUs. Of the total cost, the USACE estimates approximately $297 million for the design, construction, and construction management costs of these two USFWS features. However, it is anticipated that USFWS would develop its own costs in connection with these features. The total NER benefits for the two USFWS suggested features are 1,492 acres and 611 AAHUs. The NER RP was evaluated and justified through the incremental analysis. Therefore, each individual restoration feature is justified as a stand-alone project. These features are particularly desirable because they provide additional benefit not quantified in the evaluation and selection process (i.e. preserving critical geomorphic structure of the lake rim). These features are in the Federal interest and USFWS is encouraged to seek independent authorization and appropriation for construction.

The NER recommended Corps Plan includes a three tiered implementation sequence. (1) Tier I features may be constructed simultaneously because they would not affect the construction of any nearby Tier I NER Recommended Plan feature. Shoreline protection features would be constructed prior to marsh restoration features in an effort to better protect the more storm-vulnerable marsh restoration features. This approach contributes to the sustainability of the marsh restoration features. The project first cost for Tier 1 is $850,998,000 producing 1,930 AAHUs. (2) Tier II NER Recommended Plan features were so categorized because they utilize the same borrow or staging area, and/or construction of these features would potentially interfere with construction of a Tier I NER Recommended Plan feature. The project first cost for Tier II is $561,186,000 producing 1,117 AAHUs. (3) Tier III NER Recommended Plan features were so categorized because they would utilize the same borrow or staging area, and/or interfered with construction of a Tier II feature, and/or interfered with an existing mitigation project. The project first cost for Tier III is $776,002,000 producing 1,318 AAHUs.

Construction of NER RP features would overlap ten permitted mitigation projects. Completion of the permit obligation requirements range between 2016 and 2040. Project-induced impacts to the mitigation projects would be avoided by tiering construction of NER RP features until after mitigation permit obligations have been satisfied. As contemplated in the current recommended tiered construction schedule, the expiration date for each mitigation project identifies the earliest construction start date for the corresponding NER RP feature. Prior to initiating construction of the NER RP measures, the Government and the NFS shall first obtain written confirmation from the permitting authority that the mitigation obligations and all other permit obligations have been satisfied by the permittee. Commencement of implementing the NER RP measure that overlaps a permitted mitigation project would be delayed until such time as written confirmation is obtained. Given that some mitigation features will not be completed for 20+ years, there is a risk that NER feature construction costs, schedules, and implementability could change from current estimates. Table 4-5 identifies mitigation projects and the tiers into which they are assigned based upon the estimated date of satisfying permit obligations. Following confirmation that all permit requirements have been met for a mitigation project, the Government would re-assess the site to assure that the proposed NER RP feature for the site remains justified.

Table 4-5: Mitigation Projects that Interface with NER RP Features.

Permit #	Description	NER RP Feature	Permittee or Owner	Expiration Date (permit completion date + 20 years)	Mitigation Project Description
Tier I Features					
P20061888	Terraces at GIWW N of Black Lake	3a1	Gulfport Energy Corporation	11/30/2032	Proposed construction of 5,358 linear ft of terraces south of the GIWW and north of Black Lake.
P19900448	Marsh Management Plan area	124d	Apache Louisiana Minerals	11/13/2016	Install and maintain water control structures for CTU 1 and 2. In CTU 1, 64,000 linear ft of smooth cordgrass plantings. In CTU 2, 32,470 linear ft of boundary levee are to be repaired. Various water control structures are to be repaired or replaced.
P19971118	West Cove Planting Project	124d	Union Pacific Resources	7/28/2022	West Cove Planting Project; 5,000 ft of plantings of *Spartina alterniflora*.
P19950086	Marsh Management Plan area	127c3	Vermilion Corporation	4/1/2021	Eight water control structures will be installed; a riprap levee will be constructed; five double flapgated culverts and one earthen plug will be installed; two earthen plugs will be constructed.
Tier II Features					
P20141590	Spoil Placement	306a1	Hilcorp Energy Company	4/8/2040	Dredging of 15,430 cubic yards of native material to construct slip for the purpose of installing a drill rig, well protector and pilings. The dredged material will be pumped into a shallow pond adjacent to the proposed drill site using a temporary discharge pipe. An additional 301 cubic yards of material will be displaced to construct containment berms.

Tier III Features					
P20141138	Rip-rap Grand Bayou	3c1	CPRA	1/29/2040	Installation of 21,000 tons of riprap along the Calcasieu Lake Shoreline near the Peconi, Mangrove and Grand Bayou water control structures.
P19870422	Marsh Management Plan area	47a2	T.Bonsall	2/3/2023	Construction of a levee and multiple water control structures (South of Upper Mud Lake).
P20031576	Mitigation for P20031304	47a2	Kash Oil & Gas, Inc.	3/31/2029	Constructed 4,803 linear feet of terraces and planted with *Spartina alterniflora*.
P20081326	Mitigation for P20080132	47a2	PetroQuest Energy, L.L.C.	11/25/2033	Construct and plant 2,897 linear ft of wave dampening terraces that will capture re-suspended sediments and protect fragile shorelines by planting plugs of smooth cordgrass on both sides of constructed terraces.
P20071745	Mitigation for 20070883	47c1	Manti Operating Company	3/5/2025*	Construction of ten 500-foot terraces, eight 300-foot terraces, two 200-foot terraces and eight 400-foot terraces (6.1 acres). Plantings of *Spartina alterniflora* rows on each side of the terraces.

*11 years, not 20 years

4.2.3 Adaptive Management and Monitoring (AM&M)

The AM&M plan describes the adaptive management and monitoring to be used to evaluate the progress made towards meeting project goals and objectives, and is contained in Appendix A. The primary reason for implementing AM&M is to increase the likelihood of achieving desired project outcomes given the uncertainties with ecosystem restoration. Adaptive management works best when it is tailored to the specific problem(s), designed to ensure accountability and enforceability, used to promote useful learning, and supported by sufficient funding. AM&M is warranted when there are consequential decisions to be made, when there is an opportunity to apply learning, when the objectives of management are clear, when the value of reducing uncertainty is high, and when a monitoring system can be put in place to reduce uncertainty. The plan describes the organizational structure for the AM&M process, the Conceptual Ecological Model, key uncertainties, and provides potential Adaptive Management/contingency actions that may be needed to ensure success. The level of detail in the AM&M plan is based on currently available data and would be refined further in subsequent design phases. AM&M costs are based on the monitoring needed to measure ecological success and the identified risks and uncertainties. Section 2039 of the WRDA 2007 allows ecological success monitoring to be cost-shared for up to ten years post-construction. Once ecological success has been achieved, which may occur in less than ten years post-construction, no further monitoring would be performed. If ecological success cannot be determined within the ten-year post construction period of monitoring, any additional required monitoring will be a non-Federal responsibility.

4.2.4 NER RP Operation, Maintenance, Repair, Rehabilitation, and Replacement (OMRR&R)

The NFS is responsible for all of the OMRR&R of the NER RP. At the time of this Report, it is anticipated that the OMRR&R of the marsh restoration elements primarily consists of marsh renourishment through the periodic addition of dredged sediment to maintain wetland elevations. OMRR&R of the shoreline protection/stabilization features is currently anticipated to consist of periodic maintenance lifts and the addition of material for rock and/or rip-rap features. Construction and OMRR&R of the chenier reforestation features will not be required following the achievement of the minimum survival threshold criteria, which is anticipated to occur for each chenier feature by Target Year 5 (following initial planting). For purposes of this report, it has been assumed that the minimum survival threshold will be obtained on or before 10 years post construction; therefore, this report does not capture any OMRR&R beyond the 10 years post-construction date. At such time as the minimum survival threshold is obtained for a given element of the chenier feature, or 10 years from the

date of the construction of the element of the chenier feature, whichever comes first, the Government shall NCC the individual chenier element to the NFS. OMRR&R costs are the responsibility of the NFS (currently estimated at $311,573,000 for all NER RP features).The estimated average annual OMRR&R cost for the NER features is $5,958,000, which would be refined during the PED phase. The NFS shall commence OMRR&R once each project undergoes a final inspection by both USACE and the NFS and the USACE issues a NCC together with the OMRR&R Manual to the NFS.

4.2.5 Risk and Uncertainty Analysis

Risk and uncertainty are intrinsic factors in water resource plans. This section describes risk and uncertainty categories pertinent to the NER RP.

Environmental Factors

Relative Sea Level Rise: An assessment of RSLR (see Appendix O) was included in plan formulation and alternatives analysis; however there is uncertainty about how much sea level change may occur. Higher than estimated RSLR could cause salt water intrusion further into the Calcasieu and Sabine estuaries, causing significant changes to lower salinity wetlands. However, improved cohesiveness across the system should also result in a broader near-term increase in ecosystem resilience, not just for those restored wetlands, even in the face of a higher RSLR. Values for the RSLR rates were previously presented in Table 4-1. A graphic of the projected rates is also presented in Chapter 1.RSLR could impact the benefits of the NER RP. Because the features were developed using the intermediate RSLR rate, the NER RP would provide more benefits than anticipated if the lower RSLR rate occurs and less benefits if the higher RSLR rate occurs. With the high rate the marsh restoration and shoreline protection/stabilization features would be less effective because they could be overwhelmed by water levels and this could increase their vulnerability. This is a risk to the effectiveness of the NER RP but this situation would also imply that landscape-level inundation would be so great that engineered or designed features could no longer control how, when, or where water moves throughout the study area.

Storms: Risks associated with the NER RP relate to possible extreme weather events. Uncertainty about the size or frequency of storms and climate events, such as El Nino cannot be predicted over a set period of time. Storm events can cause significant damage to wetlands. Intact habitats are more resilient against the effects of hurricane storm surge and associated flooding, salinity spikes, and tidal scour, though some hurricane storm surge damages may be unavoidable.

4.2.6 Real Estate Requirements

The Real Estate Plan (Appendix E) provides a description of the lands, easements, rights-of-way, including those needed for relocations and the borrowing of material, ensuring the performance of relocations and the disposal of dredged or excavated materials (LERRDs) as deemed by the Government to be required for the construction and OMRR&R of the NER RP features. Appendix E, Table 1 describes the estates to be acquired for each NER RP feature, and indicates whether the lands are owned by private landowners or by the state of Louisiana. An estimated 158 private landowners will be affected by the NER RP. A cost estimate was prepared in April, 2014, and is included within Appendix E. Fact sheet maps for NER RP features have been prepared to show required project rights-of-way, including access, borrow, staging, and other project features (see Appendix K for more information).

The majority of the NER RP features are located on privately owned land and would require the acquisition of a standard Fee, Excluding Minerals (With Restriction of Use of Surface) estate. A standard Temporary Work Area Easement would be acquired for staging areas. A standard perpetual Utility and/or Pipeline Easement would be acquired for transport of dredged materials. A Perpetual Access Easement (Non-Material Deviation from Standard Estate) would be acquired over privately owned access areas. A Real Estate Plan providing detailed information regarding real estate acquisition for the NER RP is found in Appendix E.

4.2.7 Summary of Environmental Consequences of NER Plan

Restoration, protection/stabilization, and chenier features for the NER RP are designed to be self-mitigating and would not require compensation. Table 4-6 depicts the changes between the NER TSP contained in the December 2013 Draft Report, the 2015 Revised Draft Report, and the final NER RP contained herein.

Table 4-6: NER Plan Changes.

Plan	Recommendation	2013 Draft Report	2015 Revised Draft Report	Final Report
NER	Marsh Features (Acres/AAHUs)	9 (8,714/N/A)	9 (8,714/3,481)	9 (7,900/2,700)
	Hydrology/Salinity Control Features (Acres/AAHUs)*	2 (6,092/N/A)	1 (-56/267)	Recommended for Study[1]
	Shoreline Protection/Stabilization Features (Acres/AAHUs)	5 (5,509/N/A)	5 (5,509/1,615)	5 (6,135/1,738)
	Oyster Reef Preservation Features (Acres/AAHUs)	1 (N/A/N/A)	Removed	Removed
	Chenier Features (Acres/AAHUs)	22 (1,413/N/A)	35 (1,414/538)	35 (1,413/538)
	Project First Cost (Oct 2015 Price Level)/Total Project Cost	$992,000,000[2]	$987,738,000[2]	$2,485,025,000/ $2,491,025,000[1]

[1] *The Calcasieu Ship Channel Salinity Control Structure and the Cameron-Creole Spillway Structure are recommended for additional study ($3M for each study has been added to the Total Project Cost).*

[2] *Based on uncertified costs, no adaptive management, and without a tiered construction schedule.*

4.2.8 Significance of Benefits for the Recommended Plans

The Southwest Coastal study area is significant for multiple reasons as described below. Aside from the institutional, public, and technical considerations, the area is extremely important locally, regionally, and nationally, and the NED and NER RPs would help to preserve and sustain this importance in a number of ways.

NED Significance

Implementing the NED RP measures to reduce damages from hurricane storm surge to structures in the study area serves multiple purposes. First, it would help to lessen the financial and social impacts that tropical storms and hurricanes can cause by reducing the risk of property damage that displaces residents, shuts down commercial and industrial services, and disrupts livelihoods. If structures avoid or have reduced damages because of nonstructural measures, families and businesses can rebound much more quickly after a tropical event. This is exemplified by increasing the opportunity to return children to school where their residences and schools were not damaged from the design hurricane storm surge event; by reducing lost work days of workers who support the local or regional economy by decreasing the number of hurricane storm events that require repairs to hurricane storm surge damaged houses, businesses and other non-residential structures, by minimizing the debris from hurricane storm damaged structures that can affect other properties; and by generally improving the opportunity and time necessary for residents, businesses and government to return to normal function after the design hurricane storm event. Eligible structures that are at-risk from storm surge from the NED RP design hurricane would be subject to nonstructural measures that would reduce the risk of the anticipated storm surge Second, time, money, and energy would not be lost to repairing structures damaged by storm surge from the NED RP design hurricane, relocating to other areas due to displacement from a home or business, or disruptions in community cohesiveness. This would help to ensure that the economy would continue to operate after the NED RP design hurricane and that the stress and hardship associated with hurricane storm surge would be lessened. Implementing the NED RP would also help to preserve a sense of place and community identity by reducing the potential for this unique culture in the United States to be displaced, perhaps permanently, to other areas in the region. Finally, the study area supports national needs, logistics, and persona. For example, the nation enjoys Louisiana seafood, relies on the uninterrupted supply of energy and material goods, and benefits from having a culture that exemplifies the passionate and hard-working

spirit that defines the study area. Pronounced impacts from repetitive hurricane storm surge events, such as the NED RP design hurricane, threatens the productivity and sustainability of these important national interests by reducing the continuity, functionality, and export of supplies, commerce, and culture.

NER Significance

Restoring fresh, intermediate, brackish, and saline marshes within a framework of marsh restoration, shoreline protection/stabilization, and chenier features would interact to provide benefits greater than the sum of their parts. Together these features would help regulate fresh and saltwater flows, protect against substrate erosion, and provide important transitional estuarine habitat between upland and marine environments. Restoring lost wetlands, protecting existing wetlands, and reducing the profound environmental and habitat loss across the study area could help support the NED RP recommendations. Part of the area's vulnerability to hurricane storm surge damages is directly related to the significant loss of wetlands the area has experienced. Restoring these important habitats helps to reduce the ability of coastal floodwaters to work their way into the communities that need risk reduction measures to help reduce damages from hurricane storm surge. Wetlands provide a buffer between ever-growing open water areas that allow water (and surge) to permeate further inland and thus more directly affect the surrounding infrastructure such as roads, residences, businesses, and critical infrastructure (i.e. electrical, water, sewer, and drainage facilities). Implementing the NER RP could help increase the effectiveness of the NED RP. Wetlands provide important habitat that directly supports the viability of threatened and endangered species; commercially important species such as alligator, shrimp, and crabs; and the economy through the creation of and support for industries that depend on wetlands such as fishing and hunting guides, bait/tackle shops, birding enthusiasts, or eco-tourism. Wetlands are a unique yet imperiled ecosystem in the Nation and coastal Louisiana has experienced a tremendous loss of this important habitat.

Resource Significance—Institutional, Public, and Technical

Significance of Benefits

The NER RP would benefit a total of 15,448 net acres (Table 4-3). The significance of benefits for the NER RP is substantially greater than just the net acres restored and/or protected. Compared to the "No Action Alternative", implementing the marsh restoration, chenier reforestation, and shoreline protection/stabilization features of the NER RP would result in positive effects on resources which are institutionally, technically, and publicly recognized. Restoration supports the global, national, state, and locally significant resources within the area would contribute to the unique services, functions, and values provided by these resources.

Implementing the NER RP would reduce some forms of habitat degradation and land loss reestablishing processes that contribute plant production replenishing vertical maintenance necessary for a stable ecosystem. Restoring estuarine marsh habitats for wildlife, finfish, shellfish, and other aquatic organisms would provide habitats used for shelter, nesting, feeding, roosting, cover, nursery, and other life requirements. T&E species, such as piping plover, sea turtles, and species of interest such as the brown pelican and bald eagle would benefit from the restoration of scarce important estuarine habitats. The shoreline protection features would restore and protect approximately 335 acres of designated critical habitat for the threatened piping plover and important habitat for the threatened rufa red knot.

There would also be benefits to various resources such as estuarine EFH including: estuarine mud bottoms; marsh ponds, inner marsh and marsh edge; SAV; beach; tidal creeks; and marsh/water interface associated with the restoration of transitional estuarine habitat between upland and marine environments. This would result in restored EFH for Federally-managed species such as brown and white shrimp, red drum, Spanish mackerel, King mackerel, and cobia. Increases in available EFH would result in more opportunities for recreational and commercial fisheries. Restoring the rare and imperiled chenier forest would provide stopover habitat for migrating neotropical birds. Benefits of the NER plan would include a decrease in inter- and intra-specific competition between resident and migratory fish and wildlife species for decreasing estuarine resources.

The loss of marsh and wetlands would threaten nationally significant economic, historical, and cultural resources and have significant negative impacts on the navigation, oil and gas, and seafood industries, and the residents that service these industries. Southwest Louisiana's "Working Coast" is unique in its scope and scale, with extensive infrastructure needs to serve the navigation, oil and gas, and commercial and recreational fishing industries, which must be balanced and must exist in harmony with each other. While human populations in and near the wetland areas are moderate, Southwest Coastal Louisiana is a hub of activity supporting the numerous ports, waterways, oil and gas fields, rich fishing grounds, and other elements of a working coast. The impact of the loss of wetlands will be felt far beyond the industries directly impacted, with residents that serve important national industries, especially the offshore oil and gas fields, being forced to abandon their communities and move further inland.

A resource is considered significant if it is acknowledged in three categories:

1. *Institutional*—the resource is acknowledged in the laws, adopted plans, or other policy statements of public agencies or private groups;
2. *Public*—the resources are recognized as important by some segment of the general public as evidenced by people engaged in activities that reflect an interest or concern for that particular resource; and/or
3. *Technical*—the resources are determined to be important based on technical or scientific criteria.

Institutional Recognition

Human Environment resources (socioeconomics and human resources) within the project area are institutionally significant. Of particular relevance is the degree to which the proposed action could positively affect the public health, safety, and economic well-being; and the quality of the human environment by providing hurricane storm surge risk reduction by implementing nonstructural measures (elevating, relocating, or flood proofing structures) and coastal restoration (marsh restoration, shoreline protection/stabilization, and chenier restoration). Institutional significance is exemplified because the NER benefits are recognized in laws and policy and acknowledgment is given to the restoration and protection of these resources in the project area by the following (for example): the National Environmental Policy Act of 1969, our basic national charter for protection of the environment and involvement of the public in decisions, such as this proposed action, which could beneficially affect the quality of the human environment; the Estuary Protection Act of 1968; Clean Water Act of 1972 and amendments, etc.

Restoration of water environment resources within the project area exemplifies institutional significance because of law and policy and the acknowledgment given to these resources by the following: National Environmental Policy Act of 1969; Clean Water Act of 1972 and amendments; Coastal Barrier Resources Act; Rivers and Harbors Act of 1899; Watershed Protection and Flood Prevention Act of 1954; Submerged Land Act of 1953; Coastal Zone Management Act of 1972; and the Estuary Protection Act of 1968.

Benefits from the proposed action would result in restored and protected wetland marshes, barrier shorelines, and chenier vegetation which provide essential and critical habitat for various fish and wildlife, endangered species (e.g., piping plover), and numerous species of neotropical migrating birds. Restored coastal wetlands and vegetation resources serve as the basis of productivity, contribute to ecosystem biodiversity, provide various essential and critical habitat types, and are an indicator of the health of coastal habitats. Natural environment resources are institutionally significant because restoration of these areas is exemplified by the law and policy recognition and acknowledgment given to these resources in the project area. Significance is supported by many laws, plan, policies, and treaties. The following provides an example of species and their associated laws:

Endangered Species Act of 1973, as amended;

Piping Plover (Charadrius melodus)	Threatened
Red knot (Calidris canutus rufa)	Threatened
Red-cockaded woodpecker (Picoides borealis)	Endangered
Sprague's pipit (Anthus spragueii)	Candidate
Gulf sturgeon (Acipenser oxyrinchus desotoi)	Threatened
West Indian Manatee (Trichechus manatus)	Endangered

Green sea turtle (Chelonia mydas)	Threatened
Hawksbill sea turtle (Eretmochelys imbricata)	Endangered
Kemp's ridley sea turtle (Lepidochelys kempii)	Endangered
Leatherback sea turtle (Dermochelys coriacea)	Endangered
Loggerhead sea turtle (Caretta caretta)	Threatened

The Migratory Bird Treaty Act of 1918;

Egret: Cattle, Bubulcus ibis, Little, Egretta garzetta, Reddish, Egretta rufescens, Snowy, Egretta thula
Bluebird: Eastern, Sialia sialis
Bunting: Indigo, Passerina cyanea
Chickadee: Carolina, Poecile carolinensis
Mallard, Anas platyrhynchos

Magnuson-Stevens Fishery Conservation and Management Act of 1976, as amended:

Red Drum
Lane Snapper,
Cobia,
Bull shark.

The study area supports many different significant species and habitats that are institutionally significant as supported by the following:

Coastal Barrier Resources Act of 1982; Coastal Zone Management Act of 1972; Estuary Protection Act of 1968; Wild Bird Conservation Act of 1992; North American Wetlands Conservation Act of 1989; Fish and Wildlife Coordination Act of 1958, as amended; Marine Mammal Protection Act of 1978; and E.O. 13186 Responsibilities of Federal Agencies for Protecting Migratory Birds.

Public Recognition

Restored and protected coastal wetland resources are publicly significant because of the high priority that the public places on their aesthetic, recreational, and commercial value. Restoration of this coastal habitat positively affects the long-term health of the coastal Louisiana ecosystem which supports the well-being of the southwest Louisiana human culture, with the attendant positive monetary impacts of wetland-related human uses. Restoration helps support the fisheries industry which encompasses commercial fishing, harvesting, distribution, and processing, fisheries support industry, boat building, and recreation fishing/hunting support (marinas, fishing charter/guide services, camps, bait/tackle shops).

This resource is publicly significant because the public demands reduced risk of damage from hurricane storm surge, protection of estuaries and floodplains, and because the public demands clean water and healthy wildlife and fishery species for recreational and commercial use. Outdoor activities are very popular throughout the study area and include such activities as bird watching, recreational fishing, hunting, boating and other forms of aquatic recreation, cooking and food preparation (especially utilizing the various species that utilize the surrounding marshes and wetlands), and through cultural events such as the Marshland Festival held each July. The loss of or a reduction in the extent of the coastal ecosystem threatens the unique southwest Louisiana culture, which is closely tied to surrounding ecosystem. Numerous comments and letters were received supporting the NER RP, with many calling for even more restoration features to be included. Some significant commenters including Cameron Parish Gravity Drainage Districts No. 4 & 5 and the Audubon Society each representing thousands of individuals.

Human environment resources are publicly significant because of the direct experience by southwest coastal Louisiana citizens regarding human health, welfare, and the decline of the economic and social well-being due to adverse impacts associated with coastal land loss and hurricane storm surge damages throughout the project area. Some of the effect of this condition could be lessened by the proposed NED and NER RPs.

Technical Recognition

The loss of this habitat affects an entire ecosystem that serves as important nursery grounds for numerous species, stop-over habitat for migrating birds, and as a complex and inter-related food chain. The scarcity of this habitat is becoming more pronounced as thousands of wetland acres are eroded away each year. Water environment resources are technically significant because the proposed NED RP and NER RP could reduce the adverse impacts of hurricane storm surge damage to the human and natural environment. Water quality would be improved by wetland creation which supports most physical, chemical, geological, and biological processes throughout the entire southwest coastal Louisiana estuarine system. A collapsed ecosystem cannot support the diverse number of species that rely on the study area for their survival. Restoration of wetlands would play an important role in increasing the survival, distribution, and benefits to plants, wildlife, and fisheries resources and would increase biodiversity in the study area.

Human environment resources are technically significant because the proposed action could reduce the costs associated with hurricane storm surge flooding. Coastal wetland restoration would provide a buffer for hurricane storm surge and could help offset the impacts of hurricane storm surge damage by elevating or otherwise flood proofing structures throughout the study area. This would positively affect the social and economic welfare of citizens within the study area and the Nation.

Scarcity

Scarcity is a measure of a resource's relative abundance within a specified geographic range. Coastal wetlands are limited in range throughout the United States and are imperiled throughout their range. The Louisiana coastal area represent 40 percent of the wetlands in the nation and accounts for 90 percent of national wetland loss. The study area represents approximately 30 percent of the Louisiana wetlands total. The Southwest Coastal Louisiana area is unique in its composition of wetlands, ridges, and coastal wetlands. The area is composed of complete beachfront, coastal cheniers, and estuarine complex. The coastal geomorphology formed by the coastal cheniers is unique to the nation.

Representativeness

The study area exemplifies a natural coastal estuarine wetland habitat. There is a significant abundance of representative species and coastal landforms, because of the unique nature of the coastal cheniers in close association with estuarine complexes. The cheniers are similar in form and scale as they were prior to human settlement. The cheniers retain a large number of native oak and other hardwood tree and shrub species.

Connectivity

The connectivity of this transitional coastal estuarine system extends well beyond the study area. For example, the estuary provides nursery, foraging, hiding cover, and other essential fish habitats for marine aquatic organisms that utilize both the gulf and the estuary for various life stages and requirements. These estuaries also provide important, critical, and essential habitats for species that migrate throughout the gulf (Manatee, Bottlenose Dolphin, Gulf Sturgeon, Cobia, King Mackerel, Sea Turtles, commercial and recreational fisheries), continental (Mallard, Teal, Pintails, Redhead, Shovelers, and others), and hemisphere (Neotropical migratory birds; humming birds, warblers, sparrows, birds of prey, dabbling and diving ducks). Restoration within the study area would nourish and protect the continued and improved use of important critical and essential fish and wildlife habitats.

Limiting Habitat

This is habitat that is essential for the conservation, survival, or recovery of one or more species. The RP is protecting gulf shoreline beach which is designated critical habitat for the threatened piping plover and also used by the threatened rufia sub-species of the red knot which is critical for the survival and recovery of these two species.

The RP also restores cheniers which provides important stopover habitat for neotropical migratory birds. The area also contains 72,000 acres of Wetland Conservation area designated for an experimental population of threatened Whooping Crane. There are 84 miles of shoreline habitat designated for the threatened Piping Plover within the study area as well. The RP provides resilience that supports the sustainability of these habitats.

Biodiversity

This study area is extremely diverse and is utilized by resident as well as migratory fish and wildlife species. For example the study area is part of the central flyway for migratory waterfowl and neotropics which consists of hundreds of species and millions of individuals. This study area hosts a large percentage of this population. The study area has freshwater, estuarine, and migratory fisheries consisting of hundreds of species. That diversity in numbers is exemplified in the numbers of recreational users utilizing the area.

Status and Trends

Although the coastal wetlands and forested chenier habitats in the study area are declining at a rate less than the remainder of coastal Louisiana, the loss of these transitional estuarine wetlands and cheniers continues to threaten the terrestrial and aquatic organisms that utilize the area. This continued loss further exacerbates the nationwide scarcity of coastal wetlands and continues impairing the connectivity between the Gulf, transitional estuaries, and interior terrestrial habitats.

4.2.9 Synergy of the NED/NER Plans and Management of Residual Risk

Integration of the NED/NER Plans

The integration of the SWC NED and NER RP's is rooted in the evaluation of critical landscape features identified tin the Louisiana Coastal Protection and Restoration (LACPR) study. Work undertaken in the LACPR study to review the ADCIRC storm surge modeling output for the 100-year, 400-year, and 1,000-year base condition runs allowed the identification of landscape components that tend to produce significant effect on surge. These landscape features currently exist independent of any proposed alternative action. While some of these features might be incorporated directly into alternative risk reduction plans, the fact that they are already existing contributors to systemic risk reduction demonstrates that there are landscape benefits being derived even with no action. This also indicates that maintenance of these features, independent of any proposed alternative risk reduction plan, would be beneficial to a system of comprehensive risk reduction. The LACPR report suggested that these landscape features would merit priority, or focus for restoration, based on their identifiable contribution to risk reduction wherever they might have been incorporated into an alternative plan, or for maintenance wherever they represent elements of existing publicly-supported projects. While the performance of the NED RP is not dependent on any of these landscape features, their continued function would serve to increase the reliability and resilience of other NED risk reduction features.

The features identified in the LACPR effort ranged from critical wetland segments to natural ridges to manmade embankments. The features generally demonstrated performance in altering storm surge across all surge conditions (100-year, 400-year, and 1,000-year). The effects of these features observed in the LACPR effort are generally either a relatively rapid decrease, or a pronounced "stacking" preceding a decrease, in the forecast surge elevation. It is reasonable to suggest that these marked changes in surge elevation, and the landscape components associated with them, represent a beneficial restriction to the movement of surge further inland. These observed landscape effects are based on the modeling and output of multiple storm tracks and intensities, which subsequently represent statistical water surface effects. The actual performance of any landscape features varies widely when considering the impacts of individual storm tracks and intensities.

In the Southwest Coastal area (LACPR, Planning Unit 4), the critical landscape features identified included the entire barrier-shoreline, Grand Chenier, and the wetland areas between Vermilion Bay and the GIWW, the Freshwater Bayou channel bank, and Highway 82. In this area, the modeling indicates consistent stacking of surge at the coast with significant reduction of surge elevation inland from that point. Grand Chenier

contributes to this effect along the entire eastern portion of the planning unit. The wetland area between Vermilion Bay and the GIWW, Freshwater Bayou and Highway 82 at the eastern end of the area provides a similar effect and results in significant reduction of surge elevation in the interior of the basin. The SWC NER RP features tie into and support all of these identified critical landscape features, as well as other portions of the shoreline, connecting ridges and existing roadways .

The NER RP tiered implementation assures that those features will be implemented in a manner that will address the most potentially far reaching impacts. These impacts also represent the most likely threat to these critical features. The interface between the NER RP and these identified critical features produces additional resilience in the geomorphic structure and sustainability of the area and adds reliability in the ability of the landscape to support risk management. This in turn allows the NED RP features to perform in the most effective and efficient manner for the greatest possible duration.

Synergy of the NED/NER Plans with Parish Hazard Mitigation Plans

All three Parishes in the Southwest Coastal study area have updated their Hazard Mitigation Plans consistent with the State's Hazard Mitigation Plan in 2015. In addition to reducing life safety and property damage risk, each Parish, in identifying its hazard mitigation goals, lays out a theme of facilitating recovery and reducing risk to the infrastructure that supports recovery. The NED/NER RPs, and their integrated performance allow the direct management of the greatest identified risks and extend the performance and effectiveness of local hazard mitigation actions, as well as increase valuable ecosystem outputs. A general overview of the activities for each Parish is provided below.

The Calcasieu Parish Office of Planning and Development provides oversight for building permits and codes, land use planning, and all parish ordinances. Calcasieu Parish and its jurisdictions ensure that all adopted building codes are enforced and in compliance relating to the construction of any structure within the boundaries of the parish. Building permits are required prior to beginning any type of construction or renovation projects, installation of electrical wiring, plumbing, or gas piping, moving manufactured/modular or portable buildings, and reroofing or demolitions. While local capabilities for mitigation can vary from community to community, Calcasieu Parish as a whole has a system in place to coordinate and share these capabilities through the Calcasieu Parish Government and through their Parish Hazard Mitigation Plan. Calcasieu Parish lists only 15% of its total land area as urban/developed.

Calcasieu Parish has established hazard mitigation goals that include:

1. Reduce or prevent injury and loss of life;
2. Reduce or prevent damage to property and material assets;
3. Reduce or prevent future damage to critical facilities (fire, rescue, law enforcement, communications, command and control) essential for protection and public safety;
4. Reduce or prevent future damage to special facilities, including schools, nursing homes, health care facilities, prisons, and historical and cultural resources;
5. Reduce or prevent future damage to infrastructure, including stormwater conveyance structures, utility systems, pipelines, railroads, highways, bridges, and navigable waterways;
6. Reduce or prevent future damage to commercial facilities; and,
7. Reduce or prevent future damage to higher risk facilities that, if damaged, may result in significant loss of human life, damage to the environment, or significant harm to the local Economy. These facilities include hazardous material handling facilities, dams, flood control facilities, and other high security facilities.

Calcasieu Parish has completed actions to harden critical facilities, to acquire and elevate some properties, and has taken steps to reduce future floodplain development. The Parish, and various communities within the Parish, have also identified 120 additional actions, most with target dates of 5 years or less, to achieve their hazard mitigation goals.

Cameron Parish ensures that all building codes adopted are enforced and in compliance relating to the construction of any within the boundaries of the parish. The Cameron Parish Planning and Development Office is responsible for all building code, permitting, land use planning and ordinances. The Parish has a Flood Damage Prevention Ordinance, Coastal Use Permits, and a Coastal Zone Program that are followed. As a community, Cameron Parish has administrative and technical capabilities in place that may be utilized in reducing hazard impacts or implementing hazard mitigation activities. Such capabilities include staff, skillset, and tools available in the community that may be accessed to implement mitigation activities and to effectively coordinate resources. Cameron Parish lists only 1% of its total land area as urban/developed.

Cameron Parish has established hazard mitigation goals that include:

1. Reduce the loss of life or property;
2. Protect critical public facilities and thoroughfares;
3. Ensure post-disaster operability of strategic facilities and thoroughfares;
4. Develop incentive and community outreach/education programs that assist homeowners in protecting residential properties;
5. Provide a long term mitigation solution in locations which experience repetitive hazard damage;
6. Provide a cooperative, inter-jurisdictional / inter-agency solution to a problem;
7. Show development and implementation of comprehensive programs, standards, and regulations that reduce future hazard damage;
8. Avoid inappropriate future development in areas that are vulnerable to hazard damage;
9. Reduce the level of hazard vulnerability in existing structures and developed property; and,
10. Restore or protect natural resources, recreational areas, open space, or other environmental values

Cameron Parish has completed actions through FEMA to acquire and elevate some properties and has taken steps to reduce future floodplain development. The Parish is also pursuing 16 additional actions with target dates of 5 years or less to achieve their hazard mitigation goals.

Vermilion Parish and its jurisdictions' capabilities include planning, regulatory, administrative, technical, financial, and education and outreach resources. There are a number of mitigation-specific acts, plans, executive orders, and policies that lay out specific goals, objectives, and policy statements which already support or could support pre- and post-disaster hazard mitigation. Vermilion Parish and its jurisdictions ensure that all building codes adopted are enforced and in compliance, relating to the construction of any building within the boundaries of the parish. Some jurisdictions have extensive zoning regulations, which address use and height of buildings, density of populations, open space limitation, and lot and occupancy requirements. Before the Parish Council enacts or amends development regulations or takes any land use action, and before the Zoning Board may make any recommendation to the Parish Council regarding a proposed development regulation or land use action, the Planning Department, or other department responsible for providing findings, recommendations, papers, correspondence, and records related to the regulation, amendment, or action shall provide a written recommendation to the Council and Zoning Board regarding the consistency with the plan. The land use, zoning, and ordinance requirements address many different types of districts in the parish and its incorporated jurisdictions, ranging from suburban, conservation, and mixed-use to industrial. Vermilion Parish lists only 3% of its total land area as urban/developed.

Vermilion Parish has established hazard mitigation goals that include:

1. Identify and pursue preventative structural and non-structural measures that will reduce future damages from hazards;
2. Enhance public awareness and understanding of disaster preparedness;
3. Reduce repetitive flood losses in parish and municipalities;
4. Facilitate sound building practices in the parish and municipalities so as to reduce or eliminate the potential impact of hazards; and,
5. Improve the ability of the parish and municipalities to rapidly recover and restore facilities and services to the public.

Vermilion Parish, and various communities within the Parish, are pursuing 103 actions to achieve their hazard mitigation goals. Of those action 53 are currently ongoing. All of the actions have target completion dates of 5 years or less.

Synergy of the NED/NER Plans with the Oil and Gas Industry

The Port of Lake Charles has risen steadily from the 26th largest US port in 1980 to the 11th largest today primarily on the import and export of petroleum and natural gas products. Data from the Port of Lake Charles indicates that, in addition to significant existing oil and gas facilities, there is currently $41 billion in ongoing industrial development under construction, with an additional $97 billion pending approval. The New Orleans District has issued 5 permits specifically for LNG and petrochemical facilities over the last 5 years with an additional 4 permits in review. The estimated national economic impact of the port is $6.7 billion in GDP with and additional $4.8 billion projected over the next 10 years. In addition, the area contains major elements of the Strategic Petroleum Reserve (the West Hackberry storage facility contains one third of the total reserve) and the Henry Hub is the establish distribution point for setting the unit price of natural gas for the Nation.

Port of Lake Charles employment represents an estimated 36,000 jobs, or 31 percent of the Lake Charles MSA employment with an additional 13,000 statewide jobs outside the MSA. That is expected to increase by 25 percent over the next 10 years, roughly 9,000 additional jobs in Lake Charles and 12,000 additional jobs statewide. Population and housing data from the Parishes in the study area from 2000-2013 indicate an overall growth trend. Calcasieu Parish, the largest of the three, with the city of Lake Charles, has seen housing growth of 9.1 percent with 14.9 percent in the unincorporated areas. Vermilion Parish has seen housing growth of 12.9 percent with 21.6 percent in the unincorporated areas. This housing growth is significant given that it has occurred even before the recent, and forecast, increases in industrial development and job growth. The growth in housing in the unincorporated areas also underscores the utility of a comprehensive non-structural approach to risk management.

In a manner similar to the synergy between the function of the NED and NER RPs, the resilience and reliability of the extensive oil and gas infrastructure and attendant economy of the Southwest Louisiana area would benefit indirectly from the implementation of those plans. A significant key to the long-term performance of this oil and gas economy is the availability of human resources. The ability to assure these resources, and thereby the performance of this growing industry, is positively effected in two ways by the implementation of the SWC RP. First, as an immediate effect, it enables the more rapid reoccupation and recovery by residents, particularly those most at risk, following storm events. As a result, it also speeds the recovery of the workforce following those events. The recovery of the workforce is key for industries and businesses to return to normal operation, minimize production losses, and control secondary and third order impacts to the overall economy. Second, over the long-term, the availability and viability of housing necessary to support the workforce is enabled by the overall reduction in risk provided by the RP.

4.3 Implementation Requirements

PED and construction practices would follow USACE regulations and standards. Lands, easements, right-of-ways, relocations and borrow/disposal areas (LERRDs) are an NFS obligation (see Appendix E). A preliminary description of the NFS obligations for both the NER and the NED RPs are set forth below.

4.4 Cost Sharing and Non-Federal Sponsor Responsibilities

The CPRA Board is anticipated to be the NFS for the planning, design, construction, operation, maintenance, repair, rehabilitation, and replacement of the project. The cost share for the planning, design, and construction is 65% Federal and 35% non-Federal. Federal implementation of the project is subject to the NFS agreeing in a binding written agreement to comply with applicable Federal laws and policies and with all of the requisite non-Federal obligations, including, but not limited to the provision of all LERRDs deemed necessary by the Government for the construction and OMRR&R of the NED and NER RPs, as well as the OMRR&R of the NED and NER RPs. A more expansive list of NFS obligations can be found in Chapter 7.

4.4.1 Cost Apportionment

Table 4-7 contains a summary of estimated NED and NER costs and benefits for the full RP. Note that costs and benefit numbers have been updated compared to those described in Chapter 2 based on certified cost numbers received from the USACE Cost Engineering Mandatory Center of Expertise (see Appendix B for more details).

Table 4-7: RP summary.

	Storm Damage Risk Reduction (NED)	Ecosystem Restoration (NER)	Total
Project First Cost	$906,091,000	$2,485,025,000	$3,391,116,000
Average Annual Cost	$36,056,000	$66,642,000	$102,698,000
Equivalent Annual Benefits	$203,554,000	4,976 (AAHU's)	
Equivalent Annual Net Benefits	$167,498,000	15,448 (Net Acres)	
BCR	5.65:1	N/A	

Table 4-8 depicts the cost total and Table 4-9 depicts the cost apportionment for the NED and NER RPs. Since NER RP features (124d and 3c1) will be recommended to USFWS for its independent action to obtain Congressional authorization and funding for USFWS implementation, these features are not included in the recommended Corps Plan and will not be included among the NER RP features that USACE will cost-share with the NFS. As a result, this aspect of the NER RP requires two calculations: the total cost of all NED and NER RP features (the "Federal Plan") and the total cost of all NED and NER features that would be cost-shared between the USACE and the NFS (the "Corps Plan"). The Federal Plan cost represents the total Federal investment to fully fund the NED and NER RPs. The Corps Plan cost depicts the Federal Plan cost minus the design, construction, and management costs for the two NER features that would be constructed by USFWS if it chooses to seek and successfully obtains independent Congressional authorization and funding. Preliminary estimates by USACE indicate that the total cost for features 124d and 3c1 is approximately $296,839,000; however, it is likely that USFWS, should it choose to seek authorization and funding, will reevaluate the total cost necessary for implementation by USFWS rather than by USACE. In so doing, it is probable that USFWS would determine a different total cost for these features. The total ecosystem benefits associated with the two features are 1,492 acres and 611 AAHUs. The cost breakouts, and Federal and non-Federal cost apportionments, for both the Federal and Corps plans are provided in this section.

Table 4-8: Costs of the NED and NER RPs (Project First Costs)*.

	Storm Damage Risk Reduction (NED)	Ecosystem Restoration (NER)	Total (Federal Plan)[3]	Total (Corps Plan)[4]
PED	$39,440,000	$420,876,000	$460,316,000	$408,648,000
Construction	$788,900,000	$1,753,666,000	$2,542,566,000	$2,327,265,000
Lands, Easements, & ROW	$61,970,000	$10,932,000	$72,902,000	$72,100,000
Construction Management	$15,778,000	$236,744,000	$252,522,000	$223,456,000
Monitoring and Adaptive Management[2]	$---	$62,807,000	$62,807,000	$62,807,000
Total Project First Costs	$906,091,000	$2,485,025,000	$3,391,116,000	$3,094,276,000
Additional Studies (50/50 cost share)[4]				

CSC Salinity Barrier & Cameron Creole Spillway	$---	$6,000,000	$6,000,000	$6,000,000
Total Costs	$906,091,000	$2,491,025,000	$3,397,113,000	$3,100,276,000

** All table numbers have been rounded to the nearest thousand.*
1 – Construction of all RP features constitutes the 'Federal Cost'. The Federal Cost is 65% of all cost shared features plus 100% of the costs for Features 124d and 3c1 (to be constructed by USFWS). Costs for the 'Corps Cost', which constitutes the RP minus costs for features 124d and 3c1 are also presented.
2 – Details on AM&M cost ranges can be found in Appendix A, Annex L.

Table 4-9: NED and NER RP Cost Apportionment (Project First Costs)*.

	Federal Plan Federal Cost (65%)[1]	Corps Plan Federal Cost (65%)	Non-Federal Cost (35%)
PED	$317,289,000	$265,621,000	$143,027,000
Construction	$1,774,887,000	$1,559,568,000	$767,679,000
Lands, Easements, & ROW	$802,000[3]	$---[3]	$72,100,000
Construction Management	$174,343,000	$145,244,000	$78,210,000
Monitoring and Adaptive Management[2]	$40,825,000	$40,825,000	$21,982,000
Total Project First Costs	$2,308,116,000	$2,011,279,000	$1,082,997,000
Additional Studies (50/50 cost share)[4]			
CSC Salinity Barrier & Cameron Creole Spillway	$3,000,000	$3,000,000	$3,000,000
Total Costs	$2,311,116,000	$2,014,279,000	$1,085,997,000

** All table numbers have been rounded to the nearest thousand.*
1 – Construction of all RP features constitutes the 'Federal Cost'. The Federal Cost is 65% of all cost shared features plus 100% of the costs for Features 124d and 3c1 (to be constructed by USFWS). Costs for the 'Corps Cost', which constitutes the RP minus costs for features 124d and 3c1 are also presented.
2 – Details on AM&M cost ranges can be found in Appendix A, Annex L.
3 – Federal Plan cost consists of private lands required for construction of the two NER features partially located on USFWS property (124d and 3c1).
4 – The Calcasieu Ship Channel Salinity Barrier and the Cameron Creole Spillway are recommended as 3x3x3 compliant studies cost-shared 50/50.

4.5 Areas of Controversy and Issues Resolved for the Final Report

The 2013 Southwest Coastal Louisiana Draft Integrated Feasibility Report and Programmatic Impact Statement ("2013 Initial Draft Report") identified a Tentatively Selected Plan (TSP) for the National Economic Development (NED) and the National Ecosystem Restoration (NER) aspects of the study. However public and internal policy comments on the 2013 Draft Report identified significant issues requiring resolution prior to completing a final report. As a result, in March 2015, a Revised Integrated Draft Feasibility Report and Environmental Impact Statement ("2015 Revised Draft Report") was released with updated NED and NER TSPs that differed from those identified in 2013. Additional public and policy comment on the 2015 Revised Draft Report resulted in final modification of the recommended plans and their implementation. This final report ("2016 Final Report") updates and finalizes the 2015 Revised Draft Report (which concluded its public review in May 2015). This report contains the Recommended Plan (RP) for the NED and the NER components of the Study. Listed below are the significant areas of controversy identified in each successive reporting stage and the actions taken.

Areas of Controversy and Resolution
2013 Draft Integrated Feasibility Report and Programmatic Impact Statement

1. The 2013 Draft Report primary area of controversy was public demand for design and implementation of structural risk reduction measures (e.g., levees), not nonstructural measures (structure raising, flood proofing, etc.).

Resolution: Structural measures were reevaluated for the 2015 Revised Draft Report but were not found to be justified. Although this was considered the most significant comment on the 2013 Initial Draft Report, there is no reference to this comment with regard to the 2015 Revised Draft Report. The southwest coastal Louisiana area, with the exception of Lake Charles, is not densely populated. Rather, the population is scattered over a wide area. Developing a structural levee alignment that would provide sufficient risk reduction to the sparsely populated and widespread human populations and that would provide a positive benefit-to-cost ratio, was not possible. Consequently, the PDT developed what may be the largest nonstructural alternative the Corps has considered to date.

2. Controversy over perceived insufficient ecosystem restoration throughout the study area. The large study area has numerous areas in need of ecosystem restoration.

Resolution: The PDT took an approach to address those areas in greatest need. Although the public demands more acres of restoration to this area due to the rapid land loss being experienced incremental analysis of a broad range of restoration alternative scales did not support additional restoration at this time.

3. Controversy over an insufficient number of hydrologic/salinity control measures recommended in the TSP/RP, as well as controversy over recommending additional study of hydrologic/salinity control measures for future study instead of providing such measures for immediate construction.

Resolution: The NER Recommended Plan recommends future individual studies of the of key hydrologic/salinity measures as well as any alternative measures. As has been determined by the present and previous ecosystem restoration studies, hydrologic/salinity control measures are quite complex. The hydrologic connectivity within the study area has been significantly altered by natural processes as well as by Federal, state, parish and local entities for a number of often conflicting and opposing purposes. Consequently, such hydrologic/salinity measures must be given full consideration and analysis to determine how best to reestablish hydrologic connectivity and reduce salinity and hurricane storm surge impacts without further exacerbating existing problems. In addition, many hydrologic/salinity measures would involve authorized navigation waterways which must be maintained as authorized.

2015 Draft Integrated Feasibility Report and Environmental Impact Statement

4. The single-most important area of controversy is based upon over 2,540 oral and written comments and signatures on a petition to "PLEASE TAKE IT OUT!"; and to completely remove any and all reference or language related to 'eminent domain' and 'involuntary participation' from the study. The property owner's choice to remain at their 'own risk' or possibly without future assistance is considered the only appropriate course of action. Furthermore, the statement has been made that the goal of the plan is to restore and protect the coast and marshes, assist in preserving the unique culture, not remove people from their homes and family lands.

Resolution: The involuntary aspect of the NED TSP to remove structures that are located in the regulatory floodway, designated as 'Severe Repetitive Loss Structures' as defined by FEMA, or that present a life safety risk, has been removed from the RP. The NED RP is now 100% voluntary and there is no longer a need for the use of eminent domain to acquire structures that met these criteria in the 2015 Revised Draft Report.

5. Over 2,540 signatures on a petition and several oral and written comments requested that chenier reforestation measures be replaced by shoreline protection measures. As stated in the petition: "Shoreline protection would be a better investment for our coast's future."

Resolution: Both shoreline protection and reforestation of chenier ridges are warranted in the study area. The PDT prioritized ecosystem restoration measures and determined that, before the chenier ridges are lost, reforestation is necessary. However, the PDT also recognizes the importance and necessity of providing additional shoreline protection measures. Under the current evaluation and comparison of benefits reforestation features provide more incremental benefit than would be provided by additional shoreline protection measures for areas inland from the immediate shoreline.

6. Over 2,540 signatures on a petition and several oral and written comments request that a 'Local sponsor' be chosen to have an immediate 'voice' in the remaining planning process of the study. The petition states that local sponsors can assist in making valid and important corrections and local concerns could be immediately addressed. The PDT interprets this to mean including a local area (parish, town, other smaller area) representative on the PDT.

Resolution: Outreach efforts to interested stakeholders were increased after release of the draft report. These efforts included multiple conference calls, study update presentations to various local government officials, and progress updates to the CPRA Board.

7. Over 2,540 signatures on a petition and several oral and written comments stated that "our parish deserves 'protection'." Include Parish Priority Project and insert a list of all of the measures and projects proposed in the parishes' existing and proposed Coastal Restoration & Protection Plans. The stated purpose of this is that the inclusion of all such measures and projects will eliminate the unintentional exclusion of projects that were not tentatively selected and will clearly indicate the worthiness for future consideration for funding.

Resolution: Parish Priority Projects have been included as a separate and new appendix (Appendix P) to the Final Report and will include the following recommended statement: "Though not an endorsement of any project under this study effort, Parish Priority Projects that would be provided by the Parishes to the State for consideration as deemed necessary by the Coastal Master Plan for Louisiana and are included in this Appendix only as a reference for future planning under other study authorities."

8. Controversy over the lack of salinity and flood control measures to prevent the Calcasieu River from flooding areas upstream during storm surge events.

Resolution: This controversy is similar to controversy #3, above. The NER Recommended Plan recommends the CSC Salinity Control Structure as an additional long range study. Due to the complexity of the problem, additional study and significant modeling of the Calcasieu River navigation, salinity, and storm surge problems must be considered independent of the present proposed action.

2016 Final Integrated Feasibility Report and Environmental Impact Statement
9. A primary issue for resolution in the Final Report was the development of a prioritization for implementation of the NED RP. This Final Report recommends a strategy to implement the nonstructural Project for eligible structures. Structures that have been identified as preliminarily eligible as part of the NED RP are located across the 4,700 mile, three-parish study area.

Resolution: In order to effectively implement the NED RP, clusters of eligible structures that represent the highest risk for storm surge damages (i.e. those with a FFE below the 10-year stage) would be identified and prioritized for construction. Individual structures would be addressed based on a ranking of risk from highest to lowest within the cluster. The ranking of individual structures would be revisited as elevation work is completed, as additional funding is distributed, and as new clusters are identified. Addressing groups of structures within a small geographic area would be more cost-effective, efficient, and would also allow for a more strategic methodology for applying nonstructural measures to at-risk structures. However, it should be noted that the appropriate implementation strategy for the NED RP is highly dependent of the number and location of eligible structures whose owners desire to participate in the NED RP and upon the amount of

funding that the NED Project receives over time. For these reasons, additional work on this process is anticipated to be necessary during the design and implementation phase of the NED Project.

10. A second issue for resolution in the Final Report related to the costs of structure raising/flood proofing and the potential for significant inflation of these costs. For example, following Hurricane Katrina (2005) the reconstruction of the New Orleans HSDDR system was significantly affected by the increased costs of borrow material. As levee restoration and construction continued, the price of borrow escalated over pre-storm prices.

Resolution: The PDT developed a detailed risk analysis (see Appendix B) to determine if and how much contingency costs may be required to address the supply and demand costs for elevating structures.

4.6 USACE Campaign Plan

The USACE mission is to deliver vital engineering solutions, in collaboration with our partners, to secure our Nation, energize our economy, and reduce risk from disaster. The USACE has set several goals to help achieve this mission. Completing this Feasibility Study and Environmental Impact Statement works towards Goal 2 – Transform Civil Works (Deliver enduring and essential water resource solutions using effective transformation strategies), Goal 3 – Reduce Disaster Risks (Deliver support that responds to, recovers from, and mitigates disaster impacts to the Nation while ensuring sustainable operations), and Goal 4 – Prepare for Tomorrow (Build resilient People, Teams, Systems, and Processes to sustain a diverse culture of collaboration, innovation, and participation to shape and deliver strategic solutions).

4.7 USACE Environmental Operating Principles

The United States Army Corps of Engineers Environmental Operating Principles were developed to ensure that Corps of Engineers missions include totally integrated sustainable environmental practices. The Principles provided corporate direction to ensure the workforce recognized the Corps of Engineers role in, and responsibility for, sustainable use, stewardship, and restoration of natural resources across the Nation and, through the international reach of its support missions. The Environmental Operating Principles relate to the human environment and apply to all aspects of business and operations. Re-committing to these principles and environmental stewardship will lead to more efficient and effective solutions, and will enable the Corps of Engineers to further leverage resources through collaboration. This is essential for successful integrated resources management, restoration of the environment and sustainable and energy efficient approaches to all Corps of Engineers mission areas. It is also an essential component of the Corps of Engineers' risk management approach in decision making, allowing the organization to offset uncertainty by building flexibility into the management and construction of infrastructure.

The re-energized Environmental Operating Principles are:

- Foster sustainability as a way of life throughout the organization.
- Proactively consider environmental consequences of all Corps activities and act accordingly.
- Create mutually supporting economic and environmentally sustainable solutions.
- Continue to meet our corporate responsibility and accountability under the law for activities undertaken by the Corps, which may impact human and natural environments.
- Consider the environment in employing a risk management and systems approach throughout the life cycles of projects and programs.
- Leverage scientific, economic, and social knowledge to understand the environmental context and effects of Corps actions in a collaborative manner.
- Employ an open, transparent process that respects views of individuals and groups interested in Corps activities.

The NED and NER RPs have been developed using the Environmental Operating Principles to guide and improve the development, formulation, and evaluation of alternatives under this study effort. Consideration of the environment has been essential in ensuring the hurricane storm surge damage risk reduction and ecosystem

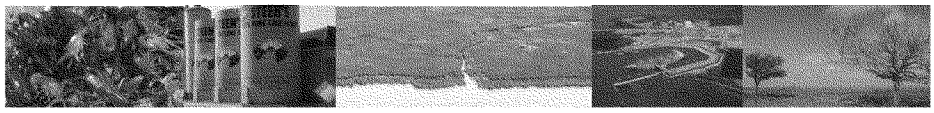
restoration missions are developed appropriately, are responsive to area problems and needs, and are supportable by the public and stakeholders.

5.0 ENVIRONMENTAL LAWS AND COMPLIANCE (*NEPA REQUIRED)

Civil works studies and projects should be in compliance with all applicable Federal environmental statutes and regulations and with applicable State laws and regulations where the Federal government has clearly waived sovereign immunity. The CEMVN will continue to coordinate with Federal and state resource agencies on the EIS. Status of compliance with the various laws and EOs is presented in Table 5-1 below. See Appendix A, Annex J for a summary of applicable laws and regulations and for a more detailed discussion of agency coordination and project compliance.

Table 5-1: Status of environmental compliance.

Law, Regulation, or Policy	Status	Comments	Full Compliance Expected
Anadromous Fish Conservation Act of 1965	Coordination concluded	Anadromous fish species would not be affected by the proposed action. Coordination with NMFS is concluded.	Full compliance achieved upon publication and review of the Integrated Final Report & EIS
Bald and Golden Eagle Protection Action of 1940	Coordination concluded	The RP would have no effect on bald or golden eagles, or their critical habitat.	Full compliance achieved upon publication and review of the Integrated Final Report & EIS
Clean Air Act of 1970	Coordination concluded	In accordance with Section 309, NEPA and CEQ regulations EPA rated the Revised Draft EIS as "EC-1" i.e., EPA has environmental concerns and requests additional information in the Final EIS. Sec. 176: Project area currently in attainment of NAAQS. No general conformity determination required	Full compliance achieved following EPA review of Integrated Final Report & EIS.
Clean Water Act of 1977	Coordination concluded	Section 401: water quality certification from LDEQ requested for NER Plan; not required for NED Plan. Section 404: A 404(b)(1) Evaluation not required for NED Plan. 404(b)(1) evaluation prepared.	Full compliance achieved. NED RP would not affect waters of the U.S. NER RP Section 401 Water Quality Certification signed July 6, 2015; Section 404(b)(1) signed February 18, 2016
Coastal Zone Management Act of 1972	Coordination ongoing	Consistency Determination for NER RP submitted to LDNR for consistency review with the Louisiana Coastal Resource Program on January 5, 2016.	February 12, 2016 letter provides full consistency for NED RP and phased consistency for NER RP. Continued coordination with LDNR, OCM requesting additional clarifying letter, per HQ request, regarding specific outstanding issues necessary to be completed before full consistency is granted for NER RP.
Coastal Barrier Resources Act of 1982 and Coastal Barrier Improvement Act of 1990	Coordination concluded	By letter dated April 4, 2016 CEMVN requested USFWS to make a determination that the proposed NER RP breakwaters measures fall within an exemption to the limitation, under 16 USC 3505(a), prohibiting Federal expenditures on projects within a unit of the Coastal Barrier Resources Act (CBRA).	Full compliance achieved upon receipt of letter dated April 7, 2016 from the USFWS indicated their determination that the proposed breakwaters fall within the exception under 16 USC 3505(a) and publication and public review of the Integrated Final Report & EIS.
Endangered Species Act of 1973	Coordination concluded	A Biological Assessment (BA) for NER Plan submitted to USFWS on March 11, 2015; USFWS concurred on March 20, 2015. BA submitted to USFWS for NED RP on July 17, 2015; USFWS concurred on August 25, 2015. A BA for the NER RP was submitted to NMFS on March 12, 2015.	Consultation with USFWS concluded with their letters of concurrence dated March 20, 2015 (NER RP) and August 25, 2015 (NED RP). Consultation with NMFS concluded with their letter of concurrence dated January 26, 2016.
Estuary Protection Act of 1968	Coordination concluded	NED RP would not impact estuaries. NER RP would positively benefit estuaries via marsh restoration and shoreline protection; there would be no significant adverse impacts to estuaries.	Full compliance achieved upon publication and public review of the Integrated Final Report & EIS.



Law, Regulation, or Policy	Status	Comments	Full Compliance Expected
Farmland Protection Policy Act of 1981	Coordination concluded	NRCS concurred with our determination by letter dated December 13, 2013 that the RPs will not "irreversibly" impact prime farmland and is therefore exempt from the rules and regulations of Section 1539-1549 of Farmland Protection Policy Act.	Full compliance achieved upon publication and public review of the Integrated Final Report & EIS.
Federal Water Project Recreation Act of 1965	Coordination concluded	Recreational opportunities have been analyzed and documented in Final EIS.	Full compliance achieved upon publication and public review of the Integrated Final Report & EIS.
Fish and Wildlife Coordination Act of 1958	Coordination ongoing	USFWS provided a draft Fish and Wildlife Coordination Act Report (CAR) dated Nov 5, 2013; a supplemental letter dated Dec 3, 2013; and revised draft CAR February 2015.	Full compliance achieved with receipt of Final FWCAR on February 3, 2016 and publication and review of Final Integrated Report & EIS.
Magnuson-Stevens Fishery Conservation and Management Act of 1976	Coordination ongoing	NMFS April 29, 2015 comment letter regarding use of BMPs during construction and updated list of EFH to be included in Appendix A and documented in the Final Report & EIS.	Full compliance achieved by receipt of NMFS January 28, 2016 letter of concurrence that proposed action is not likely to affect listed species under NMFS purview. USACE January 28, 2016 letter of response to NMFS comments on EFH.
Marine Mammal Protection Act of 1972	Coordination concluded	With implementation of the RP & BMP the West Indian Manatee and dolphin is not likely to be adversely affected.	Full compliance achieved by January 26, 2016 consultation letter of concurrence from NMFS; and, USFWS consultation letters of concurrence dated March 20, 2015 (NER RP) and August 25, 2015 (NED RP).
Marine Protection, Research, and Sanctuaries Act of 1972	Coordination concluded	No adverse impacts of the RP are anticipated to the resources under this Act.	Full compliance achieved upon publication and public review of the Integrated Final Report & EIS.
Migratory Bird Treaty Act of 1918 and Migratory Bird Conservation Act of 1929	Coordination concluded	Based on review of existing data and preliminary field surveys, the CEMVN finds that implementation of the RPs would have no adverse effect on colonial nesting water birds or other migratory species.	Full compliance achieved upon publication and public review of the Integrated Final Report & EIS.
National Environmental Policy Act of 1969	Coordination ongoing	Revised Draft EIS was released for 45-day public review and comment on March 24, 2015.	Full compliance achieved upon release of the Integrated Final Report & EIS for 30 day review and signing of the ROD.
National Historic Preservation Act of 1966, as amended	Consultation ongoing per executed Programmatic Agreements	Consultation with SHPO, ACHP, and federally-recognized Tribes is ongoing. Two Section 106 programmatic agreement documents have been executed for the Final EIS.	Full compliance Section 106 consultation achieved with signing and execution among parties (USACE, SHPO, ACHP) for Programmatic Agreements for both NED and NER RPs on February 26, 2016.
Submerged Lands Act of 1953	Coordination concluded	Impacts coordinated with LDNR (Coastal Zone Management) and LDEQ and EPA (Clean Water Act) for activities in state waters and federal waters; also coordinated through NEPA with release of Draft EIS.	Full compliance achieved upon publication and public review of the Integrated Final Report & EIS.
Rivers and Harbors Act of 1899	Coordination concluded	Coordinate dredging activities in navigable waters including Calcasieu River & Pass, Freshwater Bayou, Mermentau River and Vermilion River and Bay; coordination through Clean Water Act Sections 401 and 404, and release of Integrated Final Report and EIS.	Full compliance achieved upon publication and public review of the Integrated Final Report & EIS.
Resource Conservation and Recovery Act of 1976; Comprehensive Environmental Response, Compensation, and	Coordination concluded	For NER RP an HTRW Phase I ASTM-compliant site assessment completed July 2015. NED RP, a Phase I Environmental Site Assessment will be conducted for each structure to confirm the absence of HTRW	Full compliance achieved for NER RP with July 2015 HTRW Phase I ASTM compliant assessment completed. The NED RP HTRW Phase I would

Law, Regulation, or Policy	Status	Comments	Full Compliance Expected
Liability Act of 1980, Toxic Substances Control Act of 1976		prior to implementation of nonstructural measures.	be completed on a structure-by-structure basis to confirm absence of HTRW prior to implementation of nonstructural measures. If any HTRW would need to be resolved by structure owner or could not participate in project.
Wild and Scenic River Act of 1968	Coordination concluded	The northern reach of the Calcasieu River that is designated as a Wild and Scenic river is in northeastern Calcasieu Parish and will not be affected by the proposed actions.	Full compliance achieved upon publication and public review of the Integrated Final Report & EIS.
EO 11514 Protection and Enhancement of Environmental Quality,1970	Coordination concluded	The impacts to the quality of the environment due to implementation of the NED RP and NER RP were reported to the public in the NEPA documentation of the Draft EIS.	Full compliance achieved upon publication and public review of the Integrated Final Report & EIS.
EO 11988 Floodplain Management, 1977	Coordination concluded	Coordination accomplished through identification of flood hazards and actions taken to avoid long and short term impacts associated with occupancy and modification of the floodplain and to avoid floodplain development as disclosed in the Draft EIS and copy of report to Floodplain Manager for parishes in study area.	Full compliance achieved upon publication and public review of the Integrated Final Report & EIS.
EO 11990 Protection of Wetlands, 1977	Coordination concluded	Measures to avoid, minimize, and reduce impacts to wetlands will be maximized to the extent possible. The NER Plan provides wetland restoration. No compensatory mitigation for unavoidable impacts is anticipated for either the NED RP or NER RP.	Full compliance achieved upon publication and public review of the Integrated Final Report & EIS.
EO 12898 Environmental Justice for Low Income and Minority Populations, 1994	Coordination concluded	No disproportionate adverse impacts to EJ communities (see Appendix A, Annex O) were identified.	Full compliance achieved upon publication and public review of the Integrated Final Report & EIS.
EO 13112 Invasive Species, 1999	Coordination concluded	The project is not expected to lead to propagation of invasive species.	Full compliance achieved upon publication and public review of the Integrated Final Report & EIS.
EO 13175 Consultation and Coordination with Tribal Governments, 2000	Coordination ongoing	Consultation with federally-recognized Tribes is ongoing. Consultation would continue through all phases of implementation of the RPs.	Full compliance achieved upon execution of the PAs and implementation of the terms of the Section 106 agreements.
EO 13186 Responsibilities of Federal Agencies to Protect Migratory Birds, 2001	Coordination concluded	No compensatory mitigation for unavoidable project-induced impacts to bird and wildlife habitat is anticipated.	Full compliance achieved upon publication and public review of the Integrated Final Report & EIS.

5.1 Fish and Wildlife Coordination

The Fish and Wildlife Coordination Act (FWCA) (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) provides authority for the USFWS involvement in evaluating impacts to fish and wildlife from proposed water resource development projects. It requires Federal agencies that construct, license, or permit water resource development projects to first consult with the USFWS, the NMFS, and state resource agencies regarding the impacts on fish and wildlife resources and measures to mitigate impacts. In accordance with Section 2(b) of the FWCA, the USFWS provided a Draft Coordination Act Report (Draft CAR) dated November 5, 2013. Due to later modifications to the proposed plan, USFWS provided a revised Draft CAR dated December 3, 2013. In connection with the recommended NED and NER TSPs detailed in this report, USFWS most recently provided a Revised Draft CAR dated February 2015. These documents can be found in Appendix A, Annex G. The USFWS' position and recommendations on the final NED and NER Recommended Plan (RP) are provided in its February 3, 2016 Final CAR. Those recommendations, along with CEMVN's responses, are set forth below:

Service Position and Recommendations on Integrated Final Report and EIS and USACE Responses

1. To the greatest degree practical, borrow pits for construction of marsh creation measures should be located to avoid and minimize direct and indirect impacts to vegetated wetlands. Borrow pit construction should also avoid the following:
    a. avoid inducing wave refraction/diffraction erosion of existing shorelines
    b. avoid inducing slope failure of existing shorelines
    c. avoid submerged aquatic vegetation
    d. avoid increased saltwater intrusion
    e. avoid excessive disturbance to area water bottoms
    f. avoid inducing hypoxia

RESPONSE: CEMVN will work closely with the USFWS and other interested natural resource agencies during the PED and construction phases to further refine a design that minimizes adverse impacts.

2. Marsh creation measures should avoid, to the degree practical, areas of dense submerged aquatic vegetation.

RESPONSE: CEMVN will work closely with the USFWS and other interested natural resource agencies during the PED and construction phases to further refine a design that minimizes adverse impacts.

3. The Corps should monitor ecosystem restoration features to document the degree of success achieved. We recommend the Service and other interested natural resource agencies be included in developing those monitoring criteria and in the review of subsequent monitoring information and reports.

RESPONSE: The voluntary NED RP is not anticipated to require any monitoring. Regarding the NER RP, as documented in the Adaptive Management and Monitoring Plan (Appendix A, Annex L) monitoring performance measures are described for pre-construction/baseline data, during construction, and post-construction monitoring that will be utilized to determine restoration success. Monitoring of each element will continue until the trajectory of ecological change and/or other measures of project success are determined to have been attained, as defined by project-specific objectives. However, in accordance with the provisions of Section 2039 of the Water Resources Development Act of 2007, Federal participation in the cost of such monitoring is limited either to a period of 10 years from the date of the completion of initial construction of each element, or to the date upon which minimum restoration success is determined to be achieved, whichever date first occurs. All cost of monitoring that extends beyond 10 years from the date of initial construction of each element is 100 percent the cost of the non-Federal sponsor. CEMVN will work closely with the USFWS and other interested natural resource agencies in refining monitoring criteria and in review of monitoring information.

4. The Corps should obtain a right-of-way from the Service prior to conducting any work on Sabine or Cameron Prairie National Wildlife Refuges, in conformance with Section 29.21-1, Title 50, Right-of-Way Regulations. Issuance of a right-of-way will be contingent on a determination that the proposed work will be compatible with the purposes for which the Refuge was established.

RESPONSE: Two marsh restoration measures, Features 124d and 3c1 are partially located on USFWS property (Sabine National Wildlife Refuge and Cameron Prairie National Wildlife Refuge, respectively) and are included in the NER RP. These features are vitally important to help preserve the Calcasieu Lake rim and prevent vast new expanses of open water from forming should the lake rim be breached by erosional forces. All NED and NER RP features (including those recommended for appropriation and construction by USFWS) represent the "Federal Plan". Because USFWS is ultimately responsible for managing its refuge lands, USACE is not seeking authorization and funding for Features 124d and 3c1 (the USFWS features). The NED RP and the subset of NER features that are recommended for authorization and appropriation by USACE (all features minus 124d and 3c1) represent the "Corps Plan". Rather, USACE supports USFWS in seeking its own authorization and appropriation to construct the USFWS features and offers USFWS the information that USACE developed under this study effort as a starting point for USFWS efforts to obtain independent authorization and funding for the USFWS features of the Federal Plan. These two USFWS features are not included in the LERRDs necessary for the construction and OMRR&R of the Corps Plan.

5. All planning, design, or other construction-related activities (e.g., surveys, geotechnical borings, etc.) conducted on National Wildlife Refuges (NWRs) will require the Corps to obtain a Special Use Permit

from the Refuge Manager of the Southwest Louisiana Refuge Complex. We recommend that the Corps request issuance of a Special Use Permit well in advance of conducting any work on the refuge. Please contact the Refuge Manager (337/598-2216 or SWLRComplex@fws.gov) for further information on compatibility of proposed ecosystem restoration measures, and for assistance in obtaining a Special Use Permit. Close coordination by both the Corps and its contractor must be maintained with the Refuge Manager to ensure that construction and maintenance activities are carried out in accordance with provisions of any Special Use Permit issued by the NWR.

RESPONSE: Two marsh restoration measures, Features 124d and 3c1 are partially located on USFWS property (Sabine National Wildlife Refuge and Cameron Prairie National Wildlife Refuge, respectively) and are included in the NER RP. These features are vitally important to help preserve the Calcasieu Lake rim and prevent vast new expanses of open water from forming should the lake rim be breached by erosional forces. All NED and NER RP features (including those recommended for appropriation and construction by USFWS) represent the "Federal Plan". Because USFWS is ultimately responsible for managing its refuge lands, USACE is not seeking authorization and funding for Features 124d and 3c1 (the USFWS features). The NED RP and the subset of NER features that are recommended for authorization and appropriation by USACE (all features minus 124d and 3c1) represent the "Corps Plan". Rather, USACE supports USFWS in seeking its own authorization and appropriation to construct the USFWS features and offers USFWS the information that USACE developed under this study effort as a starting point for USFWS efforts to obtain independent authorization and funding for the USFWS features of the Federal Plan. These two USFWS features are not included in the LERRDs necessary for the construction and OMRR&R of the Corps Plan.

6. The Corps should contact the Louisiana Department of Wildlife and Fisheries prior to conducting any work on Rockefeller Refuge (337-491-2593).

RESPONSE: The CEMVN will contact the Louisiana Department of Wildlife and Fisheries (LDWF) at 337-491-2593, well in advance of conducting any work on the Rockefeller Refuge; however the non-Federal sponsor bears all responsibility for obtaining right of entry from DWF and the performance of any relocations necessary for the construction and OMRR&R of this feature of the project.

7. We recommend the Corps continue to coordinate with the Service throughout planning and construction to ensure that the proposed project does not impact waterbird nesting colonies, threatened or endangered species, or species that may be listed in the future.

RESPONSE: The CEMVN will continue to coordinate with the USFWS throughout planning and construction to ensure that the proposed project features do not impact waterbird nesting colonies, or threatened or endangered species that may be listed in the future. CEMVN notes that the eligibility of any structure to participate in the non-structural measures of the NED RP is dependent, in part, upon the absence of any threatened or endangered species that would be impacted by the applicable flood proofing measure.

8. We recommend the Corps coordinate with the Service, LDWF, and other interested natural resource agencies when developing detailed plans regarding restoration measures, especially during the Preliminary Engineering and Design Phase (PED) and construction phase, for measures where specific recommendations have been provided below.

RESPONSE: CEMVN will work closely with the USFWS, the LDWF, and other interested natural resource agencies during the PED and construction phases to achieve a design that minimizes adverse impacts.

9. To the greatest degree possible, sediment pumping should be conducted during non-growing season periods to reduce possible salinity impacts on adjoining vegetation.

RESPONSE: CEMVN will work closely with the USFWS and other interested natural resource agencies during the PED and construction phases to achieve a design that minimizes adverse impacts (response applies to recommendations 11 through 14).

10. Because Calcasieu Lake is a public Oyster Seed Ground administered by the LDWF, the Corps should contact LDWF prior to conducting construction activities within Calcasieu Lake.

RESPONSE: The CEMVN will contact the LDWF prior to conducting construction activities within Calcasieu Lake, especially with regard to the Oyster Seed Ground area.

Service recommendations regarding specific ecosystem restoration measures are provided below:

11. Marsh creation measures south of Grand Chenier (47a1, 47a2, and 47c1)
    a. Combined, these measures would convert over 2,000 acres of existing shallow open water to solid marsh. We recommend that some of those open water areas not be filled to maintain aquatic habitat (i.e., ponds) used by fisheries, waterfowl, and other wildlife.
    b. To avoid saltwater entrapment impacts, the engineers are encouraged to design channels to provide drainage/water exchange, and avoid ponding of Gulf water effluent within or adjacent to the fill areas. Similarly, we recommend any ponds or enclosed non-fill areas have drainage channels (existing or man-made) to carry away Gulf water effluent and avoid concentration of salts.
    c. To pump into eastern and western extremes of the designated fill area, the pipeline route should depart from that designated route only within the proposed fill area, and should be routed through unvegetated open water areas, to avoid impacting existing marshes.

Response: a. The CEMVN does not concur with the USFWS's recommendation that some of the open water areas not be filled. The CEMVN's experience with beneficial use of dredged material and other marsh restoration projects throughout coastal Louisiana has clearly demonstrated that the extensive coastal marsh and land loss driving factors, the different borrow sediment grain sizes and differential settling will rapidly erode and solid marsh platform resulting and naturally develop interior ponds and hydrologic connections with surrounding waters.

b. The CEMVN concurs with avoiding saltwater entrapment impacts, providing drainage and water exchange, and draining ponds and non-fill areas. However, the CEMVN reserves the right to determine and utilize best practical methods and BMP's will be utilized to avoid potential saltwater entrapment impacts, to avoid ponding of Gulf water effluent within or adjacent to the fill areas. The CEMVN does not anticipate having any enclosed non-fill areas.

c. The CEMVN will utilize BMPs to follow designated dredge pipeline route and, if it becomes necessary to deviate from designated route, to route pipeline through unvegetated open water areas and avoid impacting existing, non-targeted marshes.

12. Marsh creation along Freshwater Bayou Canal (measures 127c3 and 306a1)
    a. To avoid saltwater effluent impacts, we recommend the effluent be drained toward Freshwater Bayou Canal and not into the interior marshes. After construction, once saltwater drainage from the fill areas has been completed, those drainage routes should be plugged and drainage of the fill areas should be redirected into interior marshes.
    b. If a containment dike is constructed adjacent to the Freshwater Bayou Canal, the Service recommends that it not be degraded after construction so that it can help to maintain the desired hydrologic isolation of the interior marshes from the canal.

RESPONSE: a. The CEMVN concurs with avoiding saltwater effluent impacts. However, the CEMVN cannot, at this time concur with routing dredge borrow effluent, which may be slightly higher in salinity than the marsh restoration site, into Freshwater Bayou. The CEMVN believes the need to nourish adjacent highly degraded marshes would generally take precedence. However the CEMVN will work closely with the USFWS and other interested natural resource parties during PED and during construction phases to achieve a design that maximizes marsh restoration and nourishment, minimizes adverse impacts related to higher salinities waters in less saline marsh areas, and maintains hydrologic connectivity where appropriate and determined applicable to the specific locations.

b. The CEMVN will consider and work closely with the USFWS and other natural resource agencies during PED and construction phases if a containment dike is required adjacent to Freshwater Bayou Canal and to determine if allowing the containment dike to remain would provide greater benefits than degrading it.

13. Marsh creation near Mud Lake (measure 124c)
    a. This measure would convert over 1,900 acres of existing shallow open water to solid marsh. We recommend that some of those open water areas not be filled to maintain aquatic habitat (i.e., ponds) used by fisheries and waterfowl.
    b. To avoid saltwater entrapment impacts, the engineers are encouraged to design channels to provide drainage/water exchange, and avoid ponding of Gulf water effluent within or adjacent to the fill

areas. Similarly, we recommend any ponds or enclosed non-fill areas have drainage channels (existing or man-made) to carry away Gulf water effluent and avoid concentration of salts.

c. The proposed containment dikes along the western and southeastern fill area boundaries may block existing drainage routes for marshes adjacent to the fill area. To avoid potential saltwater entrapment impacts and impaired drainage impacts, we recommend weir boxes along those sections of dike be eliminated unless the presence of unimpeded drainage routes can be documented.

RESPONSE: a. The CEMVN does not concur with leaving some open water areas. Please see response to #12 above.

b. The CEMVN concurs with designing and using BMPs to provide avoid saltwater entrapment impacts, to avoid ponding Gulf water effluent within or adjacent to the fill areas, and to have drainage channels to carry away Gulf water effluent to avoid concentration of salts. The CEMVN reserves the right to determine best practical methods, refined designs during PED and implementation during construction.

c. The CEMVN will utilize the best practical methods, determine refined designs during PED, best BMPs during construction implementation to avoid potential saltwater entrapment impacts and impaired drainage impacts regarding containment dikes along western and southeastern fill area boundaries. For a, b and c, the CEMVN will work closely with the USFWS and other interested natural resource parties during PED and construction phases to achieve a design that maximizes marsh restoration and nourishment, minimizes adverse impacts such as saltwater entrapment, avoid ponding of Gulf water effluent and maintain hydrologic connectivity where appropriate and determined applicable to the specific locations.

14. Marsh creation near West Cove (measure 124d)

a. To prevent ponding impacts and saltwater entrapment impacts to marshes south of the fill area, we recommend the containment dike designs avoid closing both canals that provide drainage for the fill area and adjacent marshes.

b. If funding is provided to the Service to construct this or other measures located on National Wildlife Refuges, that funding should include funding necessary to cover the necessary administration, engineering, and design work.

RESPONSE: a. CEMVN is not seeking authorization and funding for measure 124d. That measure will not be authorized or implemented as a part of the Corps Plan for the NER RP. Rather, the NER RP will recommend that information regarding measure 124d be submitted to USFWS for its decision to independently seek Congressional authorization and appropriation for implementation by USFWS.

b. Two marsh restoration measures, Features 124d and 3c1 are partially located on USFWS property (Sabine National Wildlife Refuge and Cameron Prairie National Wildlife Refuge, respectively) and are included in the NER RP. These features are vitally important to help preserve the Calcasieu Lake rim and prevent vast new expanses of open water from forming should the lake rim be breached by erosional forces. All NED and NER RP features (including those recommended for appropriation and construction by USFWS) represent the "Federal Plan". Because USFWS is ultimately responsible for managing its refuge lands, USACE is not seeking authorization and funding for Features 124d and 3c1 (the USFWS features). The NED RP and the subset of NER features that are recommended for authorization and appropriation by USACE (all features minus 124d and 3c1) represent the "Corps Plan". Rather, USACE supports USFWS in seeking its own authorization and appropriation to construct the USFWS features and offers USFWS the information that USACE developed under this study effort as a starting point for USFWS efforts to obtain independent authorization and funding for the USFWS features of the Federal Plan. It is assumed that if USFWS does determine to seek independent Congressional authorization and funding for the USFWS implementation of these measures, that it will request adequate funding necessary to address the cost of USFWS efforts to administer, design and implement such work.

This final report is submitted in fulfillment of the requirements of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), and constitutes the final report of the Secretary of the Interior as required by Section 2(b) of that Act. This report has incorporated comments made by the National Marine Fisheries Service (see Appendix A) on our draft Coordination Act Report dated February 26, 2015. No comments on our February 2015 draft Coordination Act Report were received from the Louisiana Department of Wildlife and Fisheries.

6.0 PUBLIC INVOLVEMENT (*NEPA REQUIRED)

The NEPA provides people, organizations, and governments an opportunity to review and comment on proposed major Federal actions. This occurs throughout the planning process beginning with scoping meetings and continues through comment periods on draft and final reports. Comments are accepted and considered throughout the planning process.

The SWC Draft Integrated Feasibility Report and Programmatic EIS was released in December 2013 ("2013 Initial Draft Report") and the public review was completed in February 2014. As a result of substantial public, technical, and policy comments received, the CEMVN performed additional analyses in 2014 which resulted in significant revisions to the NED and NER TSPs that warranted development and release of a Revised Integrated Draft Feasibility Report and EIS in March 2015 ("2015 Revised Draft Report") and a 45-day public review from March-May 2015. Public hearings were held in April 2015 and the study website was updated to reflect changes made in this Revised Integrated Report and EIS.

Engaging and receiving input from the public, interested parties, stakeholders, government agencies, and non-governmental organizations regarding the content of the Integrated Report and EIS in all of its' stages is critical to achieving the USACE objective of enhancing trust and understanding with customers, stakeholders, teammates, and the public through strategic engagement and communication. Public participation efforts began with the study NEPA scoping process and continues through the conclusion of the formal comment period on the Final Integrated Report and EIS. In addition to traditional mailings, a web site and other social media tools were used in an effort to broadly distribute study report information.

6.1 Notice of Intent and Public Scoping Meetings

The USACE, consistent with 40 CFR §1508.22, published a Notice of Intent (NOI) in the Federal Register (Volume 74, Number 38) on February 27, 2009, to prepare an EIS to evaluate a full suite of structural, nonstructural and coastal restoration measures to achieve hurricane protection and storm damage risk reduction within Calcasieu, Cameron and Vermilion Parishes in Louisiana. The NOI also notified that public scoping meetings would be held throughout the study area to determine the range of alternatives and significant issues to be addressed in the EIS.

Scoping, required by 40 CFR §1501.7 in preparation of an EIS, is an early and open process for determining the scope and significance of issues to be analyzed in depth in the EIS. The CEMVN invited the participation of affected Federal, State, and local agencies, any affected Indian tribe, the proponent of the action, and other interested persons (including those who might not be in accord with the action on environmental grounds). The scoping process was used to identify and eliminate from detailed study issues which are not significant or which have been covered by prior environmental review (§ 1506.3), narrowing the discussion of these issues in the statement to a brief presentation of why they would not have a significant effect on the human environment or providing a reference to their coverage elsewhere. The NOI also indicated the relationship between the timing of the preparation of environmental analyses and the agency's tentative planning and decision-making schedule. A scoping report was prepared following completion of the scoping meetings that included information about the public scoping meetings, scoping meeting notices, and comments made by citizens, other interested parties, and stakeholders who attend the scoping meetings.

Public Notification: The NOI indicated that public scoping meetings would be held March 24, 2009 from 6-9 p.m. in Cameron, Louisiana, March 25, 2009 from 6-9 p.m. in Lake Charles, Louisiana and March 26, 2009 from 6-9 p.m. in Abbeville, LA (see Table 6-1). In addition to the NOI, scoping meeting announcements requesting scoping comments was mailed to Federal, state, and local agencies, and interested groups and individuals on March 13, 2009. A media advisory announcing the scoping meetings was also provided to more than 200 media outlets on March 13, 2009.



Table 6-1: Public scoping meetings.

Date	Parish	Location	Attendees
March 24, 2009 6:00 – 9:00 p.m.	**Cameron Parish** Cameron Parish Courthouse	119 Smith Circle Cameron, LA	51
March 25, 2009 6:00 – 9:00 p.m.	**Calcasieu Parish** Central School Arts & Humanities Center	809 Kirby Street Lake Charles, LA	59
March 26, 2009 6:00 – 9:00 p.m.	**Vermilion Parish** Abbeville High School	1305 Wildcat Dr. Abbeville, LA	170

Scoping Comment Categorization by Theme. A total of 382 specific comments were received during the three scoping meetings. Each comment was categorized by subject and ranked in order of occurrence. A subject raised more than three times was classified as a "theme" and a total of 13 themes were identified.

Table 6-2: Scoping comment themes.

Rank	Theme	# of Comments	% Occurrence
1	Storm risk reduction	57	14.9%
2	Importance of considering entire scope of study and cumulative effects of other projects	53	13.9%
3	Coastal protection	52	13.6%
4	Impact of changes to drainage patterns	38	9.9%
5	Importance of cooperation between Federal agencies, parishes, and stakeholders	34	8.9%
6	Timeframe and funding related to project implementation	27	7.1%
7	Other*	27	7.1%
8	Salinity and saltwater intrusion	23	6.0%
9	Wetlands protection/restoration	22	5.8%
10	Protection of existing developed land	18	4.7%
11	Permitting issues	15	3.9%
12	Concern regarding loss of Highway 82	12	3.1%
13	Impacts to wildlife	4	1.0%
	Total	382	100.0%

* Comments categorized as "other" occurred only once or were not directly related to the proposed action.

6.2 NEPA Cooperating Agencies

Cooperating agencies (as defined under 40 CFR 1501.6) for this study include the following:

- U.S. Department of the Interior–USFWS
- U.S. Department of Commerce–NOAA and NMFS
- U.S. Department of Agriculture–NRCS

6.3 Other Participating Agencies

The LDEQ and the LADNR also participated throughout the study process, but not as formal cooperating agencies.

6.4 Other Public Coordination Meetings

Other additional public meetings were held in the three parish area on:

- 2009 - July 21 thru July 23 - Various stakeholder meetings and presentations.
- 2010 - February 22 thru March 4 - Various stakeholder meetings and presentations.
- 2010 - July 12 thru July 15 - Various stakeholder meetings and presentations.
- 2011 - October 3 thru October 6 - Various stakeholder meetings and presentations.
- 2012 - April 3 thru April 6 - Various stakeholder meetings and presentations.
- 2013 - July 31 thru August 2 - Various stakeholder meetings and presentations.
- 2015 – April 14 thru April 16 – Various stakeholder meetings and presentations.

The primary interest of meeting participants was the potential levee alignments, impacts to communities, and the nonstructural involuntary aspect. Other comments were directed to the construction schedule, potential impacts to wetlands, the value of hurricane evacuation routes, and funding.

6.5 Draft Report Recipients

Federal, state, and local government agencies; elected officials; stakeholders; citizens; businesses; libraries, and universities, and other interested persons who requested copies were provided with the initial draft report. Notices of Availability and Interested Parties letters were mailed to the CEMVN District stakeholder/NEPA mailing lists. A full list of both of the Draft Report recipients is available upon request (weblinks are provided in Appendix M). The following stakeholders received a copy of the 2013 Initial Draft Report and Programmatic EIS and the March 2015 Revised Draft Report and EIS:

Table 6-3: List of 2013 and 2015 draft report recipients.

Louisiana Congressional Delegation	Louisiana State Senators & Representatives	Levee Districts & Floodplain Management Agencies
Senator David Vitter	Senator Dan "Blade" Morrish	Chenier Plain Restoration & Protection Authority
Senator William Cassidy	Senator Jonathan Perry	Iberia Parish Levee District
Congressman Ralph Abraham	Representative Bob Hensgens	
Congressman Charles W. Boustany, Jr.	Representative Simone Champagne	
Congressman Garret Graves		
Congressman John Fleming		
Congressman Cedric Richmond		
Congressman Steve Scalise		
Cameron Parish Government	**Calcasieu Parish Government**	**Vermilion Parish Government**
Darrel Farque, **Police Jury President**	Police Jury	Nathan Granger, Police Jury President
Police Jury	Parish Administrator	Police Jury
Tina Horn, Parish Administrator		Tim Creswell, Assistant Emergency Manager
City of Abbeville	**City of Lake Charles**	**Town of Delcambre Government**
Mayor	Randy Roach, Mayor	Mayor
Council	City Administrator and City Council	Alderman
Federal Agencies		
Advisory Council on Historic Preservation	**Department of Energy:** Office of Environmental Compliance	**Department of Transportation:** Division Administrator, Federal Highway Administration; Southwest Region, Federal Aviation Administration
Department of Agriculture: Carl J. Breville. *Natural Resources Conservation Service* Kevin Norton, State Conservationist; Michael Trusclair, District Conservationist	**Department of Homeland Security:** *Federal Emergency Management Agency:* Gary Zimmerer, Region VI	**Environmental Protection Agency:** Office of Federal Activities, EIS Filing Section: Region VI, Marine and Wetlands Section; Rhonda Smith, Region VI - Office of Planning and Coordination
Department of the Army: Rayford E. Wilbanks	**Department of the Interior:** *Office of Environmental Policy and Compliance. U.S. Fish and Wildlife Service:* Lacombe Office ; Lafayette Field Office, Jeff Weller, Field Supervisor	**Department of Commerce:** *National Oceanic and Atmospheric Administration:* David Bernhart, Protected Species Division; Richard Hartman, Habitat Conservation Division; NEPA Coordinator, Office of Program, Planning & Integration
Federal Emergency Management Agency: Gary Zimmerer, Region VI		
State of Louisiana Agencies and Offices		
Governor: Honorable Bobby Jindal **Lieutenant Governor:** Jay Dardenne	**Department of Agriculture & Forestry:** Office of Forestry, Mike Strain; Matthew Keppinger, Office of Agriculture & Environmental Science	**Department of Public Works**
Governor's Office for Coastal Activities	**Department of Environmental Quality:** Environmental Planning Division ; Office of the Secretary; Scott Guilliams	**Department of Transportation & Development**
Coastal Protection and Restoration Authority: Jerome Zeringue, Norwyn Johnson	**Department of Health & Hospitals:** Office of Public Health, Center for Environmental Health	**Department of Wildlife & Fisheries:** Secretary; Maurice Watson; Tim Morrison; Gary Lester, Natural Heritage Program

Table 6-3: List of 2013 and 2015 draft report recipients.

Lake Charles Harbor and Terminal District: Channing Hayden	**Department of Natural Resources:** Keith Lovell, Interagency Affairs; Charlie Mestayer, Lafayette Field Office; Division of State Lands; Office of Conservation, Surface Mining Division; Consistency Coordinator, Coastal Resources Program	**Division of Administration:** State Land Office; State Planning Office
Secretary of State	**Coastal Protection and Restoration Authority Board:** Chip Kline	**Office of Cultural Development:** Pam Breaux, State Historic Preservation Officer; Division of Outdoor Recreation
Office of the Attorney General	**Governor's Office of Indian Affairs**	**State Board of Commerce & Industry**
Federally Recognized Tribes		
Alabama Coushatta Tribe of Texas	Coushatta Tribe of Louisiana	Seminole Tribe of Florida
Caddo Nation of Oklahoma	Jena Band of Choctaw Indians	Tunica Biloxi Tribe of Louisiana
Chitimacha Tribe of Louisiana	Mississippi Band of Choctaw Indians	
Choctaw Nation of Oklahoma	Seminole Nation of Oklahoma	

6.6 Comments received on the 2013 Initial Draft Report and Programmatic EIS

The 2013 Initial Draft Report and Programmatic EIS was made available for public review and comment from December 13, 2013 until January 27, 2014. The 45-day public review period was extended until February 13, 2014, due to a technical error in receiving email comments. Two NEPA public meetings were conducted during public review of the 2013 Initial Draft Report on:

- January 7, 2014 at the Lake Charles Civic Center - Contraband Room (2nd Floor), 900 Lakeshore Drive, Lake Charles, LA 70601.
- January 9, 2014 at the Vermilion Parish Library - Abbeville Branch Library, 405 E St Victor Street, Abbeville, LA.

In January 2014, an open house for each public meeting was conducted from 6:00pm to 6:30pm with the main meeting commencing at 6:30pm and continuing until approximately 8:30pm. Comments made during the meetings were memorialized either by a court reporter or on hand-written comment cards provided at the meetings. A cumulative total of 121 people attended the 2 public hearings on January 7 and 9, 2014, with a total of 12 individuals offering oral comments. CEMVN received 11 written comments from Federal, state, parish and local governments, and 31 written comments from members of the public, all of which were postmarked within the comment period. Many of the written comments contained multiple comments and some contained attachments. A total of 578 individual comments were received during the public comment period between December 13, 2014 and February 13, 2014. The major themes of the comments included: the USACE SMART Planning procedures; levee and other forms of structural protection and/or risk reduction; consideration of impacts on agriculture, the Henry Hub, and other commercial industrial assets; the benefit/cost calculations for structural risk reduction; nonstructural risk reduction measures that were not wanted; levee "discrimination;" concerns that the project provides more protection for wetlands than for human life/people; ecosystem restoration; increasing salinities in freshwater areas; and impacts on the Calcasieu Ship Channel.

6.7 Views of the public based upon public comments received on the 2015 Revised Draft Report.

The 2015 Revised Draft Report and EIS was made available for public review and comment from March 20, 2015 until May 4, 2015. The 2015 Revised Draft Report includes comments received on the 2013 Initial Draft Report. Three NEPA public meetings were conducted during public review of the 2015 Revised Draft Report and EIS. An open house for each public meeting was conducted from 6:00pm to 6:30pm with the main meeting commencing at 6:30pm and continuing until approximately 8:30pm. Comments made during the meetings were memorialized either by a court reporter or on hand-written comment cards provided at the meetings:

- April 14, 2015 at Abbeville High School, 1305 Wildcat Drive Abbeville, LA 70510
- April 15, 2015 at the Lake Charles Civic Center - Contraband Room (2nd Floor), 900 Lakeshore Drive Lake Charles, LA 70601.
- April 16, 2015 at the Cameron Parish Police Jury Building, 119 Smith Cir, Cameron, LA 70631

A total of 184 people signed in to the public hearings; however, more people were in attendance than had signed in for all three hearing sites. The CEMVN received a total of 2,752 comments, including: 2,540 signatures on petitions; 50 emails; 40 oral comments during the public hearings; 34 governmental (including Federal, state, parish, and local); 10 letters; 7 postcards; and 4 telephone comments received during the comment period. Most comments were comprised of several specific comments; a few of the comments provided attachments.

All comments received on the 2015 Revised Draft Report and EIS, whether or not the comment is thought to merit individual discussion, are included along with comment responses in Appendix J of this final report. The most numerous comments included:

- Request to include a list of all Parish Priority Projects and Coastal Restoration and Protection Plans in the report.
- Request that any and all reference to eminent domain and involuntary participation be removed from the study.
- Request that a 'Local Sponsor' be chosen and have immediate 'voice' in the remaining planning process.
- Request to replace reforestation measures be replaced by shoreline protection measures.

The Council on Environmental Quality regulations for Implementing the NEPA (40 CFR §1503.4(a)), requires an agency preparing an EIS to assess and consider all public comments, both individually and collectively, and respond by one or more of the means listed below, stating its response in the final statement:

- Modify alternatives including the proposed action.
- Develop and evaluate alternatives not previously given serious consideration.
- Supplement, improve, or modify analyses performed.
- Make factual corrections.
- Explain why the comments do not warrant further agency response, citing the sources, authorities or reasons which support the agency's position and, if appropriate, indicate those circumstances which would trigger agency reappraisal or further response.

Written comments and oral testimonies received on both the 2013 and 2015 Draft Integrated Reports and EISs and responses are included in Appendix J. Written comments and oral testimonies were reviewed and were considered in the preparation of this 2016 Final Report and EIS. Several comments warranted revisions to each of the draft and final reports including but not limited to: the removal of the nonstructural involuntary component of the NED RP that called for the acquisition and demolition of structures located within the FEMA Regulatory Floodway, inclusion of the 0-25-year floodplain for the NED Plan, and the development of additional and sufficient detail to make both the NED RP the NER RP features constructible as opposed to programmatic. All registered commenting meeting participants, as well as those providing written comments, will be provided a copy of this Final Report. In addition, the 2013 Initial and 2015 Revised Draft Reports will be posted at: http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx.

7.0 RECOMMENDATIONS

7.1 NED Recommended Plan

The RP (Nonstructural 0-25-Year Floodplain Plan – Modified Plan 8) proposes implementing measures across the 4,700 square mile study area to reduce coastal storm surge damages to 3,462 residential structures, 342 commercial structures and public buildings, and 157 warehouses. This will be achieved by elevating residential structures, dry flood proofing non-residential structures, and constructing localized storm surge risk reduction measures around warehouses. Residential structures will be elevated to the BFE predicted to occur in the year 2075. Non-residential structures will have flood proofing measures applied generally up to 3 ft above ground level. Localized storm surge risk reduction measures will be less than 6 ft in height. Any structure that requires raising more than 13 ft above ground level would be ineligible to participate due to engineering and risk related factors. The NED RP is 100% voluntary. The expected equivalent annual net benefits are approximated at $167.4 million dollars, with $906.1 million in project first costs, and a BCR of 5.65:1. The Federal share of the project first cost of the NED RP features would be $588,959,000 (65 percent). The non-Federal share of the first costs of NED Plan would be $317,132,000 (35 percent).

Among other things, the NFS is required to prepare and implement a Floodplain Management Plan in coordination with the USACE to maintain the integrity, purpose and functionality of the project, to participate in and comply with floodplain management programs, provide annual notifications regarding the extent of risk reduction afforded by the project, and prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) which might reduce the level of risk reduction the project affords, hinder operation and maintenance of the project, or interfere with the project's proper function.

This Final Report recommends a strategy to implement the nonstructural project for eligible structures. Structures that have been identified as preliminarily eligible as part of the NED RP are located across the three-parish study area. Eligible structures are located in the 0-25-year floodplain and are individually economically justified (i.e. the costs to apply a particular nonstructural measure are less than the flood damages predicted to occur to that structure over the 50-year period of analysis). In order to effectively implement the NED RP, clusters of eligible structures that represent the highest risk for hurricane storm surge damages (i.e. those with a FFE below the 10-year stage) would be identified and prioritized for construction. Individual structures would be addressed based on a ranking of risk from highest to lowest within the cluster. The ranking of individual structures would be revisited as elevation work is completed, as additional funding is distributed, and as new clusters are identified. Addressing groups of structures within a small geographic area would be more cost-effective, efficient, and would also allow for a more strategic methodology for applying nonstructural measures to at-risk structures. Additional work on this process would occur during the design phase of the project and would result in owners being contacted to ascertain their interest in applying the appropriate nonstructural measure to their structure. More details on this process can be found in Appendix L.

No mitigation is required for the NED RP.

By and large, hurricane storm damage risk reduction projects positively contribute to public safety. This is particularly true for structural plans where for the most frequent surge events, the incidence of inundation is reduced for communities and other developed areas. However, for less frequent and more severe hurricane surge events in coastal areas that are characteristic of the study area, structural plans could have a negative effect on public safety. This may arise from some among the public who do not abide by mandatory evacuation orders in advance of an approaching storm, but who otherwise would, believing that the structural levee may provide greater protection from storm surge than may be warranted. Thus the total population exposed to storm surge in the event of overtopping or breach could be greater under with-project conditions. However, for nonstructural plans, no change is expected in evacuation behavior since the potential exaggerated expectations of performance afforded to structural measures is not present, and awareness of storm damage risk is not abated. Similarly, residual risk to critical infrastructure (i.e. hospitals, evacuation routes, public buildings) is not

expected to be different from without-project conditions since much of this infrastructure is already built and designed to operate in dire situations, especially those of greater frequency such as hurricanes and their associated flood potential.

7.2 NER Recommended Plan

The NER RP is Plan CM-4 "Small Integrated Restoration", which focuses on stabilizing perimeter geomorphology and consists of 49 ecosystem restoration features recommended for construction (9 marsh restoration features; 35 chenier reforestation features; and 5 shoreline protection features). The NER RP is the least-cost, cost-effective, comprehensive ecosystem restoration plan that addresses land loss and ecosystem degradation. The NER RP contains features to restore 15,448 acres of wetlands; restore and protect 335 acres of designated critical habitat (for threatened piping plover and red knot); enhance plant productivity; and reinforce and protect critical landscape features. The Calcasieu Ship Channel Salinity Control Structure and the Cameron-Creole Watershed Spillway are recommended as additional long-range studies. Each study would be subject to a Federal/non-Federal cost share of 50 percent.

Two marsh restoration measures, Features 124d and 3c1 are partially located on USFWS property (Sabine National Wildlife Refuge and Cameron Prairie National Wildlife Refuge, respectively) and are included in the NER RP. These features are vitally important to help preserve the Calcasieu Lake rim and prevent vast new expanses of open water from forming should the lake rim be breached by erosional forces. All NED and NER RP features (including those recommended for appropriation and construction by USFWS) represent the "Federal Plan". Because USFWS is ultimately responsible for managing its refuge lands, USACE is not seeking authorization and funding for Features 124d and 3c1 (the USFWS features). The NED RP and the subset of NER features that are recommended for authorization and appropriation by USACE (all features minus 124d and 3c1) represent the "Corps Plan". Rather, USACE supports USFWS in seeking its own authorization and appropriation to construct the USFWS features and offers USFWS the information that USACE developed under this study effort as a starting point for USFWS efforts to obtain independent authorization and funding for the USFWS features of the Federal Plan. These two USFWS features are not included in the LERRDs necessary for the construction and OMRR&R of the Corps Plan.

USACE estimates total project costs of $296,839,000 for the two NER RP features that would be submitted to USFWS for its consideration and implementation (after first securing independent Congressional authorization and appropriations). However, it is likely that USFWS, should it choose to seek authorization and funding, will reevaluate the total cost necessary for implementation by USFWS rather than by USACE. In so doing, it is probable that USFWS would determine a different total cost for these features.

The NER RP features comprise an integrated restoration plan that would have synergy with other ecosystem restoration projects and would facilitate hydrologic and geomorphic stability and resilience. The NER RP total project first cost estimate is $2.485 billion. The Federal share of the Federal Plan is $1.719 billion (which represents 65% of all cost-shared features plus the entire cost of the two USFWS features); The Federal share of the Corps Plan, for which authorization is being recommended is $1.422 billion. The Non-Federal share of either NER plan is $766 million. Additionally, the two long range studies recommended under the NER RP are estimated to cost $6,000,000 with a 50/50 cost share.

7.3 Federal and Non-Federal Cost-Sharing

For each of the two long-range studies at Calcasieu Ship Channel Salinity Control Structure and the Cameron-Creole Watershed Spillway, it is anticipated that the CPRAB would be the NFS for each study effort, with a cost share for each study of 50 percent Federal and 50 percent non-Federal.

The State of Louisiana acting through the CPRAB will be the NFS for design, construction, operation, maintenance, repair, rehabilitation and replacement of that portion of the project that constitutes the Corps Plan (hereafter the Project). The cost share for the design and construction of the project will be 65 percent Federal and 35 percent non-Federal. Among other responsibilities, the CPRAB must provide all project

LERRDs required for the project and submit any work-in-kind (WIK) request for approval by the Federal government for the PED phase of the project. WIK associated with the construction of localized storm surge risk reduction system components of the project will be negotiated with the NFS, contingent upon approval at the Assistant Secretary of the Army for Civil Works (ASACW) (or appropriate designee) in accordance with applicable guidance and regulations. The OMRR&R cost of the project is estimated to cost on an average annual basis $5,963,000 and is a 100% NFS responsibility. The estimated total project cost for the Federal Plan (the Federal NED and NER RPs, including projects that will be submitted to USFWS for its consideration to seek independent Congressional authorization and funding) is $3,391,113,000 at FY 2016 price levels. The estimated total project cost for the Corps Plan, for which authority is being recommended, is $3,094,276,000 at FY 2016 price levels.

7.4 Federal Responsibilities for the Corps Plan Project (the Project)

Since implementation by USFWS of features 3c1 and 124d of the NER RP is subject to independent authorization and funding by USFWS, this section and section 7.6 will not attempt to outline the Federal and non-Federal responsibilities for the construction and OMRR&R of those features. References to the "Project" refer only to those features of the Federal NED and NER RPs that will be implemented by USACE (the Corps Plan).

The Federal government (USACE) will be responsible for PED and construction of the project in accordance with the applicable provisions of Public Law 99-662 (WRDA of 1986), as amended. The Government (USACE), subject to Congressional authorization, the availability of funds, and the execution of a binding agreement with the NFS in accordance with Section 221 of the Flood Control Act of 1970, as amended, and using those funds provided by the NFS, shall expeditiously construct the Project, applying those procedures usually applied to Federal projects, pursuant to Federal laws, regulations, and policies.

7.5 Non-Federal Responsibilities for the NED Recommended Plan

Federal implementation of the Project would be subject to the NFS agreeing in a binding written agreement to comply with applicable Federal laws and policies, and to perform the following non-Federal obligations, including, but not limited, to the following:

a. Provide 35 percent of total hurricane storm surge risk reduction project costs as further specified below:

1. Provide the non-Federal share of design costs allocated by the Government to hurricane storm surge damage risk reduction in accordance with the terms of a design agreement entered into prior to commencement of design work for the hurricane storm surge damage risk reduction features of the project;

2. Provide, during the first year of construction, any additional funds necessary to pay the full non-Federal share of design costs allocated by the Government to hurricane storm surge risk reduction features of the project;

3. Provide all lands, easements, and rights-of-way, including those required for relocations, the borrowing of material, and the disposal of dredged or excavated material; perform or ensure the performance of all relocations; and construct all improvements required on lands, easements, and rights-of-way to enable the disposal of dredged or excavated material all as determined by the Government to be required or to be necessary for the construction, operation, maintenance, repair, rehabilitation and replacement of the hurricane storm surge damage risk reduction features of the project;

4. Provide, during construction, any additional funds necessary to make its total contribution equal to 35 percent of total hurricane storm surge risk reduction costs;

b. Do not use funds provided by a Federal agency under any other Federal program, to satisfy, in whole or in part, the non-Federal share of the cost of the project unless the Federal agency that provides the funds determines that the funds are authorized to be used to carry out the project;

c. Comply with all applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended (42 U.S.C. 4601-4655), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way required for construction, operation, and maintenance of the project, including those necessary for relocations, the borrowing of materials, or the disposal of dredged or excavated material; and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act;

d. For so long as the project remains authorized, operate, maintain, repair, rehabilitate, and replace the project, or functional portions of the project, including any mitigation features, at no cost to the Federal Government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government; provided however, that the NFS shall have no obligation to address loss or risk reduction due to relative sea level rise through the repair, rehabilitation or replacement of components associated with the construction of localized storm surge risk reduction measures around non-residential warehouse structures, nor shall the NFS be obligated to OMRR&R those nonstructural flood proofing measures that constitute elevation of individual residential structures or dry flood proofing of non-residential commercial or public structures;

e. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor owns or controls for access to the project for the purpose of completing, inspecting, operating, maintaining, repairing, rehabilitating, or replacing the project;

f. Hold and save the United States free from all damages arising from the construction, operation, maintenance, repair, rehabilitation, and replacement of the project and any betterments, except for damages due to the fault or negligence of the United States or its contractors;

g. Keep and maintain books, records, documents, or other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of 3 years after completion of the accounting for which such books, records, documents, or other evidence are required, to the extent and in such detail as will properly reflect total project costs, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 Code of Federal Regulations (CFR) Section 33.20;

h. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended (42 U.S.C. 1962d-5), and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended (33 U.S.C. 2213), which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element;

i. Comply with all applicable Federal and State laws and regulations, including, but not limited to: Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d) and Department of Defense Directive 5500.11 issued pursuant thereto; Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army" and all applicable Federal labor standards requirements including, but not limited to, 40 U.S.C. 3141- 3148 and 40 U.S.C. 3701 – 3708 (revising, codifying and enacting without substantial change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a et seq.), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 et seq.), and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c et seq.);

j. Perform, or ensure performance of, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Public Law 96-510, as amended (42 U.S.C. 9601-9675), that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for construction, operation, and maintenance of the project. However, for lands that the Federal Government determines to be subject to the navigation servitude, only the Federal Government shall perform such investigations unless the Federal Government provides the non-Federal sponsor with prior specific written direction, in which case the non-Federal sponsor shall perform such investigations in accordance with such written direction;

k. Assume, as between the Federal Government and the non-Federal sponsor, complete financial responsibility for all necessary cleanup and response costs of any hazardous substances regulated under CERCLA that are located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for construction, operation, and maintenance of the project, including those lands, structures and interests necessary for the implementation of all of the non-structural components of the project as described in this report;

l. Agree, as between the Federal Government and the non-Federal sponsor, that the non-Federal sponsor shall be considered the operator of the project for the purpose of CERCLA liability, and to the maximum extent practicable, operate, maintain, repair, rehabilitate, and replace the project in a manner that will not cause liability to arise under CERCLA;

m. Prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) such as any new developments on project lands, easements, and rights-of-way or the addition of facilities which might reduce the level of protection the project affords, hinder operation and maintenance of the project, or interfere with the project's proper function;

n. Not less than once each year, inform affected interests of the extent of protection afforded by the project;

o. Agree to participate in and comply with applicable Federal floodplain management and flood insurance programs;

p. Comply with Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), which requires a non-Federal sponsor to prepare a floodplain management plan within one year after the date of signing a project partnership agreement, and to implement such plan not later than one year after completion of construction of the project;

q. Publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in adopting regulations, or taking other actions, to prevent unwise future development and to ensure compatibility with protection levels provided by the project;

r. Shall not use any project features or lands, easements, and rights-of-way required for such features as a wetlands bank or mitigation credit for any other project;

s. Pay all costs due to any project betterments or any additional work requested by the sponsor, subject to the sponsor's identification and request that the Government accomplish such betterments or additional work, and acknowledge that if the Government in its sole discretion elects to accomplish the requested betterment or additional work, or nay portion thereof, the Government shall so notify the non-Federal sponsor in writing that sets forth any applicable terms and conditions.

7.6 Non-Federal Responsibilities for the NER Recommended Plan

a. Provide 35 percent of total ecosystem restoration costs as further specified below:

1. Provide the non-Federal share of design costs allocated by the Government to ecosystem restoration in accordance with the terms of a design agreement entered into prior to commencement of design work for ecosystem restoration features of the project;

2. Provide, during the first year of construction, any additional funds necessary to pay the full non-Federal share of design costs allocated by the Government to ecosystem restoration;

3. Provide all lands, easements, and rights-of-way, including those required for relocations, the borrowing of material, and the disposal of dredged or excavated material; perform or ensure the performance of all relocations; and construct all improvements required on lands, easements, and rights-of-way to enable the disposal of dredged or excavated material all as determined by the Government to be required or to be necessary for the construction, operation, and maintenance of the ecosystem restoration features of the project;

4. Provide, during construction, any additional funds necessary to make its total contribution equal to 35 percent of total ecosystem restoration costs;

b. Do not use funds provided by a Federal agency under any other Federal program, to satisfy, in whole or in part, the non-Federal share of the cost of the project unless the Federal agency that provides the funds determines that the funds are authorized to be used to carry out the project;

c. Comply with all applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended (42 U.S.C. 4601-4655), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way required for construction, operation, and maintenance of the project, including those necessary for relocations, the borrowing of materials, or the disposal of dredged or excavated material; and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act;

d. For so long as the project remains authorized, operate, maintain, repair, rehabilitate, and replace the project, or functional portions of the project, including any mitigation features, at no cost to the Federal Government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government;

e. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor owns or controls for access to the project for the purpose of completing, inspecting, operating, maintaining, repairing, rehabilitating, or replacing the project;

f. Hold and save the United States free from all damages arising from the construction, operation, maintenance, repair, rehabilitation, and replacement of the project and any betterments, except for damages due to the fault or negligence of the United States or its contractors;

g. Keep and maintain books, records, documents, or other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of 3 years after completion of the accounting for which such books, records, documents, or other evidence are required, to the extent and in such detail as will properly reflect total project costs, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 Code of Federal Regulations (CFR) Section 33.20;

h. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended (42 U.S.C. 1962d-5), and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended (33 U.S.C. 2213), which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element;

i. Comply with all applicable Federal and State laws and regulations, including, but not limited to: Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d) and Department of Defense Directive 5500.11 issued pursuant thereto; Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army" and all applicable Federal labor standards requirements including, but not limited to, 40 U.S.C. 3141- 3148 and 40 U.S.C. 3701 – 3708 (revising, codifying and enacting without substantial change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a et seq.), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 et seq.), and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c et seq.);

j. Perform, or ensure performance of, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Public Law 96-510, as amended (42 U.S.C. 9601-9675), that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for construction, operation, and maintenance of the project. However, for lands that the Federal Government determines to be subject to the navigation servitude, only the Federal Government shall perform such investigations unless the Federal Government provides the non-Federal sponsor with prior specific written direction, in which case the non-Federal sponsor shall perform such investigations in accordance with such written direction;

k. Assume, as between the Federal Government and the non-Federal sponsor, complete financial responsibility for all necessary cleanup and response costs of any hazardous substances regulated under CERCLA that are located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for construction, operation, and maintenance of the project;

l. Agree, as between the Federal Government and the non-Federal sponsor, that the non-Federal sponsor shall be considered the operator of the project for the purpose of CERCLA liability, and to the maximum extent practicable, operate, maintain, repair, rehabilitate, and replace the project in a manner that will not cause liability to arise under CERCLA;

m. Prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) such as any new developments on project lands, easements, and rights-of-way or the addition of facilities which might reduce the outputs produced by the ecosystem restoration features, hinder operation and maintenance of the project, or interfere with the project's proper function; and,

n. Not use project or lands, easements, and rights-of-way required for the project as a wetlands bank or mitigation credit for any other project.

7.7 Recommendation

The recommendations herein reflect the information available at the time and current Department of the Army policies governing the formulation of individual projects. They do not reflect programming and budgeting priorities inherent in the formulation of national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently the recommendations may be modified before they are transmitted to Congress as proposals for implementing funding. However, prior to the transmission to Congress, the state, Federal agencies and other parties will be advised of any modifications and afforded the opportunity to comment.

Richard L. Hansen
Colonel, US Army
District Engineer



US Army Corps
of Engineers ®

New Orleans District

ADDENDUM
September 2016

TO THE

INTEGRATED FINAL FEASIBILITY REPORT AND
ENVIRONMENTAL IMPACT STATEMENT

Southwest Coastal Louisiana

Feasibility Study Dated

April 2016

September 2016

ADDENDUM

Final Study Report

Southwest Coastal Louisiana

1.0 PURPOSE OF ADDENDUM

The purpose of this Addendum is to summarize the updates made to the Southwest Coastal Louisiana Feasibility Study dated April 2016 during the final review and comment period. It is intended to be part of the final report and be an integral part of the project process. Since the submission of the report in April, the Washington Level review resulted in several changes in the report. These items include the addition of information supporting selection of the recommended plan and general editorial comments. Details and supporting documentation pertaining to these changes are available in the files of the Regional Planning and Environmental Division of the New Orleans District Corps of Engineers.

The Southwest Coastal Louisiana Report, as supplemented by this Addendum, is intended to serve as the basis for project authorization and, ultimately the execution of a Project Partnership Agreement (PPA). Information contained in this Addendum makes no change to the recommendations contained in the April 2016 report.

2.0 SUMMARY OF REPORT CHANGES

2.1 Executive Summary

Addenda to page v –insert the following section "Recommended Plan – Integrated Solution of Combined NED and NER Plans" and text immediately prior to the "Risk and Uncertainty" section:

Although the NED Plan and NER Plan are presented herein as separable elements for ease of discussion, the Recommended Plan is an integrated solution to water resources issues of the study area that combines both the NED and NER Plans. The implementation of the NER Plan features would provide green infrastructure which would provide additional resiliency to the NED Plan features.

2.2 Chapter 2

2.2.1 Addenda to Section 2.5.6, page 2-15 – after the 2nd paragraph, "*Structural and nonstructural solutions were evaluated across the three-parish study area. Nonstructural solutions consisted of several measures such as elevations and relocations. Relocations to areas outside of the 100-year floodplain were considered but were not as cost-effective as raising in place. A retreat scenario suggests an entire removal of all structures from*

vulnerable areas. However, not all structures along the coast experience the same vulnerability. A full retreat scenario would implement expensive measures on structures experiencing no/low/mild/moderate damages and would therefore fall far short of any economic justification but will be reconsidered if high sea level persists. This analysis led the PDT to focus on elevation of the most vulnerable structures and alternatives based solely on acquisition and relocation were screened from consideration."

2.2.2 Addenda to Section 2.8.1, page 2-19 – in the 2nd to last sentence in the first paragraph, "*...approximately 950 structures...*" is to be replaced by "*...approximately 991 structures...*"

2.3 Chapter 4

2.3.1 Addenda to Section 4.2.9, Integration of the NED/NER Plans, page 4-29 –2nd paragraph, sentence 3, following "preceding a" add "*five to six foot*"

2.3.2 Addenda to Section 4.2.9, Integration of the NED/NER Plans, page 4-30 –1st paragraph, end of last sentence, add *", which enhances the resiliency of these features as well as their reliability in providing a multi-foot reduction in surge elevation"*

2.4 Chapter 5

2.4.1 Addenda to page 5-1 – the following is to replace text in Table 5-1, row entitled "Endangered Species Act of 1973", and column entitled "Full Compliance Expected":

Full compliance achieved by receipt of USFWS letters of concurrence on March 20, 2015 (NED RP) and August 25, 2015 (NED RP); and January 26, 2016 letter of concurrence from NMFS.

2.4.2 Addenda to page 5-2 – the following is to replace text in Table 5-1, row entitled "National Historic Preservation Act of 1966, as amended", and column entitled "Full Compliance Expected":

Because the NED Plan is entirely voluntary, it is preliminary at this time to make any assessment as to potential effects to historic structures. Each structure that meets the qualification criteria and decides to participate will be assessed for impacts on a case-by-case basis and coordination with the SHPO will continue.

2.4.3 Addenda to page 5-2 – the following is to replace text in Table 5-1, row entitled "Farmland Protection Policy Act of 1981", and column entitled "Full Compliance Expected":

Full compliance with the Farmland Protection Policy Act was achieved with the completion of AD-1006 dated December 13, 2013, as contained in Appendix A, Annex E. This form confirms that the Farmland Protection Act does not apply to this project.

2.4.4 Addenda to page 5-3 – the following is to be inserted as a new row into Table 5-1 following the row entitled "EO 12898 Environmental Justice for Low Income and Minority Populations, 1994":

EO 13045 Protection of Children from Environmental Health and Safety Risks	Coordination concluded	No schools or other areas with disproportionate populations of children or other critical infrastructure are at risk and will need to be relocated as part of the NED plan. Some structures to be relocated may be near areas where areas with disproportionate populations of children where noise impacts during construction may impact children. Structures will be relocated on a voluntary basis and will comply with noise mitigation measures identified in Section 3.7 to ensure the NED plan does not have a significant environmental or safety risk to children in the area. No disproportionate populations of children are located near the NER plan. Construction of the NER plan will comply with noise mitigation measures identified in Section 3.7 to ensure the NED plan does not have a significant environmental or safety risk to children that may be in the area.	Full compliance achieved upon publication and public review of the Integrated Final Report & EIS.

2.4.5 Addenda to page 5-3 – the following to be inserted as a new row into Table 5-1 following the last row entitled "EO 13186 responsibilities of Federal Agencies to Protect Migratory Birds, 2001":

Federal Aviation Administration	Coordination concluded	While there are some airport facilities in the study area, thousands of square miles of wetlands already exist nearby which help support a massive amount of bird habitat, including several National Wildlife Refuges. NER features propose to fill in degraded areas or use measures to protect vulnerable areas from further erosion. This results in discrete areas of restoration within large swaths of existing bird habitat. Large scale NER features address critical erosion needs within the overall quantity of surrounding wetlands which makes the increased likelihood of bird encounters minimal. The closest NER feature to a fixed wing airport, Lake Charles Regional, is approximately 13 miles.	Full compliance achieved upon receipt of the email from Mr. Tim Tandy on 26 September 2016, Environmental Protection Specialist with the Louisiana/New Mexico Airports District Office of FAA. Mr. Tandy stated the FAA does not anticipate adverse impacts to civil aviation.

SOUTHWEST COASTAL LOUISIANA
INTEGRATED FINAL FEASIBILITY REPORT
AND
ENVIRONMENTAL IMPACT STATEMENT

APPENDIX A
Annex A
Clean Water Act Section 401 Water Quality Certification
Clean Water Act Section 404(b)(1) Evaluation

APPLICATION FOR DEPARTMENT OF THE ARMY PERMIT *(33 CFR 325)*	*OMB APPROVAL NO. 0710-003 Expires October 1996*

Public reporting burden for this collection of information is estimated to average 5 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters Service Directorate of Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0710-0003), Washington, DC 20503. Please DO NOT RETURN your form to either of those addresses. Completed applications must be submitted to the District Engineer having jurisdiction over the location of the proposed activity.

PRIVACY ACT STATEMENT

Authority: 33 USC 401, Section 10; 1413, Section 404. Principal Purpose: These laws require permits authorizing activities in, or affecting, navigable waters of the United States, the discharge of dredged or fill material into waters of the United States, and the transportation of dredged material for the purpose of dumping it into ocean waters. Routine Uses: Information provided on this form will be used in evaluating the application or a permit. Disclosure: Disclosure of requested information is voluntary. If information is not provided, however, the permit application cannot be processed nor can a permit be issued.

One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned.

(ITEMS 1 THRU 4 TO BE FILLED BY THE CORPS)

1. APPLICATION NO.	*2. FIELD OFFICE CODE*	*3. DATE RECEIVED*	*4. DATE APPLICATION COMPLETED*

(ITEMS BELOW TO BE FILLED BY APPLICANT)

5. APPLICANT'S NAME	*8. AUTHORIZED AGENT'S NAME AND TITLE (an agent is not required)*
US Army Corps of Engineers, New Orleans District	Same as Applicant
6. APPLICANT'S ADDRESS	*9. AGENT'S ADDRESS*
Planning , Programs and Programs and Project Management Division CEMVN-PDN-CEP P.O. Box 60267 New Orleans, LA 70160-0267 ATTN: William P. Klein, Jr.	
7. APPLICANT'S PHONE NOS. W/AREA CODE	*10. AGENT'S PHONE NOS. W/AREA CODE*
a. Residence ***b. Business*** (504) 862-2540	*a. Residence* *b. Business*

11. STATEMENT OF AUTHORIZATION

STILES.SANDRA.ELAINE.1230921748 January 5, 2016

APPLICANT'S SIGNATURE *DATE*

NAME, LOCATION AND DESCRIPTION OF PROJECT OR ACTIVITY

12. PROJECT NAME OR TITLE *(see instructions)*
Southwest Coastal Louisiana
Revised Draft Integrated Feasibility Report and Environmental Impact Statement

13. NAME OF WATERBODY, IF KNOWN (if applicable)	*14. PROJECT STREET ADDRESS (if applicable)*
All of Calcasieu, Cameron and Vermilion Parishes	All of Calcasieu, Cameron and Vermilion Parishes
13. LOCATION OF PROJECT Calcasieu, Cameron and Vermilion Parishes *COUNTY* Louisiana *STATE*	

16. OTHER LOCATION DESCRIPTIONS, IF KNOWN, (see instructions)

17. DIRECTIONS TO THE SITE

All of Calcasieu, Cameron and Vermilion Parishes

18. Nature of Activity (Description of project, include all features.)
Through separate reciprocal authorizations, Congress authorized the investigation of alternatives to: (1) provide hurricane protection and storm damage reduction, and (2) significantly restore environmental conditions that existed prior to the large scale alteration of the natural ecosystem including the Chenier Plain in Calcasieu, Cameron, and Vermilion parishes in Louisiana. The intent is to develop potential solutions to these water resource problems. The impacts described for the National Economic Development (NED) hurricane and storm damage risk reduction objective are programmatic in nature and therefore additional National Environmental Policy Act (NEPA) documents will be prepared at a later date to further analyze in detail site specific project(s) impacts prior to implementation of the NER component of the Project. Hence this Water Quality Certification application is not directed to the programmatic NED Plan. A Water Quality Certification application will be provided following more detailed, feasibility-level analysis for construction.

This Water Quality Certification application is directed to the National Ecosystem Restoration (NER) features that have been developed to a feasibility level of design and are recommended as fully constructible. The NER Tentatively Selected Plan (TSP) includes:
** 9 marsh restoration and nourishment features restoration locations include: (a) three areas on the south side of LA-82 approximately 4.5 miles west of Grand Chenier; (b) Pecan Island west of the Freshwater Bayou Canal approximately 5 miles north of the Freshwater Bayou locks; (c) Christian Marsh located east of Freshwater Bayou Canal and approximately 5 miles north of Freshwater Bayou locks; (d) southern shoreline of GIWW west of the CSC near Black Lake; (e) eastern rim of Calcasieu Lake within the Cameron-Creole Watershed; (f) east of Mud Lake and north of Highway 82; (g) Mud Lake west of Calcasieu Ship Channel adjacent to southern rim of West Cove.*
** 5 Gulf shoreline protection / stabilization features spanning 252,000 linear feet to reduce erosion of canal banks and shorelines at multiple locations of Gulf of Mexico shoreline from the Calcasieu River to Freshwater Bayou consisting of reef breakwaters located approximately 150' offshore; in addition, approximately 13.4 miles of rock revetment placed at three locations to fortify spoil banks of the GIWW and Freshwater Bayou; rock and breakwaters would also be placed at Holly Beach.*
**Hydrologic and salinity control feature is the Cameron-Creole Spillway structure south of Lambert Bayout would serve as a drainage manifold and the outfall channel into Calcasieu Lake would be rock-lined for scour protection and built to +2 ft.*
**Chenier reforestation consists of replanting of 435 seedlings per acre at 10' x 10' spacing, in 35 Chenier locations on 1,400 acres in Cameron and Vermilion parishes.*
**The CSC Salinity Barrier Navigation Study is recommended as an additional long-range study feature to adequately account for potential environmental benefits, navigation impacts, and engineering. This feature would not be constructed by the proposed action but is recommended for additional study.*

19. Project Purpose (Describe the reason or purpose of the project, (see instruction.)
NED Objective 1. Reduce the risk of damages and losses from hurricane and storm surge flooding.
NER Objective 2. Manage tidal flows to improve drainage, and prevent salinity from exceeding 2 parts per thousand (ppt) for fresh marsh and 6 ppt for intermediate marsh.
NER Objective 3. Increase wetland productivity in fresh and intermediate marshes to maintain function by reducing the time water levels exceed marsh surfaces.
NER Objective 4. Reduce shoreline erosion and stabilize canal banks to protect adjacent wetlands.
NER Objective 5. Restore landscapes, including marsh, shoreline, and cheniers to maintain their function as wildlife habitat and improve their ability to serve as protective barriers.

USE BLOCKS 20-22 IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED

20. Reason(s) for Discharge
**Marsh Restoration: Nine marsh restoration and nourishment features consist of delivering sediments to former marsh areas and eroding marsh areas (minimum of 100 acres efficiency criteria) that have water levels of less than two feet and that have been optimized to preserve or restore critical geomorphologic features to restore vegetated wetlands. This involves excavation of significant quantities and delivery of borrow material to restoration sites through designated corridors. Some restoration sites may require containment to hold sediments in place.*
**Shoreline Protection: The five Gulf shoreline protection/stabilization features would be used to reduce erosion of canal banks and shorelines in critical areas in order to protect adjacent wetlands and critical geomorphic features.*
**Hydrologic and salinity control structure is the Cameron-Creole Spillway structure south of Lambert Bayou would serve as a drainage manifold and the outfall channel into Calcasieu Lake would regulate the flow of water in certain areas and inhibit salinity intrusion above a certain threshold.*
**Chenier reforestation would not involve the discharge of dredged or fill material; rather Chenier restoration consists of replanting seedlings in 35 Chenier locations on 1,400 acres in Cameron and Vermilion parishes.*

21. Type(s) of Material Being Discharged and the Amount of Each Type in Cubic Yards.
See table: 2-18a-d

Table 1a: Details of the marsh restoration features of the NER Recommended Plan.

Measure Number	Measure Name	Basin	Marsh Type	Acres Restored	Acres Nourished	Total Acres	Net Benefits (acres)	Average Annual Habitat Units (AAHU)	Borrow Volume (cy)	Borrow Area (acres)	Renourishment Volume (cy)	Initial Construction Costs (US $)	TY 50 Renourishment (US $)
3a1	Beneficial Use of Dredged Material from Calcasieu Ship Channel	Calcasieu	Brackish	599	-	599	454	191	5,329,286	139	1,000,000	$66,593,748	$17,759,439
3c1	Beneficial Use of Dredged Material from Calcasieu Ship Channel	Calcasieu	Brackish	1,347	784	2,081	1,324	607	9,458,313	314	3,653,841	$168,194,346	$70,994,253
47a1	Marsh Restoration Using Dredged Material South of Highway 82	Mermentau	Brackish	931	88	1,021	895	272	3,022,781	1,716	3,500,000	$105,334,982	$24,230,680
47a2	Marsh Restoration Using Dredged Material South of Highway 82	Mermentau	Brackish	1,297	126	1,423	1,218	381	8,831,084	1,716	3,500,000	$97,348,440	$17,505,990
47a3	Marsh Restoration Using Dredged Material South of Highway 82	Mermentau	Brackish	1,304	4	1,308	1,035	353	8,357,120	1,716	1,000,000	$95,373,834	$14,981,607
124c	Marsh Creation at Mud Lake	Calcasieu	Saline	1,077	708	1,837	1,228	500	10,369,956	531	2,000,000	$122,219,520	$24,440,883
124d	Marsh Creation at Mud Lake	Calcasieu	Brackish	159	448	607	168	4	1,420,943	378	2,200,000	$28,682,440	$17,636,205
127c3	Marsh Restoration at Pecan Island	Mermentau	Brackish	931	62	994	735	241	7,401,057	3,950	782,000	$84,662,041	$15,683,451
306a1	Riverv Marsh Restoration Southwest Portion (Chastian Marsh)	Mermentau	Brackish	627	1,269	1,896	782	454	8,138,184	3,950	3,500,000	$75,085,691	$37,591,555
	Totals			8,173	3,439	11,666	7,900	2,350	63,428,722	14,410	16,934,452	$831,393,763	$238,102,996

Table 1a continued.

Measure Number	Measure Name	State Water Bottoms permanent (acres)	Flotation Footprint (acres)	Disposal Footprint (acres)	Dike Footprint (feet)	Dike Footprint (acres)	State Water Bottoms (temporary)	Dredge Pipeline Route (feet)	Dredge Pipeline Route (acres)	Piping Plover Critical Habitat (acres)	Construction Period
3a1	Beneficial Use of Dredged Material from Calcasieu Ship Channel	139	132	-	44,700	30.8	-	43,942	30	-	16 months
3c1	Beneficial Use of Dredged Material from Calcasieu Ship Channel	314	182	-	37,230	31.4	-	61,497	42	-	33 months
47a1	Marsh Restoration Using Dredged Material South of Highway 82	1,716	47	-	68,300	47.0	-	30,515	24	0.14	23 months
47a2	Marsh Restoration Using Dredged Material South of Highway 82	1,716	47	-	41,000	28.2	-	30,898	21	0.14	24 months
47a3	Marsh Restoration Using Dredged Material South of Highway 82	1,716	47	-	35,200	24.2	-	29,838	21	0.14	23 months
124c	Marsh Creation at Mud Lake	531	28	-	78,100	51.5	-	9,483	7	1.8	27 months
124d	Marsh Creation at Mud Lake	314	182	-	32,500	22.4	-	21,452	15	-	9 months
127c3	Marsh Restoration at Pecan Island	3,950	110	-	46,000	31.7	-	37,074	26	-	12 months
306a1	Riverv Marsh Restoration Southwest Portion (Chastian Marsh)	3,950	178	-	108,000	74.4	-	58,731	41	-	17 months
	Totals	14,347	953	-	551,500	341.6	-	329,4567	227	2.2	184 months

Table 1b Details of the shoreline protection features of the NER Recommended Plan.

Measure Number	Measure Name	Basin	Marsh Type	Net Benefits (acres)	Average annual habitat units (AAHU)	Shoreline Footage Length (ft)	Rock (tons)	Grade Rock (lbs)	Geotextile Fabric (sq yds)	Lightweight Aggregate (tons)	1st Maintenance Lift (tons)	2nd Maintenance Lift (tons)	Initial Construction Costs (US $)	TY35 Maintenance (US $)
5a	Holly Beach Shoreline Stabilization – Breakwaters	Calcasieu	Saline	28	58	46,014	660,540	250	304,480	0	129,301	86,014	$144,040,927	$101,706,222
6b1	Gulf Shoreline Restoration: Calcasieu Pass to Freshwater Bayou	Mermentau	Brackish	2,190	455	33,392	568,960	200	967,630	870,120	16,944	0	$108,600,921	N/A
6b2	Gulf Shoreline Restoration: Calcasieu Pass to Freshwater Bayou	Mermentau	Brackish	1,503	468	42,000	697,140	226	363,270	287,010	48,734	0	$140,076,301	N/A
6b3	Gulf Shoreline Restoration: Calcasieu Pass to Freshwater Bayou	Mermentau	Brackish	1,099	342	33,393	561,581	200	294,208	270,030	36,161	0	$112,270,800	N/A
10b	Freshly Sped Banks of the GIWW and Freshwater Bayou	Mermentau	Brackish	1,282	279	70,000	917,640	250	516,000	0	92,640	61,760	$236,018,000	$95,665,488
	Totals			8,335	1,708	251,328	3,395,300		1,958,625	1,315,190	433,442	147,825	$829,002,995	$322,480,890

Table 1b continued.

Measure Number	Measure Name	TY 35 Maintenance (US $)	State Water Bottoms (permanent)	Bottomless Footprint (feet)	Planation Footprint (acres)	Disposal Footprint (acres)	State Water Bottoms (Temporary)	Critical Habitat (acres)	Staging Area (acres)	Coarse Elevation (feet NAVD88)	Crown Width (feet)	Slopes	Aprons (feet)	Construction Period
5a	Holly Beach Shoreline Stabilization – Breakwaters	$101,267,740	57.6	57.6	479	461	944	-	-	3.35	20	2:1	10-ft fence & 4-ft berm	19 months
6b1	Gulf Shoreline Restoration: Calcasieu Pass to Freshwater Bayou	$15,369,340	45.9	45.9	735	711	1456	-	21	3.35	10	2:1	10-ft fence & 4-ft berm	31 months
6b2	Gulf Shoreline Restoration: Calcasieu Pass to Freshwater Bayou	$10,345,672	40.2	40.2	507	487	1004	-	21	3.35	10	2:1	10-ft fence & 4-ft berm	23 months
6b3	Gulf Shoreline Restoration: Calcasieu Pass to Freshwater Bayou	$8,041,621	37.8	37.8	372	289	661	-	21	3.35	10	2:1	10-ft fence & 4-ft berm	18 months
10b	Freshly Sped Banks of the GIWW and Freshwater Bayou	$3,986,304	77.1	77.1	338	-	-	-	-	3.00	6	3:1	none	53 months
	Totals	$50,988,182	278.4	278.4	2441	1988	4065	-	63	-	-	-	-	304 months

Table 1b continued.

Linear Feet for Access and Temporary Disposal

Measure	6a1	6b1	6b2	6b3	Total Feet	Miles
Disposal	159,742	236,008	168,533	98,653	663,936	126.1
Equipment Access	161,857	264,857	175,050	128,342	730,106	138.8

Table 1c Details of the chenier reforestation features of the NER Recommended Plan.

Measure Number	Measure Name	Net Benefits (acres)	Average Annual Habitat Units (AAHUs)	Species	Total Fence Length (feet)	Fence Height (feet)	Planting Density (#/acre)	Spacing (feet)	Initial Construction Costs (US $)	OMRR&R Costs (US $)
CR (total)	Chenier Reforestation	1,413	538	Live Oak, Hackberry	150,000	7.5	435	10 x 10	4,138,248	None Planned

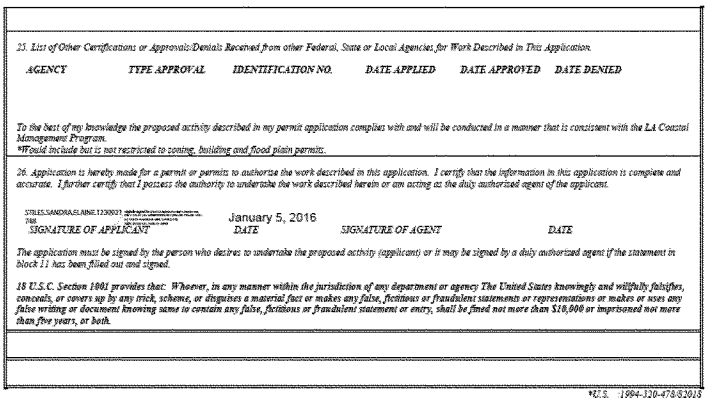
Table 1c continued.

Measure Number	Measure Name	Survival (percent)	Equipment Access Corridor (feet)	Equipment Access Corridor (acres)	State Water Bottoms (Permanent)	State Water Bottoms (Temporary)	Critical Habitat (acres)	Staging Area (acres)	Construction period
CR (total)	Chenier Reforestation	50%	13,867	10	0	0	0	0	93 months

22. Surface Area in Acres of Wetlands or Other Waters Filled (see instructions)
See tables 1-1a-d

23. Is Any Portion of the Work Already Complete? Yes ____ No __X__ IF YES, DESCRIBE THE COMPLETED WORK

24. Addresses of Adjoining Property Owners, Lessees, Etc., Whose Property Adjoins the Waterbody (If more than can be entered here, please attach a supplemental list.



23. List of Other Certifications or Approvals/Denials Received from other Federal, State or Local Agencies for Work Described in This Application.

AGENCY	*TYPE APPROVAL*	*IDENTIFICATION NO.*	*DATE APPLIED*	*DATE APPROVED*	*DATE DENIED*

To the best of my knowledge the proposed activity described in my permit application complies with and will be conducted in a manner that is consistent with the LA Coastal Management Program.
**Would include but is not restricted to zoning, building and flood plain permits.*

24. Application is hereby made for a permit or permits to authorize the work described in this application. I certify that the information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.

STILES.SANDRA.ELAINE.1230931 [illegible]
SIGNATURE OF APPLICANT January 5, 2016 *DATE* *SIGNATURE OF AGENT* *DATE*

The application must be signed by the person who desires to undertake the proposed activity (applicant) or it may be signed by a duly authorized agent if the statement in block 11 has been filled out and signed.

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency The United States knowingly and willfully falsifies, conceals, or covers up by any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statement or entry, shall be fined not more than $10,000 or imprisoned not more than five years, or both.

**U.S. : 1994-320-478/82015*

BOBBY JINDAL
GOVERNOR

PEGGY M. HATCH
SECRETARY

State of Louisiana

DEPARTMENT OF ENVIRONMENTAL QUALITY
ENVIRONMENTAL SERVICES

July 6, 2015

Mr. William P. Klein, Jr.
U.S. Army Corps of Engineers, New Orleans District
CEMVN-PDN-CEP
Post Office Box 60267
New Orleans, Louisiana 60267

AI No.: 101235
Activity No.: CER20150002

RE: Southwest Coastal Louisiana
Water Quality Certification WQC 150706-01
Calcasieu, Cameron, and Vermilion Parishes

Dear Mr. Klein:

The Louisiana Department of Environmental Quality, Water Permits Division (LDEQ), has reviewed the application to discharge fill to conduct marsh restoration and shoreline protection/stabilization projects in Calcasieu, Cameron, and Vermilion Parishes.

The information provided in the application and the Revised Integrated Draft Feasibility Report and Environmental Impact Statement received March 20, 2015, has been reviewed in terms of compliance with State Water Quality Standards, the approved Water Quality Management Plan and applicable state water laws, rules and regulations. LDEQ determined that the requirements for a Water Quality Certification have been met. LDEQ concludes the discharge of fill material will not violate water quality standards as provided for in LAC 33:IX.Chapter 11. Therefore, LDEQ hereby issues U.S. Army corps of Engineers, New Orleans District – Southwest Coastal Louisiana Water Quality Certification, WQC 150706-01.

Should you have any questions concerning any part of this certification, please contact Elizabeth Hill at (225) 219-3225 or by email at elizabeth.hill@la.gov. To ensure all correspondence regarding this certification is properly filed into the Department's Electronic Document Management System, please reference Agency Interest (AI) number 101235 on all future correspondence to this Department.

Sincerely,

Scott Guilliams
Administrator
Water Permits Division

c: IO-W
Corps of Engineers – New Orleans District

Post Office Box 4313 • Baton Rouge, Louisiana 70821-4313 • Phone 225-219-3181 • Fax 225-219-3309
www.deq.louisiana.gov

SECTION 404(b)(1) EVALUATION
Southwest Coastal Louisiana Study
Calcasieu, Cameron, and Vermilion Parishes, Louisiana

I. Project Description

a. Location.

The U.S. Army Corps of Engineers (USACE), Mississippi Valley Division, New Orleans District (CEMVN) has prepared an Integrated Final Feasibility Report and Environmental Impact Statement (Integrated Final Report) to evaluate the impacts associated with the Southwest Coastal Louisiana Study. The study area is located in southwest Louisiana and includes all of Calcasieu, Cameron, and Vermilion Parishes, Louisiana. Cameron Parish is located in the southwest corner of Louisiana. The southern boundary of the parish is the Gulf of Mexico. Eighty-two percent of Cameron Parish is coastal marshes. Geographically, it is one of the largest parishes in Louisiana. The parish is chiefly rural and the largest communities are Cameron and Hackberry. Cameron is located along LA-82, while Hackberry is located along LA-27. Other smaller communities include Creole, Johnsons Bayou, and Holly Beach. Calcasieu Parish is located due north of Cameron Parish. The town of Lake Charles is the parish seat, which is the largest urban area in the study area. Only a small portion of the parish is located in the coastal zone. Vermilion Parish is located to the east of Cameron Parish. The southern boundary of the parish is the Gulf of Mexico. Large expanses of Vermilion Parish are open water (lakes, bays, and streams). Approximately 50 percent of the land is coastal marshes. The parish is chiefly rural and the town of Abbeville is the parish seat as well as the largest urban area in the parish. Other communities include Delcambre, Kaplan, and Gueydan, which are all located along LA Hwy 14 in the northern part of the study area. Pecan Island and Forked Island are smaller communities located along LA Hwy 82 in lower Vermilion Parish. Located along LA Hwy 333, Intracoastal City is the nearest access to Vermilion Bay and the Gulf of Mexico in this region and supports the area's oil and shrimp industries.

b. General Description.

The Southwest Coastal Louisiana Study is comprised of two components consisting of a nonstructural National Economic Development (NED) plan and a National Ecosystem Restoration (NER) plan. The NED Recommended Plan (RP) would not impact waters of the United States and is therefore not subject to this evaluation. The NER RP is the Small Integrated Restoration Alternative, a comprehensive ecosystem restoration plan addressing land loss and ecosystem degradation. The NER RP is cost effective, and is the least-cost comprehensive best buy plan. The NER RP would minimize land loss; enhance plant productivity by reducing major stressors; and reinforce and protect critical landscape features. Table 1 provides a brief description of the NER RP measures. **Tables 2a, 2b**, and **2c** provide the NER RP measure details, description of construction equipment, and quantities and types of fill to be placed in wetlands. **Figures 1, 2** and **3** display locations of the NER RP measures.

There are a total of 49 ecosystem restoration features or measures:

- 9 Marsh Restoration measures
- 35 Chenier Reforestation measures; construction of these measures would not impact waters of the United States and are therefore not part of this 404(b)(1) evaluation
- 5 Shoreline Protection measures
- The Calcasieu Ship Channel Salinity Barrier measure is being recommended for long-term study.
- The Cameron-Creole Spillway Salinity Control Structure measure is being recommended for long-term study.
- Two marsh restoration measures would be located partially on U.S. Fish and Wildlife Service (USFWS) lands. Measure 124d Marsh Restoration at Mud Lake would be located on Sabine National Wildlife Refuge (NWR). Measure 3c1 Beneficial Use of Dredged Material from Calcasieu Ship Channel would be located on the Cameron Prairie NWR (**Figure 4**). While USACE believes that these features are worthy of recommendation, USACE has determined that these features would more properly be

implemented by USFWS. Therefore, USACE will not seek authorization and funding of these features. Rather USACE will recommend to USFWS that it consider seeking independent Congressional authorization and funding for implementation of these features by USFWS.

Table 1. NER RP Feature Construction Benefits

	Category	ID	Description	Net Acres	Net AAHUs
Mermantau/Teche-Vermilion (Plan M-4)	Marsh Restoration[1]	47a1	Marsh restoration using dredged material south of LA-82, about 4.5 miles west of Grand Chenier. 933 marsh acres would be restored and 88 acres would be nourished from 3M cubic yards of dredged material with one renourishment cycle.	895	272
		47a2	Marsh restoration using dredged material south of LA-82, approximately 4.5 miles west of Grand Chenier. 1,297 marsh acres would be restored and 126 acres would be nourished from 8.8M cubic yards of dredged material with one renourishment cycle.	1,218	381
		47c1	Marsh restoration using dredged material south of LA-82, approximately 4.5 miles west of Grand Chenier. 1,304 marsh acres would be restored and 4 acres would be nourished from 8.6M cubic yards of dredged material with one renourishment cycle.	1,135	353
		127c3	Marsh restoration at Pecan Island, west of the Freshwater Bayou Canal and approximately 5 miles north of the Freshwater Bayou locks. 832 marsh acres would be restored and 62 acres would be nourished from 7.3M cubic yards of dredged material with one renourishment cycle.	735	241
		306a1	Rainey marsh restoration at Christian Marsh, east of the Freshwater Bayou Canal and approximately 5 miles north of the Freshwater Bayou locks. 627 marsh acres would be restored and 1,269 acres would be nourished from 8.1M cubic yards of dredged material with one renourishment cycle.	743	151
	Shoreline Protection/ Stabilization[1]	6b1	Gulf shore protection/stabilization from Calcasieu River to Freshwater Bayou. 11.0 miles of Gulf shore protection consisting of a reef breakwater with a lightweight aggregate core. Located ~150 ft offshore consisting of geotextile fabric and stone built to an 18 ft crest width.	2,140	625
		6b2	Gulf shore protection/stabilization from Calcasieu River to Freshwater Bayou. 8.1 miles of Gulf shoreline protection consisting of a reef breakwater with a lightweight aggregate core. Located ~150 ft offshore using geotextile fabric and stone built to an 18 ft crest width.	1,583	466
		6b3	Gulf shore protection/stabilization from Calcasieu River to Freshwater Bayou. 6.3 miles of Gulf shoreline protection consisting of a reef breakwater with a lightweight aggregate core. Located ~150 ft offshore using geotextile fabric and stone built to an 18 ft crest width.	1,098	312
		16b	Fortify spoil banks of Freshwater Bayou. Approximately 13.4 miles of rock revetment at three critical locations to prevent shoreline breaching. Rock revetment would be built to +4 ft with a 4 ft crown. Two maintenance lifts would be required.	1,288	279
	Chenier Re-forestation	CR	13 separate chenier locations would be replanted. Approximately 435 seedlings per acre, at 10 ft x 10 ft spacing, with invasive species control incorporated[3].	281	96

Calcasieu/ Sabine (CM-4) (Includes all measures in this table)	Marsh Restoration[1]	3a1	Beneficial use of dredged material from the Calcasieu Ship Channel. Located adjacent to the south shore of the GIWW west of the Calcasieu Ship Channel near Black Lake. Restore 599 marsh acres with 5.3M cubic yards of dredged material with one renourishment cycle.	454	191
		3c1[2]	Beneficial use of dredged material from the Calcasieu Ship Channel. Located adjacent to the eastern rim of Calcasieu Lake and situated within the Cameron-Creole Watershed area. 1,347 marsh acres would be restored and 734 acres would be nourished from 9.4M cubic yards of dredged material with one renourishment cycle.	1,324	607
		124c	Marsh restoration at Mud Lake. Located adjacent and north of Highway 82 and east of Mud Lake. 1,077 marsh acres would be restored and 708 acres would be nourished from 10.4M cubic yards of dredged material with one renourishment cycle.	1,228	500
		124d[2]	Marsh restoration at Mud Lake. Located west of the Calcasieu Ship Channel and adjacent to the south rim of West Cove. 159 marsh acres would be restored and 448 acres would be nourished from 1.4M cubic yards of dredged material with one renourishment cycle.	168	4
	Shoreline Protection/ Stabilization[1]	5a	Holly Beach Shoreline Stabilization Breakwaters. Construction of 8.7 miles of rock and low action breakwaters and is a continuation of existing breakwaters. Crown elevation of +3.5 ft with a crown width of 24 ft. Two maintenance lifts would be required.	26	56
	Chenier Re-forestation	CR	22 separate chenier locations would be replanted. Approximately 435 seedlings per acre, at 10 ft x 10 ft spacing, with invasive species control incorporated3.	1,132	442
	TOTALS			15,448	4,976

1- Renourishment and maintenance lifts are considered an OMRR&R cost and are a 100% NFS responsibility. Renourishment material would come from the site of the initial dredging effort.
2- Features 3c1 and 124d are partially located on USFWS property. While USACE believes that these features are worthy of recommendation, USACE has determined that these features would more properly be implemented by USFWS.
3- Costs to ensure the minimum survival pervent are considered 'construction' and will be cost-shared accordingly.

Table 2a: Details of the marsh restoration measures of the NER Recommended Plan.

Measure Number	Measure Name	Basin	Marsh Type	Acres Restored	Acres Nourished	Total Acres	Net Benefits (acres)	Average Annual Habitat Units (AAHU)	Borrow Volume (cy)	Borrow Area (acres)	Renourishment Volume (cy)	Initial Construction Costs (US $)	TY 30 Renourishment (US $)
3a1	Beneficial Use of Dredged Material from Calcasieu Ship Channel	Calcasieu	Brackish	599	-	599	454	191	5,339,286	139	1,000,000	$66,593,748	$17,759,470
3c1	Beneficial Use of Dredged Material from Calcasieu Ship Channel	Calcasieu	Brackish	1,347	734	2,081	1,324	607	9,458,313	314	3,651,841	$168,194,346	$70,984,253
47a1	Marsh Restoration Using Dredged Material South of Highway 82	Mermentau	Brackish	933	88	1,021	895	272	3,022,782	1,716[1]	1,500,000	$105,234,982	$21,239,680
47a2	Marsh Restoration Using Dredged Material South of Highway 82	Mermentau	Brackish	1,297	126	1,423	1,218	381	8,831,084	1,716[1]	1,500,000	$97,348,440	$17,585,890
47c1	Marsh Restoration Using Dredged Material South of Highway 82	Mermentau	Brackish	1,304	4	1,308	1,135	353	8,557,120	1,716[1]	1,800,000	$95,372,834	$14,981,607
124c	Marsh Restoration at Mud Lake	Calcasieu	Saline	1,077	708	1,837	1,228	500	10,369,956	531	2,001,611	$112,219,520	$24,680,885
124d	Marsh Restoration at Mud Lake	Calcasieu	Brackish	159	448	607	168	4	1,420,943	378	1,200,000	$28,882,160	$17,636,205
127c3	Marsh Restoration at Pecan Island	Mermentau	Brackish	832	62	894	735	241	7,301,057	3,950[2]	781,000	$61,662,041	$15,683,451
306a1	Rainey Marsh Restoration Southwest Portion (Christian Marsh)	Mermentau	Brackish	627	1,269	1,896	743	151	8,128,181	3,950[2]	3,500,000	$75,885,692	$37,551,555
	Totals			8,175	3,439	11,666	7,900	2,700	62,428,722	7,028	16,934,452	$811,393,763	$238,102,996

1- This borrow source provides the sediment for all three restoration features but the full amount of available material will not be dredged each cycle. Therefore this total acreage is only counted once in the column total.
2- This borrow source provides the sediment for both restoration features but the full amount of available material will not be dredged each cycle. Therefore this total acreage is only counted once in the column total.

JA 37-899 10/04/2019 226

Table 2a: continued.

Measure Number	Measure Name	Impact to State Water Bottoms permanent (acres)	Floatation Footprint (acres)	Disposal Footprint (acres)	Dike Footprint (feet)	Dike Footprint (acres)	Impact to State Water Bottoms (temporary)	Dredge Pipeline Route (feet)	Dredge Pipeline Route (acres)	Piping Plover Critical Habitat (temporary impact acres)	Construction Period
3a1	Beneficial Use of Dredged Material from Calcasieu Ship Channel	139	132	-	44,700	30.8	-	43,942	30	-	16 months
3c1	Beneficial Use of Dredged Material from Calcasieu Ship Channel	314	182	-	97,250	51.4	-	61,497	42	-	33 months
47a1	Marsh Restoration Using Dredged Material South of Highway 82	1,716	47	-	68,300	47.0	-	35,519	24	0.14	23 months
47a2	Marsh Restoration Using Dredged Material South of Highway 82	1,716	47	-	41,000	28.2	-	30,898	21	0.14	24 months
47c1	Marsh Restoration Using Dredged Material South of Highway 82	1,716	47	-	35,200	24.2	-	29,858	21	0.14	23 months
124c	Marsh Restoration at Mud Lake	531	28	-	78,100	31.5	-	9,485	7	1.8	27 months
124d	Marsh Restoration at Mud Lake	314	182	-	32,500	22.4	-	21,452	15	-	9 months
127c3	Marsh Restoration at Pecan Island	3,950	110	-	46,000	31.7	-	37,074	26	-	12 months
306a1	Rainey Marsh Restoration Southwest Portion (Christian Marsh)	3,950	178	-	108,000	74.4	-	59,731	41	-	17 months
	Totals	14,347	953		551,50	341.6		329,456	227	2.2	---

JA 37-899 10/04/2019 227

Table 2b: Details of the shoreline protection measures of the NER Recommended Plan.

Measure Number	Measure Name	Basin	Marsh Type	Net Benefits (acres)	Average annual habitat units (AAHU)	Shoreline Feature Length (ft)	Rock (tons)	Grade Rock (lbs)	Geotextile Fabric (sq yds)	Lightweight Aggregate (tons)	1st Maintenance Lift (tons)	2nd Maintenance Lift (tons)	Initial Construction Costs (US $)	TY15 Maintenance (US $)
5a	Holly Beach Shoreline Stabilization – Breakwaters	Calcasieu	Saline	26	56	46,014	860,540	250	386,460	0	129,081	86,054	$144,044,021	$16,786,222
6b1	Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou	Mermentau	Brackish	2,140	625	58,293	868,480	250	447,830	479,150	86,848	0	$198,480,921	NA
6b2	Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou	Mermentau	Brackish	1,583	466	42,883	687,140	250	363,270	357,010	68,714	0	$145,876,561	NA
6b3	Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou	Mermentau	Brackish	1,098	312	33,355	561,530	250	244,205	279,030	56,153	0	$115,270,890	NA
16b	Fortify Spoil Banks of the GIWW and Freshwater Bayou	Mermentau	Brackish	1,288	279	70,983	617,640	250	516,860	0	92,646	61,764	$36,018,600	$5,695,468
	Totals			6,135	1,738	251,528	3,595,330		1,958,625	1,115,190	433,442	147,818	$639,690,993	$22,481,690

JA 37-899 228 10/04/2019

Table 2b: continued.

Measure Number	Measure Name	TY 25 Maintenance (US $)	Impacts to State Water Bottoms (permanent)	Breakwater Footprint (feet)	Flotation Footprint* (acres)	Temporary Disposal Footprint* (acres)	Impact to State Water Bottoms (temporary acres)	Critical Habitat (acres)	Temporary Staging Area (acres)	Crown Elevation (feet NAVD88)	Crown Width (feet)	Slopes	Aprons (feet)	Construction Period
5a	Holly Beach Shoreline Stabilization – Breakwaters	$11,247,740	57.4	57.4	479	462	941	-	-	3.50	24	2:1	10-ft front & 6-ft back	19 months
6b1	Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou	$15,389,345	65.9	65.9	725	711	1436	-	21	3.25	18	2:1	10-ft front & 6-ft back	31 months
6b2	Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou	$11,343,672	40.2	40.2	507	497	1004	-	21	3.25	18	2:1	10-ft front & 6-ft back	23 months
6b3	Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou	$9,041,421	37.8	37.8	372	289	661	-	21	3.25	18	2:1	10-ft front & 6-ft back	18 months
16b	Fortify Spoil Banks of the GIWW and Freshwater Bayou	$3,966,404	77.1	77.1	358	-	-	-	-	3.00	4	4:1	none	13 months
	Totals	$50,988,582	278.4	278.4	2,441	1,959	4,042	-	63	-	-	-	-	---

**- Access for heavy equipment to construct shoreline stabilization features consists of dredging a channel in open water to allow construction equipment to reach shoreline areas and placing the dredged material alongside the channel so the necessary channel depth is maintained. This material stored adjacent to the channel will be returned to the access channel after construction. These impacts are temporary and will naturally revert to existing conditions over time.*

Table 2b: continued.

Linear Feet for Access and Temporary Disposal							
Measure	**5a**	**6b1**	**6b2**	**6b3**	**16b***	**Total Feet**	**Miles**
Disposal	159,741	239,001	168,533	98,683	0	665,958	126.1
Equipment Access	161,957	244,857	173,050	126,542	0	706,406	133.8

**- No dredging or temporary disposal is anticipated for Feature 16b since Freshwater Bayou has adequate water depths to allow the necessary construction equipment access.*

JA
37-899
229
10/04/2019

Table 2c: Details of the chenier reforestation measures of the NER Recommended Plan.

Measure Name	Net Benefits (acres)	Benefits (AAHU)	Species	Total Fence Length (feet)	Fence Height (feet)	Planting Density (#/acre)	Spacing (feet)	Min. Survival % at Year 4*	Equip-ment Access Corridor (feet)	Equip-ment Access Corridor (acres)	State Water Bottoms (permanent)	State Water Bottoms (tempor-ary)	Critical Habitat (acres)	Staging Area (acres)
Chenier Reforestation (CR)	1,413	538	Live Oak; Hackberry	150,000	7.5	435	10 x 10	57%	13,867	10	0	0	0	0

**- For a given planting, a minimum of 250 seedlings/saplings per acre must be present (with a 60 to 40 hard mast to soft mast ratio) at the end of the fourth year (i.e., Year 5) following successful attainment of the one-year survivorship criteria. Costs to ensure the minimum survival percent are considered 'construction' and will be cost-shared accordingly.*

JA
37-899
230
10/04/2019

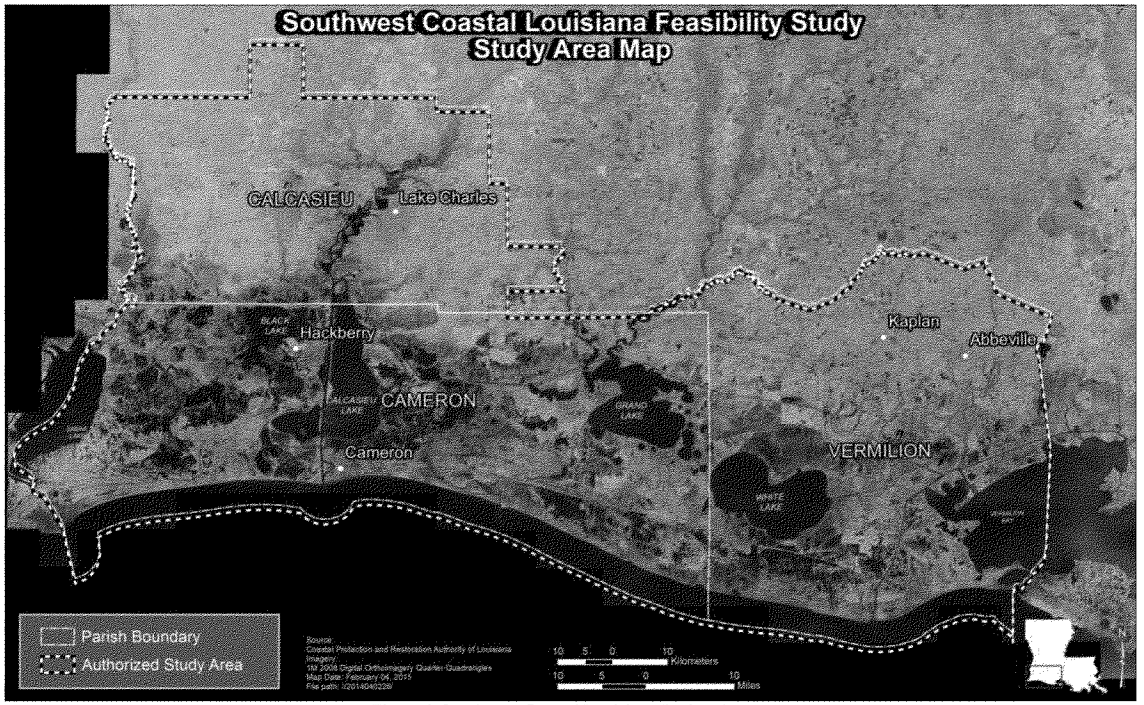


Figure 1. Southwest Coastal Louisiana Project Area

JA
37-899
231
10/04/2019

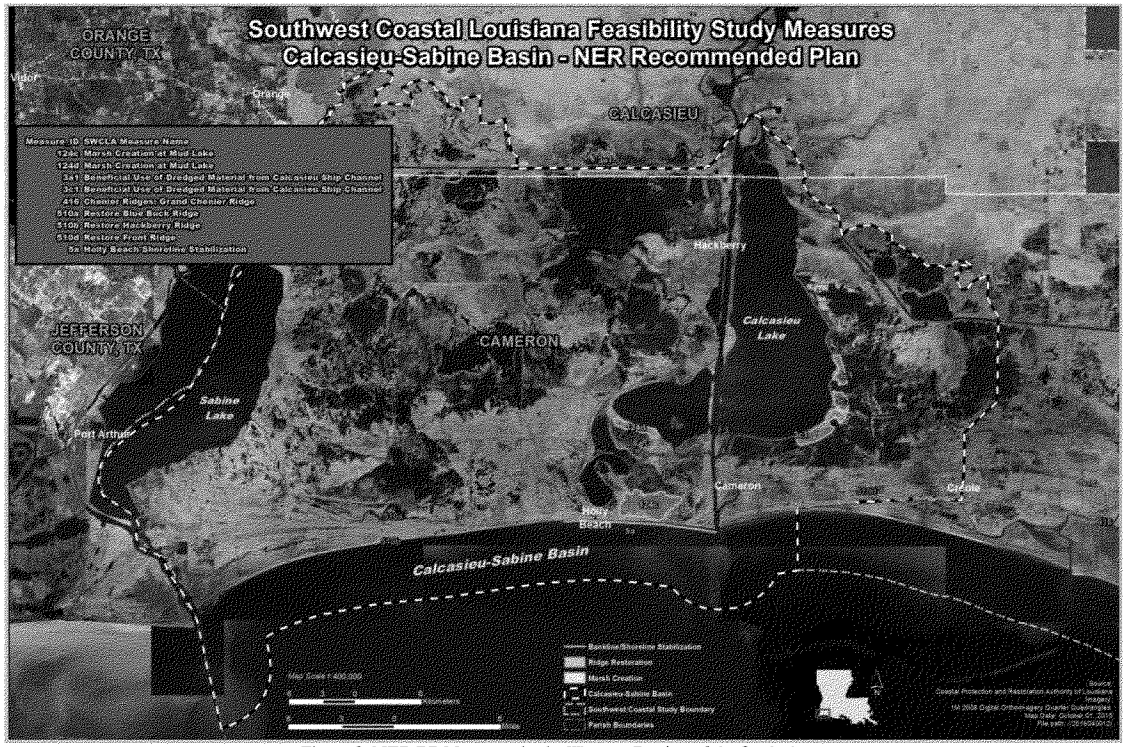


Figure 2. NER RP Measures in the Western Portion of the Study Area.

JA 37-899 232 10/04/2019

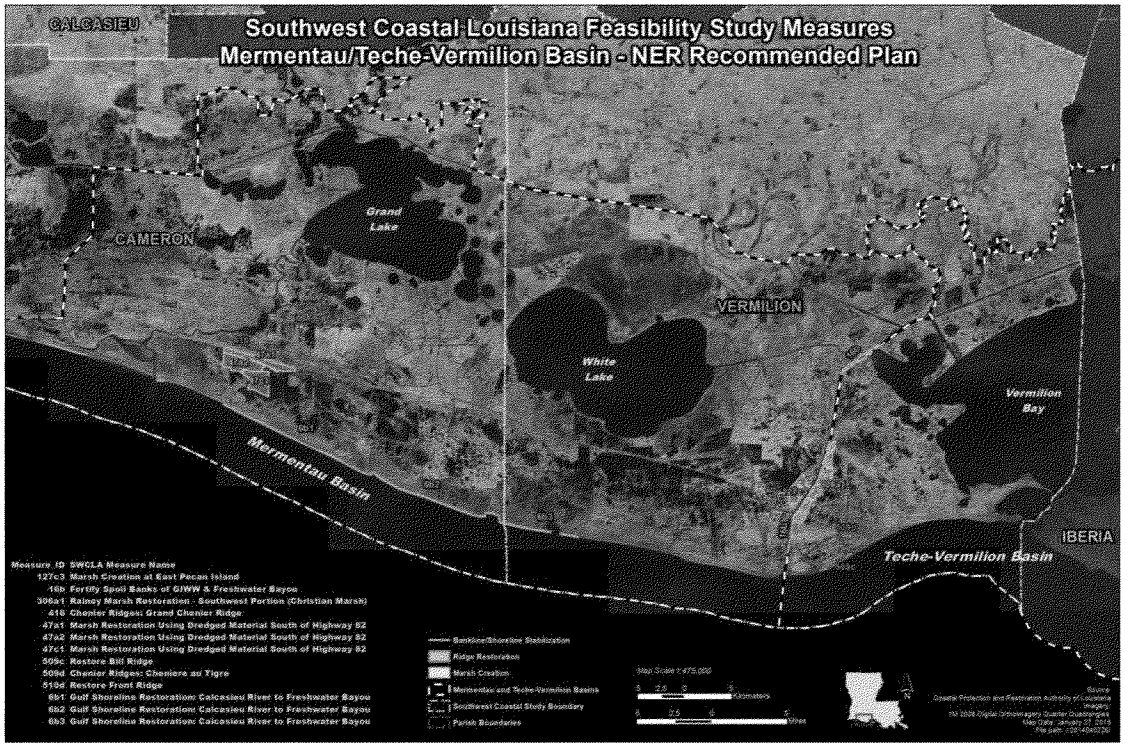


Figure 3. NER RP Measures in the Eastern Portion of the Study Area.

JA 37-899 233 10/04/2019

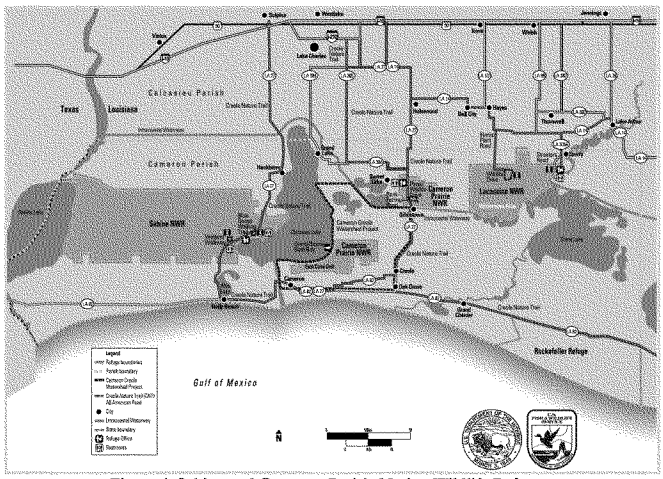


Figure 4. Sabine and Cameron Prairie Nation Wildlife Refuges.

Coastal Restoration Projects Impacted by NER RP Measures: Many of the NER RP measures would be constructed in the immediate vicinity of other coastal restoration projects, such as the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) projects (**Figure 5**). **Table 3** lists the names of other coastal restoration projects within the Southwest Coastal Louisiana project area corresponding to **Figure 5**. The following projects would be impacted by the implementation of the NER RP.

- Shoreline protection Measure 5a (Holly Beach Shoreline Stabilization-Breakwaters) would be located immediately offshore of the projects CS-31 (Holly Beach Sand Management) and CS 33 (Cameron Parish Shoreline).
- Project CS-59 (Oyster Bayou Marsh Creation and Terracing) would be directly impacted by construction of the NER RP marsh restoration measure 124c (**Figure 6**). Project CS-054 (Cameron-Creole Watershed Grand Bayou Marsh Creation) would be directly impacted by construction of the NER RP marsh restoration measure 3c1 (**Figure 7**). Due to the close proximity, the proposed NER RP measures would be constructed to avoid existing coastal restoration project by construction of temporary containment/exclusion dikes that would contain dredged borrow sediments used for construction of the NER RP measure and also prevent dredged effluents from entering the existing coastal restoration project sites. Temporary containment/exclusion dikes would be allowed to degrade naturally to restore connectivity with surrounding areas or they would be degraded by the NFS the third year following completion of construction, whichever occurs first.

Mitigation Projects Directly Impacted by the NER RP Measures: In addition to above cited coastal restoration projects, existing mitigation projects, identified by Mitigation Manger Kelley Templet with the LADNR, Office of Coastal Management, were constructed by various companies (e.g., oil and gas, Union Pacific, and others) and are designed and constructed to offset unavoidable anticipated losses to wetlands from permitted activities.

Figure 8 and **Table 4** contain information about mitigation projects that occur within the project area. In most instances, these mitigation projects were developed to provide a sustainable buffer from wave action and storm surge generated by tropical storms and hurricanes. Where overlap occurs, proposed NER RP measures would not be constructed until the mitigation projects satisfy their permit obligations.

Fact Sheets located in Appendix K of the Integrated Final Report and EIS contain additional NER RP measure details, description of construction equipment, and quantities and types of fill to be placed in wetlands. *The proposed action itself consists of measures to minimize the adverse effects of storm water erosion and thus requires no separate measures or controls for compliance with CWA Section 402(p) and LAC 33:IX.2341.B.14.j.*

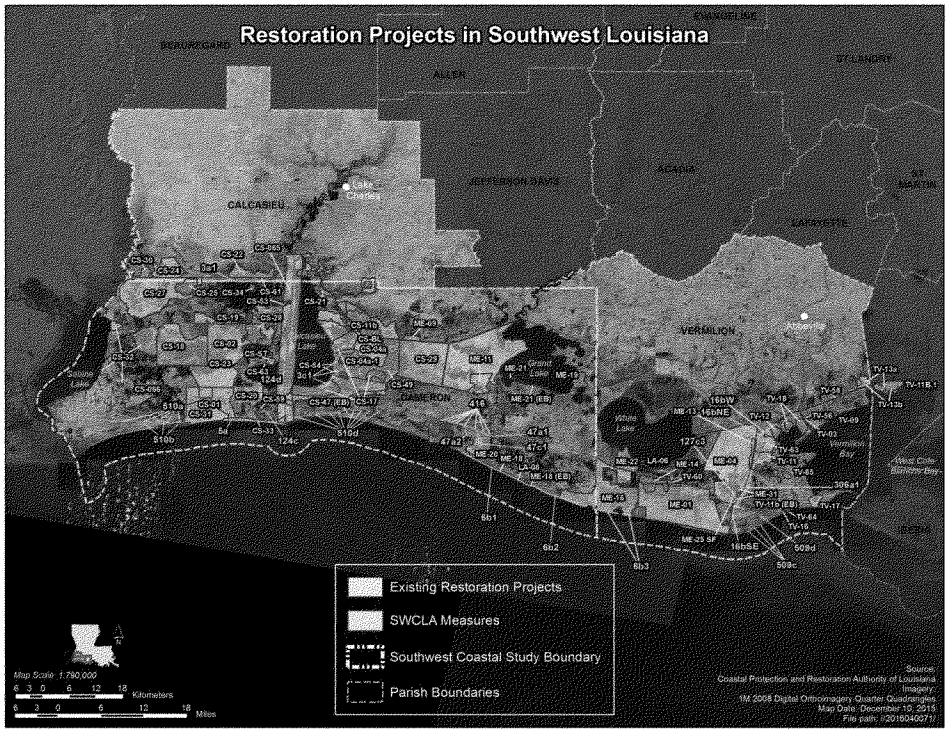


Figure 5. Ecosystem Restoration Activities and proposed NER RP Projects in Southwest Coastal Louisiana Project Area.

JA 37-899 236 10/04/2019

Table 3. List of Ecosystem Projects Displayed in Figure 3-1. (*projects would be impacted/benefitted by the NER RP measures)

CS-01 Holly Beach Breakwaters Project CS-02 Rycade Canal Marsh Management CS-04a Cameron-Creole Maintenance CS-04a-1 Cameron-Creole Structure Automation CS-11b Sweet Lake/Willow Lake Hydrologic Restoration CS-17 Cameron Creole Plugs CS-18 Sabine National Wildlife Refuge Erosion Protection CS-19 West Hackberry Vegetative Planting Demo CS-20 East Mud Lake Marsh Management CS-21 Highway 384 Hydrologic Restoration CS-22 Clear Marais Bank Protection CS-23 Replace Sabine Refuge Water Control Structures CS-24 Perry Ridge Shore Protection CS-25 Plowed Terraces Demonstration CS-27 Black Bayou Hydrologic Restoration CS-28-1 Sabine Refuge Marsh Creation, Cycle 1 CS-28-2 Sabine Refuge Marsh Creation, Cycle 2 CS-28-3 Sabine Refuge Marsh Creation, Cycle 3 CS-28-4-5 Sabine Refuge Marsh Creation, Cycles 4-5 CS-29 Black Bayou Culverts Hydrologic Restoration CS-30 GIWW - Perry Ridge West Bank Stabilization *CS-31 Holly Beach Sand Management (impacted by NER RP Measure 5a) CS-32 East Sabine Lake Hydrologic Restoration *CS-33 Cameron Parish Shoreline Restoration (impacted by NER RP Measure 5a) CS-34 Marcantel Supplemental Beneficial Use Disposal Area CS-47 Trosclair Road Repairs CS-49 Cameron-Creole Freshwater Introduction CS-53 Kelso Bayou Marsh Creation	CS-53 Kelso Bayou Marsh Creation *CS-54 Cameron-Creole Watershed Grand Bayou Marsh Creation (impacted by NER RP Measure 3c1) *CS-59 Oyster Bayou Marsh Creation and Terracing (impacted by NER RP Measure 124c) CS-61 Brannon Ditch CS-63 Sabine Shellbank Stabilization CS-65 Calcasieu Ship Channel Salinity Controls CS-66 Cameron Meadows Marsh Creation and Nourishment CS-BL Blind Lake CS-ST Sabine Terraces LA-06 SP Foundation Improvements Demo LA-08 Bio-Engineered Oyster Reef Demo ME-01 Pecan Island Freshwater Introduction ME-04 Freshwater Bayou Wetland Protection ME-09 Cameron Prairie National Wildlife Refuge Shoreline Protection ME-11 Humble Canal Hydrologic Restoration ME-13 Freshwater Bayou Bank Stabilization ME-14 Pecan Island Terracing ME-16 Freshwater Introduction South of Highway 82 ME-18 Rockefeller Refuge Gulf Shoreline Stabilization ME-19 Grand-White Lakes Landbridge Protection ME-20 South Grand Chenier Marsh Creation ME-21 Grand Lake Shoreline Protection ME-22 South White Lake Shoreline Protection ME-25 Marsh Creation Near Freshwater Bayou ME-31 Freshwater Bayou Marsh Creation	TV-03 Vermilion River Cutoff Bank Protection TV-09 Boston Canal/Vermilion Bay Bank Protection TV-11 Freshwater Bayou Bank Protection TV-11b Freshwater Bayou Bank Stabilization TV-11b.1 Acadiana Gulf of Mexico Access Channel TV-12 Little Vermilion Bay Sediment Trapping TV-13a Oaks/Avery Canal Hydrologic Restoration, Increment 1 TV-13b Oaks/Avery Structures TV-16 Cheniere Au Tigre Sediment Trapping Demonstration TV-17 Lake Portage Land Bridge TV-18 Four Mile Canal Terracing and Sediment Trapping TV-56 Four-Mile Canal Storm Surge Reduction Construction TV-58 Boston Canal TV-60 Front Ridge Chenier Terracing/Protection TV-63 Cole's Bayou Restoration TV-64 Cheniere au Tigre TV-65 Rainey Audubon Wildlife Sanctuary Earthen Terraces

JA 37-899 237 10/04/2019

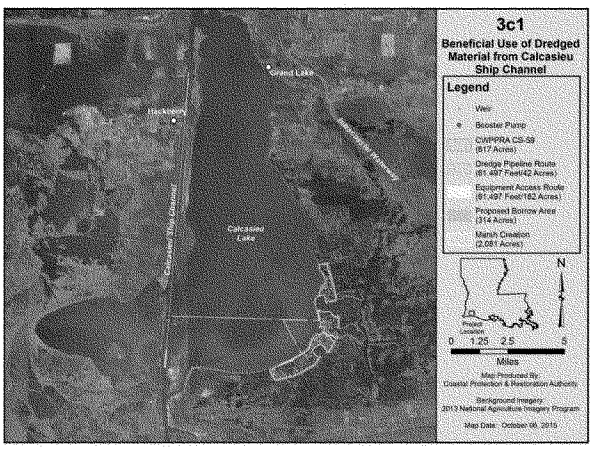


Figure 6. NER RP Measure 3c1 Adjacent to CWPPRA Project CS-54 Cameron Creole Watershed

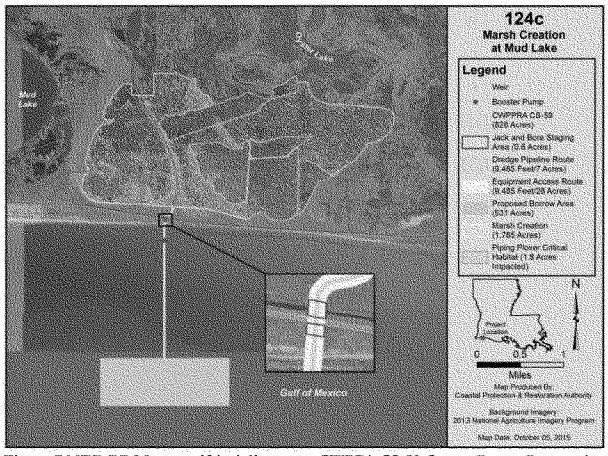


Figure 7 NER RP Measure 124c Adjacent to CWPPA CS-59 Oyster Bayou Restoration

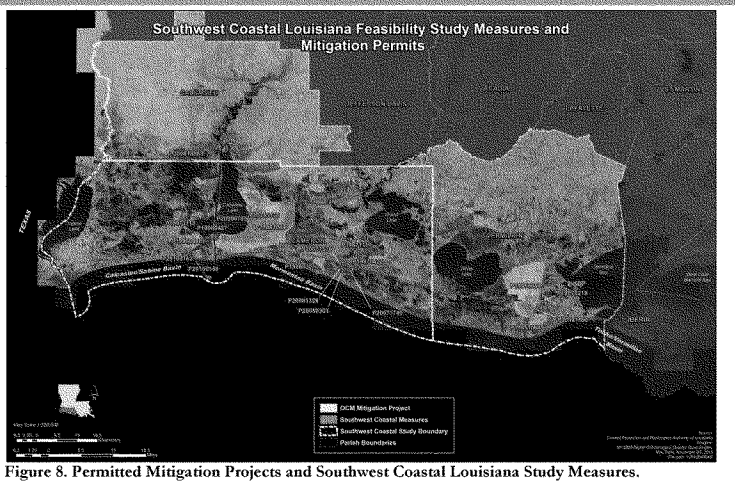


Figure 8. Permitted Mitigation Projects and Southwest Coastal Louisiana Study Measures.

Table 4: Mitigation Projects that Overlap with NER RP Features.

Permit #	Description	NER RP Feature	Permittee or Owner	Expiration Date (permit completion date + 20 years)	Mitigation Project Description
Tier I Features					
P20061888	Terraces at GIWW N of Black Lake	3a1	Gulfport Energy Corporation	11/30/2032	Proposed construction of 5,358 linear ft of terraces south of the GIWW and north of Black Lake.
P19900448	Marsh Management Plan area	124d	Apache Louisiana Minerals	11/13/2016	Install and maintain water control structures for CTU 1 and 2. In CTU 1, 64,000 linear ft of smooth cordgrass plantings. In CTU 2, 32,470 linear ft of boundary levee are to be repaired. Various water control structures are to be repaired or replaced.
P19971118	West Cove Planting Project	124d	Union Pacific Resources	7/28/2022	West Cove Planting Project; 5,000 ft of plantings of *Spartina alterniflora*.
P19950086	Marsh Management Plan area	127c3	Vermilion Corporation	4/1/2021	Eight water control structures will be installed; a riprap levee will be constructed; five double flapgated culverts and one earthen plug will be installed; two earthen plugs will be constructed.
Tier II Features					

P20141590	Spoil Placement	306a1	Hilcorp Energy Company	4/8/2040	Dredging of 15,430 cubic yards of native material to construct slip for the purpose of installing a drill rig, well protector and pilings. The dredged material will be pumped into a shallow pond adjacent to the proposed drill site using a temporary discharge pipe. An additional 301 cubic yards of material will be displaced to construct containment berms.
Tier III Features					
P20090785	Spoil disposal/levee restoration	3c1	Cameron Parish Drainage District #3	8/13/2034	Consists of five water control structures and 17.1 miles of earthen levee (CWPPRA Project CS-04A-L Phase II).
P20141138	Rip-rap Grand Bayou	3c1	CPRA	1/29/2040	Installation of 21,000 tons of riprap along the Calcasieu Lake Shoreline near the Peconi, Mangrove and Grand Bayou water control structures.
P19870422	Marsh Management Plan area	47a2	T. Bonsall	2/3/2023	Construction of a levee and multiple water control structures (South of Upper Mud Lake).
P20031576	Mitigation for P20031304	47a2	Kash Oil & Gas, Inc.	3/31/2029	Constructed 4,803 linear feet of terraces and planted with *Spartina alterniflora*.
P20081326	Mitigation for P20080132	47a2	PetroQuest Energy, L.L.C.	11/25/2033	Construct and plant 2,897 linear ft of wave dampening terraces that will capture re-suspended sediments and protect fragile shorelines by planting plugs of smooth cordgrass on both sides of constructed terraces.
P20071745	Mitigation for 20070883	47c1	Manti Operating Company	3/5/2025*	Construction of ten 500-foot terraces, eight 300-foot terraces, two 200-foot terraces and eight 400-foot terraces (6.1 acres). Plantings of *Spartina alterniflora* rows on each side of the terraces.

c. Authority and Purpose.

Study Authority
An investigation for additional hurricane storm damage risk reduction and related purposes was authorized by a Resolution of the Committee on Transportation and Infrastructure, U.S. House of Representatives, Docket 2747, on December 7, 2005, which included consideration of a plan for an armored 12-foot levee along the Gulf Intracoastal Waterway (GIWW) across Calcasieu, Cameron, and Vermilion Parishes.

CEMVN initiated the Section 905(b) reconnaissance study in April 2006. NED alternatives to mitigate for hurricane-induced damages within Calcasieu, Cameron, and Vermilion Parishes were formulated through a series of planning meetings with the State of Louisiana, local parishes, and other stakeholders. Structural, nonstructural, and coastal restoration measures were considered; however, the economic analysis focused on NED benefits only. The 905(b) reconnaissance study found sufficient Federal interest to conduct a feasibility study and was approved to advance to the feasibility phase in 2007.

The investigation of large scale ecosystem restoration concepts, including the Chenier Plain Freshwater Management and Allocation Reassessment Study (Chenier Plain Study), was recommended in the January 31, 2005 Chief's Report for the LCA, Ecosystem Restoration program. The Chenier Plain Study was one of six large-scale restoration concepts that were purported to have the ability to "significantly restore environmental

conditions that existed prior to large-scale alteration of the natural ecosystem" upon construction. The LCA program was authorized in Title VII of WRDA 2007. Guidance provided by the Director of Civil Works on December 19, 2008 states that "*the coastal restoration components proposed as part of the LCA Chenier Plain study will be evaluated as part of the Southwest Coastal Louisiana feasibility study*". A Feasibility Cost Share Agreement between USACE and the Louisiana Coastal Protection and Restoration Authority Board (CPRAB) as the non-Federal Sponsor was executed on January 14, 2009 for the study and analysis of the NED and NER study alternatives.

Study Purpose
The study purpose is to evaluate coastal storm flood damages and coastal ecosystem degradation in Cameron, Calcasieu, and Vermilion parishes in Louisiana. The intent is to develop potential solutions to these water resource problems.

d. General Description of Dredged or Fill Material

(1) General Characteristics of Material. (grain size, soil type)
The borrow material to be dredged for the nine marsh restoration measures is characterized primarily as silt and clay, with varying amounts of organic material and sands. For shoreline protection measures, the fill material would be rock (200-pound gradation) and geotextile fabric.

(2) Quantity of Material. (cubic yards)
See **Tables 2a, 2b,** and **2c,** attached Fact Sheets describing NER measures and Appendix K for project measure details. **Table 5** presents the borrow site dimensions.

Table 5. Southwest Coastal Louisiana Study Borrow Site Dimensions

Marsh Restoration Measures	Length by Width (ft)[1]	Borrow Area (acres)	Borrow Area Cut depth (ft)	Access Route Length by Width (ft)	Access Route Area (acres)	Access Route Cut Elevation (ft)[2]
3a1	USACE authorized channel dimensions			No dredging required for access		
3c1	USACE authorized channel dimensions			3,500 x 96	7.7	-8
47a1, 47a2, 47c1[3]	4,922 x 14,855	1,679	-15	10,000 x 96	22	-8
124c	2,937x7,880	531	-15	4,000 x 96	8.8	-8
124d	USACE authorized channel dimensions	USACE authorized channel dimensions		21,453 x 96	47.3	-8
127c3[4]	11,516 x 18,655	4,932	-15	1,400 x 96	2.2	-8
306a1[4]	11,516 x 18,655	4,932	-15	No dredging required for access		

[1]- Impacts to the shoreline due to the off shore borrow areas would be modeled in the PED Phase. Presently all off shore borrow areas were delineated, based on previous engineering experience, to have no significant impacts to the existing shoreline.
[2]-All excavated access routes would be backfilled upon construction completion.
[3]- These restoration features will utilize the same borrow source for construction but at different times.
[4]- These restoration features will utilize the same borrow source for construction but at different times.

(3) Source of Material.
Marsh restoration borrow material would be dredged from a number of off-shore borrow areas and from the Calcasieu Ship Channel (**Figures 9** and **10**). See Fact Sheets in Appendix K for additional measure and borrow area details. Rock material for the shoreline protection measures would be imported from outside the study area and transported via barges from an inland commercial quarry.



Figure 9. NER RP measures, including borrow and access routes in western portion of study area.

JA 37-899 10/04/2019 242



Figure 10. NER RP measures including borrow and access routes in eastern portion of study area.

JA 37-899 10/04/2019 243

e. Description of the Proposed Discharge Site(s)

Proposed marsh restoration measures are located in interior fragmented marshlands throughout the entire study area (**Figures 9** and **10**). Shoreline protection measures are located along the Gulf of Mexico and Freshwater Bayou shorelines (**Figures 9** and **10**). Measure 5a (Holly Beach Shoreline Stabilization-Breakwaters) would be located immediately offshore of the projects CS-31 (Holly Beach Sand Management) and State project CS 33 (Cameron Parish Shoreline). The remaining shoreline protection measures would be located offshore of brackish and saline marsh-dominated shorelines. If no action is taken, the beach and marsh habitats would continue to be subjected to the prevailing erosional processes that would eventually result in a direct loss and conversion of the existing marsh to open water. This marsh loss would reduce available marsh habitat and result in the loss of critical habitat for threatened and endangered species, essential fish habitat, and marsh and barrier beach habitats used by species of special interest. This habitat loss would adversely impact Federally-managed fisheries, other aquatic resources, and diminish the storm-surge protection benefits of the barrier beach and marsh systems.

Material dredged via mechanical dredge for access corridors for construction of the five shoreline protection measures would be temporarily side-cast onto water bottoms immediately adjacent to the temporary access corridor. Following construction, the side-cast material would be returned to the temporary access corridor.

Both the Calcasieu Ship Channel Salinity Barrier measure and the Cameron-Creole Spillway Salinity Control Structure measure are being recommended for additional long term study. Additional modeling and NEPA analysis would be required before implementation of these measures.

(1) Location. (map)

See **Figures 1, 2** and **3** for NER RP measure locations; **Figures 9** and **10** display NER RP measures, borrow sites and access corridors.

(2) Size. (acres)

The size of each NER RP measure is listed in **Tables 2a, 2b,** and **2c**.

(3) Type of Site. (confined, unconfined, open water)

Disposal sites for the marsh restoration are comprised of shallow open-water and fragmented marsh (**Figures 2** and **3**). See also Fact Sheets and Appendix K of the Main Report for measure details of construction.

Disposal sites for the breakwater measures include shallow open water immediately offshore of the Gulf Shoreline (**Figures 2** and **3**). The shoreline protection measures would be placed on existing marsh shorelines (**Figures 2** and **3**).

(4) Type(s) of Habitat.

The nine marsh restoration measures are characterized by shallow open-water, fragmented and degraded emergent marsh which provides low quality wetland habitat. Breakwaters would be located immediately offshore in the Gulf of Mexico waters. The remaining shoreline protection measures would be located offshore of brackish and saline marsh-dominated shorelines. Salinity within the disposal areas is variable due to tidal fluctuation; a variety of marine and freshwater fauna utilize the area. These wetland habitats also function as critical nursery areas for various species of finfish and shellfish. Interior marsh is necessary for the successful completion of the life cycles of several species, and provides detritus that forms the basis of the food chain for organisms utilizing the area.

(5) Timing and Duration of Discharge.

NER RP measures were categorized in to three tiers whereby Tier I measures would be constructed before Tier II, and Tier II measures constructed before Tier III. Tier I measures may be constructed simultaneously because they would not affect the construction of any nearby Tier I project measure. Shoreline protection measures

would be constructed prior to marsh restoration measures in order to provide immediate protection of the storm-vulnerable marsh restoration measures. This approach contributes to the sustainability of the marsh restoration measures. Tier II project measures were so categorized because they utilize the same borrow or staging area, and/or construction of these measures would potentially interfere with construction of a Tier I project measure. Tier II project measures would be constructed contemporaneously as the construction of any one of these project measures would not affect any other project measure within this grouping. Tier III project measures were so categorized because they would utilize the same borrow or staging area, and/or interfered with construction of a Tier II project, and/or interfered with an existing mitigation project. Tier III project measures would be constructed contemporaneously if they would not affect construction of the other project measures within this grouping. In categorizing project measures, it was assumed that all construction funds would be available, multiple construction contracts could be let at one time, and an adequate supply of all materials to facilitate construction. More detailed design and analysis would be conducted during the Preconstruction Engineering and Design (PED) Phase. The construction schedule for completing all project measures is expected to last a total of about 60 months. Dredge spoil retention measures would be constructed prior to discharge of dredged material at marsh restoration sites. Duration of construction for each measure is provided in **Tables 2a, 2b,** and **2c**.

Tier I Projects:

- Holly Beach Shoreline Stabilization – Breakwaters (5a)
- Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou (6b1)
- Fortify Spoil Banks of the GIWW and Freshwater Bayou (16bSE)
- Fortify Spoil Banks of the GIWW and Freshwater Bayou (16bNE)
- Fortify Spoil Banks of the GIWW and Freshwater Bayou (16bW)
- Beneficial Use of Dredged Material from the Calcasieu Ship Channel (3a1)
- Marsh Restoration at Mud Lake (124d)[1]
- Marsh Restoration at Pecan Island (127c3)
- Chenier Ridges: Grand Chenier Ridge (416)[2]
- Restore Bill Ridge (509c)[2]
- Chenier Ridges: Cheniere au Tigre (509d)[2]
- Restore Blue Buck Ridge (510a)[2]
- Restore Hackberry Ridge (510b)[2]
- Restore Front Ridge (510d)[2]

Tier II Projects:

- Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou (6b2)
- Marsh Restoration at Mud Lake (124c)
- Rainey Marsh Restoration Southwest Portion (Christian Marsh) (306a1)

Tier III Projects:

- Beneficial Use of Dredged Material from the Calcasieu Ship Channel (3c1)[1]
- Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou (6b3)
- Marsh Restoration Using Dredged Material South of Highway 82 (47a1)
- Marsh Restoration Using Dredged Material South of Highway 82 (47a2)
- Marsh Restoration Using Dredged Material South of Highway 82 (47c1)

Recommended for Further Study:

- Calcasieu Ship Channel Salinity Control Structure
- Cameron-Creole Spillway Structure

[1]- Recommended for USFWS independent Congressional authorization and appropriation for construction by USFWS
[2]- Individual features that comprise the chenier reforestation measure

f. Description of Disposal Method. (hydraulic, drag line, etc.)
Sediments for the nine marsh restoration measures would be dredged from a number of off-shore borrow areas (see **Figures 9** and **10** and Fact Sheets located in Appendix K of the Integrated Final Report for individual project measure descriptions) and from the Calcasieu Ship Channel (via USACE maintenance dredging). The contractor would use a hydraulic dredge to excavate fill from the available borrow areas or to convey material from Calcasieu Ship Channel that was dredged during CEMVN maintenance dredging events. The fill would then be pumped through a series of booster pumps to the disposal (marsh restoration) areas via submerged sediment pipeline.

II. Factual Determinations

a. Physical Substrate Determinations

(1) Substrate Elevation and Slope.
Dredged borrow sediments used for the nine marsh restoration measures would be placed to achieve a post-construction marsh target elevation of +1.5 feet North American Vertical Datum of 1988 (NAVD88) following dewatering and consolidation. Earthen containment dikes would be constructed of *in situ* material obtained from within the marsh restoration cells with side slopes of no more than 4H:1V with a crown width of approximately 5 feet. The five shoreline protection measures would have varying elevations and slopes ranging from +3.5 feet NAVD88 with 2:1 side slopes to +3.0 feet NAVD88 with 4:1 side slopes. Water bottom substrates dredged for temporary access corridors to the five shoreline protection sites would be temporarily side-cast. Following completion of construction activities, this side-cast material would be returned to the dredged temporary access corridor. The NER RP would utilize the best available practical techniques and BMPs during dredging and construction to avoid and minimize potential adverse impacts to the physical substrate.

(2) Sediment Type
Dredged borrow sediments, taken from a number of off-shore borrow areas and the Calcasieu Ship Channel (see **Figures 9** and **10** and Fact Sheets located in Appendix K of the Integrated Final Report), are composed primarily of silt, with varying amounts of organic material and sand. Detailed grain-size analysis would be performed prior to construction as part of the Preconstruction Engineering and Design (PED) phase. Sediments in the project area are similar to sediments discharged by the Atchafalaya River. Sediment travels westward from Atchafalaya Bay and the GIWW. A large percentage of Atchafalaya River sediments are deposited along the Gulf shoreline in the vicinity of Freshwater Bayou while coarser sediments continue westward along the shoreline. The NER RP would utilize the best available practical techniques and BMPs during dredging and construction to avoid and minimize potential adverse impacts.

(3) Dredged/Fill Material Movement.
Little or no movement of dredged or fill material is anticipated to occur following dewatering and consolidation of sediments used for the nine marsh restoration measures, because of the typically low velocities of water flow across the nine marsh restoration measures, construction of earthen containment dikes within the marsh restoration/nourishment areas, construction of temporary containment/exclusion dikes surrounding existing coastal restoration projects, and the use of best available practical techniques and BMPs during construction.

Rock placed for the five shoreline protection measures is expected to settle initially following construction due to the overburden pressure that the rock would create on underlying unconsolidated substrate. However, placement of geotextile fabric between rock and substrate would help to prevent the complete sinking of the rock over time. Additional placement of rocks during Operations and Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) is anticipated (on the existing footprint) but rocks are not expected to move laterally

following placement. The NER RP would utilize the best available practical techniques and BMPs during dredging and construction to avoid and minimize potential adverse impacts and dredged/fill movement.

(4) Physical Effects on Benthos. (burial, changes in sediment types, etc.)

Dredging and construction activities would have localized effects on benthos. The factors primarily responsible could include increased turbidity and total suspended sediments, organic enrichment, chemical leaching, reduced dissolved oxygen, and elevated carbon dioxide levels, among others. Dredging for borrow sediments and temporary access corridors, discharge of dredged borrow sediments and construction of containment/exclusion dikes for the nine marsh restoration measures and to prevent dredged effluent from entering existing coastal restoration projects would smother and destroy immobile benthic organisms and force mobile benthos to move from the borrow and discharge areas. It is expected, however, that benthic organisms would re-colonize the borrow sites and the discharge sites within 1-3 years due to its similarity with the existing substrate in the disposal areas (Wilber et al 2008). The conversion of shallow open-water and fragmented marsh to restored contiguous marsh would temporarily preclude larger aquatic organisms from initially re-entering the disposal area. Smaller organisms would, however, be able to access the newly restored marsh during high tides. Temporary containment/exclusion dikes would naturally degrade or would be breached in multiple places at three years following construction, if necessary, to restore aquatic organism and fish access if natural degradation is not sufficient. Breach locations would correspond to weir locations. Following dredging and construction, dredged sediments would consolidate and differentially settle to different elevations thereby resulting in development of lower-lying areas that would develop into small ponds and streams further enabling aquatic organism access from surrounding waters. Wetlands throughout coastal Louisiana and the study area have been fragmenting, degrading and being loss at significant rates. Therefore, restoring marsh is considered to have a higher ecological value than shallow open-water because of its benefits to terrestrial and aquatic organisms in an area with decreasing wetland habitats.

Dredging temporary access corridors, the placement of geotextile fabric and rock for shoreline protection would smother sessile and slow moving benthic organisms and force mobile organisms to move from the disposal areas. The rock and geotextile fabric, by design, covers benthic subtidal sediments; hence, infauna would likely be absent. However, rock would provide substrate for epifaunal colonization (Bilkovic and Mitchell 2013). The NER RP would utilize the best available practical techniques and BMPs during dredging and construction to avoid and minimize potential adverse impacts and dredged/fill movement.

(5) Other Effects.

No other physical substrate determinations.

(6) Actions Taken to Minimize Impacts.

Dredged sediments would be placed at the nine marsh restoration sites to achieve a post-construction marsh target elevation to achieve of +1.5 feet NAVD88, following dewatering and consolidation. During construction of the nine marsh restoration sites, effluent from dewatering would be discharged into adjacent wetlands via spill box weirs. Earthen containment/exclusions dikes would be constructed from *in-situ* material located within the marsh restoration/nourishment area using a mechanical (clamshell or bucket) dredge. Access for the mechanical dredge would be via the designated pipeline corridors. Borrow areas used for construction of earthen containment/exclusion dikes would be refilled during the placement of dredged material for marsh restoration. One foot of freeboard for containment/exclusion dikes would be maintained at all times during dredge discharge operations. Containment/exclusion dikes would be breached in multiple places three years following construction, if necessary, to restore fish access if natural degradation is not sufficient. Breach locations would correspond to weir locations or most appropriate.

Construction of the five shoreline protection measures and placement of rock and geotextile fabric would utilize the best available practical techniques and BMPs to avoid and minimize potential adverse impacts to surrounding aquatic and terrestrial environment. Geotextile fabric would be placed to reduce subsidence of placed rock, and rock would be placed with a barge-mounted crane to increase precision of placement.

b. Water Circulation, Fluctuation, and Salinity Determinations

(1) Water

(a) Salinity

The Louisiana coastal area is horizontally stratified with water salinities decreasing gradually from the coast inland (Gosselink 1984). Dredging borrow sites, construction of temporary access corridors, the nine marsh restoration measures and the five shoreline protection measures would have little, if any, effects on local or basin-wide salinity. The proposed action would not significantly alter existing waterways or other water movement patterns. Sediments and dredge effluent taken from off-shore borrow areas (see Fact Sheets) and placed at interior disposal marsh restoration areas may have higher salinities compared to the saline marsh restoration sites. However, any differences would likely be minimal and the dredged effluent and higher saline borrow sediments would rapidly desalinate to those ambient salinity conditions following dewatering and consolidation of sediments. Borrow areas would be configured so that stratification would be minimized by orienting the long axis of each borrow area parallel to the Gulf shoreline and with side slopes no steeper than 4(H):1(V).

Construction of shoreline protection measures would not result in localized changes to salinities for the areas immediately behind the shoreline protection measure because these areas would retain connectivity to protected waters through the placement of gaps in the shoreline protection structures to allow hydrologic connectivity. Shoreline protection structures would not provide a hydraulic barrier to the exchange of waters; rather, these structures would reduce wave erosion. Any potential adverse impacts would be minimized and controlled by utilizing the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to salinity.

(b) Water Chemistry. (pH, etc.)

Construction activities, hydraulic dredging and placement of sediments and other fill materials can result in a localized and temporary reduction in the pH of receiving area waters toward more acidic conditions. The factors responsible include increased turbidity, organic enrichment, chemical leaching, reduced dissolved oxygen, and elevated carbon dioxide levels, among others. Tidal currents present in the project measure areas would serve to disperse and thereby dilute localized changes to pH. Following construction, pH levels in the area would return to those observed prior to measure construction. Any such impacts would be minimized and controlled by utilizing the use of the best available practical techniques and BMPs. The proposed action would have no significant long-term adverse impacts to water chemistry. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to water chemistry.

(c) Clarity

Dredging, placement of dredged sediments, and construction activities in the nine marsh restoration measures would temporarily reduce water clarity due to increased turbidity and suspended sediments. Containment of the dredged material and management of the effluent would minimize impacts to water clarity outside of the disposal areas. The placement of rock for the five shoreline protection measures is expected to result in the disturbance of water bottom, causing a minor, temporary, and localized increase in turbidity levels and decrease in water clarity. Following construction activities, turbidity levels and water clarity in the vicinity of measures would return to those which existed prior to construction activities. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to clarity.

(d) Color.

Construction activities, dredging and placement of dredged sediments in the nine marsh restoration measures, and placement of geotextile fabric and rock for the five shoreline protection measures may temporarily change water color. Turbidity levels and suspended sediment levels are expected to temporarily increase at the

construction site until construction is completed. Following completion of construction activities, affected waters would clarify and the water color would return to conditions observed prior to construction.

The disturbance of water bottom substrate during placement of rock and geotextile fabric for the five shoreline protection measures may result in temporary and localized changes to water color. In addition, because shoreline protection would serve to reduce wave erosion, some minor changes to water color in areas protected by the rock breakwaters are expected, as the rock would serve to significantly reduce the wave energy-driven resuspension of water bottom substrate for those areas. Any such impacts would be minimized by the use of the best available practical techniques and BMPs. Following completion of construction activities color conditions would return to those observed prior to construction. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to color.

(e) Odor.

Construction and dredging activities of reduced sulfur-bearing sediments, typical of estuarine marshes, can result in the emission of reduced sulfur compounds including hydrogen sulfide, often characterized as an objectionable rotten-egg smell. However, these emissions would likely occur infrequently, at low levels and are not expected to be significant or detectable by any sensitive human occupied areas. There would be no expected odors detectible outside of the dredged borrow sites, temporary access corridors, nine marsh restoration measures and five shoreline protection measures construction areas. Following completion of construction activities, odors in the vicinity of project measures would return to those which existed prior to construction activities. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to odor.

(f) Taste.

During construction and dredging activities there could be a release of sulfur compounds from sediments; increased turbidity, total suspended sediments, and water temperatures; and decreased oxygen which could likely cause changes to water taste within and immediately adjacent to construction sites. However, there are no human water intakes or other human consumption of waters activities located within or adjacent to any of the project measures. Any change in taste is not expected to be detectable to any nearby human inhabitants. Following construction activities, water taste in the vicinity of measures would return to that which existed prior to construction activities. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to taste.

(g) Dissolved Gas Levels.

The biological and chemical content of suspended materials released during dredging, discharge and other construction activities may react with the dissolved oxygen in the water, which can result in temporary and localized, but minor oxygen depletions and a release of ammonia. The introduction of organic material to the water column as a result of discharge can lead to temporary and localized, but minor, high biochemical oxygen demand (BOD) which in turn can lead to temporary and localized, but minor, reduced dissolved oxygen thereby potentially affecting the survival of many aquatic organisms. Decomposition of organic material within the nine marsh restoration measures following discharges of dredged sediments may result in temporary and localized, but minor, reduction in dissolved oxygen and a release of ammonia. Following completion of construction activities, dissolved gas levels in the vicinity of these measures would return to that which existed prior to construction activities.

Placement of rock and geotextile fabric for the five shoreline protection measures may result in disturbances of water bottom substrate along the footprint of the measures. Because of organic material contained within the bottom substrate, this disturbance may result in minor, localized, and short-term reductions in dissolved oxygen levels and ammonia. Tidal currents are expected to quickly disperse waters affected by construction of these measures, such that no significant impacts to dissolved oxygen levels are anticipated. Following completion of construction activities, dissolved gas levels in the vicinity of these measures would return to that

which existed prior to construction activities. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to dissolved gas levels.

(h) Nutrients.

Dredged sediments excavated from the borrow sites would contain low but variable concentrations of organic material adsorbed or complex plant nutrient compounds which, if available for biological uptake and use, can lead to eutrophication. However, nutrients released from sediments resuspended during dredging operation have given mixed results as to their ability to stimulate algal growth. However, as these releases are expected to be minor, and because there is expected to be adequate flows and sufficient dissolved oxygen levels in the water column for converting ammonia into non-toxic nitrate, any effects associated with dredging and construction activities associated with these measures are expected to be minor and temporary and nutrients within the water column would rapidly cease following construction. Following completion of construction activities, nutrients within the water column in the vicinity of these measures would return to that which existed prior to construction activities.

Construction activities involving placement of rock and geotextile fabric for the five shoreline protection measures can result in the disturbance of water bottom substrate, which may expose variable levels of organic material to resuspension in the water column, and also resulting in the release of nutrient compounds However, as these releases are expected to be minor, and because there is expected to be sufficient dissolved oxygen levels in the adjacent waters for converting ammonia into non-toxic nitrate, any effects associated with construction activities associated with these measures are expected to be localized and short-lived and would return to nutrient levels that which existed prior to construction activities. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to nutrients.

(i) Eutrophication.

Dredged sediments could contain low but variable concentrations of organic material, and sufficient quantities of ammonia, nitrogen and phosphorous compounds which, if released in available forms during dredging and construction operations, could stimulate the growth of algae and other aquatic plants. Decomposition of organic material within the nine marsh restoration measures following discharges of dredged material may result in a release of ammonia. While ammonia and nitrate may stimulate phytoplankton production, adverse or persistent algal blooms are not expected during construction. Following completion of construction activities, potential for eutrophication in the vicinity of these measures would return to that which existed prior to construction activities.

Placement of rock and geotextile fabric for the five shoreline protection measures could result in the disturbance of water bottom substrate, which may expose variable levels of organic matter, nitrogen and phosphorus to the water column, resulting in the release of minor amounts of these compounds into the water column. While ammonia and nitrate may stimulate phytoplankton production, adverse or persistent algal blooms are not expected during construction. Following completion of construction activities, nutrients within the water column in the vicinity of these measures would return to that which existed prior to construction activities. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts of eutrophication.

(j) Others as Appropriate.

No other water circulation, fluctuation, or salinity determinations.

(2) Current Patterns and Circulation

(a) Current Patterns and Flow.

Dredging and construction of the access corridors, the nine marsh restoration measures and the five shoreline protection measures can significantly change local current patterns and local water circulation. The higher substrate elevations resulting from marsh restoration of shallow open water and fragmented marsh areas may

slightly reduce and modify local throughput (current patterns and flow) of water over the footprint of each of these measures. However, overall basin current patterns and flows would be similar to that which existed prior to the widespread coastal marsh fragmentation, degradation, and loss we are currently experiencing.
The five shoreline protection measures are designed to reduce wave erosion of shorelines and back marsh areas. In addition shoreline protection measures would include fish dips which would allow water flows to proceed unimpeded by these measures. Shoreline protection measures would also reduce shoreline erosion by moderating the wave erosion caused by wind, tidal, and other current patterns, water circulation and flows. These impacts are considered positive and would provide protection of back marsh lands in an otherwise degrading marsh area. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to current patterns and flows.

(b) Velocity.

Dredging and construction of access corridors, the nine marsh restoration measures and the five shoreline protection measures could significantly reduce localized water velocities in the immediate vicinity of the these measures and to a lesser extent on adjacent marsh and shorelines.

Elevations of the nine marsh restoration measures, about +1.5 feet NAVD 88, would reduce water velocities compared to velocities found in adjacent existing shallow open water and fragmented marsh area. The five shoreline protection measures, by design, would reduce water velocities and protect back marsh areas from wave induced erosion. However, the shoreline protection would be segmented with lower elevated fish dips that would provide access for fish and other aquatic organisms as well as for waters to infiltrate to interior portions of the created marshlands. The positive impacts of the shoreline protection measures is to reduce the waves and velocities from eroding and further degrading shorelines and back marsh areas and are therefore considered positive in an overall degrading coastal marsh system. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts of water velocities.

(c) Stratification.

The Louisiana coastal area is horizontally stratified with sediment and water salinities decreasing gradually from the coast inland (Gosselink 1984). The larger tidal passes at the Gulf of Mexico typically display salinity stratification in these deeper waterways. However, within the numerous shallow waterbodies and marsh areas throughout the Chenier Plain, there is little salinity stratification (Miller and Meselhe 2007). Dredging and disposal, and other construction activities associated with the access corridors, the nine marsh restoration measures and the five shoreline protection measures would not cause stratification of waters or any associated adverse impacts of hypoxia in the vicinity of the project measures. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to stratification.

(d) Hydrologic Regime.

Hydrologic regimes are dependent on climatic, wind, terrain, vegetation, and other hydrologic conditions. Dredging and construction of the access corridors, the nine marsh restoration measures and the five shoreline protection measures would not significantly alter the existing hydrologic regime.

Construction of the NER RP measures would be localized and would displace existing shallow open water and fragmented marsh areas by restoring and nourishing marsh and providing shoreline protection. NER RP measures would act primarily as a roughness factor on local flows and waves but would otherwise have no significant effects on the hydrologic regime of the area. Acting as a roughness factor, the higher substrate elevations resulting from restoration and nourishment of the nine marsh restoration measures in shallow open water and fragmented marsh areas may slightly reduce throughput of water over the footprint of these measures. By design, the five shoreline protection measures would reduce wave erosion. However, the localized changes to water flows and reduction of erosive wave impacts in a degrading coastal marsh ecosystem are considered positive effects in an otherwise degrading coastal marsh ecosystem. The NER RP would utilize the

best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts.

(3) Normal Water Level Fluctuations.

Dredging and construction of the access corridors, the nine marsh restoration measures and the five shoreline protection measures would not significantly change normal water level fluctuations in the project area. The higher substrate elevations resulting from restoration of marsh land in shallow open water and fragmented marsh areas may slightly reduce throughput (normal water level fluctuations) of water over the footprint of these measures. However, these impacts are considered positive by restoring marsh in a degrading coastal marsh ecosystem.

By design, the five shoreline protection measures would be constructed to reduce the erosive forces of wave action and flows. However, normal water level fluctuations, such as tidal flows, would remain unimpeded by these measures. Hence, these impacts are considered positive due to the protection of shoreline and back marsh lands in an overall degrading coastal marsh ecosystem. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts normal water fluctuations.

(4) Salinity Gradients.

The Louisiana coastal area is horizontally stratified with water salinities decreasing gradually from the coast inland (Gosselink 1984). Dredging and construction of the access corridors, the nine marsh restoration measures and the five shoreline protection measures would not significantly affect salinity gradients.

For the nine marsh restoration measures, the higher substrate elevations resulting from restoration of marsh land in shallow open water and fragmented marsh areas may slightly reduce throughput of waters over the footprint of these measures. However, any such impacts would not change salinity gradients. The positive effects of marsh restoration and nourishment would help to offset the degrading, fragmenting and systemic marsh loss throughout the project area.

The five shoreline protection measures, by design, would be constructed to reduce the erosive forces of wave action and flows. However, normal water level fluctuations and salinity gradients would remain unimpeded by these measures. Hence, these impacts are considered positive due to the protection of shoreline and back marsh lands in an overall degrading coastal marsh ecosystem. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to salinity gradients.

(5) Actions That Would Be Taken to Minimize Impacts.

Storm Water Pollution Prevention Plans (SWPPPs) shall be prepared in accordance with good engineering practices emphasizing storm water best available practical techniques and BMPs and complying with Best Available Technology Economically Achievable (BAT) and Best Conventional Pollutant Control Technology (BCT). The SWPPP shall identify potential sources of pollution, which may reasonably be expected to affect storm water discharges associated with the construction activity. In addition, the SWPPP shall describe and ensure the implementation of practices which are to be used to reduce pollutants in storm water discharges associated with the construction activity and to assure compliance with the terms and conditions of this permit.

c. Suspended Particulate/Turbidity Determinations

(1) Expected Changes in Suspended Particulates and Turbidity Levels in Vicinity of Disposal Site.

Dredging and construction of the access corridors, the nine marsh restoration measures and the five shoreline protection measures would result in localized and temporary increases in total suspended particulates and turbidity in the vicinity of the dredge borrow, access corridors, marsh restoration/nourishment and shoreline protection sites. These temporary impacts would be localized and occur primarily due to disturbance of water

bottoms during dredging and construction activities (temporary access corridors, dredging and placement operations for marsh restoration, and placement of rock and geotextile fabric for shoreline protection measures). However, these temporary and localized impacts would be minimized by utilizing the best available practical techniques and BMPs during construction. During marsh restoration, effluent from the dredge discharge pipe would be directed to adjacent fragmented marsh for nourishment. The placement of rock for the shoreline protection measures is expected to result in the disturbance of water bottom, causing a minor, temporary, and localized increase in suspended particulate/turbidity levels. Following dredging and construction activities, suspended particulates and turbidity levels in the vicinity of NER RP measures would return to those which existed prior to construction activities. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to suspended particulates and turbidity levels.

(2) Effects on Chemical and Physical Properties of the Water Column.

(a) Light penetration.

Water column effects, including light penetration, associated with construction activities would be localized and temporary, occurring only during dredging and construction of the access corridors, the nine marsh restoration measures and the five shoreline protection measures. These temporary and localized impacts would include reduction of light penetration due to the increased turbidity and total suspended sediments levees associated with dredging and construction operations. However, these temporary and localized effects would be minimized by utilizing the best available practical techniques and BMPs during construction. During marsh restoration and nourishment, effluent from the dredge discharge pipe would be directed to adjacent fragmented marsh for nourishment. Following dredging and construction, turbidity and total suspended sediment levels would rapidly return to those conditions observed prior to construction thereby resulting in light penetration returning to pre-construction conditions. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts of light penetration.

(b) Dissolved oxygen

Water column effects, including lower dissolved oxygen levels, associated with dredging and construction activities would be localized and temporary, occurring only during dredging, construction of the access corridors, the nine marsh restoration measures and the five shoreline protection measures. Decomposition of organic material within the nine marsh restoration measures following placement of dredged material may result in a temporary and localized reduction of dissolved oxygen.

Placement of rock for the five shoreline protection measures may result in disturbances of water bottom substrate along the footprint and in the immediate area of the measures during construction. Because of organic material contained within the substrate, this disturbance may result in minor, localized, and short-term reductions in dissolved oxygen levels. Once construction is complete, tidal currents are expected to quickly disperse waters affected by these measures, such that no significant impacts to dissolved oxygen levels are anticipated.

These temporary and localized impacts of decreased dissolved oxygen would be minimized and controlled by utilizing the best available practical techniques and BMPs during construction. During marsh restoration and nourishment, effluent from the dredge discharge pipe would be directed to adjacent fragmented marsh for nourishment. Following construction dissolved oxygen conditions would return to those observed prior to construction. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to dissolved oxygen.

(c) Toxic metals and organics.

A Phase I environmental site assessment of the NER RP project area was conducted in accordance with applicable sections of the American Society for Testing and Materials (ASTM) Standard E1527-13, Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process; ASTM Standard E2247-08, Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment

Process for Forestland or Rural Property; the U.S. Environmental Protection Agency (USEPA) 40 CFR Part 312 Standards and Practices for All Appropriate Inquiry, Final Rule; and BEM's scope of work dated December 16, 2014 to assess for the presence of Hazardous, Toxic, and Radioactive Wastes (HTRW) within the ASTM E1527-13 recommended approximate minimum search distance of 1 mile from the NER RP restoration measures. The majority of the recognized environmental conditions and areas of environmental concern within the project area are located: 1) adjacent to Highway 82 on the east side of Grand Chenier and from the right descending bank of the Calcasieu Ship Channel east to Highway 27 and in the northern vicinity of Hackberry adjacent to Highway 27; 2) along Freshwater Bayou. However, records indicate that the majority of these sites have been cleaned, remediated, and closed. Based on the Phase I environmental site assessment, the proposed restoration activities within the NER RP project area would likely result in the "capping" of any potentially impacted areas through the placement of overlying materials that may include dredged sand and sediment, rocks, and placement of reinforced structures. This action would potentially minimize future recognized environmental conditions and environmental concerns from existing petroleum or metal-impacted sediment through the placement of the overlying dredged materials.

Water column effects, including toxic metals and organics, associated with dredging and construction activities could be temporary, localized and occur only during dredging and construction of the access corridors, the nine marsh restoration measures and the five shoreline protection measures. Decomposition of organic material within the disposal areas following placement of dredged material may result in a temporary and localized release of ammonia. These temporary and localized impacts would be minimized and controlled by utilizing the best available practical techniques and BMPs during construction. During marsh restoration, effluent from the dredge discharge pipe would be directed to adjacent fragmented marsh for nourishment. Following construction, toxic metals and organics conditions would return to those observed prior to construction. Material to be used for marsh restoration and material to be excavated for temporary access corridors for the shoreline protection measures is being obtained from offshore water bottoms and the Calcasieu Ship Channel. Some temporary access corridor dredging may be required in Calcasieu Lake, which would be along existing authorized access channels. Initial evaluation of Environmental Database Reviews for the project area indicate no recognized environmental conditions (e.g., unmitigated oil spills or other activities), in the borrow areas, temporary access corridors, or placement areas that would preclude project implementation. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts of toxic metals and organics.

(d) Pathogens.

Water column effects, including release of pathogens associated with dredging and construction activities could be temporary, localized and occur only during dredging and construction of the access corridors, the nine marsh restoration measures and the five shoreline protection measures. These temporary and localized impacts would be minimized and controlled by utilizing the best available practical techniques and BMPs during construction. During marsh restoration, effluent from the dredge discharge pipe would be directed to adjacent fragmented marsh for nourishment. Following construction, any pathogens released would return to those observed prior to construction. No significant short or long term effects on water column pathogens are anticipated from the dredged/fill material disposal activities. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts of pathogens.

(e) Aesthetics.

Water column effects, including aesthetics, associated with construction activities could be temporary, localized and occur only during dredging and construction of the access corridors, the nine marsh restoration measures and the five shoreline protection measures. The primary aesthetic effects would be primarily associated with dredging construction activities resulting in temporary and localized turbid waters and emission of reduced sulfur compounds including hydrogen sulfide, often characterized as an objectionable rotten-egg smell. However, these emissions would likely occur infrequently, at low levels and are not expected to be significant or detectable by any sensitive human occupied areas. There would be no expected odors detectible outside of the dredged borrow sites, temporary access corridors, nine marsh restoration measures and five shoreline

protection measures construction areas. Following completion of construction activities, odors in the vicinity of project measures would return to those which existed prior to construction activities. Any such impacts would be minimized and controlled by utilizing the use of the best available practical techniques and BMPs. During marsh restoration, effluent from the dredge discharge pipe would be directed to adjacent fragmented marsh for nourishment. Following construction, aesthetics conditions would return to those observed prior to construction. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to aesthetics.

(f) Others as Appropriate.

Water column effects, including particulate matter, associated with dredging and construction activities would be significant but temporary and localized in nature and occur only during dredging and construction of the access corridors, the nine marsh restoration measures and the five shoreline protection measures. These temporary and localized impacts would be minimized and controlled by utilizing the best available practical techniques and BMPs during construction. During marsh restoration, effluent from the dredge discharge pipe would be directed to adjacent fragmented marsh for nourishment. Following construction other effect conditions, including particulate matter, would return to those observed prior to construction. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impact.

(3) Effects on Biota.

(a) Primary production, photosynthesis.

Potential adverse effects on biota, including primary production photosynthesis, could be primarily associated with increased turbidity and total suspended sediments, increased water temperature and lower dissolved oxygen during dredging and construction activities of the access canals, the borrow sites, the nine mash restoration measures and the five shoreline protection measures. Any such adverse effects would generally be temporary and localized. Increased turbidity and total suspended sediments, increased water temperature and lower dissolved oxygen could result in temporary and localized reduction of photosynthesis due to blocking of sunlight into the waters. However, these temporary and localized effects would be minimized and controlled by utilizing the best available practical techniques and BMPs during construction. During marsh restoration, effluent from the dredge discharge pipe would be directed to adjacent fragmented marsh for nourishment. Following dredging and construction, turbidity levels, total suspended sediments, water temperatures, and dissolved oxygen levels would return to that observed prior to construction. Consequently, primary production and photosynthesis conditions would return to that observed prior to construction. It is anticipated that primary production and photosynthesis would show localized increases at the nine marsh restoration sites. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to biota.

(b) Suspension/filter feeders.

Potential adverse effects on biota, including suspension and filter feeders, could be primarily associated with increased turbidity and total suspended sediments, increased water temperature and lower dissolved oxygen during dredging and construction activities of the access corridors, the borrow sites, the nine marsh restoration measures and the five shoreline protection measures. Any such effects would generally be temporary and localized. During dredging and construction activities, dredging temporary access corridors, dredging and placement of dredged sediments for the nine marsh restoration measures and placement of geotextile fabric and rock for the five shoreline protection measures would smother sessile and immobile suspension/filter feeders and force more mobile organisms to move from the disposal/construction areas. However, it is expected that benthic suspension/filter feeders would re-colonize the newly deposited dredged material at marsh restoration sites within 1-3 years due to its similarity with the existing substrate in the disposal areas. The conversion of shallow open-water to marsh habitat would prevent some larger aquatic suspension/filter feeders from immediately re-entering the disposal area (marsh restoration/nourishment sites). However, following dredging and construction activities, suspension and filter feeder organisms would gain access to the newly formed marsh and tidal pools and permeable rocked shoreline protection during normal water flows and tides.

Marsh is considered to have a higher ecological value than shallow open-water in this coastal ecosystem that is presently experiencing widespread coastal land loss.

Dredging and construction could also have additional effects associated with increases in turbidity levels and suspended sediments. This could clog the gills and feeding mechanisms of sessile suspension/filter-feeding organisms and temporarily displace mobile suspension/filter-feeding organisms. These temporary and localized impacts would be minimized and controlled by utilizing the best available practical techniques and BMPs during construction. During marsh restoration, effluent from the dredge discharge pipe would be directed to adjacent fragmented marsh for nourishment. Following construction, suspension/filter feeders conditions would return to those observed prior to construction. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to suspension and filter feeders.

(c) Sight feeders.

Adverse effects on biota, including sight feeders, would generally be temporary, localized and occur only during dredging and construction activities of the access corridors, the nine marsh restoration measures and the five shoreline protection measures. These impacts would include temporary and localized increased turbidity and total suspended sediments, increased water temperature and lower dissolved oxygen. The conversion of shallow open-water to marsh and the displacement of shallow open water and fragmented marsh to geotextile and rock shoreline protection would displace sight feeders. However, following settlement and consolidation of dredged sediments into marsh and following construction of shoreline protection measures, smaller organisms would have access to the newly formed marsh during normal and high tidal fluctuations. These temporary and localized impacts would be minimized and controlled by utilizing the best available practical techniques and BMPs during construction. During marsh restoration, effluent from the dredge discharge pipe would be directed to adjacent fragmented marsh for nourishment. Following construction sight feeders conditions would return to those observed prior to construction. Other effects on biota, including sight feeders, associated with construction activities would be temporary, localized and occur only during construction of the nine marsh restoration measures and five shoreline protection measures. This could include temporary and localized increases in turbidity levels and total suspended sediments from placement of dredged material and geotextile fabric and rock, which could impede the foraging success of sight-feeding organisms. These temporary and localized impacts would be minimized and controlled by utilizing the best available practical techniques and BMPs during construction. During marsh restoration, effluent from the dredge discharge pipe would be directed to adjacent fragmented marsh for nourishment. Following construction sight feeders conditions would return to those observed prior to construction. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to sight feeders.

(4) Actions Taken To Minimize Impacts.

For the nine marsh restoration measures, dredged sediments would be placed to achieve a post-construction target elevation suitable for the establishment of marsh vegetation following dewatering. During construction, effluent from dewatering would be discharged into adjacent wetlands via spill box weirs. Earthen containment/exclusion dikes would be constructed from in-situ material located within the marsh restoration/nourishment area using a mechanical (clamshell or bucket) dredge. Temporary access for the mechanical dredge would be via the pipeline corridor. The borrow area used for construction of the earthen containment/exclusion dike would be within the footprint of the marsh restoration site and would be refilled during the placement of dredged sediments for marsh restoration. One (1) foot of freeboard would be maintained at all times during dredge discharge operations. Containment/exclusion dikes would be breached in multiple places at three years following construction, if necessary, to restore fish access if natural degradation is not sufficient. Breach locations would correspond to weir locations. Construction of marsh restoration measures would utilize the best available practical techniques and BMPs to avoid and minimize potential adverse impacts to surrounding aquatic and terrestrial environment.

Construction of the five shoreline protection measures would utilize the best available practical techniques and BMPs to avoid and minimize potential adverse impacts to surrounding aquatic and terrestrial environment.

d. Contaminant Determinations.

An evaluation of the Environmental Data Resources report, performed during the Southwest Coastal Louisiana Phase I Environmental Site Assessment, indicates there appear to be no recognized environmental conditions within the study area. Further research is being conducted concerning potential sediment contaminants in the Calcasieu Ship Channel and the GIWW (i.e., the reaches within the Calcasieu restoration area as outlined in the Phase I maps). If contaminant levels are discovered to be significant, the reach in the Calcasieu Ship Channel may be avoided and material obtained from adjacent, less-contaminated reaches.

Water and sediment from 32 stations within the ship channel were collected in December 2006. Samples were analyzed in accordance with the protocols described in *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. - Testing Manual* (ITM) (USEPA/USACE, 1998) and *Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore, or Upland Confined Disposal Facilities - Testing Manual* (UTM) (USACE, 2003). Only the stations relevant to the Southwest Coastal Louisiana Study are discussion below.

Physical and chemical analyses were performed on sediment from each in-channel station. Dredged Material Management Unit (DMMU) 4 consisted of in-channel stations D4-06-1 through D4-06-5 (approximate channel mile 24 to channel mile 21 and Devil's Elbow). DMMU 5 consisted of in-channel stations D5-06-1 through D5-06-5 (approximate channel mile 21 to channel mile 16); and DMMU 6 consisted of in-channel stations D6-06-1 through D6-06-6 (approximate channel mile 16 to channel mile 5.

Results from chemical analyses of sediment from the three DMMUs within the Calcasieu River and Pass, revealed the presence of 12 metals, nine PAHs, four pesticides, three petroleum hydrocarbons, three PCBs, and ammonia.

Concentrations of most metals detected in river sediments were similar and within the same order of magnitude for the three DMMUs. Metal detected included antimony (0.101 to 0.111 ppb), arsenic (2.26 to 2.70 ppb), barium (68.6 to 116 ppb), beryllium (0.396 to 0.564 ppb), chromium (6.90 to 8.58 ppb), copper (5.00 to 6.90 ppb), hexavalent chromium (0.0957 to 0.152 ppb), lead (7.60 to 8.42 ppb), mercury (0.0335 to 0.0501 ppb), nickel (6.92 to 8.54 ppb), selenium (0.253 to 0.502 ppb), and zinc (24.4 to 26.4 ppb). Antimony and hexavalent chromium were not detected at DMMU 5.

Polycyclic aromatic hydrocarbons (PAHs) were detected in DMMUs 4 and 5, but not in DMMU 6. While PAHs were most prevalent in DMMU 4, the sum of all detected PAHs was relatively low with a total of 158 ppb. Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, and phenanthrene were detected at DMMU 4. Fluoranthene was the only PAH analyte detected at DMMU 6 (14.0 ppb).

Pesticides were detected in two DMMUs, and were most prevalent in DMMU 4. Concentration of 4,4'-DDT were detected in DMMUs 4 and 6 (2.08 ppb and 1.85 ppb). Other pesticides were detected in river sediments only: endosulfan II in DMMUs 4 and 6 (2.05 ppb and 2.11 ppb), heptachlor in DMMU 4 (0.574 ppb), and gamma-BHC in DMMU 4 (0.618 ppb).

Diesel range organics (DRO) and ammonia were common to river sediments. DRO ranged from 18,157 to 43,600 ppb and ammonia ranged from 24,714 to 27,000 ppb, and tended to decrease from upper (DMMU 4) to lower reaches (DMMU 6) of the river. Gasoline range organics (GRO) and motor oil range organics (MRO) were detected only in DMMU 4 (172 ppb and 50,500 ppb, respectively) above Calcasieu Lake. PCB 1016 was detected in DMMUs 4 and 6 (2.0 ppb and 0.7 ppb), while PCB 1254 and PCB 1260 only occurred in DMMU 4 (1.2 ppb and 0.9 ppb). A single volatile organic compound (tetrachloroethylene at 1.3 ppb) was detected at DMMU 6.

e. Aquatic Ecosystem and Organism Determinations

(1) Effects on Plankton.

Temporary and localized adverse effects on aquatic ecosystems and organisms, including plankton, would be primarily associated with construction activities and would include increased turbidity and total suspended solids, increased water temperatures and lower dissolved oxygen. These temporary and localized effects would occur only during dredging and construction of the access corridors, the nine marsh restoration measures and the five shoreline protection measures. These temporary and localized impacts would be minimized and controlled by utilizing the best available practical techniques and BMPs during construction. During marsh restoration, effluent from dredge discharge pipe would be directed to adjacent fragmented marsh for nourishment. Following construction plankton conditions would return to those observed prior to construction. The restored and protected marsh would provide increased estuarine habitat suitable for re-colonization. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to plankton.

(2) Effects on Benthos.

Localized adverse effects on aquatic ecosystems and organisms, including benthos, would primarily be associated with dredging and construction activities and could include smothering and permanent loss of sessile and slower moving benthic organisms during dredging and placement of borrow sediments for marsh restoration as well as during placement of geotextile fabric and rock for shoreline protection. More mobile benthic organisms could move out of the immediate construction areas. Following construction activities, marsh bottoms would be rapidly recolonized by benthic organisms within 1-3 years (Wilber et al. 2008). Rocks for shoreline protection measures would provide substrate and micro habitats suitable for some smaller organisms and benthos. Other impacts would include temporary and localized increases in turbidity and total suspended solids, increased water temperatures and decreased dissolved oxygen that would occur only during construction of the nine marsh restoration measures and five shoreline protection measures. These temporary and localized impacts can inhibit photosynthesis and affect respiration of benthic organisms by silt deposition on respiratory structures. However, these temporary and localized impacts would be minimized and controlled by utilizing the best available practical techniques and BMPs during construction. During construction of marsh restoration measures, effluent from dredge discharge pipe would be directed to adjacent fragmented marsh for nourishment. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to benthos.

(3) Effects on Nekton.

Localized sessile and slow-moving nekton would be smothered and permanently lost by dredging and placement of borrow sediments during marsh restoration as well as during placement of geotextile fabric and rock for shoreline protection. However, most nekton are mobile and would be displaced from nine marsh restoration measures and five shoreline protection measures. Much of the marsh restoration sites would be temporarily unavailable for nekton or other aquatic organisms during construction and until containment/exclusion dikes degrade naturally or as part of project construction at three years following construction, after which nekton would have access to the newly restored marsh. The open water areas where shoreline protection sites would be constructed would be permanently unavailable for use by nekton. However, gaps in the shoreline protection would allow aquatic organism access to back marsh areas. Construction activities would be temporary and localized increases in turbidity and total suspended solids, increased water temperatures and decreased dissolved oxygen that would occur only during construction of the nine marsh restoration measures and five shoreline protection measures. These temporary and localized impacts can inhibit predator-prey interactions and affect respiration of nekton by silt deposition on respiratory structures. However these temporary impacts would not likely impact most nekton, which are generally mobile enough to avoid areas during construction. In addition, these temporary and localized impacts would be minimized and controlled by utilizing the best available practical techniques and BMPs during construction. During construction of marsh restoration measures, effluent from dredge discharge pipe would be directed to adjacent fragmented marsh for nourishment.

Sediments in marsh restoration areas would differentially settle following construction into higher and lower lying lands enabling reestablishment of natural water connections for access of aquatic organisms from nearby and adjacent waters. Marsh restoration measures would also provide essential fish habitat for Federally-managed species. Rock placed for shoreline protection would provide a variety of micro-habitats and substrates for various prey species that could be utilized by nekton. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to nekton.

(4) Effects on the Aquatic Food Web.

Effects on the aquatic food web would be temporary and localized increases in turbidity and total suspended solids, increased water temperatures and decreased dissolved oxygen that would occur only during construction of the nine marsh restoration measures and five shoreline protection measures. Although these temporary and localized impacts can disrupt and inhibit predator-prey interactions, they would be minimized and controlled by utilizing the best available practical techniques and BMPs during construction. During construction of marsh restoration measures, effluent from dredge discharge pipe would be directed to adjacent fragmented marsh for nourishment. The aquatic food web would benefit from both short and long term changes to the marsh restoration disposal areas, including additions in energy to basal elements of the food web, habitat preservation, and increased habitat complexity. Nutrients and detritus released during the discharge of dredged sediments into marsh restoration areas would be added to the existing food web. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to the aquatic food web.

(5) Effects on Special Aquatic Sites.

(a) Sanctuaries and Refuges.

Existing Coastal Restoration Projects: Marsh restoration measures 124c and 3c1 would be constructed on portions of projects CS-59 Oyster Bayou Marsh Creation and Terracing (**Figure 5**) and CS-54 Cameron-Creole Watershed Grand Bayou Marsh Creation (**Figure 6**), respectively. The proposed marsh restoration measures would be constructed to avoid the existing coastal restoration projects that they may overlap. This would generally include construction of temporary containment/exclusion dikes to prevent dredged sediments used for construction of proposed NER RP marsh restoration measures from entering existing coastal restoration project sites. Temporary containment/exclusion dikes would degrade naturally to restore connectivity with surrounding areas or would be degraded at three years after construction has been completed.

National Wildlife Refuges: Portions of NER RP measure 124d would be constructed on the Sabine National Wildlife Refuge (NWR) and portions of NER RP measure 3c1 would be constructed on the Cameron Prairie NWR (**Figure 4**). The effect of marsh restoration these refuges would be significantly positive and long term, if not permanent, and primarily associated with restoration and protection of wetlands on these NWRs and adjacent lands. These measures would restore and protect important and essential habitats utilized by terrestrial and aquatic organisms as well as provide essential fish habitat (EFH) utilized by Federally managed fisheries. No other proposed actions would impact any other sanctuaries or refuges in the study area.

State Wildlife Refuges: The implementation of three of the five shoreline protection measures (6b1, 6b2, and 6b3) would have a significant and long-term positive effect on wetlands in the Rockefeller State Wildlife Refuge and Game Preserve (Rockefeller Refuge). The installation of a field of light-weight aggregate core rock breakwaters offshore of the Gulf of Mexico shoreline of the Rockefeller Refuge would decrease the wave energy reaching the shoreline, which would reduce background erosion rates, protecting existing saline wetlands.

Mitigation Projects: **Table 3** indicates the Office of Coastal Management (OCM) permitted mitigation projects that proposed NER RP marsh restoration measures would be constructed upon. However, construction of the NER RP marsh restoration measures would not be initiated until each mitigation project has completed its permit completion/expiration date.

The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to sanctuaries and refuges.

(b) Wetlands.

Implementation of the proposed action would significantly and positively effect and increase the area of estuarine wetlands in the study area and, in turn, provide and protect important, essential and in some instances critical habitats used by various terrestrial and aquatic organisms for shelter, nesting, feeding, roosting, cover, nursery, EFH and other life requirements; as well as increase productivity. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to wetlands.

(c) Mud Flats.

Some existing mud flats would be significantly and permanently impacted by marsh restoration and nourishment of nine marsh restoration measures and five shoreline protection measures that would be constructed near Calcasieu Lake. The placement of fill material for marsh restoration and rock for shoreline protection measures would cover any existing mud flats, converting them to other habitats (intertidal marsh and rock, respectively). Since intertidal marsh is degrading throughout the study area, the conversion of shallow open water and some mud flats to marsh and the protection of marsh would be beneficial in the long term. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to mud flats.

(d) Vegetated Shallows.

Some existing vegetated shallows would be significantly and permanently impacted by marsh restoration and nourishment of nine marsh restoration measures and five shoreline protection measures around Calcasieu Lake. Permanent impacts to state water bottoms through the conversion to marsh or the placement of rock include 14,346 acres from the nine marsh restoration measures and 278.4 acres from the five shoreline protection measures. This would result in the vegetation being covered by fill material. Not all of these shallow-water areas are vegetated (range of 0 to 40% coverage). In addition, proposed measures would encourage the growth of submerged aquatic vegetation in open water shallows such as through the reduction in water fetch and wave energy by shoreline protection measures. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to vegetated shallows.

(e) Coral Reefs.

The proposed action would not impact coral reefs.

(f) Riffle and Pool Complexes.

The proposed action would not impact riffle and pool complexes.

(6) Threatened and Endangered Species.

The CEMVN has determined that the proposed action "may affect but will not likely adversely affect" the piping plover or it's critical habitat, red knot, Sprague's pipit, West Indian manatee, Gulf sturgeon, loggerhead and Kemps Ridley sea turtles; would have no effect on the red-cockaded woodpecker, green, leatherback, and hawksbill sea turtles or loggerhead critical habitat and would not adversely impact other species of concern that could potentially be found in the project area. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to threatened and endangered species.

(7) Other Wildlife.

The NER RP measure areas would be temporarily unavailable for use by wildlife during dredging and construction activities. Temporary and localized increases in turbidity and total suspended solids, increased water temperatures and decreased dissolved oxygen would occur only during dredging and construction of the access corridors, the nine marsh restoration measures and the five shoreline protection measures. Although

these temporary and localized impacts can disrupt and preclude wildlife from using the access corridors, the nine marsh restoration measures and the five shoreline protection measure areas, these impacts would be minimized and controlled by utilizing the best available practical techniques and BMPs during construction. Also during construction of marsh restoration measures, effluent from dredge discharge pipe would be directed to adjacent fragmented marsh for nourishment. However, these temporary and localized adverse effects would be offset by the proposed action restoration and protection of estuarine marsh habitats which can provide an array of foraging, breeding, and cover habitat for a variety of birds, mammals, reptiles and other wildlife species. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to other wildlife.

(8) Actions to Minimize Impacts.

Dredged sediments would be placed for the nine marsh restoration sites to achieve a post-construction target elevation following dewatering that would be suitable for natural colonization by marsh vegetation. During construction, effluent from dewatering would be discharged into adjacent wetlands via spill box weirs. Temporary earthen containment/exclusion dikes would be constructed from in-situ material located within the marsh restoration/nourishment area using a mechanical (clamshell or bucket) dredge. Temporary access for the mechanical dredge would be via the pipeline corridor. The borrow area used for construction of the earthen containment dike would be refilled during the placement of dredged material. One foot of freeboard would be maintained at all times during dredge discharge operations. Containment/exclusion dikes would be breached in multiple places at three years following construction, if necessary, to restore connectivity and fish access if natural degradation is not sufficient. Breach locations would correspond to weir locations. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid and minimize potential adverse impacts special aquatic sites and to surrounding aquatic and terrestrial environment.

f. Proposed Disposal Site Determinations

(1) Mixing Zone Determination.

The State of Louisiana, Department of Environmental Quality (LDEQ), mandates a mixing zone no greater than 200 feet from discharge locations in coastal lakes. Any contaminant release resulting from construction activities should diminish to ambient conditions before exiting the mixing zone. The discharge of dredged material at marsh restoration sites and placement of temporary access corridor material as sidecast adjacent to the temporary access corridors are not expected to introduce contaminants in the Southwest Coastal Louisiana Study Area or outside of the mixing zone. An Environmental Database Review conducted as part of the Phase I Environmental Site Assessment did not discover any recognized environmental conditions that would indicate a high potential of introducing contaminants through fill material or rock placement. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to mixing zones.

(2) Determination of Compliance with Applicable Water Quality Standards.

LDEQ mandates a mixing zone no greater than 200 feet from discharge locations in coastal lakes. The discharge of dredged material and stone during construction of marsh restoration, shoreline protection, and temporary access corridor measures are not expected to exceed water quality criteria in the Sabine Pass, Calcasieu Lake, Calcasieu Ship Channel, Freshwater Bayou, Vermilion Bay, Gulf of Mexico, or adjacent bayous more than 200 feet from the discharge sites. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to water quality.

(3) Potential Effects on Human Use Characteristics.

(a) Municipal and private water supply.

The proposed action would not impact municipal and private water supply. Large quantities of moderately saline to highly saline groundwater are generally located throughout southern Cameron Parish (with the exception of an area approximately 20 miles east of the town of Cameron) and southwestern Vermilion Parish. All fresh groundwater withdrawals in Cameron and Vermilion Parishes come from the Chicot aquifer system, which mainly underlies the north-central and north-eastern areas of Cameron Parish and most of Vermilion

Parish. Underlying aquifers in the southern portion of the parishes contain saltwater. The base of the Chicot aquifer system's fresh groundwater ranges from about 300 feet below the National Geodetic Vertical Datum of 1929 (NGVD29) in the southeastern part of Cameron Parish to about 800 feet below NGVD29 in the north-central area, and in Vermilion parish ranges from less than 300 feet below NGVD29 in southwestern area to about 1,000 feet below NGVD29 in northeastern Vermilion Parish. No fresh groundwater is present in the southern portion of the parishes (where many of the restoration area measures are located) or along the southeastern coastline (USGS 2014). The Town of Hackberry is the only drinking water source within the NER RP area. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to municipal and private water supplies.

(b) Recreational and commercial fisheries.

There would be temporary and localized reduction of opportunities for recreational and commercial fisheries during construction activities. There can also be increased turbidity and total suspended solids, increased water temperatures and lower dissolved oxygen associated with construction which can restrict recreational and commercial fisheries in the local area. These temporary and localized effects would occur primarily during construction of the nine marsh restoration measures and five shoreline protection measures in the immediate construction area. Following construction, restrictions on recreational fisheries and commercial fisheries activities would be lifted. Implementation of the marsh creation and shoreline protection measures could attract recreational and commercial fishery species due to the addition of marsh EFH and structure to the degrading marsh habitats. The shallow open water areas converted to shoreline protection would no longer be available for recreational or commercial fisheries. However, the restored marsh habitat would support recreational and commercial fisheries species by providing marsh EFH. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to recreational and commercial fisheries.

(c) Water-related recreation.

Water-related recreation would be temporarily unavailable at dredging and construction sites for the corridors, the nine marsh restoration measures and the five shoreline protection measures. Construction of the nine marsh restoration measures and the five shoreline protection measures would permanently restrict water-related recreation from these sites. Following completion of construction, water-related recreation would resume similar to preconstruction levels in surrounding waters, except for the nine marsh restoration sites and the five shoreline protection sites. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to water-related recreation.

(d) Aesthetics.

The proposed action would temporarily and locally affect aesthetics at dredging and construction sites. This effect would primarily be associated with the presence and noise of dredging and construction equipment, emission of reduced sulfur compounds including hydrogen sulfide, often characterized as an objectionable rotten-egg smell. However, these emissions would likely occur infrequently, at low levels and are not expected to be significant or detectable by any sensitive human occupied areas. There would be no expected odors detectible outside of the dredged borrow sites, temporary access corridors, nine marsh restoration measures and five shoreline protection measures construction areas. Following completion of construction activities, odors and turbid waters in the vicinity of project measures would return to those which existed prior to construction activities. Any such impacts would be minimized and controlled by utilizing the use of the best available practical techniques and BMPs. There would be permanent change to the viewscape by placement of shoreline protection rock to an otherwise fragmented and eroding marsh shoreline. However, the aesthetics of the project area would be improved by the marsh restoration and shoreline protection in an area that is otherwise highly fragmented and degrading marsh. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to aesthetics.

(e) Parks, National and Historical Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar preserves.

Two marsh restoration measures would be located partially on U.S. Fish and Wildlife Service (USFWS) properties, and are therefore recommended for construction by the USFWS. NER RP measure 124d Marsh Creation at Mud Lake would be located on the Sabine NWR. NER RP measure 3c1 Beneficial Use of Dredged Material from Calcasieu Ship Channel would be located on the Cameron Prairie NWR (**Figure 4**). NER RP measure 124d would initially create (159 acres) and nourish (448 acres) a total of 607 acres that would provide over the 50 year period of analysis 168 net acres and 4 AAHUs which would synergistically benefit the Sabine NWR. NER RP Measure 3c1 would initially create (1,347 acres) and nourish (734 acres) a total of 2,081 acres that would provide over the 50 year period of analysis 1,324 net acres and 607 AAHU which would synergistically benefit the Cameron Prairie NWR.

Implementation of three of the five shoreline protection measures (6b1, 6b2, and 6b3) would have a significant and long-term positive effect on wetlands in the Rockefeller State Wildlife Refuge and Game Preserve (Rockefeller Refuge). The installation of a field of light-weight aggregate core rock breakwaters offshore of the Gulf of Mexico shoreline of the Rockefeller Refuge would decrease the wave energy reaching the shoreline, which would reduce background erosion rates, protecting existing saline wetlands. In all cases, the impacts would be positive.

The other NER RP measures would not impact other parks, national historic monuments, national seashores, wilderness areas, research sites, and similar preserves. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to parks, national and historical monuments, national seashores, wilderness areas, research sites, and similar preserves.

g. Determination of Cumulative Effects on the Aquatic Ecosystem

Cumulative effects are the changes in the aquatic ecosystem that are attributable to the incremental and collective effect of the individual discharges of dredged or fill material resulting from implementing the NER RP measures when added to other past, present and reasonably foreseeable future individual discharges of dredged and fill material regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Dredging and construction effects, such as increased turbidity and total suspended sediments, organic enrichment, chemical leaching, reduced dissolved oxygen, and elevated carbon dioxide levels, that would be temporary and localized. The only significant long term adverse cumulative effect expected from implementing the NER RP measures would be associated with the conversion of existing fragmented marsh and shallow water bottom habitats to transitional estuarine marsh habitat and rocked shoreline protection habitats. However, conversion of fragmented marsh and shallow water bottoms to these transitional estuarine marsh habitat and shoreline protection habitat would provide greater long-term positive benefits when considered within the context of the ongoing extensive land loss throughout coastal Louisiana and the project area which is converting extensive areas of marsh to shallow open water.

Over the 50-year period of analysis, the NER RP would protect, restore, and nourish a net total of 14,035 net acres of emergent marsh (including 7,900 net acres from the nine marsh restoration measures and 6,135 net acres from the five shoreline protection measures). At the end of the 50 year period of analysis, the marsh restoration and shoreline protection measures together would achieve a total net ecological benefit of 4,430 AAHUs; with 2,700 AAHUs from the nine marsh restoration measures, and 1,738 AAHUs from the five shoreline protection measures. The chenier restoration measures, although not part of this 404(b)(1) analysis, would restore a net total of 1,413 net acres with 538 AAHUs. The positive cumulative impacts of implementing the NER RP marsh restoration measures would be the additive, and in some instances the synergistic, effects of restoring and nourishing sites over the 50 year period of analysis with estimated benefits of 7,900 net acres and 2,700 AAHUs. The five NER RP shoreline protection measures would span approximately 251,528 linear feet, and are anticipated to protect/stabilize approximately 6,135 net acres and 1,738 AAHUs. Although not

impacting waters of the United States, the approximately 1,413 net acres from 35 reforestation sites in Cameron and Vermilion Parishes would be reforested over the 50 year period of analysis, resulting in 538 AAHUs.

Additional long term positive cumulative impacts would be related to increased recreational and commercial fishing opportunities provided by marsh restoration measures that would provide important, critical and essential habitats as well as protection of recreational marsh lands from wave erosion effects by the shoreline protection measures. The cumulative impacts of the proposed action would be a positive increasing the visual resources, especially the viewscape, in the form of providing additional acres of marsh wetlands (and chenier ridge) in an area that is otherwise being degraded, fragmented and lost throughout the southwest coastal basin, coastal Louisiana, and the Nation. Restoration of marsh would convert existing view sheds of open water into marsh wetlands interspersed with large bodies of open water and use the basic design elements of form, line, texture, color, and repetition to create an aesthetically pleasing view shed.
The cumulative effects of the NER RP measures would be in addition to, and in many instances synergistic to, the impacts and benefits from marsh acres restored, nourished and protected by other Federal, state, local, and private restoration efforts within or near the Southwest Coastal Louisiana Study Area, the Louisiana state coastal area, and the nation's coastal areas. Some of these other efforts include the following:

- Existing Coastal Restoration Projects and CWPPRA Projects – There are currently 149 active CWPPRA projects throughout coastal Louisiana. In September 2015, 101 projects were completed, benefiting over 97,401 acres. 21 projects are currently under active construction with 22 additional projects approved and in the engineering and design phase of development (source: https://lacoast.gov/new/About/FAQs.aspx; accessed November 23, 2015). Existing coastal restoration projects within the three parish area include: are 8 projects in Calcasieu Parish, 39 projects in Cameron Parish, and 12 projects in Vermilion Parish. **Table 5** lists the existing coastal restoration projects, including CWPPRA projects, within the three parishes and also describes the potential direct and secondary impacts of proposed NER RP measures on existing coastal restoration projects.

Table 5. Potential Direct and Indirect Impacts of NER RP Measures on Existing Coastal Restoration Projects in Calcasieu, Cameron and Vermilion Parishes

Project Number	Project Name	Project Types	Net Acres Benefited	Southwest Coastal Louisiana NER RP Measure Impacts
Calcasieu Parish Coastal Restoration Projects				
CS-09	Brown Lake Hydrologic Restoration (Deauthorized)	Hydrologic Restoration	37	NER RP measures would have no potential impacts on this deauthorized CWPPRA project.
CS-22	Clear Marais Bank Protection	Shoreline Protection	1,067	No potential impacts by NER RP restoration and protection measures.
CS-24	Perry Ridge Shore Protection	Shoreline Protection	1,203	No potential impacts by NER RP restoration and protection measures.
CS-27	Black Bayou Hydrologic Restoration	Hydrologic Restoration	3,594	No potential impacts by NER RP restoration and protection measures.
CS-30	GIWW - Perry Ridge West Bank Stabilization	Shoreline Protection	83	No potential impacts by NER RP restoration and protection measures.
LA-03a	Nutria Harvest for Wetland Restoration Demonstration	Demonstration, Herbivory Control	0	No potential impacts by NER RP restoration and protection measures.
LA-03b	Coastwide Nutria Control Program	Herbivory Control	14,963	No potential impacts by NER RP restoration and protection measures.
LA-30	Coastwide Reference Monitoring System	Monitoring	--	No potential impacts by NER RP restoration and protection measures.
Cameron Parish CWPPRA Projects				

Table 5. Potential Direct and Indirect Impacts of NER RP Measures on Existing Coastal Restoration Projects in Calcasieu, Cameron and Vermilion Parishes

Project Number	Project Name	Project Types	Net Acres Benefited	Southwest Coastal Louisiana NER RP Measure Impacts
CS-04a	Cameron-Creole Maintenance	Hydrologic Restoration	2,602	NER RP measure 3c1 could provide some indirect benefits to the CS-04a project, completed in 1997, by reducing the tidal prism in the Cameron-Creole Watershed. This would reduce the velocities through the water control structures by reducing fetch in the open water areas thereby providing some protection from wind-driven wave erosion.
CS-09	Brown Lake Hydrologic Restoration (Deauthorized)	Hydrologic Restoration	37	NER RP measures would have no potential impacts on this deauthorized CWPPRA project.
CS-11b	Sweet Lake/Willow Lake Hydrologic Restoration	Shoreline Protection	247	No potential impacts by NER RP restoration and protection measures.
CS-17	Cameron Creole Plugs	Hydrologic Restoration	865	No potential impacts by NER RP restoration and protection measures.
CS-18	Sabine National Wildlife Refuge Erosion Protection	Shoreline Protection	5,542	No potential impacts by NER RP restoration and protection measures.
CS-19	West Hackberry Vegetative Planting Demonstration	Demonstration, Sediment Trapping, Vegetative Planting	0	No potential impacts by NER RP restoration and protection measures.
CS-20	East Mud Lake Marsh Management	Marsh Management	1,520	NER RP measure 124c could provide secondary benefits to the CS-20 water control structures by reducing open water fetch and tidal prism which would reduce erosion from wind-driven waves and tidal velocities through the water control structures.
CS-21	Highway 384 Hydrologic Restoration	Hydrologic Restoration	150	No potential impacts by NER RP restoration and protection measures.
CS-23	Replace Sabine Refuge Water Control Structures at Headquarters Canal, West Cove Canal, and Hog Island Gully	Marsh Management	953	No potential impacts by NER RP restoration and protection measures.
CS-25	Plowed Terraces Demonstration	Demonstration, Sediment and Nutrient Trapping	0	No potential impacts by NER RP restoration and protection measures.
CS-26	Compost Demonstration (Deauthorized)	Demonstration	0	No potential impacts by NER RP restoration and protection measures.
CS-27	Black Bayou Hydrologic Restoration	Hydrologic Restoration	3,594	No potential impacts by NER RP restoration and protection measures.
CS-28-1	Sabine Refuge Marsh Creation, Cycle 1	Marsh Creation	214	No potential impacts by NER RP restoration and protection measures.
CS-28-2	Sabine Refuge Marsh Creation, Cycle 2	Marsh Creation	261	No potential impacts by NER RP restoration and protection measures.
CS-28-3	Sabine Refuge Marsh Creation, Cycle 3	Marsh Creation	187	No potential impacts by NER RP restoration and protection measures.
CS-28-4-5	Sabine Refuge Marsh Creation, Cycles 4 and 5	Marsh Creation	331	No potential impacts by NER RP restoration and protection measures.
CS-29	Black Bayou Culverts Hydrologic Restoration	Hydrologic Restoration	540	No potential impacts by NER RP restoration and protection measures.

Table 5. Potential Direct and Indirect Impacts of NER RP Measures on Existing Coastal Restoration Projects in Calcasieu, Cameron and Vermilion Parishes

Project Number	Project Name	Project Types	Net Acres Benefited	Southwest Coastal Louisiana NER RP Measure Impacts
CS-31	Holly Beach Sand Management	Shoreline Protection	330	NER RP Measure 5a would provide shoreline protection and stabilization that would secondarily benefit this existing CWPPRA project, which was completed in 2003.
CS-32	East Sabine Lake Hydrologic Restoration	Hydrologic Restoration	225	No potential impacts by NER RP restoration and protection measures.
CS-49	Cameron-Creole Freshwater Introduction	Freshwater Diversion	473	This authorized CWPPRA project, is scheduled to begin construction in September 2016. NER RP measure 3c1 would create marsh within and adjacent to the vegetative planting areas at the westernmost reaches of CS-49, which would increase the resiliency and habitat function of the wetlands in the area.
CS-53	Kelso Bayou Marsh Creation	Marsh Creation	274	No potential impacts by NER RP restoration and protection measures.
CS-54	Cameron-Creole Watershed Grand Bayou Marsh Creation	Marsh Creation	476	NER RP measure 3c1 would secondarily impact this CWPPRA project, authorized for construction in January 2015, by creating marsh adjacent to the westernmost reaches of CS-54 and providing some indirect protection from wave-induced erosion.
CS-59	Oyster Bayou Marsh Creation and Terracing	Marsh Creation, Terracing	433	NER RP 124c measure would create marsh adjacent to CS-59, scheduled to be completed in October 2016, which would increase the resiliency and habitat function of the wetlands in the area.
CS-66	Cameron Meadows Marsh Creation and Terracing	Marsh Creation, Terracing	264	No potential impacts by NER RP restoration and protection measures.
CS-78	No Name Bayou Marsh Creation	Marsh Creation	497	No potential impacts by NER RP restoration and protection measures.
LA-03a	Nutria Harvest for Wetland Restoration Demonstration	Demonstration, Herbivory Control	0	No potential impacts by NER RP restoration and protection measures.
LA-03b	Coastwide Nutria Control Program	Herbivory Control	14,963	No potential impacts by NER RP restoration and protection measures.
LA-08	Bio-Engineered Oyster Reef Demonstration	Demonstration	0	NER RP shoreline protection measure 6b1 would provide positive direct effects for the existing LA-08 oyster reef CWPPRA demonstration project by installing a lightweight aggregate core breakwater field thereby protecting LA-08 from high energy Gulf of Mexico wind-driven wave erosion
LA-30	Coastwide Reference Monitoring System	Monitoring	--	No potential impacts by NER RP restoration and protection measures.
ME-09	Cameron Prairie National Wildlife Refuge Shoreline Protection	Shoreline Protection	247	No potential impacts by NER RP restoration and protection measures.
ME-11	Humble Canal Hydrologic Restoration	Hydrologic Restoration	378	No potential impacts by NER RP restoration and protection measures.
ME-16	Freshwater Introduction South of Highway 82	Hydrologic Restoration	296	The SWC shoreline protection measures 6b2 and 6b3 would provide direct benefits to the outfall area of the ME-16 hydrologic restoration CWPPRA project, completed in 2006, by reducing Gulf of Mexico shoreline erosion through the installation of lightweight aggregate core breakwater fields.
ME-17	Little Pecan Bayou Hydrologic Restoration (Deauthorized)	Hydrologic Restoration	56	This CWPPRA hydrologic restoration project was deauthorized prior to construction, so would have no potential impacts on or by NER RP restoration and protection measures.
ME-18	Rockefeller Refuge Gulf Shoreline Stabilization	Shoreline Protection	256	The ME-18 project would be constructed from 2016 to 2018, and would consist of a lightweight

Table 5. Potential Direct and Indirect Impacts of NER RP Measures on Existing Coastal Restoration Projects in Calcasieu, Cameron and Vermilion Parishes

Project Number	Project Name	Project Types	Net Acres Benefited	Southwest Coastal Louisiana NER RP Measure Impacts
				aggregate core breakwater field extending from Joseph Harbor approximately 3 miles west. This would preclude the need to install the lightweight aggregate core breakwater field in this section as part of the 6b1measure, but the 6b1 measure would construct a lightweight aggregate core breakwater field from the western end of the ME-18 project to a point approximately 8 miles to the west.
ME-19	Grand-White Lakes Landbridge Protection	Shoreline Protection	213	No potential impacts by NER RP restoration and protection measures.
ME-20	South Grand Chenier Marsh Creation	Hydrologic Restoration	414	This CWPPRA project, which is expected to be completed in 2016, would provide indirect protection to SWC marsh restoration measure 47c3 by reducing erosion from the eastern direction in the southern area. The 3c1 measure would restore marsh adjacent to the westernmost reach of the marsh creation cells, which would provide some indirect protection from erosion.
ME-21	Grand Lake Shoreline Protection	Shoreline Protection	45	No potential impacts by NER RP restoration and protection measures.
ME-24	Southwest LA Gulf Shoreline Nourishment and Protection (Transferred)	Shoreline Protection	888	This CWPPRA project has not been authorized for construction. However, the NER RP shoreline protection measure 6b3 would protect ME-24 project from wind-driven wave erosion from the Gulf of Mexico once authorized and constructed.
ME-32	South Grand Chenier Marsh Creation - Baker Tract	Marsh Creation	393	No potential impacts by NER RP restoration and protection measures.
Vermilion Parish Coastal Restoration Projects				
LA-03a	Nutria Harvest for Wetland Restoration Demonstration	Demonstration, Herbivory Control	0	No potential impacts by NER RP restoration and protection measures.
LA-03b	Coastwide Nutria Control Program	Herbivory Control	14,963	No potential impacts by NER RP restoration and protection measures.
LA-06	Shoreline Protection Foundation Improvements Demonstration	Demonstration, Shoreline Stabilization	0	No potential impacts by NER RP restoration and protection measures.
LA-30	Coastwide Reference Monitoring System	Monitoring	--	No potential impacts by NER RP restoration and protection measures.
ME-04	Freshwater Bayou Wetland Protection	Hydrologic Restoration, Shoreline Protection	1,593	Although NER RP measure 127c3 is located nearby there would be no potential impacts by NER RP measures on ME-04, which was constructed in 1998.
ME-08	Dewitt-Rollover Vegetative Plantings Demonstration (Deauthorized)	Demonstration	0	No potential impacts by NER RP restoration and protection measures on this deauthorized project.
ME-12	Southwest Shore White Lake Demonstration (Deauthorized)	Demonstration	0	No potential impacts by NER RP restoration and protection measures on this deauthorized project
ME-13	Freshwater Bayou Bank Stabilization	Shoreline Protection	511	No potential impacts by NER RP restoration and protection measures.
ME-14	Pecan Island Terracing	Sediment and Nutrient Trapping	442	No potential impacts by NER RP restoration and protection measures.

Table 5. Potential Direct and Indirect Impacts of NER RP Measures on Existing Coastal Restoration Projects in Calcasieu, Cameron and Vermilion Parishes

Project Number	Project Name	Project Types	Net Acres Benefited	Southwest Coastal Louisiana NER RP Measure Impacts
ME-22	South White Lake Shoreline Protection	Shoreline Protection	844	No potential impacts by NER RP restoration and protection measures.
ME-23	South Pecan Island Freshwater Introduction (Deauthorized)	Hydrologic Restoration	98	No potential impacts by NER RP restoration and protection measures.
ME-24	Southwest LA Gulf Shoreline Nourishment and Protection (Transferred)	Shoreline Protection	888	NER RP shoreline protection measure 6b3 would provide secondary benefits for the ME-24 CWPPRA project by installing a lightweight aggregate core breakwater field, which would protection it from wind-driven wave erosion from the Gulf of Mexico.
ME-31	Freshwater Bayou Marsh Creation	Marsh Creation	279	No potential impacts of NER RP measure 127c3 because this CWPPRA project has not been authorized for construction.
TV-03	Vermilion River Cutoff Bank Protection	Shoreline Protection	65	No potential impacts by NER RP restoration and protection measures.
TV-09	Boston Canal/Vermilion Bay Bank Protection	Shoreline Protection, Vegetative Planting	378	No potential impacts by NER RP restoration and protection measures.
TV-11b	Freshwater Bayou Bank Stabilization - Belle Isle Canal to Lock (Inactive)	Shoreline Stabilization	241	NER RP 16b would construct a foreshore rock dike along a reach proposed by CWPPRA TV-11b, which has not been constructed. If TV-11b is constructed, the NER RP 16b reach of shoreline protection would not be required under TV-11b.
TV-12	Little Vermilion Bay Sediment Trapping	Shoreline Protection, Sediment Trapping	441	No potential impacts by NER RP restoration and protection measures.
TV-13a	Oaks/Avery Canal Hydrologic Restoration, Increment 1	Hydrologic Restoration	160	No potential impacts by NER RP restoration and protection measures.
TV-16	Chenière Au Tigre Sediment Trapping Demonstration	Demonstration, Sediment and Nutrient Trapping	0	No potential impacts by NER RP restoration and protection measures.
TV-17	Lake Portage Land Bridge	Shoreline Protection	24	No potential impacts by NER RP restoration and protection measures.
TV-18	Four Mile Canal Terracing and Sediment Trapping	Sediment and Nutrient Trapping	167	No potential impacts by NER RP restoration and protection measures.
TV-63	Cole's Bayou Marsh Restoration	Hydrologic Restoration, Marsh Creation	398	No potential impacts by NER RP restoration and protection measures.

- Project CS-59 (Oyster Bayou Marsh Creation and Terracing) would be indirectly impacted by construction of marsh restoration NER RP measure 124c (**Figure 6**). Project CS-054 (Cameron-Creole Watershed Grand Bayou Marsh Creation) would be indirectly impacted by construction of marsh restoration NER RP measure 3c1 (**Figure 7**). Project CS-59 is on Priority Project List 20 with Phase 1 funding approval for engineering and design work to restore 609 acres and nourish about 7 acres of brackish marsh. Project CS-54 is on Project Priority List 21 with specific goals to create 510 acres of saline marsh, nourish 90 acres of existing saline marsh; create 17,500 linear feet of terraces; and, reduce wave/wake erosion. When overlap occurs, proposed NER RP measures would be constructed to avoid existing coastal restoration projects. This would generally include construction of temporary containment/exclusion dikes to contain dredged borrow sediments used for construction of the NER RP measure and also prevent dredged effluents from entering the existing coastal restoration project sites. Temporary containment/exclusion dikes would degrade naturally to restore connectivity with surrounding areas or would be degraded at three years after construction has been completed.

- NER RP shoreline protection measure 5a (Holly Beach Shoreline Stabilization-Breakwaters) would be located immediately offshore of the projects CS-31 (Holly Beach Sand Management) and CS 33 (Cameron Parish Shoreline) indirectly benefiting these existing projects by providing shoreline protection and stabilization from high energy Gulf wave erosion.
- Inactive project TV-11B could be impacted by NER RP marsh restoration measure 3c1 if constructed.

- The Louisiana Coastal Area (LCA), Ecosystem Restoration Study (2004 USACE) recommends 15 near-tern measures aimed at addressing the critical restoration needs. The components recommended for authorization include five critical near-term ecosystem restoration measures, a demonstration program consisting of a series of demonstration projects, a beneficial use of dredged material (BUDMAT) program, and a science and technology program. The five critical near-term ecosystem restoration measures, demonstration projects, and BUDMAT projects are all subject to the approval of feasibility level of detail decision documents by the Secretary of the Army. The January 31, 2005 Chief's Report approved the Near-Term Plan substantially in accordance with the 2004 LCA Study. Title VII of the Water Resources Development Act of 2007 (WRDA 2007) (Public Law 110-114) authorized an ecosystem restoration Program for the Louisiana Coastal Area substantially in accordance with the Near-Term Plan.
  - The Chenier Plain Freshwater Management and Allocation Reassessment Study (Chenier Plain Study), recommended in the 2005 Chief's Report was one of six large-scale restoration concepts that were purported to have the ability to "significantly restore environmental conditions that existed prior to large-scale alteration of the natural ecosystem" upon construction. Guidance provided by the Director of Civil Works on December 19, 2008 states that "the coastal restoration components proposed as part of the LCA Chenier Plain study will be evaluated as part of the Southwest Coastal Louisiana feasibility study". Although several of these projects have been authorized for construction, there is presently no willing local non-Federal Sponsor. Consequently, the authorized projects without an identified local non-Federal Sponsor are not considered reasonably foreseeable and are therefore not considered part of either the No Action Alternative (future without project conditions [FWOP]) or the future with project conditions. Nevertheless, the LCA Program is mentioned here since there is some potential that a willing local non-Federal Sponsor may be determined and these projects could therefore become part of the cumulative impacts assessment under the FWOP and future with project conditions.
  - The CEMVN and its local non-Federal Sponsor, Plaquemines Parish, recently completed the 44-acre West Bay Marsh Creation Tier 1 project, part of the LCA's Beneficial Use of Dredged Material (BUDMAT) Program.
  - BUDMAT project (Environmental Assessment #535). Plaquemines Parish is also the non-Federal Sponsor for two additional LCA BUDMAT projects: Ridge Restoration at Tiger Pass, and Restoration of Cat Island. These two projects are still in the study phase.
- An ongoing effort by CPRAB is development of the 2012 Louisiana's Comprehensive Master Plan for a Sustainable Coast (source: http://issuu.com/coastalmasterplan/docs/coastal_master_plan-v2?e=3722998/2447530; accessed November 23, 2015). However, the unauthorized and unfunded conceptual projects are not reasonably foreseeable under the FWOP conditions or the future with project conditions. Nevertheless, the Louisiana State Master Plan is mentioned here since there is some potential that these projects would become funded and therefore considered as part of a cumulative impacts assessment under the FWOP and future with project conditions. The 2012 State Master Plan indicates that the CPRAB has, since 2007:
  - Built or improved 159 miles of levees
  - Benefited 19,405 acres of coastal habitat
  - Secured approximately $17 billion in state and Federal funding for protection and restoration projects

- Identified and used dozens of different Federal, state, local and private funding sources of projects
- Moved over 150 projects into design and construction
- Constructed projects in 20 parishes
- Constructed 32 miles of barrier islands/berms
- The 2012 State Master Plan developed and evaluated a total of 397 projects, with each project having its own timeline and budget, including:
  - 248 restoration projects,
  - 33 structural risk reduction (protection) projects, and
  - 116 conceptual nonstructural flood risk reduction projects
- The 2012 State Master Plan developed a total of 42 projects for the southwest coast, with 36 projects to be constructed in the 1st Implementation Period (2012 -2032) including: 5 bank stabilization, 11 hydrologic restoration, 8 marsh creation, 4 ridge restoration, 6 shoreline protection, and 1 each structural protection and multiple protection measure; a total of 6 projects would be constructed in the 2nd Implementation Period (2032-2051) including: 2 each marsh creation and shoreline protection, and 1 each ridge restoration and multiple protection measures.
- However, the Tulane Institute on Water Resources Law & Policy 2014 Issue Paper "Turning Coastal Restoration and Protection Plans Into Realities: The Cost of Comprehensive Coastal Restoration and Protection" indicates that the 2012 State Master Plan has not come to terms with the true costs of saving coastal Louisiana and how to finance it:

  > *…the cost of implementing those measures will exceed the $50 billion figure set forth in the Plan, in all likelihood by a factor of at least two. When one includes the anticipated costs of the Urban Water Plan, federal flood protection, and other factors excluded from the 2012 Master Plan, the cost of restoring this coast and protecting its people can be expected to exceed $100 billion over 50 years.30 The reasons for this lie primarily in the 2012 Master Plan's use of 2010 dollars instead of inflation adjusted dollars and the exclusion of a range of projects and programs from the Plan's cost estimates. The use of present value dollars in the 2012 Master Plan and the Urban Water Plan was neither hidden nor inappropriate as a methodology, and no criticism of that methodology is intended. However, when looking forward to the challenge of financing everything that is planned and necessary, a more comprehensive approach must be used. The value of keeping this coast ecologically and economically in business has been repeatedly demonstrated to be immense and well in excess of the adjusted price of the 2012 Master Plan. The price of putting the pieces of coastal Louisiana and the Gulf Coast back together after Hurricanes Katrina and Rita alone approached $100 billion. Knowing what is at stake and coming to terms with the true costs of saving coastal Louisiana are prerequisites for a robust civic conversation about how best to finance it. It will require engagement at the local, state, and national levels from a broad range of public and private stakeholders, and answers will not come easily.*

- Restoration of injuries to natural resources damaged by the 2010 Deepwater Horizon oil spill:
  - The Natural Resource Damage Assessment (NRDA) is a legal process under the Oil Pollution Act of 1990 (OPA) and the Louisiana Oil Spill Prevention and Response Act of 1991 (LOSPRA) whereby designated trustees represent the public to ensure that natural resources injured in an oil spill are restored (source: http://la-dwh.com/AboutNRDA.aspx; accessed November 25, 2015). Both federal and state NRDA regulations provide a step-by-step process for trustees to determine injuries, to assess damages, and to develop and implement restoration projects that compensate the public for injuries to natural resources impacted by an incident. In general, the NRDA process involves three steps: (1) pre-assessment; (2) restoration planning; and (3) restoration implementation.
  - On July 11, 2011, Governor Bobby Jindal unveiled the "Louisiana Plan" which outlines 13 initial proposed early restoration projects (source: http://la-dwh.com/LouisianaPlanProjects.aspx; accessed November 25, 2015). The proposed projects

come in many forms including marsh restoration, barrier island restoration, shoreline projection measures, resource-specific projects, and projects aimed at addressing impacts to our citizens' ability to use Louisiana's natural resources. The projects are consistent with Louisiana's Coastal Master Plan; they are consistent with the criteria outlined in the early restoration framework agreement and applicable regulations; and they support the goal of compensating the public for natural resource injuries resulting from the Deepwater Horizon Oil Spill (**Table 6**).

Table 6. "Louisiana Plan" proposed early restoration projects

Project Name	Approximate Cost ($)
Oyster Reestablishment Program (Louisiana Oyster Cultch Project)	$15 M
Saltwater Hatchery	$48 M
Shell Island - Larger Lobe	$110 M
Chandeleur Islands Restoration	$65 M
Biloxi Marsh Shoreline Protection Phase 2	$45 M
Lake Hermitage Additional Increment - (Lake Hermitage Marsh Creation – NRDA Early Restoration Project)	$13.9 M
Grand Liard Marsh & Ridge Restoration	$31.3 M
Cheniere Ronquille Barrier Island Restoration	$44 M
Bay Side Segmented Breakwater at Grand Isle	$3.3 M
West Grand Terre Beach	$9 M
West Grand Terre Stabilization	$3 M
Barataria Basin Barrier Shoreline Restoration - Caminada Headland	$75 M
Maintain Land bridge between Caillou Lake and Gulf of Mexico	$71 M

- On October 5, 2015, the Deepwater Horizon Natural Resource Damage Assessment Trustees released the Deepwater Horizon Oil Spill Draft Programmatic Damage Assessment and Restoration Plan and Programmatic Environmental Impact Statement (PDARP/PEIS) for public review and comment (source: http://la-dwh.com/PDARP_PEIS/Draft_PDARP_PEIS.aspx; accessed November 25, 2015). The Trustees identified Alternative A as their preferred alternative. Alternative A (described in Section 5.5) is an integrated restoration portfolio that emphasizes the broad ecosystem benefits that can be realized through coastal habitat restoration in combination with resource-specific restoration in the ecologically interconnected northern Gulf of Mexico ecosystem. **Table 7** is a copy of Table 5.10-1 from the PDARP/PEIS, and shows the Trustees' allocations by goal and restoration type (rows) and restoration area (columns). This table also highlights where investments have already been made through the Trustees' Early Restoration efforts (source: http://www.gulfspillrestoration.noaa.gov/wp-content/uploads/Chapter-5_Restoring-Natural-Resources1.pdf; accessed November 25, 2015). Under the PDARP/PEIS, the State of Louisiana would receive $5 billion of the total $8.1 billion restoration funding allocation for the Early Restoration work. Due to the large proportion of the wetlands and coastal and nearshore habitat funding allocated to Louisiana, wetland projects identified in the Louisiana Master Plan were used to evaluate the potential magnitude of benefits achievable here. However, as described in Section 5.5.2 of the PDARP/PEIS, the restoration dollars could be used for a variety of restoration approaches. For illustration purposes only, the approximately $4 billion allocated to Louisiana for this restoration type could be sufficient to create 20,000 to 40,000 acres of coastal marsh in Louisiana (LA Master Plan) along hundreds of miles of shoreline, supporting the diversity of fish, birds, and animals that depend on coastal marsh.

- The EPA, reporting on the Nation, states the number of restoration projects grows yearly. Current Federal initiatives call for a wide range of restoration actions, including improving or restoring 25,000 miles of stream corridor; achieving a net increase of 100,000 acres of wetlands each year and establishing two million miles of conservation buffers (source: http://water.epa.gov/type/wetlands/restore/principles.cfm; accessed March 12, 2015).

Table 7. Settlement of NRD claims and final allocations (source: http://www.gulfspillrestoration.noaa.gov/wp-content/uploads/Chapter-5_Restoring-Natural-Resources1.pdf; accessed November 25, 2015).

Major Restoration Categories	Unknown Conditions	Regionwide	Open Ocean	Alabama	Florida	Louisiana	Mississippi	Texas	Total Restoration Funding*
1. Restore and Conserve Habitat									
Wetlands, Coastal, and Nearshore Habitats				65,000,000	5,000,000	4,009,062,700	55,500,000	100,000,000	4,234,562,700
Habitat Projects on Federally Managed Lands				3,000,000	17,500,000	50,000,000	5,000,000		75,500,000
Early Restoration (through Phase IV)				28,110,000	15,629,367	259,625,700	80,000,000		383,365,067
2. Restore Water Quality									
Nutrient Reduction (Nonpoint Source)				5,000,000	35,000,000	20,000,000	27,500,000	22,500,000	110,000,000
Water Quality (e.g., Stormwater Treatments, Hydrologic Restoration, Reduction of Sedimentation, etc.)					300,000,000				300,000,000
3. Replenish and Protect Living Coastal and Marine Resources									
Fish and Water Column Invertebrates			380,000,000						380,000,000
Early Restoration Fish and Water Column Invertebrates			20,000,000						20,000,000
Sturgeon			15,000,000						15,000,000
Sea Turtles		60,000,000	55,000,000	5,500,000	20,000,000	10,000,000	5,000,000	7,500,000	163,000,000
Early Restoration Turtles		29,256,165						19,965,000	49,221,165
Submerged Aquatic Vegetation						22,000,000			22,000,000
Marine Mammals		19,000,000	55,000,000	5,000,000	5,000,000	50,000,000	10,000,000		144,000,000
Birds		70,480,000	70,000,000	30,000,000	40,000,000	148,500,000	25,000,000	20,000,000	403,980,000
Early Restoration Birds		1,823,100		145,000	2,835,000	71,937,300		20,603,770	97,344,170
Mesophotic and Deep Benthic Communities			273,300,000						273,300,000
Oysters		64,372,413		10,000,000	20,000,000	26,000,000	20,000,000	22,500,000	162,872,413
Early Restoration Oysters				3,329,000	5,370,596	14,874,300	13,800,000		37,173,896
4. Provide and Enhance Recreational Opportunities									
Provide and Enhance Recreational Opportunities				25,000,000	63,274,513	38,000,000	5,000,000		131,274,513
Early Restoration Recreational Opportunities			22,997,916	85,505,305	120,543,167	22,000,000	18,957,000	18,582,688	287,986,076
5. Monitoring, Adaptive Management, Administrative Oversight									
Monitoring and Adaptive Management		65,000,000	200,000,000	10,000,000	10,000,000	225,000,000	7,500,000	2,500,000	520,000,000
Administrative Oversight and Comprehensive Planning		40,000,000	150,000,000	20,000,000	20,000,000	33,000,000	22,500,000	4,000,000	289,500,000
Adaptive Management NRD Payment for Unknown Conditions	700,000,000								700,000,000
Total NRD Funding	$700,000,000	$349,951,678	$1,249,997,916	$295,589,305	$680,152,643	$5,000,000,000	$295,557,000	$218,151,458	

*The total restoration funding allocation for the Early Restoration work; each restoration type; and monitoring, adaptive management, and administrative oversight is $8.1 billion (plus up to an additional $700 million for adaptive management and unknown conditions).

- The NOAA Restoration Center has restored 2,812 projects nationwide and its programs provide funding and technical assistance for coastal habitat restoration projects throughout the United States and territories. In Louisiana, the Restoration Center is planning, implementing or has restored 100 projects including CWPPRA and community-based restoration projects (source: https://restoration.atlas.noaa.gov/src/html/index.html; accessed November 25, 2015). In Southwest Coastal Louisiana, the NOAA Restoration Center has 20 restoration projects (**Table 8**):
-

Table 8. NOAA Restoration Center projects in Southwest Coastal Louisiana (source: https://restoration.atlas.noaa.gov/src/html/index.html; accessed November 25, 2015)

Project	Program	Partner	Status	Habitat
Black Bayou Hydrologic Restoration Project	CWPPRA	LDNR	completed	*2960 acres tidal wetland habitat restored *634 acres tidal wetland habitat protected

Table 8. NOAA Restoration Center projects in Southwest Coastal Louisiana (source: https://restoration.atlas.noaa.gov/src/html/index.html; accessed November 25, 2015)

Project	Program	Partner	Status	Habitat
Cameron Meadows Marsh Creation and Terracing	CWPPRA	CPRA	implementation	tidal wetland
Cameron Shoreline Vegetation Planting Phase II	Community-based	Cameron Parish, Cheniere Energy, Gulf Coast Soil & Water Conservation Service, State Farm Insurance Co., Lonnie G. Harper and Associates, LLC, Coalition to Restore Coastal Louisiana, America's Wetlands, Restore America's Estuaries, Disney, LDNR, 143 volunteers contributed 920 hours to this project.	completed	6.5 acres of dune habitat restored by installing a sand fence and shoreline planting
Peveto Beach Sand Fencing	Community-based	Imperial Calcasieu Resource Conservation and Development Council, Inc., 48 volunteers contributed 238 hours to this project.	completed	10 acres of dune habitat restored
Peveto Sand Fencing and Vegetation Project 2	Community-based	Gulf of Mexico Foundation, Imperial Calcasieu Resource Conservation and Development Council, Inc., 12 volunteers contributed 372 hours to this project.	completed	1.72 acres of dune habitat restored
Oyster Bayou Marsh Creation	CWPPRA	Office of Coastal Protection and Restoration (LA OCPR), CPRA	implementation	tidal wetland
Bayou Verdine CERCLA –Sabine 1999 Unit Hydrologic Restoration and Marsh Creation	DARRP	Contributed to this project	completed	Create 14.7 acres of marsh in open water areas. Additionally, a 260-acre area of marsh and shallow mud flats will be restored to tidal hydrology
Cameron-Creole Watershed Mottled Duck Research and Terracing Project	Community-based	National Fish and Wildlife Foundation, Ducks Unlimited, Miami Corporation, Black Lake Land and Oil, LLC, British Petroleum (BP) America, Louisiana Department of Natural Resources	completed	Ducks Unlimited is working to construct 70,000 linear feet of earthen terraces benefiting 900 acres of fisheries habitat located in the Cameron-Creole Watershed in southwest Louisiana. 530 acres of tidal wetland habitat restored and

Table 8. NOAA Restoration Center projects in Southwest Coastal Louisiana (source: https://restoration.atlas.noaa.gov/src/html/index.html; accessed November 25, 2015)

Project	Program	Partner	Status	Habitat
				100 acres of tidal wetland habitat restored
Bio-Engineered Oyster Reef Demonstration	CWPPRA	CPRA, LDNR	implementation	The demonstration project consisted of an Oysterbreak, approximately 1000 feet long to provide oyster reef/shell bottom
Rockefeller Refuge Gulf Shoreline Stabilization Project	CWPPRA	LDNR	implementation	the construction of a continuous rock breakwater extending approximately 50,691 feet from the west bank of Joseph Harbor to the east bank of Beach Prong to protect tidal wetlands
Pecan Island Terrace Creation Project	CWPPRA	LDNR	completed	constructed 198,400 linear feet of adjacent terrace cells; 425 acres of soft bottom mud/sand habitat restored 145 acres of tidal wetland habitat restored
Christian Marsh Terracing Project	Community-based	Coalition to Restore Coastal Louisiana, Randy Moertle and Associates, CPRA, McIlhenney Corporation, Restore America's Estuaries, Louisiana State University, Vermilion Corporation, Cargill, Incorporated, COYPU Foundation, Vermilion Soil and Water Conservation District, National Audubon Society, 87 volunteers contributed 696 hours to this project	Completed	Created over 25,000 linear feet of terraces, enhancing and protecting an additional 300 acres of adjacent marsh.
Louisiana Acadiana Bay Oyster Reef Construction and Gulf-wide Oyster Planning	Community-based	State of Louisiana, Louisiana State University Agriculture Extension Service, National Fish and Wildlife Foundation, The Nature Conservancy	Completed	installed ~670 linear feet of bioengineered oyster reef along the coastal shoreline of the Paul J. Rainey Wildlife Sanctuary in Vermilion Bay in southwest Louisiana; 0.15 acres of oyster/shell bottom habitat restored
Vermilion Bay Oyster Reef Restoration and Shoreline Protection	Community-based	LDWF, Louisiana Wetlands Association, 30 volunteers contributed 200 hours	Completed	This project implemented the first large-scale shell recycling program in Louisiana. A 600-foot oyster reef was constructed, which protected the adjacent shoreline, renewed oyster productivity

Table 8. NOAA Restoration Center projects in Southwest Coastal Louisiana (source: https://restoration.atlas.noaa.gov/src/html/index.html; accessed November 25, 2015)

Project	Program	Partner	Status	Habitat
				in the bay, and benefited marine habitat.
Coles Bayou Marsh Restoration	CWPPRA	Office of Coastal Protection and Restoration (LA OCPR), Louisiana Coastal Protection and Restoration Authority	Planning	Objective of this project is to create and nourish brackish marsh and improve hydrology in order to increase freshwater and sediment inflow into the interior wetlands, the latter through culvert installation.
Little Vermilion Bay Sediment Trapping Project	CWPPRA	LDNR	Completed	390 acres of tidal wetland habitat restored 51 acres of tidal wetland habitat protected
McIlhenney Planting Program- Little White Lake	Community-based	Louisiana State Agricultural Center, McIlhenney Corporation, Randy Moertle and Associates, Boy Scouts of America, Coalition to Restore Coastal Louisiana, 91 volunteers contributed 910 hours to this project.	Completed	5 acres of tidal wetland habitat restored
Four Mile Canal Terracing and Sediment Trapping	CWPPRA	LDNR	Completed	214 acres of tidal wetland habitat restored 113 acres of tidal wetland habitat protected
Rainey Wildlife Sanctuary Terrace Project	Community-based	LDNR, Coalition to Restore Coastal Louisiana, 20 volunteers contributed 400 hours to this project	Completed	640 acres of tidal wetland habitat restored
M/V Formosa Six	DARRP	LDNR, LDWF, National Fish and Wildlife Foundation, LDEQ, NRCS	Completed	142 acres of tidal wetland habitat restored

- Some other large scale ecosystem restoration projects affecting coastal waters of the United States include the following:
  - The CALFED Environmental Restoration Program, approved by the California state legislature in fall 2000, has been successfully acquiring and protecting important lands in the Delta and along its tributaries. To date, more than 130,000 acres of habitat targeted for species of import to the Delta have been enhanced, protected and restored, mostly through easements obtained by working with local land owners and communities (source: http://calwater.ca.gov/calfed/objectives/ecosystem_restoration.html#EcoHistory; accessed December 2, 2015).
  - The Chesapeake Bay Program is a unique regional partnership that has led and directed the restoration of the Chesapeake Bay since 1983. The Chesapeake Bay Program partners include

the states of Maryland, Pennsylvania and Virginia; the District of Columbia; the Chesapeake Bay Commission, a tri-state legislative body; the Environmental Protection Agency, representing the federal government; and participating citizen advisory groups (source: http://www.chesapeakebay.net/about; accessed December 2, 2015)

- The Comprehensive Everglades Restoration Program (CERP), provides a framework and guide to restore, protect and preserve the water resources of central and southern Florida, including the Everglades. It covers 16 counties over an 18,000-square-mile area and centers on an update of the Central & Southern Florida (C&SF) Project also known as the Restudy (source: http://141.232.10.32/about/about_cerp_brief.aspx; accessed December 2, 2015).
- The Mississippi Coastal Improvements Program Comprehensive Plan (MsCIP) is a system wide approach linking structural and nonstructural hurricane and storm damage risk reduction with ecosystem restoration with the goal of providing a coastal community more resilient to hurricanes and storms (source: http://www.sam.usace.army.mil/Portals/46/docs/program_management/mscip/docs/MSCIP%20ChiefR%20Report.pdf; accessed December 2, 2015).
- The Coastal Texas Protection and Restoration Project a comprehensive plan to determine the feasibility of carrying out projects for flood damage reduction, hurricane and storm damage reduction, and ecosystem restoration in the coastal areas of the State of Texas (source: http://www.swg.usace.army.mil/Portals/26/docs/PAO/0827%20Hou-Galv%20Coastal%20TX%20Public%20mtg%20August%2027%202014.pdf; accessed December 2, 2015).

- The Cameron Parish Master Plan for Coastal Restoration & Protection identifies a total of 253 priority projects including: 150 hydrologic restoration, 17 beneficial use/marsh creation, 2 oyster reef preservation projects, 9 shoreline/embankment maintenance projects, and 75 canal maintenance projects. The intent is to have the parish projects looked at in a holistic way to be considered for the 2017 State Master Plan. These conceptual projects are not authorized or funded for construction and are therefore not considered reasonably foreseeable in the FWOP or future with project conditions. They are included at the request of Cameron Parish.
- Calcasieu Parish's priority project is the Rabbit Island Project and then the entire Cameron Parish Project list at this time. Calcasieu Parish believes that protecting Cameron Parish will protect Calcasieu Parish. Calcasieu Parish anticipates updating their coastal plan which will include a priority projects list. Those projects will be viable projects for consideration of funding for protecting Lake Charles to the 500 year level of protection as deemed necessary by the Coastal Master Plan for Louisiana 2012. These conceptual projects are not authorized or funded for construction and are therefore not considered reasonably foreseeable in the FWOP or future with project conditions. They are included at the request of Cameron Parish.
- The Vermilion Parish Coastal Priority Project list identifies a total of 42 priority projects including: 10 hurricane protection projects, 17 shoreline protection and bank stabilization projects, 6 marsh creation projects, 7 hydrologic restoration projects, and 2 ridge restoration projects. These conceptual projects are not authorized or funded for construction and are therefore not considered reasonably foreseeable in the FWOP or future with project conditions. They are included at the request of Vermilion Parish.
- Other Gulf shore protection and restoration projects have been constructed along the Gulf shoreline through other funding sources. Segmented breakwaters have been constructed under at least two separate projects to the west of the proposed Holly Beach Shoreline Stabilization (5a) measure. The proposed breakwater would provide shoreline protection from the eastern end of the existing breakwaters eastward to the Calcasieu Pass jetty and compliment that existing project. The shoreline where the proposed Holly Beach measure would be built has been nourished with material dredged from the bottom of the Gulf of Mexico to help ensure that shoreline erosion did not compromise Louisiana Highways 27/82. Rock and riprap have also been placed at critical locations where shoreline erosion has threatened the highway. The proposed Holly Beach measure is compatible with and would augment these prior efforts. There have been proposals to construct shore protection measures along

the Gulf where the proposed Gulf shoreline restoration [Calcasieu River to Freshwater Bayou (6b1, 6b2, and 6b3)] measures are located, but no projects have been built.

The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse cumulative impacts to aquatic and terrestrial organisms and their habitats.

h. Determination of Secondary Effects on the Aquatic Ecosystem

Secondary or indirect effects are effects on an aquatic ecosystem that are associated with a discharge of dredged or fill materials, but do not result from the actual placement of the dredged or fill material. The NER RP 35 chenier reforestation measures would have no secondary effects on the aquatic ecosystem. In addition to secondary effects described above, there would be long-term losses of shallow open water habitats in the Southwest Coastal Louisiana project area due to construction of NER RP marsh restoration and shoreline protection measures. However, there is an abundance of shallow open water habitat throughout the Southwest Coastal Louisiana project area for use by aquatic organisms and other users. **Table 5** summarizes the direct and secondary (indirect) effects of NER RP measures on existing coastal restoration projects in Calcasieu, Cameron and Vermilion Parishes.

NER RP Measures 124d and 3c1 would be partially located on USFWS properties and are therefore recommended for construction by the USFWS.

Projects CS-59 would be potentially indirectly impacted by construction of marsh restoration NER RP measure 124c. Project CS-054 would be potentially indirectly impacted by construction of marsh restoration NER RP measure 3c1. The NER RP measures would be constructed immediately adjacent and surrounding the existing coastal restoration projects. However, when overlap occurs, proposed NER RP measures would be constructed to avoid existing coastal restoration projects by construction of temporary containment/exclusion dikes to contain dredged borrow sediments used for construction of the NER RP measure and also prevent dredged effluents from entering the existing coastal restoration project sites. Inactive project TV-11B could be impacted by NER RP marsh restoration measure if reactivated.

In addition, existing mitigation projects are also located within areas proposed for restoration under the NER RP. **Figure 8** and **Table 4** contains information about mitigation projects that occur within the NER RP project area. In most instances, these mitigation projects were developed to provide a sustainable buffer from wave action and storm surge generated by tropical storms and hurricanes. When overlap occurs, proposed NER RP measures would not be constructed until the mitigation projects satisfy their permitted obligations.

The nourishment, restoration and protection of degraded marsh and shallow open water to transitional estuarine coastal marsh habitats would indirectly benefit plankton, benthic, nekton and wildlife resources by providing increased dissolved organic compounds and detritus that would, in turn, provide food and energy resources for benthic organisms and the aquatic food web. This would eventually increase local epifauna which, in turn, would help reduce turbidity, regenerate ammonia and phosphorous, and serve as important sources of food for birds, nekton, and people. An increase in the export of dissolved organic compounds and detritus from the restored, nourished and protected marsh habitats would benefit local plankton populations by increasing the planktonic food web. Some local plankton populations would be displaced to other shallow open water areas, of which there are an increasing abundance due to the extensive coastal land loss. Also as described above, the NER RP would provide and protect important, essential and in some instances critical habitats used by various terrestrial and aquatic organisms for shelter, nesting, feeding, roosting, cover, nursery, EFH and other life requirements would likely lead to localized increase in productivity. Furthermore, implementing the NER RP measures would further complement, sustain and protect existing coastal restoration projects, mitigation and USFWS properties. There could also be localized increases in recreational and commercial fisheries due to the increased areal extent of transitional estuarine EFH. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse secondary impacts to aquatic and terrestrial organisms and their habitats.

III. Findings of Compliance or Non-compliance with the Restrictions on Discharge

a. Adaptation of the Section 404(b)(1) Guidelines to this Evaluation
No significant adaptations of the guidelines were made relative to this evaluation.

b. Evaluation of Availability of Practicable Alternatives to the Proposed Discharge Site Which Would Have Less Adverse Impacts on the Aquatic Ecosystem
The discharge represents the least environmentally damaging practicable alternative. The proposed action consists of measures to minimize the adverse effects of coastal marsh and shoreline land loss. This would include the discharge for hydraulic placement of borrow sediments for marsh restoration measures and the placement of geotextile fabric and rock for shoreline stabilization and protection.

c. Compliance with Applicable State Water Quality Standards
The material released during dredging and disposal operations are not expected to exceed Louisiana Water Quality Standards.

d. Compliance with Applicable Toxic Effluent Standard or Prohibition Under Section 307 of the Clean Water Act
The proposed action does not appear to violate effluent standards prohibited under Section 307 of the Clean Water Act.

e. Compliance with the Endangered Species Act of 1973
The proposed action is compliant with the Endangered Species Act of 1973, as amended. The proposed action would not significantly affect endangered or threatened species or their critical habitats.

f. Compliance with Specified Protection Measures for Marine Sanctuaries Designated by the Marine Protection, Research, and Sanctuaries Act of 1972
The proposed action is compliant with specified protection measures for marine sanctuaries designated by the Marine Protection, Research, and Sanctuaries Act of 1972. All marsh restoration disposal sites and effects are located in inland waters. Some of the shoreline protection measures would be located in the Gulf of Mexico near shore area to protect barrier shorelines. However, no effects would occur to marine sanctuaries in the Gulf of Mexico.

g. Evaluation of Extent of Degradation of the Waters of the United States
(1) Significant Adverse Effects on Human Health and Welfare
(a) Municipal and Private Water Supplies.
The proposed action would not cause or contribute to significant degradation of waters of the United States including adverse effects on municipal and private water supplies. Rather, the proposed action would protect and restore marsh wetland which would improve water quality filtering water and trapping sediments and retaining excess nutrients and other pollutants such as heavy metals. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to municipal and private water supplies.

(b) Recreational and Commercial Fisheries.
Dredging and discharge of sediments for marsh restoration and placement of geotextile and rock for shoreline protection would result in a loss of benthic prey items and availability of open water habitat. Temporary and localized increases in turbidity, total suspended sediments, and water temperatures and decreases in dissolved oxygen would return to pre-construction conditions following completion of construction. Following construction, temporary containment/exclusion dikes would naturally degrade or would be degraded at three years following construction, if necessary, to re-establish connectivity with surrounding waters thereby providing access for recreational and commercial fish species. Both recreational and commercial fishery catch

would likely return to pre-construction conditions or show improvements due to the restoration and protection of marsh. Shoreline protection measures would provide protection to marsh from erosive tidal and wind driven waves thereby protecting restored and other valuable intertidal estuarine marsh habitats utilized by many aquatic species for shelter, nesting, feeding, cover, nursery, and other life requirements. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to recreational and commercial fisheries.

(c) Plankton.

Effects on plankton would be temporary, localized and expected to occur primarily during construction of the nine marsh restoration measures and five shoreline protection measures. Adverse effects would be primarily related to increased turbidity and total suspended sediments, increased water temperatures and decreased dissolved oxygen. Following construction these temporary effects would diminish and conditions would return to those observed prior to construction. Bacterioplankton would resume consuming organic materials, which would increase in availability due to restored and protected marshes. Zooplankton, or animal plankton would continue to feed on other plankton and other organisms. The protected and restored marsh areas would be expected to increase the local ecosystem health. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to plankton.

(d) Fish.

Effects on fish during construction of the nine marsh restoration measures and five shoreline protection measures would result in the temporary displacement of fish during dredging and placement and other construction activities due to increased turbidity and total suspended sediments, localized increase in water temperatures and decrease dissolved oxygen. Following construction, these temporary conditions would diminish and the area would return to conditions similar to those observed prior to construction. Following construction, temporary containment/exclusion dikes would naturally degrade or would be degraded at three years following construction, if necessary, to re-establish connectivity with surrounding waters thereby providing access for fish. The proposed action is expected to restore and protect marsh EFH and areas of intertidal emergent vegetation, which provide an array of foraging, breeding, spawning, and cover habitat for a variety of adult and juvenile fishes. The protected and restored marsh areas would be expected to increase local ecosystem health. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to fish.

(e) Shellfish.

Shrimp and crab are the primary shellfish inhabiting the Study Area. Effects of the nine marsh restoration measures and five shoreline protection measures on sessile shellfish species would be similar to those described above for benthic organisms. Effects on more mobile shellfish (e.g. shrimp and crabs) would be similar to those described above for fish. Following construction, temporary containment/exclusion dikes would naturally degrade or would be degraded at three years following construction to re-establish connectivity with surrounding waters thereby providing access for shellfish. The proposed action is expected to restore and preserve marsh that provide an array of foraging, breeding, and cover habitat for a variety of shellfish. The protected and restored marsh areas would be expected to increase local ecosystem health. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to shellfish.

(f) Wildlife.

The nine marsh restoration measures and five shoreline protection measures would, as described above, restore and protect valuable intertidal estuarine marsh and shoreline habitats utilized by an array of birds, mammals and reptiles for shelter, nesting, feeding, roosting, cover, nursery, and other life requirements. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to wildlife.

(g) Special Aquatic Sites.

Some existing special aquatic sites would be significantly and permanently positively affected, as described above, by marsh restoration and nourishment of nine marsh restoration measures and five shoreline protection measures. These include: sanctuaries and refuges, including existing coastal restoration projects CS-54 and CS-59, portions of Sabine NWR and Cameron Prairie NWR, existing mitigation projects (**Table 4**), wetlands, mud flats, and vegetated shallows, threatened and endangered species, and other wildlife. The proposed action would have no effects or impacts on coral reefs or riffle and pool complexes. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to special aquatic sites.

(2) Significant Adverse Effects on Life Stages of Aquatic Life and Other Wildlife Dependent on Aquatic Ecosystems.

The proposed action would not cause or contribute to significant degradation of waters of the United States including adverse effects on life stages of organisms dependent on the aquatic ecosystems. The proposed action is expected to restore and preserve marsh and areas of inter-tidal emergent vegetation, which provide an array of foraging, breeding, spawning, and cover habitat for a variety of adult and juvenile fishes, birds, mammals, and reptiles. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts on Life Stages of Aquatic Life and Other Wildlife Dependent on Aquatic Ecosystems.

(3) Significant Adverse Effects on Aquatic Ecosystem Diversity, Productivity and Stability.

The proposed action would not cause or contribute to significant degradation of waters of the United States including adverse effects on ecosystem diversity, productivity and stability. The proposed action would restore and protect marsh and areas of inter-tidal emergent vegetation, thereby restoring and protecting diversity, productivity, and stability of the Southwest Coastal Louisiana Study Area. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts on aquatic ecosystem diversity, productivity and stability.

(4) Significant Adverse Effects on Recreational, Aesthetic, and Economic Resources.

The proposed action would not cause or contribute to significant degradation of waters of the United States including adverse effects on recreational, aesthetic, and economic resources. The proposed action would restore and preserve marsh and areas of inter-tidal emergent vegetation, thereby providing and protecting marsh wetland areas that contribute to recreational, aesthetic, and economic benefits. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts on recreational, aesthetic, and economic resources.

h. Appropriate and Practicable Steps Taken to Minimize Potential Adverse Impacts of the Discharge on the Aquatic Ecosystem

Appropriate and practicable steps have been taken to minimize potential adverse impacts of the discharges on the aquatic ecosystem. Substrate at the shallow open-water disposal sites are similar to dredged material that would be discharged during marsh restoration. Dredged material discharged at marsh restoration sites would be confined by earthen retention dikes, existing marsh or other natural measures, and the existing shorelines and the five shoreline protection measures to reduce migration of fill into the Gulf of Mexico and other adjacent waterways. Dredged material would be discharged at the nine marsh restoration sites to elevations conducive to marsh development. Construction activities at the dredge borrow areas, the nine marsh restoration sites and the five shoreline protection sites would be conducted using the best available practical techniques and BMPs to minimize potential adverse impacts of discharges on the aquatic ecosystem.

i. On the Basis of the Guidelines, the Proposed Disposal Site(s) for the Discharge of Dredged Material (specify which) is or are (select one)

(1) Specified as complying with the requirements of these guidelines; or,

NA

(2) Specified as complying with the requirements of these guidelines, with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects on the aquatic ecosystem; or,
On the basis of the guidelines, the proposed disposal sites for the discharge of dredged material comply with the requirement of these guidelines, with the inclusion of appropriate and practicable conditions to minimize pollution or adverse effects on the aquatic ecosystem.

(3) Specified as failing to comply with the requirements of these guidelines.

NA

IV. Evaluation Responsibility

a. Water Quality Input Prepared by: William P. Klein, Jr., Biologist
b. Project Description and Biological Input Prepared by: William P. Klein, Jr., Biologist

_____ _____

Date

Joan Exnicios
Chief, Environmental Planning

References

1. Environmental Regulatory Code, Part IX. Water Quality Regulation, Louisiana Department of Environmental Quality, September 2014.
2. State of Louisiana Water Quality Management Plan, 2012 Water Quality Inventory: Integrated Report, Louisiana Department of Environmental Quality, Office of Water Resources, 2012.
3. http://sero.nmfs.noaa.gov/deepwater_horizon_oil_spill.htm
4. http://www.geoplatform.gov/gulfresponse/
5. http://www.nrc.uscg.mil/
6. USACE, Final Dredged Material Management Plan and Supplemental Environmental Impact Statement: Calcasieu River and Pass, Louisiana, Volume I, 22 November 2010.
7. USGS, Water Resources of Cameron Parish, Louisiana, Louisiana Department of Transportation and Development, March 2014.
8. USGS, Water Resources of Vermilion Parish, Louisiana, Louisiana Department of Transportation and Development, December 2014.
9. Gosselink, J.G. 1984. The ecology of delta marshes of coastal Louisiana: a community profile. USFWS FWS/OBS-84/09 134pp.
10. Miller, R. and E. Meselhe. 2007. Louisiana Chenier Plain Regional Hydrodynamic and Salinity Numerical Model. In Proceedings of the Tenth International Conference on Estuarine and Coastal Modeling Congress, pp. 407-426. 2007.
11. Wilber D.H., G.L. Ray, D.G. Clarke, and R.J. Diaz. 2008. Responses of Benthic Infauna to Large-Scale Sediment Disturbance in Corpus Christi Bay, Texas. Journal of Experimental Marine Biology and Ecology Volume 365, Issue 1, pp. 13–22.
12. Bilkovic, D.M. and M.M. Mitchell. 2013. Ecological tradeoffs of stabilized saltmarshes as a shoreline protection strategy: Effects of artificial structures on macrobenthic assemblages. Ecological Engineering 61:469–481

(2) Specified as complying with the requirements of these guidelines, with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects on the aquatic ecosystem; or,
On the basis of the guidelines, the proposed disposal sites for the discharge of dredged material comply with the requirement of these guidelines, with the inclusion of appropriate and practicable conditions to minimize pollution or adverse effects on the aquatic ecosystem.

(3) Specified as failing to comply with the requirements of these guidelines.

NA

IV. Evaluation Responsibility

a. Water Quality Input Prepared by:

b. Project Description and Biological Input Prepared by: William P. Klein, Jr., Biologist

February 18, 2016
Date

STILES.SANDRA.ELAINE.12309...
21748

Joan Exnicios
Chief, Environmental Planning

References

1. Environmental Regulatory Code, Part IX. Water Quality Regulation, Louisiana Department of Environmental Quality, September 2014.
2. State of Louisiana Water Quality Management Plan, 2012 Water Quality Inventory: Integrated Report, Louisiana Department of Environmental Quality, Office of Water Resources, 2012.
3. http://sero.nmfs.noaa.gov/deepwater_horizon_oil_spill.htm
4. http://www.geoplatform.gov/gulfresponse/
5. http://www.nco.uscg.mil/
6. USACE, Final Dredged Material Management Plan and Supplemental Environmental Impact Statement: Calcasieu River and Pass, Louisiana, Volume I, 22 November 2010.
7. USGS, Water Resources of Cameron Parish, Louisiana, Louisiana Department of Transportation and Development, March 2014.
8. USGS, Water Resources of Vermilion Parish, Louisiana, Louisiana Department of Transportation and Development, December 2014.
9. Gosselink, J.G. 1984. The ecology of delta marshes of coastal Louisiana: a community profile. USFWS FWS/OBS-84/09 134pp.
10. Miller, R. and E. Meselhe. 2007. Louisiana Chenier Plain Regional Hydrodynamic and Salinity Numerical Model. In Proceedings of the Tenth International Conference on Estuarine and Coastal Modeling Congress, pp. 407-426. 2007.
11. Wilber D.H., G.L. Ray, D.G. Clarke, and R.J. Diaz. 2008. Responses of Benthic Infauna to Large-Scale Sediment Disturbance in Corpus Christi Bay, Texas. Journal of Experimental Marine Biology and Ecology Volume 365, Issue 1, pp. 13–22.
12. Bilkovic, D.M. and M.M. Mitchell. 2013. Ecological tradeoffs of stabilized saltmarshes as a shoreline protection strategy: Effects of artificial structures on macrobenthic assemblages. Ecological Engineering 61:469–481

SOUTHWEST COASTAL LOUISIANA
INTEGRATED FINAL FEASIBILITY REPORT
AND
ENVIRONMENTAL IMPACT STATEMENT

APPENDIX A

Annex B

Revised Louisiana Coastal Resources Program Consistency Determination

JOHN BEL EDWARDS
GOVERNOR

THOMAS F. HARRIS
SECRETARY

State of Louisiana

DEPARTMENT OF NATURAL RESOURCES

OFFICE OF COASTAL MANAGEMENT

February 26, 2016

Troy Constance
Corps of Engineers- New Orleans District
P.O. Box 60267
New Orleans, LA 70160-0267
Via e-mail: Troy.G.Constance@usace.army.mil

RE: **C20160002,** Coastal Zone Consistency
New Orleans District, Corps of Engineers (COE-NOD)
Direct Federal Action
Louisiana Coastwide Authority, Southwest Coastal Louisiana Project; National Economic Development (NED) and National Ecosystem Restoration (NER) Recommended Plans,
Vermilion, Cameron and Calcasieu Parishes, Louisiana

Dear Mr. Constance:

This letter is in response to your staff's inquiries for additional information regarding our recent Coastal Zone Consistency decision (C20160002) for the Southwest Coastal (SWC), Louisiana Project; National Economic Development (NED) and National Ecosystem Restoration (NER). Recommended Plans, as described in the consistency determination filed with the Louisiana Department of Natural Resources, Office of Coastal Management (OCM) on January 5, 2016, and more fully described in the Southwest Coastal Louisiana Study Integrated Final Feasibility Report and Environmental Impact Statement.

After close coordination between your staff and OCM personnel, we can reiterate that at this feasibility phase, both the NED and the NER Recommended Plans (RPs) and plan features are generally consistent with the Louisiana Coastal Resources Program (LCRP). Because the project is at the Feasibility Study stage, detailed information about project design and construction, and the potential effects on coastal resources, has not yet been generated. Therefore OCM's concurrence with your consistency determination has been evaluated appropriately under the provisions of NOAA Federal Consistency Regulations for phased consistencies (15 CFR Part 930.37(d)).

Consistency determinations, broadly, are prepared when sufficient information has been developed to reasonably determine the consistency of the activity with the State's approved coastal management plan. The consistency determination must include a detailed description of the proposed activity and reasonably foreseeable coastal effects, and comprehensive data and information sufficient to support the consistency determination. When this level of detail is not available, the phased consistency provides for State agreement that the federal activity is consistent at that early stage of planning, while anticipating that additional information and decisions will be developed in later phases, such as Preconstruction Engineering and Design, and will be subject to further consistency review. The phased consistency affords the Corps of Engineers and the State of Louisiana the opportunity to work

Post Office Box 44487 • Baton Rouge, Louisiana 70804-4487
617 North Third Street • 10th Floor • Suite 1078 • Baton Rouge, Louisiana 70802
(225) 342-7591 • Fax (225) 342-9439 • http://www.dnr.louisiana.gov
An Equal Opportunity Employer

towards full consistency as project design proceeds.

As noted in our concurrence letter, each specific measure in the NER RP will have details of design and construction which must be determined before their coastal effects can be fully evaluated. Also, over the period of implementation adaptive management responses to changes in technology, varied site conditions and project performance might result in refinements to the plan measures. The phased consistency will help expedite future efforts to evaluate coastal effects and ensure compliance with the Louisiana Coastal Resources Program (LCRP).

Examples of some of the information which is incomplete at the current phase were identified for five specific plan features of the recommended plan in an electronic mail message, dated January 29, 2016, from Jeff Harris of my staff to Dr. William Klein, and have been thoroughly discussed between our organizations at the staff level. These include, but are not limited to, sediment discharge management plans, staging and pipe laydown areas, access routes and methods, booster pump locations and placement, effects on existing infrastructure, etc. A copy of the e-mail is attached for your easy reference. OCM anticipates that the final consistency determinations for Recommend Plan measures will include project information of comparable detail. In that regard, OCM will issue concurrence letters for each specific NER RP measure, following our satisfactory review of measure-specific consistency determinations along with the supporting detail that is developed during the Project Design phase.

OCM has worked with the Corps on many projects in the Louisiana coast and finds no reason for concern that would prevent implementation of the recommended plan or any feature of the plan. The New Orleans District has successfully completed numerous consistency determinations for activities in the Louisiana coastal zone; our experience suggests that the consistency requirements for later phases of this project will be achieved through the usual project development process, and will be similar in nature to that of prior Corps projects in Louisiana.

Through continued close collaboration between the USACE and OCM staffs we anticipate concurring with the full consistency determination for each of NER project features. Proceeding by way of the phased consistency determination assures that both our agencies can be successful in meeting our missions and achieving a positive outcome for Louisiana's coast.

I look forward to continuing a close collaboration between our organizations. If you have any additional questions please contact Mr. Jeff Harris of my staff.

Sincerely,

/S/ Keith Lovell
Assistant Secretary

cc: Joan Exnicios, COE-NOD
Sandra Stiles, COE-NOD
William Klein, COE-NOD

ATTACHMENT

(* Note: Latitude/longitude coordinates have been deleted for clarity)

From: Jeff Harris [mailto:Jeff.Harris@LA.GOV]
Sent: Friday, January 29, 2016 3:01 PM
To: Klein, William P Jr MVN <William.P.Klein.Jr@usace.army.mil>
Subject: [EXTERNAL] RE: C20160002 LCA Southwest Coastal Louisiana (UNCLASSIFIED)

Bill--

I've done a preliminary review of the three of the NER RD measures, 3a1, 3c1, and 47a1, and 47a2 and 47c1 will largely be similar to 47a1. I've identified some concerns, mostly due to lack of detail in the proposed plans, and I wanted to give you as much time as possible to review and address them. Rather than dumping all of it on you on Feb. 11.

I want to stress that this is preliminary. The comments below are, literally, my review notes.

Look them over and we can discuss next week.

Have a great weekend,

--Jeff

3a1 Beneficial Use of Dredged Material from Calcasieu Ship Channel
- Disposal dikes along shoreline: located on wetlands? Impacts? Need description or cross section showing relationship.
- Need plats & description of staging areas, discharge pipe laydown areas.
- Booster pump locations are vague. Propose to —minimize! wetland impacts also vague.
- Existing internal dike located at approx. * : How will it be dealt with, within the disposal area? How will the new & existing dike intersection be constructed? Description or plat needed.
- Access to disposal area: across GIWW bankline, or at weir at approx. * ? Impacts? Restored?
- Access of clamshell dredge: across shoreline? Impacts? Restored?
- Pg B-73, Guideline 3.8: For all NER RD, beach crossings will be restored to at least preproject conditions. Good

3c1 Beneficial Use of Dredged Material from Calcasieu Ship Channel
- "Navigation traffic is not anticipated to be impacted." What measures will be taken so boats can cross the pipeline, in Calcasieu Lake and along the back dike canal?
- Access to disposal area: across shoreline, or at the weirs at approx. * ? Impacts? Restored?
- Access of clamshell dredge: across shoreline? Impacts? Restored?
- Need plats & description of staging areas, discharge pipe laydown areas.
- Confirm that no dredging is anticipated to be necessary for moving booster pumps to their proposed locations. Oyster impacts.
- Pg B-73, Guideline 3.8: For all NER RD, beach crossings will be restored to at least preproject conditions. Good

47a1 Marsh Restoration Using Dredged Material South of Highway 82
- The disposal area has complex internal geography. Sediment discharge management plans?
- Need plats & description of staging areas, discharge pipe laydown areas.
- Oil field access road within the disposal area at approx. * . How will the containment dikes impact this road? How will sediment be conveyed across it? How will it be kept clear?

- At least 12 active or inactive oil and gas wells are located within the disposal area. How will access to these be maintained? Does it need to be maintained for P&A'ed wells?
- Canal dredging "not anticipated." 2013 aerials show channel to be narrow, partially filled. Alternate plans?
- There are at least three pipeline crossings along the proposed access route, at approx. * ; and one road crossing at approx. * . Will this require changes to the access plans?
- Borrow area wave refraction: No study until PED stage? Potential beach erosion?
- Pg K-9 refers to typical cross section of borrow area in Annex A; no cross section present.
- Pg B-73, Guideline 3.8: For all NER RD, beach crossings will be restored to at least preproject conditions. Good

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, NEW ORLEANS DISTRICT
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO ATTENTION OF

January 5, 2016

Regional Planning and Environment
Division South
Environmental Planning Branch

Mr. Keith Lovell
Interagency Affairs – LADNR
Field Services Division
P.O. Box 44487, Capital Station
Baton Rouge, LA 70804-4487

Dear Mr. Lovell:

Reference your letters dated June 30, 2014, and June 2, 2015 regarding Consistency Zone Consistency #C20150064 for the Southwest Coastal Louisiana project. As noted in these letters, at the programmatic level, this project was considered consistent with the Louisiana Coastal Resources Program by the LADNR. However, these letters notified us that as more detailed information is developed and planning proceeds, consistency reviews would be necessary for each of the individual elements which make up the Southwest Coastal Louisiana Project.

The attached revised consistency determination includes detailed and constructible nonstructural flood risk reduction plan features for the National Economic Development Recommended Plan (NED RP), as well as detailed and constructible ecosystem restoration plan features for the National Ecosystem Restoration Recommended Plan (NER RP) as will be presented in the Integrated Final Feasibility Study and Environmental Impact Statement. Following this updated project information, a detailed analysis of the applicable Coastal Use Guidelines for both the NED and NER RP is provided. Also included are fact sheets describing, in more detail, the NER RP features.

The primary change to the NED RP is the mandatory requirement to acquire and demolish structures located within the FEMA Regulatory Floodway has been removed. The NED RP is now entirely voluntary. The nonstructural NED RP measures include: elevating eligible residential structures; dry floodproofing eligible non-residential structures, including warehouses and industrial complexes, and; construction of flood proofing barriers or berms less than 6 feet in height around non-residential structures, primarily industrial complexes and warehouses.

The NER RP proposes three types of ecosystem restoration: 9 marsh restoration features; 5 shoreline protection features; and 35 chenier reforestation features. The Calcasieu Calcasieu Ship Channel Salinity Barrier feature and the Cameron-Creole

-2-

Spillway Salinity Control Structure feature are recommended for long-term study. Two marsh restoration features, located partially on U.S. Fish and Wildlife Service (USFWS) properties, are recommended for construction by the USFWS. Feature 124d Marsh Restoration at Mud Lake would be located on Sabine National Wildlife Refuge (NWR). Feature 3c1 Beneficial Use of Dredged Material from Calcasieu Ship Channel would be located on the Cameron Prairie NWR.

Many of the NER RP features would be constructed in the immediate vicinity of Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) projects. The NER RP shoreline protection Feature 5a (Holly Beach Shoreline Stabilization-Breakwaters) would be located immediately offshore of the projects CS-31 (Holly Beach Sand Management) and CS 33 (Cameron Parish Shoreline). The NER RP marsh restoration feature 124c would overlap portions of Project CS-59 (Oyster Bayou Marsh Creation and Terracing). The NER RP marsh restoration feature 3c1 would overlap portions of Project CS-054 (Cameron-Creole Watershed Grand Bayou Marsh Creation). When overlap occurs, proposed NER RP features would be constructed to avoid existing coastal restoration projects by construction of temporary containment/exclusion dikes that would contain dredged borrow sediments used for construction of the NER RP feature and also prevent dredged effluents from entering the existing coastal restoration projects sites. Temporary containment/exclusion dikes would degrade naturally to restore connectivity with surrounding areas or would be degraded at three years after construction has been completed.

Existing mitigation projects are also located within areas proposed for restoration under the NER RP. Mitigation projects are designed and constructed to offset anticipated losses from permitted activities. This revised Consistency Determination contains specific information about mitigation projects that occur within the project area. In most instances, these mitigation projects were developed to provide a sustainable buffer from wave action and storm surge generated by tropical storms and hurricanes. When overlap occurs, the proposed NER RP features would not be constructed until the mitigation projects satisfy their 20-year permitted obligations.

Based upon the revised evaluation, the U.S. Army Corps of Engineers, Mississippi Valley Division, New Orleans District, has determined that the proposed action is consistent, to the maximum extent practicable, with the State of Louisiana's Coastal Resources Program.

Questions should be mailed to the attention of Ms. Sandra E. Stiles; U.S. Army Corps of Engineers; Regional Planning and Environment Division South; New Orleans

-2-

Environmental Branch; CEMVN-PDN-CEP; P.O. Box 60267; New Orleans, Louisiana 70160-0267. Ms. Sandra E. Stiles may be contacted at (504) 862-1583 if questions arise.

Sandra Stiles
for Joan M. Exnicios
Chief, Environmental Planning Branch

Attachments:

Southwest Coastal Louisiana, Revised Louisiana Coastal Resources Consistency Determination

Appendix K Fact Sheets and Maps for Features of the National Ecosystem Restoration Recommended Plan

JOHN BEL EDWARDS
GOVERNOR

THOMAS F. HARRIS
SECRETARY

State of Louisiana

DEPARTMENT OF NATURAL RESOURCES

OFFICE OF COASTAL MANAGEMENT

February 12, 2016

Joan Exnicios
Environmental Branch
Corps of Engineers- New Orleans District
P.O. Box 60267
New Orleans, LA 70160-0267
Via e-mail: Joan.M.Exnicios@usace.army.mil

RE: **C20160002,** Coastal Zone Consistency
New Orleans District, Corps of Engineers (COE-NOD)
Direct Federal Action
Louisiana Coastwide Authority, Southwest Coastal Louisiana Project; National Economic Development (NED) and National Ecosystem Restoration (NER) Recommended Plans,
Vermilion, Cameron and Calcasieu Parishes, Louisiana

Dear Ms. Exnicios:

The Office of Coastal Management (OCM) has received the above referenced federal application for consistency review with the approved Louisiana Coastal Resources Program (LCRP) in accordance with Section 307(c) of the Federal Coastal Zone Management Act of 1972, as amended.

National Economic Development Recommended Plan

After careful review, OCM finds that the NED Recommended Plan, as amended, is fully consistent with the LCRP. Further coordination with OCM on individual NED measures is not required provided those measures meet the stipulations described in the January 21, 2016, e-mail from Dr. William Klein of your staff. Specifically, those stipulations are:

1. No NED activities will be conducted in wetlands. This includes work areas, access routes, staging areas, and borrow and discharge locations. Wetlands would be defined by a Corps of Engineers wetland delineation, or as identified on LDNR's SONRIS GIS system, or other suitable source.
2. No NED work on cheniers will involve excavation; any necessary fill will be hauled in from approved borrow sites. Minor foundation excavation for purposes of raising a structure will be permissible provided the excavations are restored to preproject conditions.
3. NED projects will not significantly alter the local hydrology.
4. NED projects which do not meet these criteria will require pre-construction coordination with LDNR Office of Coastal Management, and may require an individual consistency determination or other authorization.

Post Office Box 44487 • Baton Rouge, Louisiana 70804-4487
617 North Third Street • 10th Floor • Suite 1078 • Baton Rouge, Louisiana 70802
(225) 342-7591 • Fax (225) 342-9439 • http://www.dnr.louisiana.gov
An Equal Opportunity Employer

C20160002
Corps of Engineers
February 12, 2016
Page 2

Measures which do not meet those stipulations or which otherwise may have reasonably foreseeable coastal effects which have not been evaluated for consistency with the LCRP will require further review by OCM prior to implementation.

National Ecosystem Restoration Recommended Plan

Significant decisions or alternatives for the proposed NER measures remain undecided and will be finalized only after additional information is developed during the design phase. Therefore, review of this determination has proceeded per National Oceanic and Atmospheric Administration (NOAA) regulations on federal consistency at 15 CFR §930.36(d) for phased consistency determinations. OCM finds that this feasibility phase of the NER Recommended Plan is consistent with the LCRP, however, pursuant to federal regulations, consistency determinations must be submitted for each major decision in subsequent phases of the project measures that are subject to Federal discretion. The federal agency shall ensure that the measures under development continue to be consistent to the maximum extent practicable with the LCRP until such plans are finalized.

In order to fully review the activities addressed by this consistency determination, clear descriptions and depictions of proposed activities must be provided. Information necessary for OCM review includes precise locations and dimensions of proposed access routes; work and staging areas; temporary and permanent rights-of way; and estimates of temporary and permanent impacts to wetlands, shorelines, cheniers, and other sensitive coastal features, including those resulting from access to and staging for work sites.

As planning for the proposed measures proceeds and detailed information is developed, please provide additional consistency determinations as appropriate to ensure compliance with the LCRP. Please understand that this concurrence letter specifically does not authorize any construction or other NER Recommended Plan activities which may have reasonably foreseeable effects on coastal land use, water use, or natural resources.

If you have any questions concerning these comments, please contact Jeff Harris of the Consistency Section at (225) 342-7949.

Sincerely,

/S/ Don Haydel
Acting Administrator
Interagency Affairs/Field Services Division

DH/SK/jdh

cc: Sandra Stiles, COE-NOD
William Klein, COE-NOD
Dave Butler, LDWF
Kaili Patterson, OCM/FI
Darin Thomassee, OCM/FI
Laurie Cormier, Calcasieu Parish
Kara Bonsall, Cameron Parish

From: Jennifer Mouton
To: Klein, William P Jr MVN; Jeff Harris
Cc: Varnado, Paul A MVN; MacInnes, Andrew D MVN; Axtman, Timothy J MVN; Broussard, Darrel M MVN; Stiles, Sandra E MVN; Exnicios, Joan M MVN; Gilmore, Tammy N MVN; Tye Fitzgerald; Ken Duffy; Bren Haase; Brian Lezina
Subject: [EXTERNAL] RE: C20160002 LCA Southwest Coastal Louisiana (UNCLASSIFIED)
Date: Thursday, February 04, 2016 5:18:10 PM
Attachments: Borrow Typical Section.pdf

Jeff – here is a typical design drawing for the borrow area for 47a1, 47a2 and 47c1. The design for the borrow area for measures 127c3 and 306a1 would be very similar. At this time, we do not have actual geotechnical data for any borrow areas so the current design (as reflected in the attached plat and the Appendix K fact sheets) is our best estimate using best engineering judgment of what borrow areas will be needed. The location of the borrow area included an initial rudimentary assessment that took into account constraints such as pipelines, known hazards, structures, etc. More precise information on the borrow areas will be developed during the engineering and design phase when sediment sampling and bathymetric surveys will take place. Updated designs and dimensions will be provided to LDNR prior to construction activities. Should there be any significant changes in the design of this features or their borrow areas, a revised consistency determination will be provided to LDNR for review.

I will ensure that the attached drawing is included in the next iteration of Appendix K, Annex A. Thanks. Jennifer

From: Jennifer Mouton
Sent: Thursday, February 04, 2016 8:22 AM
To: 'Klein, William P Jr MVN'; Jeff Harris
Cc: Varnado, Paul A MVN; MacInnes, Andrew D MVN; Axtman, Timothy J MVN; Broussard, Darrel M MVN; Stiles, Sandra E MVN; Exnicios, Joan M MVN; Tammy Gilmore; Tye Fitzgerald; Ken Duffy; Bren Haase; Brian Lezina
Subject: RE: C20160002 LCA Southwest Coastal Louisiana (UNCLASSIFIED)

Jeff – please see our responses below. Thanks for your quick review and comments. Jenn

3a1 Beneficial Use of Dredged Material from Calcasieu Ship Channel

- Disposal dikes along shoreline: located on wetlands? Impacts? Need description or cross section showing relationship.

Part of the constructed containment dikes will be on the shoreline. The others will be constructed along existing ridges and in open water. Wetland impacts will be restricted to the footprint of the constructed dikes and any adverse impacts will be offset by the creation and restoration of wetlands as described in the study. We have provided typical design drawings for containment dikes which contain the construction details such as slope, fill elevation, borrow area dimensions, etc. Project specific design drawings and plats have not yet been developed but will completed once the project goes to the engineering and design phase. Updated drawings and plats will be submitted to LDNR at that time and prior to construction. Should any significant changes occur in design or project features, an updated consistency determination will be submitted to LDNR for review.

- Need plats & description of staging areas, discharge pipe laydown areas.

Site specific plats and cross-sections beyond the measure factsheet and map in Appendix K, p. K-5, have not yet been developed. However, as it is currently depicted, the discharge pipe will be floated in via the GIWW along the bank line. The discharge pipe will be moved around in the outfall area so as to distribute sediment in such a way as to provide a dewatered surface elevation conducive to marsh vegetation establishment. The frequency and distance of pipeline relocation will depend on the quality (grain size and water/sediment ratio) of the slurry. The staging area and equipment, as envisioned, will be outside of the feature area and barged in via open water. No dredging is anticipated to be required to locate the staging barge. Should any changes be made to the design or project features, an updated consistency determination with site specific plats and descriptions will be submitted to LDNR for review prior to construction.

- Booster pump locations are vague. Propose to "minimize" wetland impacts also vague.

The booster pump quantity and locations were estimated based on previous marsh creation projects. The exact quantity and location of booster pumps are best determined by the size/horsepower of the Contractor's equipment. While all reasonable efforts will be made to comply with the project features as proposed in the Appendix K fact sheet and map, should the need arise to alter booster pump locations in such a way as to cause adverse impacts to wetlands, an updated project description, design and plat will be provided to LDNR to review and consistency determination. Additionally, any adverse impacts to the wetlands, should they occur, due to booster pumps, will be temporary with restoration of the impacted areas to the pre-project conditions. It should be noted that at this stage of project design, it is anticipated that all booster pumps will be barge-mounted, and floated at the margin of the navigation, thus avoiding wetland impacts altogether. However, as mentioned above, the precise locations of the booster pumps will be dependent on the equipment used for dredging the Calcasieu Ship Channel and is unknown at this time. These details will become known during the bid process and subsequent to the engineering and design phase of this specific measure. Any significant changes to the project design or features will be fully described in an updated consistency determination request and submitted to LDNR for review prior to construction.

- Existing internal dike located at approx. Long 99.2244o: How will it be dealt with, within the disposal area? How will the new & existing dike intersection be constructed? Description or plat needed.

The this time, site specific plats have not yet been developed. However, it is anticipated that existing internal dikes and terraces will largely be left in place, and slurry will be added around them thus allowing the two marsh creation areas to be constructed in a side-by-side fashion. For the purposes of the WVA benefits, the existing internal dike was treated as existing marsh and counted as re-nourished rather than created. The existing internal dike will be breached once the southern retention dike is in place so that water exchange and fish access can occur. The number and locations of the breaches will be determined in PED. Updated project plats will be submitted to LDNR once they have been developed during the engineering and design phase. Any significant changes to the project design or project features will be fully described in an updated consistency determination request and submitted to LDNR for review prior to project construction.

- Access to disposal area: across GIWW bankline, or at weir at approx. 30.0585 o, 93.4550 o? Impacts? Restored?

This crossing will be finalized during engineering and design. As presently configured, the discharge pipeline crossing is located adjacent to the rock weir you mentioned. All crossing will be restored to pre-construction conditions prior to project completion. Any significant changes will be forwarded to LDNR for review prior to construction.

- Access of clamshell dredge: across shoreline? Impacts? Restored?

A clamshell dredge will not be used in construction of the Marsh Creation Area, as it would require flotation access through the existing GIWW bank line. Therefore, no impacts from the dredge are expected. Instead, marsh buggies will be used in the Marsh Creation Area and will access the Marsh Creation Area at the same location as the discharge pipeline to minimize impacts. Impacts due to the use of marsh buggies will be minimized by the use of the established best management practices for use of marsh buggies during construction. At project construction completion, this crossing will be restored to pre-construction conditions. Should any changes to this design or construction method occur, an updated project description and design plat will be submitted to LDNR for review to determine coastal consistency.

- Pg B-73, Guideline 3.8: For all NER RD, beach crossings will be restored to at least pre-project conditions. Good

No additional information needed.

3c1 Beneficial Use of Dredged Material from Calcasieu Ship Channel

- "Navigation traffic is not anticipated to be impacted." What measures will be taken so boats can cross the pipeline, in Calcasieu Lake and along the back dike canal?

The discharge pipeline will be submerged and marked, per USCG requirements, at the locations mentioned in the above comment. In addition, close communication and coordination with the Calcasieu and Lake Charles River Pilots will be maintained at all times during construction to ensure no impacts to navigation safety. Navigation precautions similar to those followed during the construction of Mississippi River beneficial use of dredged material projects will be utilized to ensure minimal disruptions to navigation traffic.

- Access to disposal area: across shoreline, or at the weirs at approx. 29.8483 o, 93.2476 o and 29.8632 o, 93.2355 o ? Impacts? Restored?

Access to the Marsh Creation Areas will be across the shoreline/levee. The discharge pipeline and equipment will not cross over any weirs. Although temporary adverse impacts may occur during construction at the bank line crossings, these areas will be restored to pre-construction conditions prior to project completion. Should any changes to this construction method occur, an updated consistency determination request will be submitted to LDNR for review prior to project construction.

- Access of clamshell dredge: across shoreline? Impacts? Restored?

A clamshell dredge will not be used in construction of the Marsh Creation Area, as it would require flotation access through the existing GIWW bank line. Therefore, no impacts from the dredge are expected. Instead, marsh buggies will be used in the Marsh Creation Area and will access the Marsh Creation Area at the same location as the discharge pipeline to minimize impacts. Impacts due to the use of marsh buggies will be minimized by the use of the established best management practices for use of marsh buggies during construction. At project construction completion, this crossing will be restored to pre-construction conditions. Should any changes to this design or construction method occur, an updated project description and design plat will be submitted to LDNR for review to determine coastal consistency.

- Need plats & description of staging areas, discharge pipe laydown areas.

Site specific plats and cross-sections beyond the measure factsheet and map in Appendix K, p. K-8, have not yet been developed. However, as it is currently depicted, the discharge pipe will be floated in via the Calcasieu Ship Channel and Calcasieu Lake. The discharge pipe will be moved around in the outfall area so as to distribute sediment in such a way as to provide a dewatered surface elevation conducive to marsh vegetation establishment. The frequency and distance of pipeline relocation will depend on the quality (grain size and water/sediment ratio) of the slurry. The staging area and equipment, as envisioned, will be outside of the feature area and barged in via open water. Should any changes be made to the design or project features, an updated consistency determination with site specific plats and descriptions will be submitted to LDNR for review prior to construction.

- Confirm that no dredging is anticipated to be necessary for moving booster pumps to their proposed locations. Oyster impacts.

At this time, we do not anticipate any dredging to be necessary. However, we do not know the draft necessary for a Contractor's booster pumps, so some dredging may be required. If dredging is necessary, all access dredging will be backfilled upon completion of the project. Calcasieu Lake is a Tier 2 oyster seed ground. We have entered into agreements with LDWF to dredge Tier 2 Seed Grounds, specifically Calcasieu Lake (access route and borrow area), and would expect to have the same agreement for construction of this project. Any activities that affect oyster seed grounds or harvest areas will be done in accordance with LDWF requirements and will be obtained prior to any project construction activities commencing.

- Pg B-73, Guideline 3.8: For all NER RD, beach crossings will be restored to at least pre-project conditions. Good

No additional information needed.

47a1 Marsh Restoration Using Dredged Material South of Highway 82

- The disposal area has complex internal geography. Sediment discharge management plans?

A discharge plan will be finalized during engineering and design. At this time, given the large area of fill, we plan to break the large Marsh Creation Area into to smaller adjoining cells where applicable. A sediment discharge management plan can be forwarded to LDNR upon request and prior to project construction.

- Need plats & description of staging areas, discharge pipe laydown areas.

Site specific plats and cross-sections for the 47 projects beyond the measure factsheets and maps in Appendix K, p. K-9-17, have not yet been developed. However, as it is currently depicted, the discharge pipe will be floated in via the existing access channel from the Gulf of Mexico. The discharge pipe will be moved around in the outfall area so as to distribute sediment in such a way as to provide a dewatered surface elevation conducive to marsh vegetation establishment. The frequency and distance of pipeline relocation will depend on the quality (grain size and water/sediment ratio) of the slurry. The staging area and equipment, as envisioned, will be outside of the feature area and barged in via open water. Alternative access for equipment can be made via Highway 82 if necessary. Should any changes be made to the design or project features, an updated consistency determination with site specific plats and descriptions will be submitted to LDNR for review prior to construction.

- Oil field access road within the disposal area at approx. 29.7483 o, 92.9035 o. How will the containment dikes impact this road? How will sediment be conveyed across it? How will it be kept clear?

We will work with the road/landowner should they require the oil field access road to remain accessible. One way to achieve this is to use the road as one of the divisions between Marsh Creation Area cells similar to the existing internal dike as described in Measure 3a1. Dredge material would then be discharged on either side of the road. Where the discharge pipe needs to cross the access road a ramp can be constructed. Any impacts to existing access roads or banklines will be restored to their pre-project condition at the completion of construction.

- At least 12 active or inactive oil and gas wells are located within the disposal area. How will access to these be maintained? Does it need to be maintained for P&A'ed wells?

Access agreements to all well sites will be negotiated with the well owners during engineering and design. A design to ensure they are not restricted from accessing their oil and gas wells will be refined at that time. Land access designs and copies of access agreements will be provided to LDNR upon request prior to project construction activities.

- Canal dredging "not anticipated." 2013 aerials show channel to be narrow, partially filled. Alternate plans?

At this time, we anticipate the Contractor will be able to float the discharge pipe through the narrow canal with a small boat, or airboat, not requiring dredging. If this is not possible a marsh buggy could be used to pull the discharge pipe through the canals. Any significant changes to this plan will be documented and forwarded to LDNR for review for consistency.

- There are at least three pipeline crossings along the proposed access route, at approx. 29.7110 o, 92.9346 o, at 29.7160 o, 92.9251 o, and at 29.7277 o, 92.9116 o; and one road crossing at approx.. 29.7109 o, 92.9342o. Will this require changes to the access plans?

If crossing agreements cannot be made for the proposed access routes, the discharge pipe can be floated over the pipelines. At the oilfield access road, a ramp could be constructed to maintain access. There will be no impacts to existing pipelines. Any impacts to existing access roads or banklines will be temporary in nature. All impacted areas outside of the project feature will be restored to its pre-project condition at the completion of construction. Any changes to the access plans which occur during engineering and design will be provided to LDNR upon request. Should any significant changes be made to the design or project features, including site access plans, an updated consistency determination with site specific plats and descriptions will be submitted to LDNR for review prior to construction.

- Borrow area wave refraction: No study until PED stage? Potential bench erosion?

We have modeled for shoreline impacts due to our offshore borrow areas on all of CPRA's projects. To date, no such study has resulted has shown significant impacts with borrow areas similar to this design. However, once the exact borrow area size and dimensions are determined during the engineering and design phase, a borrow area analysis will be done to determine if dredging of the borrow area may result in any adverse impact on shoreline stability. The results of the borrow area analysis will be provided to LDNR in an updated consistency request at that time. Or, in the alternative, if no effects are found to exist, a negative declaration will be provided to LDNR prior to project construction.

- Pg K-9 refers to typical cross section of borrow area in Annex A; no cross section present.

It appears that drawing was inadvertently omitted from the report. A typical cross section will be forwarded to you as soon as possible.

- Pg B-73, Guideline 3.8: For all NER RD, beach crossings will be restored to at least pre-project conditions. Good

No additional information needed.

From: Klein, William P Jr MVN [mailto:William.P.Klein.Jr@usace.army.mil]
Sent: Monday, February 01, 2016 8:00 AM
To: Jeff Harris
Cc: Varnado, Paul A MVN; MacInnes, Andrew D MVN; Axtman, Timothy J MVN; Broussard, Darrel M MVN; Stiles, Sandra E MVN; Exnicios, Joan M MVN; Jennifer Mouton
Subject: RE: C20160002 LCA Southwest Coastal Louisiana (UNCLASSIFIED)

CLASSIFICATION: UNCLASSIFIED

Thanks Jeff for providing your comments and enabling us to provide you with responses as soon as possible instead of waiting to receive all comments on Feb 11.

We will get comment responses to you as soon as possible. \

Bill

From: Jeff Harris [mailto:Jeff.Harris@LA.GOV]
Sent: Friday, January 29, 2016 3:01 PM
To: Klein, William P Jr MVN <William.P.Klein.Jr@usace.army.mil>
Subject: [EXTERNAL] RE: C20160002 LCA Southwest Coastal Louisiana (UNCLASSIFIED)

Bill--

I've done a preliminary review of the three of the NER RD measures, 3a1, 3c1, and 47a1, and 47a2 and 47c1 will largely be similar to 47a1. I've identified some concerns, mostly due to lack of detail in the proposed plans, and I wanted to give you as much time as possible to review and address them. Rather than dumping all of it on you on Feb. 11.

I want to stress that this is preliminary. The comments below are, literally, my review notes.

Look them over and we can discuss next week.

Have a great weekend,

--Jeff

3a1 Beneficial Use of Dredged Material from Calcasieu Ship Channel

- Disposal dikes along shoreline: located on wetlands? Impacts? Need description or cross section showing relationship.
- Need plats & description of staging areas, discharge pipe laydown areas.
- Booster pump locations are vague. Propose to "minimize" wetland impacts also vague.
- Existing internal dike located at approx. Long 99 2244o: How will it be dealt with, within the disposal area? How will the new & existing dike intersection be constructed? Description or plat needed.
- Access to disposal area: across GIWW bankline, or at weir at approx. 30.0585 o, 93.4550 o? Impacts? Restored?
- Access of clamshell dredge: across shoreline? Impacts? Restored?
- Pg B-73, Guideline 3.8: For all NER RD, beach crossings will be restored to at least preproject conditions. Good

3c1 Beneficial Use of Dredged Material from Calcasieu Ship Channel

- "Navigation traffic is not anticipated to be impacted." What measures will be taken so boats can cross the pipeline, in Calcasieu Lake and along the back dike canal?
- Access to disposal area: across shoreline, or at the weirs at approx. 29.8483 o, 93.2476 o and 29.8632 o, 93.2355 o ? Impacts? Restored?
- Access of clamshell dredge: across shoreline? Impacts? Restored?
- Need plats & description of staging areas, discharge pipe laydown areas.
- Confirm that no dredging is anticipated to be necessary for moving booster pumps to their proposed locations. Oyster impacts.
- Pg B-73, Guideline 3.8: For all NER RD, beach crossings will be restored to at least preproject conditions. Good

47a1 Marsh Restoration Using Dredged Material South of Highway 82

- The disposal area has complex internal geography. Sediment discharge management plans?

- Need plats & description of staging areas, discharge pipe laydown areas.

- Oil field access road within the disposal area at approx. 29.7483 o, 92.9035 o. How will the containment dikes impact this road? How will sediment be conveyed across it? How will it be kept clear?

- At least 12 active or inactive oil and gas wells are located within the disposal area. How will access to these be maintained? Does it need to be maintained for P&A'ed wells?

- Canal dredging "not anticipated." 2013 aerials show channel to be narrow, partially filled. Alternate plans?

- There are at least three pipeline crossings along the proposed access route, at approx. 29.7130 o, 92.9340 o, at 29.7160 o, 92.9251 o, and at 29.7277 o, 92.9116 o; and one road crossing at approx.. 29.7109 o, 92.9342o. Will this require changes to the access plans?

- Borrow area wave refraction: No study until PED stage? Potential beach erosion?

- Pg K-9 refers to typical cross section of borrow area in Annex A; no cross section present.

- Pg B-73, Guideline 3.8: For all NER RD, beach crossings will be restored to at least preproject conditions. Good

---

CONFIDENTIALITY NOTICE
This email communication may contain confidential information which also may be legally privileged and is intended only for the use of the intended recipients identified above. If you are not the intended recipient of this communication, you are hereby notified that any unauthorized review, use, dissemination, distribution, downloading, or copying of this communication is strictly prohibited. If you are not the intended recipient and have received this communication in error, please immediately notify us by reply email, delete the communication and destroy all copies.
COMPUTER SYSTEM USE/CONSENT NOTICE
This message was sent from a computer system which is the property of the State of Louisiana and the Department of Natural Resources (DNR). It is for authorized business use only. Users (authorized or unauthorized) have no explicit or implicit expectation of privacy. Any or all uses of this system and all files on this system may be intercepted, monitored, recorded, copied, audited, inspected, and disclosed to Department of Natural Resources and law enforcement personnel. By using this system the user consents to such interception, monitoring, recording, copying, auditing, inspection, and disclosure at the discretion of DNR.

CLASSIFICATION: UNCLASSIFIED

From: Jennifer Mouton
To: Klein, William P Jr MVN; Jeff Harris
Cc: Varnado, Paul A MVN; MacInnes, Andrew D MVN; Axtman, Timothy J MVN; Broussard, Darrel M MVN; Stiles, Sandra E MVN; Easton, Joan M MVN; Gilmore, Tammy H MVN; Tye Fitzgerald; Ken Duffy; Brian Haase; Brian Lezina
Subject: [EXTERNAL] RE: C20160002 LCA Southwest Coastal Louisiana (UNCLASSIFIED)
Date: Thursday, February 04, 2016 8:24:04 AM

Jeff – please see our responses below. Thanks for your quick review and comments. Jenn

3a1 Beneficial Use of Dredged Material from Calcasieu Ship Channel

- Disposal dikes along shoreline: located on wetlands? Impacts? Need description or cross section showing relationship.

Part of the constructed containment dikes will be on the shoreline. The others will be constructed along existing ridges and in open water. Wetland impacts will be restricted to the footprint of the constructed dikes and any adverse impacts will be offset by the creation and restoration of wetlands as described in the study. We have provided typical design drawings for containment dikes which contain the construction details such as slope, fill elevation, borrow area dimensions, etc. Project specific design drawings and plats have not yet been developed but will completed once the project goes to the engineering and design phase. Updated drawings and plats will be submitted to LDNR at that time and prior to construction. Should any significant changes occur in design or project features, an updated consistency determination will be submitted to LDNR for review.

- Need plats & description of staging areas, discharge pipe laydown areas.

Site specific plats and cross-sections beyond the measure factsheet and map in Appendix K, p. K-5, have not yet been developed. However, as it is currently depicted, the discharge pipe will be floated in via the GIWW along the bank line. The discharge pipe will be moved around in the outfall area so as to distribute sediment in such a way as to provide a dewatered surface elevation conducive to marsh vegetation establishment. The frequency and distance of pipeline relocation will depend on the quality (grain size and water/sediment ratio) of the slurry. The staging area and equipment, as envisioned, will be outside of the feature area and barged in via open water. No dredging is anticipated to be required to locate the staging barge. Should any changes be made to the design or project features, an updated consistency determination with site specific plats and descriptions will be submitted to LDNR for review prior to construction.

- Booster pump locations are vague. Propose to "minimize" wetland impacts also vague.

The booster pump quantity and locations were estimated based on previous marsh creation projects. The exact quantity and location of booster pumps are best determined by the size/horsepower of the Contractor's equipment. While all reasonable efforts will be made to comply with the project features as proposed in the Appendix K fact sheet and map, should the need arise to alter booster pump locations in such a way as to cause adverse impacts to wetlands, an updated project description, design and plat will be provided to LDNR to review and consistency determination. Additionally, any adverse impacts to the wetlands, should they occur, due to booster pumps, will be temporary with restoration of the impacted areas to the pre-project conditions. It should be noted that at this stage of project design, it is anticipated that all booster pumps will be barge-mounted, and floated at the margin of the navigation, thus avoiding wetland impacts altogether. However, as mentioned above, the precise locations of the booster pumps will be dependent on the equipment used for dredging the Calcasieu Ship Channel and is unknown

at this time. These details will become known during the bid process and subsequent to the engineering and design phase of this specific measure. Any significant changes to the project design or features will be fully described in an updated consistency determination request and submitted to LDNR for review prior to construction.

• Existing internal dike located at approx. Long 99.2244o: How will it be dealt with, within the disposal area? How will the new & existing dike intersection be constructed? Description or plat needed.

The this time, site specific plats have not yet been developed. However, it is anticipated that existing internal dikes and terraces will largely be left in place, and slurry will be added around them thus allowing the two marsh creation areas to be constructed in a side-by-side fashion. For the purposes of the WVA benefits, the existing internal dike was treated as existing marsh and counted as re-nourished rather than created. The existing internal dike will be breached once the southern retention dike is in place so that water exchange and fish access can occur. The number and locations of the breaches will be determined in PED. Updated project plats will be submitted to LDNR once they have been developed during the engineering and design phase. Any significant changes to the project design or project features will be fully described in an updated consistency determination request and submitted to LDNR for review prior to project construction.

• Access to disposal area: across GIWW bankline, or at weir at approx. 30.0585 o, 93.4550 o? Impacts? Restored?

This crossing will be finalized during engineering and design. As presently configured, the discharge pipeline crossing is located adjacent to the rock weir you mentioned. All crossing will be restored to pre-construction conditions prior to project completion. Any significant changes will be forwarded to LDNR for review prior to construction.

• Access of clamshell dredge: across shoreline? Impacts? Restored?

A clamshell dredge will not be used in construction of the Marsh Creation Area, as it would require flotation access through the existing GIWW bank line. Therefore, no impacts from the dredge are expected. Instead, marsh buggies will be used in the Marsh Creation Area and will access the Marsh Creation Area at the same location as the discharge pipeline to minimize impacts. Impacts due to the use of marsh buggies will be minimized by the use of the established best management practices for use of marsh buggies during construction. At project construction completion, this crossing will be restored to pre-construction conditions. Should any changes to this design or construction method occur, an updated project description and design plat will be submitted to LDNR for review to determine coastal consistency.

• Pg B-73, Guideline 3.8: For all NER RD, beach crossings will be restored to at least pre-project conditions. Good

No additional information needed.

3c1 Beneficial Use of Dredged Material from Calcasieu Ship Channel

• "Navigation traffic is not anticipated to be impacted." What measures will be taken so boats can cross the pipeline, in Calcasieu Lake and along the back dike canal?

The discharge pipeline will be submerged and marked, per USCG requirements, at the locations mentioned in the above comment. In addition, close communication and coordination with the Calcasieu and Lake Charles River

Pilots will be maintained at all times during construction to ensure no impacts to navigation safety. Navigation precautions similar to those followed during the construction of Mississippi River beneficial use of dredged material projects will be utilized to ensure minimal disruptions to navigation traffic.

- Access to disposal area: across shoreline, or at the weirs at approx. 29.8483 o, 93.2476 o and 29.8632 o, 93.2355 o ? Impacts? Restored?

Access to the Marsh Creation Areas will be across the shoreline/levee. The discharge pipeline and equipment will not cross over any weirs. Although temporary adverse impacts may occur during construction at the bank line crossings, these areas will be restored to pre-construction conditions prior to project completion. Should any changes to this construction method occur, an updated consistency determination request will be submitted to LDNR for review prior to project construction.

- Access of clamshell dredge: across shoreline? Impacts? Restored?

A clamshell dredge will not be used in construction of the Marsh Creation Area, as it would require flotation access through the existing GIWW bank line. Therefore, no impacts from the dredge are expected. Instead, marsh buggies will be used in the Marsh Creation Area and will access the Marsh Creation Area at the same location as the discharge pipeline to minimize impacts. Impacts due to the use of marsh buggies will be minimized by the use of the established best management practices for use of marsh buggies during construction. At project construction completion, this crossing will be restored to pre-construction conditions. Should any changes to this design or construction method occur, an updated project description and design plat will be submitted to LDNR for review to determine coastal consistency.

- Need plats & description of staging areas, discharge pipe laydown areas.

Site specific plats and cross-sections beyond the measure factsheet and map in Appendix K, p. K-8, have not yet been developed. However, as it is currently depicted, the discharge pipe will be floated in via the Calcasieu Ship Channel and Calcasieu Lake. The discharge pipe will be moved around in the outfall area so as to distribute sediment in such a way as to provide a dewatered surface elevation conducive to marsh vegetation establishment. The frequency and distance of pipeline relocation will depend on the quality (grain size and water/sediment ratio) of the slurry. The staging area and equipment, as envisioned, will be outside of the feature area and barged in via open water. Should any changes be made to the design or project features, an updated consistency determination with site specific plats and descriptions will be submitted to LDNR for review prior to construction.

- Confirm that no dredging is anticipated to be necessary for moving booster pumps to their proposed locations. Oyster impacts.

At this time, we do not anticipate any dredging to be necessary. However, we do not know the draft necessary for a Contractor's booster pumps, so some dredging may be required. If dredging is necessary, all access dredging will be backfilled upon completion of the project. Calcasieu Lake is a Tier 2 oyster seed ground. We have entered into agreements with LDWF to dredge Tier 2 Seed Grounds, specifically Calcasieu Lake (access route and borrow area), and would expect to have the same agreement for construction of this project. Any activities that affect oyster seed grounds or harvest areas will be done in accordance with LDWF requirements and will be obtained prior to any project construction activities commencing.

- Pg B-73, Guideline 3.8: For all NER RD, beach crossings will be restored to at least pre-project conditions.

Good

No additional information needed.

47a1 Marsh Restoration Using Dredged Material South of Highway 82

- The disposal area has complex internal geography. Sediment discharge management plans?

A discharge plan will be finalized during engineering and design. At this time, given the large area of fill, we plan to break the large Marsh Creation Area into to smaller adjoining cells where applicable. A sediment discharge management plan can be forwarded to LDNR upon request and prior to project construction.

- Need plats & description of staging areas, discharge pipe laydown areas.

Site specific plats and cross-sections for the 47 projects beyond the measure factsheets and maps in Appendix K, p. K-9-17, have not yet been developed. However, as it is currently depicted, the discharge pipe will be floated in via the existing access channel from the Gulf of Mexico. The discharge pipe will be moved around in the outfall area so as to distribute sediment in such a way as to provide a dewatered surface elevation conducive to marsh vegetation establishment. The frequency and distance of pipeline relocation will depend on the quality (grain size and water/sediment ratio) of the slurry. The staging area and equipment, as envisioned, will be outside of the feature area and barged in via open water. Alternative access for equipment can be made via Highway 82 if necessary. Should any changes be made to the design or project features, an updated consistency determination with site specific plats and descriptions will be submitted to LDNR for review prior to construction.

- Oil field access road within the disposal area at approx. 29.7483 o, 92.9035 o. How will the containment dikes impact this road? How will sediment be conveyed across it? How will it be kept clear?

We will work with the road/landowner should they require the oil field access road to remain accessible. One way to achieve this is to use the road as one of the divisions between Marsh Creation Area cells similar to the existing internal dike as described in Measure 3a1. Dredge material would then be discharged on either side of the road. Where the discharge pipe needs to cross the access road a ramp can be constructed. Any impacts to existing access roads or bunklines will be restored to their pre-project condition at the completion of construction.

- At least 12 active or inactive oil and gas wells are located within the disposal area. How will access to these be maintained? Does it need to be maintained for P&A'ed wells?

Access agreements to all well sites will be negotiated with the well owners during engineering and design. A design to ensure they are not restricted from accessing their oil and gas wells will be refined at that time. Land access designs and copies of access agreements will be provided to LDNR upon request prior to project construction activities.

- Canal dredging "not anticipated." 2013 aerials show channel to be narrow, partially filled. Alternate plans?

At this time, we anticipate the Contractor will be able to float the discharge pipe through the narrow canal with a small boat, or airboat, not requiring dredging. If this is not possible a marsh buggy could be used to pull the discharge pipe through the canals. Any significant changes to this plan will be documented and forwarded to LDNR for review for consistency.

- There are at least three pipeline crossings along the proposed access route, at approx. 29.7110 o, 92.9340 o, at 29.7160 o, 92.9251 o, and at 29.7277 o, 92.9116 o; and one road crossing at approx.. 29.7109 o, 92.9342o. Will this require changes to the access plans?

If crossing agreements cannot be made for the proposed access routes, the discharge pipe can be floated over the pipelines. At the oilfield access road, a ramp could be constructed to maintain access. There will be no impacts to existing pipelines. Any impacts to existing access roads or bunklines will be temporary in nature. All impacted areas outside of the project feature will be restored to its pre-project condition at the completion of construction. Any changes to the access plans which occur during engineering and design will be provided to LDNR upon request. Should any significant changes be made to the design or project features, including site access plans, an updated consistency determination with site specific plats and descriptions will be submitted to LDNR for review prior to construction.

- Borrow area wave refraction: No study until PED stage? Potential beach erosion?

We have modeled for shoreline impacts due to our offshore borrow areas on all of CPRA's projects. To date, no such study has resulted has shown significant impacts with borrow areas similar to this design. However, once the exact borrow area size and dimensions are determined during the engineering and design phase, a borrow area analysis will be done to determine if dredging of the borrow area may result in any adverse impact on shoreline stability. The results of the borrow area analysis will be provided to LDNR in an updated consistency request at that time. Or, in the alternative, if no effects are found to exist, a negative declaration will be provided to LDNR prior to project construction.

- Pg K-9 refers to typical cross section of borrow area in Annex A; no cross section present.

It appears that drawing was inadvertently omitted from the report. A typical cross section will be forwarded to you as soon as possible.

- Pg B-73, Guideline 3.ft: For all NER RD, beach crossings will be restored to at least pre-project conditions. Good

No additional information needed.

From: Klein, William P Jr MVN [mailto:William.P.Klein.Jr@usace.army.mil]
Sent: Monday, February 01, 2016 8:00 AM
To: Jeff Harris
Cc: Varnado, Paul A MVN; MacInnes, Andrew D MVN; Axtman, Timothy J MVN; Broussard, Darrel M MVN; Stiles, Sandra E MVN; Exnicios, Joan M MVN; Jennifer Mouton
Subject: RE: C20160002 LCA Southwest Coastal Louisiana (UNCLASSIFIED)

CLASSIFICATION: UNCLASSIFIED

Thanks Jeff for providing your comments and enabling us to provide you with responses as soon as possible instead of waiting to receive all comments on Feb 11.

We will get comment responses to you as soon as possible. \

Bill

From: Jeff Harris [mailto:Jeff.Harris@LA.GOV]
Sent: Friday, January 29, 2016 3:01 PM
To: Klein, William P Jr MVN <William.P.Klein.Jr@usace.army.mil>
Subject: [EXTERNAL] RE: C20160002 LCA Southwest Coastal Louisiana (UNCLASSIFIED)

Bill--

I've done a preliminary review of the three of the NER RD measures, 3a1, 3c1, and 47a1, and 47a2 and 47c1 will largely be similar to 47a1. I've identified some concerns, mostly due to lack of detail in the proposed plans, and I wanted to give you as much time as possible to review and address them. Rather than dumping all of it on you on Feb. 11.

I want to stress that this is preliminary. The comments below are, literally, my review notes.

Look them over and we can discuss next week.

Have a great weekend,

--Jeff

3a1 Beneficial Use of Dredged Material from Calcasieu Ship Channel

- Disposal dikes along shoreline: located on wetlands? Impacts? Need description or cross section showing relationship.
- Need plats & description of staging areas, discharge pipe laydown areas.
- Booster pump locations are vague. Propose to "minimize" wetland impacts also vague.
- Existing internal dike located at approx. Long 99.2244o: How will it be dealt with, within the disposal area? How will the new & existing dike intersection be constructed? Description or plat needed.

- Access to disposal area: across GIWW bankline, or at weir at approx. 30.0585 o, 93.4550 o? Impacts? Restored?
- Access of clamshell dredge: across shoreline? Impacts? Restored?
- Pg B-73, Guideline 3.8: For all NER RD, beach crossings will be restored to at least preproject conditions. Good

3c1 Beneficial Use of Dredged Material from Calcasieu Ship Channel

- "Navigation traffic is not anticipated to be impacted." What measures will be taken so boats can cross the pipeline, in Calcasieu Lake and along the back dike canal?
- Access to disposal area: across shoreline, or at the weirs at approx. 29.8483 o, 93.2476 o and 29.8632 o, 93.2355 o ? Impacts? Restored?
- Access of clamshell dredge: across shoreline? Impacts? Restored?
- Need plats & description of staging areas, discharge pipe laydown areas.
- Confirm that no dredging is anticipated to be necessary for moving booster pumps to their proposed locations. Oyster impacts.
- Pg B-73, Guideline 3.8: For all NER RD, beach crossings will be restored to at least preproject conditions. Good

47a1 Marsh Restoration Using Dredged Material South of Highway 82

- The disposal area has complex internal geography. Sediment discharge management plans?
- Need plats & description of staging areas, discharge pipe laydown areas.
- Oil field access road within the disposal area at approx. 29.7483 o, 92.9035 o. How will the containment dikes impact this road? How will sediment be conveyed across it? How will it be kept clear?
- At least 12 active or inactive oil and gas wells are located within the disposal area. How will access to these be maintained? Does it need to be maintained for P&A'ed wells?
- Canal dredging "not anticipated." 2013 aerials show channel to be narrow, partially filled. Alternate plans?
- There are at least three pipeline crossings along the proposed access route, at approx. 29.7110 o, 92.9340 o, at 29.7160 o, 92.9251 o, and at 29.7277 o, 92.9116 o; and one road crossing at approx.. 29.7109 o, 92.9342o. Will this require changes to the access plans?
- Borrow area wave refraction: No study until PED stage? Potential beach erosion?
- Pg K-9 refers to typical cross section of borrow area in Annex A; no cross section present.
- Pg B-73, Guideline 3.8: For all NER RD, beach crossings will be restored to at least preproject conditions. Good

---

CONFIDENTIALITY NOTICE
This email communication may contain confidential information which also may be legally privileged and is

intended only for the use of the intended recipients identified above. If you are not the intended recipient of this communication, you are hereby notified that any unauthorized review, use, dissemination, distribution, downloading, or copying of this communication is strictly prohibited. If you are not the intended recipient and have received this communication in error, please immediately notify us by reply email, delete the communication and destroy all copies.

COMPUTER SYSTEM USE/CONSENT NOTICE

This message was sent from a computer system which is the property of the State of Louisiana and the Department of Natural Resources (DNR). It is for authorized business use only. Users (authorized or unauthorized) have no explicit or implicit expectation of privacy. Any or all uses of this system and all files on this system may be intercepted, monitored, recorded, copied, audited, inspected, and disclosed to Department of Natural Resources and law enforcement personnel. By using this system the user consents to such interception, monitoring, recording, copying, auditing, inspection, and disclosure at the discretion of DNR.

CLASSIFICATION: UNCLASSIFIED

From: Klein, William P Jr MVN
To: Jeff Harris
Cc: Vannoy, Paul A MVN; Mackiewicz, Andrew D MVN; Ashman, Timothy J MVN; Broussard, Darrel M MVN; Stiles, Sandra E MVN; Bandeiras, Joan M MVN; Jennifer Maurice
Subject: RE: C20160002 LCA Southwest Coastal Louisiana (UNCLASSIFIED)
Date: Monday, February 01, 2016 8:00:00 AM

CLASSIFICATION: UNCLASSIFIED

Thanks Jeff for providing your comments and enabling us to provide you with responses as soon as possible instead of waiting to receive all comments on Feb 11.

We will get comment responses to you as soon as possible. \

Bill

From: Jeff Harris [mailto:Jeff.Harris@LA.GOV]
Sent: Friday, January 29, 2016 3:01 PM
To: Klein, William P Jr MVN <William.P.Klein.Jr@usace.army.mil>
Subject: [EXTERNAL] RE: C20160002 LCA Southwest Coastal Louisiana (UNCLASSIFIED)

Bill--

I've done a preliminary review of the three of the NER RD measures, 3a1, 3c1, and 47a1, and 47a2 and 47c1 will largely be similar to 47a1. I've identified some concerns, mostly due to lack of detail in the proposed plans, and I wanted to give you as much time as possible to review and address them. Rather than dumping all of it on you on Feb. 11.

I want to stress that this is preliminary. The comments below are, literally, my review notes.

Look them over and we can discuss next week.

Have a great weekend,

--Jeff

3a1 Beneficial Use of Dredged Material from Calcasieu Ship Channel

- Disposal dikes along shoreline: located on wetlands? Impacts? Need description or cross section showing relationship.
- Need plats & description of staging areas, discharge pipe laydown areas.
- Booster pump locations are vague. Propose to "minimize" wetland impacts also vague.
- Existing internal dike located at approx. Long 99.2244o: How will it be dealt with, within the disposal area? How will the new & existing dike intersection be constructed? Description or plat needed.
- Access to disposal area: across GIWW bankline, or at weir at approx. 30.0585 o, 93.4550 o? Impacts? Restored?
- Access of clamshell dredge: across shoreline? Impacts? Restored?
- Pg B-73, Guideline 3.8: For all NER RD, beach crossings will be restored to at least preproject conditions. Good

3c1 Beneficial Use of Dredged Material from Calcasieu Ship Channel

- "Navigation traffic is not anticipated to be impacted." What measures will be taken so boats can cross the pipeline, in Calcasieu Lake and along the back dike canal?
- Access to disposal area: across shoreline, or at the weirs at approx. 29.8483 o, 93.2476 o and 29.8632 o, 93.2355 o ? Impacts? Restored?
- Access of clamshell dredge: across shoreline? Impacts? Restored?
- Need plats & description of staging areas, discharge pipe laydown areas.
- Confirm that no dredging is anticipated to be necessary for moving booster pumps to their proposed locations. Oyster impacts.
- Pg B-73, Guideline 3.8: For all NER RD, beach crossings will be restored to at least preproject conditions. Good

47a1 Marsh Restoration Using Dredged Material South of Highway 82

- The disposal area has complex internal geography. Sediment discharge management plans?
- Need plats & description of staging areas, discharge pipe laydown areas.
- Oil field access road within the disposal area at approx. 29.7483 o, 92.9035 o. How will the containment dikes impact this road? How will sediment be conveyed across it? How will it be kept clear?
- At least 12 active or inactive oil and gas wells are located within the disposal area. How will access to these be maintained? Does it need to be maintained for P&A'ed wells?
- Canal dredging "not anticipated." 2013 aerials show channel to be narrow, partially filled. Alternate plans?
- There are at least three pipeline crossings along the proposed access route, at approx. 29.7110 o, 92.9340 o, at 29.7160 o, 92.9251 o, and at 29.7277 o, 92.9116 o; and one road crossing at approx.. 29.7109 o, 92.9342o. Will this require changes to the access plans?

- Borrow area wave refraction. No study until PED stage? Potential beach erosion?
- Pg K-9 refers to typical cross section of borrow area in Annex A; no cross section present.
- Pg B-73, Guideline 3.8: For all NER RD, beach crossings will be restored to at least pregroject conditions. Good

---

CONFIDENTIALITY NOTICE
This email communication may contain confidential information which also may be legally privileged and is intended only for the use of the intended recipients identified above. If you are not the intended recipient of this communication, you are hereby notified that any unauthorized review, use, dissemination, distribution, downloading, or copying of this communication is strictly prohibited. If you are not the intended recipient and have received this communication in error, please immediately notify us by reply email, delete the communication and destroy all copies.
COMPUTER SYSTEM USE/CONSENT NOTICE
This message was sent from a computer system which is the property of the State of Louisiana and the Department of Natural Resources (DNR). It is for authorized business use only. Users (authorized or unauthorized) have no explicit or implicit expectation of privacy. Any or all uses of this system and all files on this system may be intercepted, monitored, recorded, copied, audited, inspected, and disclosed to Department of Natural Resources and law enforcement personnel. By using this system the user consents to such interception, monitoring, recording, copying, auditing, inspection, and disclosure at the discretion of DNR.

CLASSIFICATION: UNCLASSIFIED

From: Klein, William P Jr MVN
To: Jeff Harris
Cc: Wamsley, Paul A MVN; MacInnes, Andrew D MVN; Sillen, Sandra E MVN; Kinsey, Mary V MVN; Probst, Ann E MVN; Axtman, Timothy J MVN
Subject: updated numbers for Southwest Coastal Louisiana Consistency determination (UNCLASSIFIED)
Date: Wednesday, January 27, 2016 8:57:00 AM
Attachments: Revised CZM table 2a Klein 01272016.docx

CLASSIFICATION: UNCLASSIFIED

Jeff Harris:

Upon further review we have discovered that borrow areas were double counted for marsh restoration features.

Please see attached updated Table 2a column total for Borrow Areas for marsh restoration measures.

Please revise 14,410 acres total to 7,028 acres total.

Thank You!

Bill

William P. Klein, Jr.
US Army Corps of Engineers
PO Box 60267
New Orleans, LA 70160-0267
504-862-2540
william.p.klein.jr@usace.army.mil

CLASSIFICATION: UNCLASSIFIED

From: Klein, William P Jr MVN
To: Jeff Harris
Cc: Vernado, Paul A MVN; MacInnes, Andrew D MVN; Stiles, Sandra E MVN; Klein, William P Jr MVN
Subject: FW: C20160002 LCA Southwest Coastal Louisiana (UNCLASSIFIED)
Date: Thursday, January 21, 2016 2:03:00 PM

CLASSIFICATION: UNCLASSIFIED

Jeff
The following updated section has been added to the LDNR Consistency Determination on page B-7, following the general description of the NED Plan on B-5 to B-6 and prior to the "Details of the Nonstructural NED RP section. Thank you for accepting these revisions via email.

LDNR Specific Concerns about the NED RP
By electronic mail on January 21, 2016, the LDNR requested the USACE to provide specific responses to the below comments despite although several of these comments are covered in different sections throughout the document.

1. No NED activities will be conducted in wetlands. This includes work areas, access routes, staging areas, and borrow and discharge locations. Wetlands would be defined by a Corps of Engineers wetland delineation, or as identified on LDNR's SONRIS GIS system, or other suitable source.

RESPONSE: Concur. If wetlands would be impacted by NED construction, the structure would no longer be eligible for nonstructural measures. Will include revised language as requested up front. Also, I already have in report (responses to some specific Coastal Guidelines) that work would be done on previously disturbed residential and commercial lands and that we would not impact waters of the USA (which includes wetlands).

2. No NED work on cheniers will involve excavation; any necessary fill will be hauled in from approved borrow sites. Minor foundation excavation for purposes of raising a structure will be permissible provided the excavations are restored to preproject conditions.

RESPONSE: No NED work will take place on cheniers (excavation or fill). All NED measures will be confined to existing structure locations and previously impacted sites and any required borrow material would be from an approved site.

3. NED projects will not significantly alter the local hydrology.

RESPONSE: Concur. Part of the definition of a nonstructural measure is that it reduces human exposure to a flood hazard without altering the nature or extent of that hazard. Nonstructural measures are tightly confined to the flood-proofed structure and they will not impact local hydrology. Additional language would be included in the CD up front. I already mention in some Consistency guidelines that the NED plan would not impact hydrology.

4. NED projects which do not meet these criteria will require pre-construction coordination with LDNR Office of Coastal Management, and may require an individual consistency determination or other authorization.

RESPONSE: Concur. Responses to LDNR's above cited specific concerns has been provided in the general description section prior to responses of individual Consistency Guidelines.

Please let me know if you require any additional information.
Thank you,

Bill

-----Original Message-----
From: Jeff Harris [mailto:Jeff.Harris@LA.GOV]
Sent: Thursday, January 21, 2016 10:55 AM
To: Klein, William P Jr MVN <William.P.Klein.Jr@usace.army.mil>
Cc: Jennifer Mouton <Jennifer.Mouton@LA.GOV>; Varnado, Paul A MVN <Paul.A.Varnado@usace.army.mil>; MacInnes, Andrew D MVN <Andrew.D.MacInnes@usace.army.mil>; Stiles, Sandra E MVN <Sandra.E.Stiles@usace.army.mil>
Subject: [EXTERNAL] C20160002 LCA Southwest Coastal Louisiana

Bill—

As we discussed by telephone this morning, I've begun reviewing the referenced consistency determination and have some concerns that should be addressed for the National Economic Development Recommended Plan.

The issue is that, at this stage, the specific locations and work activities involved in the proposed NED floodproofing are not yet determined, and concurring with a broad consistency statement without knowing details about the actual activities is problematic. We can, however, fully concur with the consistency determination (by which I mean, I can recommend full concurrence to my superiors) for the NED portion of the project, if the consistency determination includes statements along the following lines:

- No NED activities will be conducted in wetlands. This includes work areas, access routes, staging areas, and borrow and discharge locations. Wetlands would be defined by a Corps of Engineers wetland delineation, or as identified on LDNR's SONRIS GIS system, or other suitable source.

- No NED work on cheniers will involve excavation; any necessary fill will be hauled in from approved borrow sites. Minor foundation excavation for purposes of raising a structure will be permissible provided the excavations are restored to preproject conditions.

- NED projects will not significantly alter the local hydrology.

- NED projects which do not meet these criteria will require pre-construction coordination with LDNR Office of Coastal Management, and may require an individual consistency determination or other authorization.

I realize several of these points are covered in different places throughout the document. For OCM's purposes, we'd prefer a single concise statement of these criteria.

If acceptable, please send a revision to the consistency determination indicating that you wish to include these criteria. If we need to discuss further, please don't hesitate to write or call.

Thanks,

--Jeff

225-342-7949

CONFIDENTIALITY NOTICE
This email communication may contain confidential information which also may be legally privileged and is intended only for the use of the intended recipients identified above. If you are not the intended recipient of this communication, you are hereby notified that any unauthorized review, use, dissemination, distribution, downloading, or copying of this communication is strictly prohibited. If you are not the intended recipient and have received this communication in error, please immediately notify us by reply email, delete the communication and destroy all copies.
COMPUTER SYSTEM USE/CONSENT NOTICE
This message was sent from a computer system which is the property of the State of Louisiana and the Department of Natural Resources (DNR). It is for authorized business use only. Users (authorized or unauthorized) have no explicit or implicit expectation of privacy. Any or all uses of this system and all files on this system may be intercepted, monitored, recorded, copied, audited, inspected, and disclosed to Department of Natural Resources and law enforcement personnel. By using this system the user consents to such interception, monitoring, recording, copying, auditing, inspection, and disclosure at the discretion of DNR.
CLASSIFICATION: UNCLASSIFIED

COASTAL ZONE CONSISTENCY DETERMINATION

Reference June 30, 2014, and June 2, 2015 letters from the Louisiana Department of Natural Resources, Office of Coastal Management (LDNR) regarding Consistency Zone Consistency #C20150064 for the Southwest Coastal Louisiana project. As noted in these letters, at the programmatic level, this project was considered consistent with the Louisiana Coastal Resources Program (LCRP) by the LDNR. However, these letters notified the CEMVN that as information is developed and planning proceeds, consistency reviews will be necessary for each of the individual elements which make up the Southwest Coastal Louisiana Project. Hence, the following revised consistency determination contains more detailed feasibility level description of the proposed action. The Southwest Coastal Louisiana Study is comprised of two components consisting of a nonstructural National Economic Development (NED) plan and a National Ecosystem Restoration (NER) plan. The NED Recommended Plan (RP) is the Nonstructural 0-25-Year Floodplain Plan (Modified Plan 8 –RP) that would provide hurricane and storm damage risk reduction. The NER RP is the Small Integrated Restoration Alternative, a comprehensive ecosystem restoration plan addressing land loss and ecosystem degradation. The NER RP is cost effective, and is the least-cost comprehensive best buy plan. The NER RP would minimize land loss; enhance plant productivity by reducing major stressors; and reinforce and protect critical landscape features. Table 1 provides a brief description of the NER RP measures. Tables 2a, 2b, and 2c provide the NER RP measure details, description of construction equipment, and quantities and types of fill to be placed in wetlands. Figures 1, 2 and 3 display locations of the NER RP measures. Following this updated project information, a more detailed analysis of the applicable Coastal Use Guidelines for both the Nonstructural NED RP and NER RP is provided. The State of Louisiana, through the Coastal Protection and Restoration Authority Board (CPRAB), would be the non-Federal Sponsor and therefore responsible for the operation, maintenance, repair, replacement, and rehabilitation costs (OMRR&R).

INTRODUCTION

Section 307 of the Coastal Zone Management Act of 1972, 16 U.S.C. 1451 et. seq. requires that "each federal agency conducting or supporting activities directly affecting the coastal zone shall conduct or support those activities in a manner which is, to the maximum extent practicable, consistent with approved state management programs." In accordance with Section 307, a Consistency Determination has been prepared for the proposed Southwest Coastal Louisiana project. Coastal Use Guidelines were written to implement the policies and goals of the Louisiana Coastal Resources Program, and serve as a set of performance standards for evaluating projects. Compliance with the Louisiana Coastal Resources Program, and therefore, Section 307, requires compliance with applicable Coastal Use Guidelines.

PURPOSE AND NEED FOR THE PROPOSED ACTION

Problem

The people, economy, unique environment, and cultural heritage of southwest Louisiana are at risk due to storm surge flooding and wave impacts from tropical storms. The area's low elevation, proximity to the Gulf of Mexico, land subsidence, and rising sea level, are expected to exacerbate coastal flooding, shoreline erosion, saltwater intrusion, and loss of wetland and chenier habitats in the future.

Purpose

The study purpose is to evaluate coastal storm flood damages and coastal ecosystem degradation in Cameron, Calcasieu, and Vermilion parishes in Louisiana. The intent is to develop potential solutions to these water resource problems. The Federal objective of water and related land resources planning is to provide the greatest net contribution to Nonstructural NED RP consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements. The ecosystem objective is to contribute to NER by restoring function and structure to significant ecological resources.

Study Objectives

1. Reduce the risk of damages and losses from hurricane and storm surge flooding in southwest Louisiana.
2. Manage tidal flows to improve drainage and prevent salinity from exceeding 2 parts per thousand (ppt) for fresh marsh and 6 ppt for intermediate marsh.
3. Increase wetland productivity in southwest coastal Louisiana in fresh and intermediate marshes to maintain function by reducing the time that water levels exceed marsh surfaces.
4. Reduce shoreline erosion and stabilize canal banks in southwest coastal Louisiana areas to protect adjacent wetlands.
5. Restore landscapes, including marsh, shoreline, and cheniers in southwest coastal Louisiana, to maintain their function as wildlife habitat and improve their ability to serve as protective barriers.

Constraints

- Federally authorized commercial navigation.
- Federally threatened and endangered species (i.e., piping plover) and their critical habitats.
- Essential fish habitat, especially intertidal wetlands.
- Historic and cultural resources.

General

The Southwest Coastal Louisiana (SWC) project, encompassing approximately 4,700 square miles and including all of Calcasieu, Cameron, and Vermilion parishes, would provide nonstructural hurricane and storm surge damage risk reduction measures/measures as well as ecosystem restoration measures/measures throughout the project area (**Figure 1**).

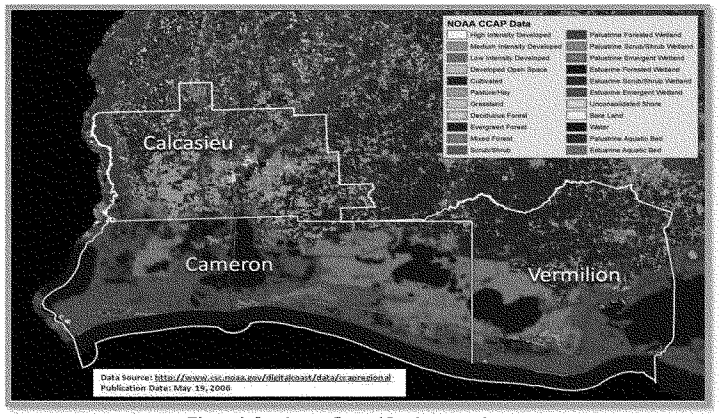


Figure 1. Southwest Coastal Louisana study area.

Impacts of both the Nonstructural NED RP and the NER RP are also described in the Final Integrated Report & EIS. Cameron Parish is located in the southwest corner of Louisiana. The southern boundary of the parish is the Gulf of Mexico. Eighty-two percent of Cameron Parish is coastal marshes. Geographically, it is one of

the largest parishes in Louisiana. The parish is chiefly rural and the largest communities are Cameron and Hackberry. Cameron is located along LA-82, while Hackberry is located along LA-27. Other smaller communities include Creole, Johnsons Bayou, and Holly Beach. Calcasieu Parish is located due north of Cameron Parish. The town of Lake Charles is the parish seat, which is the largest urban area in the study area. Only a small portion of the parish is located in the coastal zone. Vermilion Parish is located due east of Cameron Parish. The southern boundary of the parish is the Gulf of Mexico. Large expanses of Vermilion Parish are open water (lakes, bays, and streams). Approximately 50 percent of the land is coastal marshes. The parish is chiefly rural and the town of Abbeville is the parish seat as well as the largest urban area in the parish. Other communities include Delcambre, Kaplan, and Gueydan, which are all located along LA-14 in the northern part of the study area. Pecan Island and Forked Island are smaller communities, both located along LA-82 in lower Vermilion Parish. Located along LA-333, Intracoastal City is the nearest access to Vermilion Bay and the Gulf of Mexico in this region and supports the area's oil and shrimp industries.

NED Recommended Plan: Southwest Coastal Louisiana communities are at increasing risk to hurricane and storm surge flooding due to wetland loss, sea level rise, and land subsidence. The purpose of the voluntary Nonstructural NED RP is to provide hurricane and storm damage risk reduction to reduce the risk of flood damages caused by hurricane and storm surges. Eligible properties must have a first floor elevation at or below the 2025 25-year Base Flood Elevation (BFE). Eligible structures would be raised to the 2075 100-year BFE. Proposed measures of the voluntary Nonstructural NED RP include:

- elevating eligible residential structures;
- dry flood proofing of eligible non-residential structures, excluding large warehouses and industrial complexes, and;
- construction of flood proofing barriers or berms less than 6 feet in height around non-residential structures, primarily industrial complexes and warehouses.

NER Recommended Plan: The purpose of the NER RP is to restore environmental conditions for the Chenier Plain ecosystem as more fully described in the 2004 Louisiana Coastal Area, Ecosystem Restoration Study. Ecosystem restoration measures are focused on areas of critical need where restoration would replace lost habitats and/or help prevent predicted habitat losses. The Nonstructural NER RP would provide important, essential and critical habitats used for shelter, nesting, feeding, roosting, cover, nursery, and other life requirements of migratory birds, wildlife, finfish, shellfish and other aquatic organisms; increase productivity and essential fish habitat (EFH); increase transitional coastal wetland habitats between estuarine and marine environments; and restore imperiled chenier forest habitats used as stopover habitat by migrating neotropic birds. Restoration and protection of coastal wetlands and chenier habitats would help buffer and protect human habitations by ameliorating hurricane and storm surges. Restoration of coastal wetlands would also help improve water quality by filtering pollutants and sediments. The U.S. Army Corps of Engineers, Mississippi Valley Division, New Orleans District (CEMVN) proposes three types of ecosystem restoration measures in the Calcasieu/Sabine and Mermentau/Tech-Vermilion basins:

- 9 marsh restoration measures;
- 5 shoreline protection measures; and
- 35 chenier reforestation and invasive species control 35 locations in Cameron and Vermilion Parishes.
- The Calcasieu Ship Channel Salinity Barrier measure is being recommended for long term study.
- The Cameron-Creole Spillway Salinity Control Structure measure is being recommended for long-term study.
- Two marsh restoration measures, located partially on U.S. Fish and Wildlife Service (USFWS) properties, are recommended for construction by the USFWS. Measure 124d Marsh Creation at Mud Lake would be located on Sabine National Wildlife Refuge (NWR). Measure 3c1 Beneficial Use of Dredged Material from Calcasieu Ship Channel would be located on the Cameron Prairie NWR.

The CEMVN does not anticipate a need for compensatory mitigation as a result of implementing either the Nonstructural NED RP or the NER RP. Environmental Justice (EJ) requires the fair treatment and meaningful

involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. The Nonstructural NED RP and the NER RP would not adversely impact minority or low-income populations and is fully compliant with Executive Order 12898.

NATIONAL ECONOMIC DEVELOPMENT RECOMMENDED PLAN

A primary goal of the Nonstructural NED RP is to reduce flood risk for residential and non-residential structures that have first floor elevations at or below the 0-25-year floodplain (**Figure 2**), based on hydrologic conditions predicted to occur in 2025 (the beginning of the 50 year period of analysis). Participation in the Nonstructural NED RP is voluntary, and would provide reduced risk of hurricane and storm surge flood damage for a total of 3,961 impacted structures consisting of 3,462 eligible residential structures; 342 eligible commercial structures and public buildings; and 157 eligible industrial complexes and warehouses.

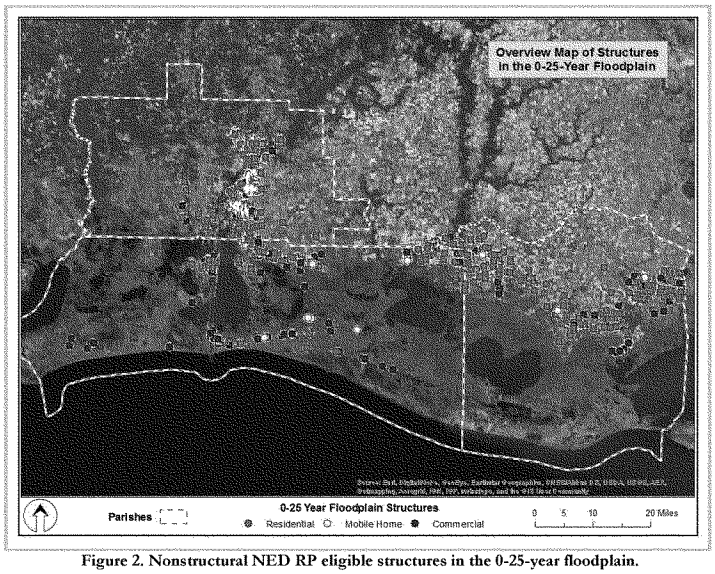


Figure 2. Nonstructural NED RP eligible structures in the 0-25-year floodplain.

Eligible structures would require additional structure specific analysis during the preconstruction engineering and design (PED) and construction phases to determine the best, most cost-effective measures to be employed for reducing risk of hurricane storm surge damage. Consequently, each eligible structure would be inspected by a floodplain engineer, structural engineer, cost engineer, civil engineer, environmental specialist, real estate specialist, and experts from other disciplines if necessary to determine the type of nonstructural measure to be employed for each structure. The inspection of individual structures has not been performed at this stage of the study.

Flood-proofing is generally described as any combination of structural and nonstructural additions, changes, or adjustments to structures, which reduce or eliminate the risk of hurricane and storm surge flood damage to real estate or improved real property, water, and sanitation facilities or structures with their contents. The most common flood-proofing measures are: the elevation of structures; the removal of at-risk structures from floodplains and floodways; detached flood-proofing around structures through the construction of small localized storm surge risk reduction measures no higher than 6 feet above grade; and actions by local governments to strengthen local floodplain management regulations, building and zoning codes, and training and educating local floodplain management officials.

The Nonstructural NED RP consists of the following hurricane and storm surge flood damage risk reduction measures of which participation of eligible structures is voluntary:

1. Elevation to the 100-year base flood elevation based on year 2075 hydrology of eligible residential structures. If the required elevation is greater than 13 feet above ground level, the structure would be identified for voluntary acquisition. Tenants of structures that would be elevated are eligible for certain benefits in accordance with Uniform Relocation Assistance and Real Property Acquisition Policies for Federal and Federally Assisted Programs of 1970, Public Law 91-646, 84 Stat. 1894 (42 U.S.C. 4601), as amended by the Surface Transportation and Uniform Relocation Assistance Act of 1987, Title IV of Public Law 100-17, 101 Stat. 246-256; 49 Code of Federal Regulations 24; and HUD Handbook 1378.
2. Dry flood-proofing to the BFE generally means the use of a variety of techniques that make a structure waterproof and substantially impenetrable to floodwaters. For example, the walls, doors, windows, and other openings of eligible non-residential structures are made impermeable to water penetration.
3. Construction of localized storm surge risk reduction measures of less than 6 feet in height around industrial complexes and warehouses.

Hurricane and storm surge flood damage risk reduction actions taken to comply with Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12) will be the obligation of the Non-Federal Sponsor (NFS), which will work to ensure development, compliance, and enforcement by municipal and parish governments in Cameron, Vermilion, and Calcasieu Parishes with local floodplain management plans and regulations, adoption of more stringent local floodplain regulations, adoption of more restrictive parish and municipal building codes, land use and zoning regulations, and other developmental controls. The NFS shall prevent obstructions or encroachments on the property being flood-proofed (including prescribing and enforcing regulations to prevent such obstructions or encroachments) such as the addition of facilities which might reduce the level of protection the Nonstructural NED RP affords, hinder operation and maintenance of the Nonstructural NED RP, or interfere with the Nonstructural NED RP's proper function.

Although the National Flood Insurance Program (NFIP) provides some relief for historic structures from having to comply with floodplain management requirements, the NFIP and FEMA recognize that historic structures should participate in mitigation measures that can reduce the impacts of flood damages. Under the NFIP regulations and the floodplain regulations of some of the communities in the study area, a historic structure is not eligible for elevation if the elevation or alteration through flood-proofing methods would preclude the structure's continued designation as an "historic structure" or would be damaging to the historical character or value of the structure as determined by the Louisiana State Historic Preservation Office.

Given the total Project cost and the estimated total investment required to complete the Nonstructural NED RP, it is anticipated that implementation of the Nonstructural Plan would occur over an approximate 14-year period (assuming funding of ~$50 million/year). However, the scale of the Project is highly dependent upon the number of structures actually receiving nonstructural measures and the amount of funding allocated in any given year. The combined effects of the Biggert-Waters Insurance Reform Act, the modified conditions imposed by the Homeowner Flood Insurance Affordability Act, and the likelihood of property transfers provide an incentive for property owners to have their structures flood-proofed. In addition, the clear and present risk of future storm events, and subsequent disaster declarations and relief funding, indicate potential

situations for advantageously incentivizing and accelerating implementation. Awareness of and education about these issues would help lead to successful Project implementation, and would help ensure a successful Nonstructural Plan that meets the SWC study goals.

LDNR Specific Concerns about the NED RP

By electronic mail on January 21, 2016, the LDNR requested the USACE to provide specific responses to the below comments despite although several of these comments are covered in different sections throughout the document.

1. No NED activities will be conducted in wetlands. This includes work areas, access routes, staging areas, and borrow and discharge locations. Wetlands would be defined by a Corps of Engineers wetland delineation, or as identified on LDNR's SONRIS GIS system, or other suitable source.

   RESPONSE: Concur. If wetlands would be impacted by NED construction, the structure would no longer be eligible for nonstructural measures. Will include revised language as requested up front. Also, I already have in report (responses to some specific Coastal Guidelines) that work would be done on previously disturbed residential and commercial lands and that we would not impact waters of the USA (which includes wetlands).

2. No NED work on cheniers will involve excavation; any necessary fill will be hauled in from approved borrow sites. Minor foundation excavation for purposes of raising a structure will be permissible provided the excavations are restored to preproject conditions.

   RESPONSE: No NED work will take place on cheniers (excavation or fill). All NED measures will be confined to existing structure locations and previously impacted sites and any required borrow material would be from an approved site.

3. NED projects will not significantly alter the local hydrology.

   RESPONSE: Concur. Part of the definition of a nonstructural measure is that it reduces human exposure to a flood hazard without altering the nature or extent of that hazard. Nonstructural measures are tightly confined to the flood-proofed structure and they will not impact local hydrology. Additional language would be included in the CD up front. I already mention in some Consistency guidelines that the NED plan would not impact hydrology.

4. NED projects which do not meet these criteria will require pre-construction coordination with LDNR Office of Coastal Management, and may require an individual consistency determination or other authorization.

   RESPONSE: Concur. Responses to LDNR's above cited specific concerns has been provided in the general description section prior to responses of individual Consistency Guidelines.

Details of the Nonstructural NED RP

The following process shall apply to property owners who are willing and determined by the NFS to be preliminarily eligible to have their residential structures elevated:

- Property owners must execute an authorization for entry which would grant USACE and the NFS authorization to enter in and upon the structure and land for purposes of investigating, inspecting, surveying, performing limited environmental testing and a hazardous, toxic, and radioactive waste (HTRW) assessment, evaluating the condition of the structure, determining elevation requirements, verifying the current elevation, performing an appraisal, and conducting other activities necessary for USACE to make a determination of structure eligibility;
- The property owner must submit satisfactory proof of ownership and a current Elevation Certificate;

- Title research and appraisals would be completed by the NFS. The property must have clear title. The property owner would be responsible to clear the title of all ownership issues and obtain any necessary subordination agreements from holders of liens, encumbrances, or third party interests at the property owner's sole expense; the failure to provide clear title shall result in a determination of ineligibility;
- An ASTM Phase I HTRW/Asbestos investigation (and if warranted, may be accompanied by additional HTRW investigations), inspections, surveys, and boundary monumentations would be completed. The land and the structure must be certified as "clean" by the appropriate State office before any Project funds may be expended. All asbestos must be abated and disposed of properly. Asbestos impacted by flood proofing would be removed at Project cost, while HTRW impacted by flood proofing must be remediated by the property owner prior to the initiation of the flood proofing work;
- After all inspections, investigations, assessments, and other activities are completed, a determination of eligibility for elevation would be made by USACE;
- A Flood-Proofing Agreement containing an easement(s) in favor of the NFS, that authorizes the Government, the NFS or their contractors to enter the property for purposes of implementing the flood-proofing action and for inspection and enforcement purposes, an agreement to hold harmless the NFS and the Government for any damages arising from the flood-proofing work, and a covenant running with the land shall be executed by all owners of the property. The covenant shall prohibit the conversion of any part of the structure located below the lowest habitable finished floor for human habitation and the alteration of the structure in any way to impede the movement of flood waters under the structure, as well as prohibiting the construction of any other structure in a manner that would impede the movement of floodwaters under the structure. The Flood-Proofing Agreement, together with the easement(s) and covenant running with the land, as well as any required subordination agreements, shall be recorded by the NFS in the public records of the Parish in which the property is located;
- After the Flood-proofing Agreement together with the easement and covenant and any required subordination agreements are recorded in the public records, the elevation of the structure would be commenced, completed, inspected, and after final approval by the District Engineer, a notice of construction completion would be issued to the NFS and the individual elevation project would be closed out as complete.

Elevation of eligible residential structures

Elevation of eligible residential structures would be performed "in place". The habitable floors would be raised to levels which would reduce risk to the residential structures from hurricane and storm surge flooding to reduce future losses by allowing the free movement of floodwaters beneath and around the raised structures. State and local building and zoning codes must be taken into consideration in the implementation process. Some zoning codes contain restrictions on "substantial improvements" to existing non-confirming structures which require that the entire structure be brought up to current building code requirements which may increase the costs beyond that of the elevation costs alone. In addition, zoning codes may have height restrictions for buildings in residential areas that might affect the ability of certain structures to be raised without obtaining a variance or other form of relief from the zoning code. Other eligibility considerations may include whether the structure is eligible for participation in another state, local, or Federal elevation program to avoid redundancy.

Dry flood-proofing of eligible non-residential structures

Dry flood-proofing consists of sealing all areas below the hurricane and storm surge flood damage risk reduction level of a structure to make it watertight and ensure that floodwaters cannot get inside by making walls, doors, windows and other openings impermeable to water penetration. Based on NFIP testing conducted at the Engineering Research and Development Center, dry flood-proofing can generally only be performed on the walls and portions of a conventionally built structure from the ground level to up to three feet. Walls are coated with sealants, waterproofing compounds, or plastic sheeting is placed around the walls and covered, and back-flow from water and sewer lines prevention mechanisms such as drain plugs,

standpipes, grinder pumps and back-up valves are installed. Openings, such as doors, windows, sewer lines and vents, may also be closed temporarily, with sandbags or removable closures, or permanently. Dry flood-proofing achieves hurricane and storm surge flood damage risk reduction but it is not recognized by the NFIP for any flood insurance premium rate reduction when applied to residential structures, and may not be used under the NFIP for new or substantially damaged buildings located in a Special Flood Hazard Area. A structural analysis of the wall strength is required to achieve higher level of risk reduction. Closure panels may be used at openings. This measure is viable for appropriate structures if design hurricane and storm surge flood depths are generally less than 3 feet, and hydrodynamic forces would also be a consideration. For structures with crawlspaces, the only effective way to dry flood-proof is to make the first floor impermeable to the passage of floodwater. Some common flood proofing measures include:

- Backflow valves;
- Closures on doors, windows, stairwells and vents--they may be temporary or permanent;
- Rearranging or protecting damageable property--e.g., relocate or raise utilities;
- Sump pumps and sub-drains; and
- Water resistant material; metal windows, doors and jambs; waterproof adhesives; sealants and floor drains.

The following process would apply to non-residential property owners who are willing and determined by the NFS to be preliminarily eligible to have their structures dry flood-proofed:

- Property owners who wish to have their structure dry flood-proofed must execute an authorization for entry using a form provided by the NFS which would grant USACE and the NFS authorization to enter in and upon the structure and land for purposes of investigating, inspecting, surveying, performing limited environmental testing and a HTRW assessment, evaluating the condition of the structure, determining flood-proofing requirements, verifying the current elevation, performing an appraisal, and conducting other activities necessary to make for USACE to make a determination of structure eligibility;
- The property owner must submit satisfactory proof of ownership and a current Elevation Certificate;
- Title research and appraisals would be completed by the NFS. The property must have a clear title. The property owner would be responsible to clear the title of all ownership issues and obtain any necessary subordination agreements from holders of liens, encumbrances, or third party interests at the property owner's sole expense; the failure to provide clear title shall result in a determination of ineligibility;
- An ASTM Phase I HTRW/Asbestos investigation, inspections (and if warranted, may be accompanied by additional HTRW investigations), surveys and boundary monumentations would be performed. The land and the structure must be certified as "clean" by the appropriate State office before any Project funds may be expended. All asbestos must be abated and disposed of properly. Asbestos impacted by flood-proofing would be removed at Project cost, while HTRW impacted by flood proofing must be remediated by the property owner prior to the initiation of the flood proofing work;
- After all inspections, investigations, assessments, and other activities are completed, a determination of eligibility for dry flood-proofing would be made by USACE;
- All property owners shall execute a Flood-Proofing Agreement containing an easement(s) in favor of the NFS, that authorizes the Government, the NFS or their contractors to enter the property for purposes of implementing the flood-proofing action and for inspection and enforcement purposes, includes an agreement to hold harmless the NFS and the Government for any damages arising from the flood-proofing work, and a covenant running with the land prohibiting the removal or alteration of the flood-proofing measures or the construction of additions to the existing structure or new structures that are not flood-proofed in accordance with the Project purpose. The Flood-Proofing Agreement, together with the easement(s) and covenant running with the land, as well as any required subordination agreements, shall be recorded by the NFS in the public records of the Parish in which the property is located;

- Each structure that is dry flood proofed must have an approved sanitary disposal system and be in compliance with local and state health and building codes;
- After the Flood-proofing Agreement together with the easement and covenant and any required subordination agreements are recorded in the public records, the dry flood-proofing work would be commenced, completed, inspected, and after final approval by the District Engineer, a notice of construction completion would be issued by to the NFS and the individual dry flood-proofing project would be closed out as complete.

Construction of localized storm surge risk reduction measures of less than 6 feet in height around industrial complexes and warehouses

These voluntary measures are intended to reduce the frequency of flooding but not eliminate floodplain management and flood insurance requirements. Localized storm surge risk reduction measures less than 6 feet in height installed around industrial complexes and warehouses that are eligible for the Project. These risk reduction measures could be constructed of earth, concrete, masonry, or steel and placed around a single structure or a contiguous group of structures. Some local governments may have adopted floodplain management rules that exceed the minimum requirements of the NFIP, and may limit the ability of certain flood-proofing measures to be constructed if the effects of the localized storm surge risk reduction measures create the potential for drainage problems by displacing flood storage. The following process would apply to willing non-residential property owners who are determined by the NFS to be preliminarily eligible to have localized storm surge risk reduction measures of less than 6 feet in height constructed around their industrial complex and/or warehouse:

- Property owners who wish to have localized storm surge risk reduction measures constructed around their industrial complex and/or warehouse must execute an authorization for entry using a form provided by the NFS which would grant USACE and the NFS authorization to enter in and upon the structure and land for purposes of investigating, inspecting, surveying, performing limited environmental and HTRW assessment, evaluating the condition of the land and structure, determining flood-proofing requirements, verifying the current elevation, performing an appraisal, and conducting other activities necessary for USACE to make a determination of eligibility for the construction of localized storm surge risk reduction measures;
- The property owner(s) must submit satisfactory proof of ownership and a current Elevation Certificate;
- Title research and appraisals would be completed by the NFS. The property must have clear title. The property owner(s) would be responsible to clear the title of all ownership issues and obtain any necessary subordination agreements from holders of liens, encumbrances, or third party interests at the property owner's sole expense; the failure to provide clear title shall result in a determination of ineligibility;
- An ASTM Phase I HTRW/Asbestos investigation (and if warranted, may be accompanied by additional HTRW investigations), inspections, surveys and boundary monumentations would be performed. The land and the structure must be certified as "clean" by the appropriate State office before any Project funds may be expended;
- After all inspections, investigations, assessments, and other activities are completed, a determination of eligibility would be made by USACE;
- All property owners shall execute a Flood-Proofing Agreement containing an easement(s) in favor of the NFS that authorizes the Government, the NFS or their contractors to enter the property for purposes of constructing the localized storm surge risk reduction measures and for inspection and enforcement purposes, includes an agreement to hold harmless the NFS and the Government for any damages arising from the construction of the localized storm surge risk reduction measures and a covenant running with the land prohibiting the removal or alteration of the localized storm surge risk reduction measures. The Flood-Proofing Agreement, together with the easement(s) and covenant running with the land and any required subordination agreements shall be recorded by the NFS in the public records of the Parish in which the property is located;
- After the Flood-proofing Agreement together with the easement and covenant and any required

subordination agreements are recorded in the public records, the localized storm surge risk reduction work would be commenced, completed, inspected, and after final approval by the District Engineer, a notice of construction completion would be issued by to the NFS and the individual flood-proofing project would be closed out as complete.

Hurricane storm surge damage risk reduction actions to be taken by the NFS in Calcasieu, Cameron, and Vermilion Parishes

Hurricane and storm surge flood damage risk reduction actions taken to comply with Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12) would be the obligation of the NFS, which would work to ensure development, compliance, and enforcement by municipal and Parish governments in Cameron, Vermilion, and Calcasieu Parishes with local floodplain management plans and regulations, adoption of more stringent local floodplain regulations, adoption of more restrictive parish and municipal building codes, land use and zoning regulations, and other developmental controls. The NFS obligations in this regard include:

- Not less than once each year the NFS would inform affected interests of the extent of protection afforded by the Nonstructural NED RP;
- The NFS would participate in and comply with applicable Federal floodplain management and flood insurance programs;
- The NFS would comply with Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), which requires a non-Federal interest to prepare a floodplain management plan within one year after the date of signing the Project Partnership Agreement, and to implement such plan not later than one year after completion of construction of the Nonstructural NED RP, or functional elements of the Nonstructural NED RP. The plan shall be designed to reduce the impacts of future hurricane and storm surge flood events in the project area, including but not limited to, addressing those measures to be undertaken by non-Federal interests to preserve the level of hurricane storm surge risk reduction provided by the Nonstructural NED RP. The NFS would provide an information copy of the plan to the Government upon its preparation; and
- The NFS would publicize floodplain information in the area concerned and would provide this information to zoning and other regulatory agencies for their use in adopting regulations, or taking other actions, to prevent unwise future development and to ensure compatibility with hurricane and storm surge flood risk reduction levels provided by the Nonstructural NED RP.

Additionally, the NFS would be obligated to prevent obstructions or encroachments on the properties that have been flood-proofed (including prescribing and enforcing regulations to prevent such obstructions or encroachments) or the addition of facilities which might reduce the level of protection the Nonstructural NED RP affords, hinder operation and maintenance of the Nonstructural NED RP, or interfere with the Nonstructural NED RP's proper function.

Presently, Calcasieu Parish, Cameron Parish, and Vermilion Parish, including the cities and towns of Abbeville, Dequincy, Delcambre, Erath, Iowa, Kaplan, Lake Charles, Maurice, Sulphur, Vinton, and Westlake are all communities participating in the NFIP (See FEMA Community Status Book, Louisiana June 2015).

Residential Structure Elevation Criteria

Property owners who wish to have their residential structure elevated must currently own both the structure and the land on which the structure is located. Proof of ownership shall require a Certificate of Title and a Certificate of Mortgage that identifies the names of all of the owners of the property, as well as any third party interest holders and any holders of a lien or encumbrance against the property. Additionally, the property owner shall provide written verification from the tax assessor that no taxes are due and payable on the property, as well as documentation from any holder of a mortgage, lien, or encumbrance, that the mortgage, lien, or encumbrance is in good standing or has been satisfied and released. Residential structures that are eligible for elevation and the property owner(s) must meet the following eligibility criteria:

1. The structure is in a condition suitable for human habitation;

2. The property has a clear title;
3. The property is not located in a Regulatory Floodway or on Federal leased land;
4. The structure can be elevated to meet the required BFE so that the habitable floors are raised to levels which would protect the residential structures from storm surge flooding to reduce future losses from the likelihood of the 100-Year Flood Event to the extent practicable. However, in no event would a structure be raised greater than 13 feet above the ground level;
5. The structure and land is not contaminated with HTRW or materials;
6. The property owner is willing to enter into a Flood Proofing Agreement and execute the required easements and restrictive covenant running with the land;
7. Based on a visual assessment, the structure does not have signs of actual or potential significant structural defects, distress, or failure (i.e., no evidence of corrosion of steel framing or concrete; no water or insect damage to wood framing; no framing that is in obvious need of repair or replacement, no settlement, cracking, buckling, or collapse of the foundation; no damage to load bearing or masonry walls; no damage to veneer or siding, no evidence of unrepaired roof leaks, etc.);
8. The property owner does not owe taxes or other debts to any state or local governmental entity or to the Federal government;
9. The property is located in a community that participates in the NFIP and the property owner has a current Elevation Certificate;
10. The property owner has not previously received any disaster assistance for the elevation of the structure;
11. The structure complies with the building code and floodplain management codes under which the structure was originally permitted;
12. The property owner is willing to expend any costs that may be necessary in connection with the elevation of the structure which are not eligible costs;
13. There are no special considerations or unique circumstances which prohibit elevation;
14. The property owner agrees to insure the elevated home to an amount at least equal to the maximum limit of coverage made available with respect to the particular property, whichever is less, through the NFIP as long as the property owner holds title to the property; and
15. The property owner, and all successors in title to the property owner, agree to record notice to subsequent purchasers and lien holders in the appropriate jurisdiction's land records that includes the name of the current property owner (including book/page reference to record of current title, if readily available), a legal description of the property, and the following statement of flood insurance requirements:

    This property has received Federal elevation assistance. Federal law requires that flood insurance coverage on this property must be maintained during the life of the property regardless of transfer of ownership of such property. Pursuant to 42 U.S.C. §5154a, failure to maintain flood insurance on this property may prohibit the owner from receiving federal disaster assistance with respect to this property in the event of a flood disaster. The property owner is also required to maintain this property in accordance with the flood plain management criteria of Title 44 of the Code of Federal Regulations Part 60.3 and the floodplain management regulations adopted by the community within which this property is located.

Failure to abide by the above conditions may prohibit the property owner and/or any subsequent purchasers from receiving Federal disaster assistance with respect to the property in the event of any future flood disasters. Residential structures which have been designated as a "Severe Repetitive Loss" property in accordance with FEMA criteria, are eligible for elevation.

If a property owner and/or the property owner's family member who is an occupant of the structure, is physically disabled or has mobility impairments such as in the case of elderly homeowners, a physician actively licensed by the state of Louisiana and in good standing must provide a written medical opinion and confirmation that special handicapped access is required before any means of special access may be included in the elevation. Multiple special access points are eligible for funding where necessary to meet state or local building code compliance. Where ramps are used to provide access, the ramps shall be designed to meet Federal

standards for slope and width. Where ramps are not technically feasible, a mechanical chairlift may be installed. Special access features shall be subject to state and local building and other applicable codes.

Tenants who reside in structures being elevated may be eligible for certain benefits in accordance with Uniform Relocation Assistance and Real Property Acquisition Policies for Federal and Federally Assisted Programs of 1970, Public Law 91-646, 84 Stat. 1894 (42 U.S.C. 4601), as amended by the Surface Transportation and Uniform Relocation Assistance Act of 1987, Title IV of Public Law 100-17, 101 Stat. 246-256; 49 Code of Federal Regulations 24; and HUD Handbook 1378 (collectively referred to as the URA). The URA provides for different replacement housing payments based on a displaced person's occupancy status and length of occupancy. Temporary relocation should not extend beyond one year before the person is returned to his or her previous unit or location. Any residential tenant who has been temporarily relocated for more than one year must be offered all permanent relocation assistance which may not be reduced by the amount of any temporary relocation assistance previously provided. Appropriate advisory services, including reasonable advance written notice of the following:

- Date and approximate duration of the temporary relocation;
- Address of the suitable decent, safe, and sanitary dwelling to be made available for the temporary period;
- Terms and conditions under which the tenant may lease and occupy a suitable decent, safe and sanitary dwelling in the building/complex upon completion of the project;
- Provisions of reimbursement for all reasonable out of pocket expenses incurred in connection with the temporary relocation;
- In addition to relocation advisory services, residential displaced persons may be eligible for other relocation assistance including relocation payments for moving expenses and replacement housing payments for the increased costs of renting or purchasing a comparable replacement dwelling; and
- All temporary housing costs must be approved in advance in writing by the NFS.

Nonstructural NED RP Implementation Methods

Traditional method. The "traditional method" of implementation is generally described in publications of the USACE National Flood Proofing Committee and Flood Risk Management Planning Center of Expertise. Under the traditional method, the USACE District utilizes a Federal procurement to obtain design and construction contractors for the various flood-proofing measures. The property owner enters into a Flood Proofing Agreement, which contains an easement for inspection and enforcement and a restrictive covenant running with the land in favor of the NFS and/or USACE. The form of the Agreement (and easement and covenant) would be prepared during PED and would be submitted to CEMVD and HQUSACE for review and approval. The Agreement would identify among other things, a "not-to-exceed" dollar amount, the Government contractor performing the flood proofing work, restrictions on the future development and alteration of the structure after the flood proofing work is completed, and requirements for compliance with local flood management regulations and/or the NFIP. The Agreement would require the property owners and their heirs and assigns, to covenant, warrant, and agree to forever release, discharge, indemnify, defend, and hold and save harmless USACE and the NFS (and their contractors) from and against any liability or any claim of any kind or nature whatsoever which might arise out of the work performed on the structure in connection with the Project, and any damages or injuries resulting either directly or indirectly from any elevation work and/or any flooding of the land or of the structure. In addition, the Agreement would authorize right of entry to the property and the structure by the NFS and USACE for the elevation work. The Agreement and the "Residential Structure Elevation Covenant Running With The Land" shall prohibit future alteration or new construction for human habitation on the property at an elevation lower than the predicted 2075 100-year BFE and shall contain the following restrictions: (a) upon completion of the elevation work, no part of the structure located below the level of the lowest habitable finished floor would thereafter be converted to living area for human habitation, or otherwise altered in any manner which would impede the movement of waters beneath the structure; (b) the area below the predicted 2075 100-year BFE shall be used solely for the parking of vehicles, limited storage, or access to the structure and would never be used for human habitation; (c) that mechanical,

electrical or plumbing devices shall not be installed below the BFE. These restrictions and the following statement must be specifically included in every deed and instrument that conveys or purports to convey title to or any interest in the land or structures thereon which is executed subsequent to the execution of the covenant:

> *This property has received Federal elevation assistance. Federal law requires that flood insurance coverage on this property must be maintained during the life of the property regardless of transfer of ownership of such property. Pursuant to 42 U.S.C. §5154a, failure to maintain flood insurance on this property may prohibit the owner from receiving Federal disaster assistance with respect to this property in the event of a flood disaster. The property owner is also required to maintain this property in accordance with the flood plain management criteria of Title 44 of the Code of Federal Regulations Part 60.3 and the floodplain management regulations adopted by the community within which this property is located.*

The executed Agreement would be recorded with an elevation certificate in the public records of the jurisdiction where the property is located.

The Government would procure contracts that would allow a contractor to perform flood-proofing work on multiple structures through a series of one or more task orders and who would be responsible for all work associated with the elevation from approval of the elevation plans for each structure to final inspection. A notice of construction completion would be provided at the appropriate time for each flood-proofed structure through an official letter from the District Engineer to the NFS. The NFS would maintain a copy of recorded elevation certificate and a certified copy of the original recorded Flood Proofing Agreement. The final inspection checklist shall be signed by the local floodplain administrator/coordinator. Upon completion of the flood-proofing of each structure, a Notice of Construction Completion is issued by USACE to the NFS, and the NFS is responsible for ensuring and maintaining compliance with any enforceable restrictions for the structure and property. The property owner is required to operate and maintain the integrity of their specific nonstructural measures.

A Certificate of Occupancy must be issued by a qualified building official to certify that the construction was properly completed. When the elevation work is completed, all structures must be covered by flood insurance in an amount at least equal to the costs of the flood-proofing work or to the maximum limit of coverage made available with respect to the property, whichever is less. Upon completion of the elevation, the property owner must provide USACE with an NFIP Elevation Certificate prepared by a professional land surveyor and verifying that the structure has been elevated to the required elevation and any elevation certificates showing the elevation level before the structure was elevated.

Elevation Costs

Eligible Elevation Costs. Property inspections would be conducted for eligible properties whose property owners have submitted the required proof of ownership and Elevation Certificate. The inspection does not guarantee acceptance of the structure for elevation. A determination that a structure is qualified for elevation would be made after all inspections, investigations, assessments, title research and all other work required to determine eligibility for elevations is complete and prior to the development of the elevation scope of work. If additional work is required as a condition of building permit issuance, and if such work is not listed as eligible above, the property owner would be required to provide funds equal to the amount of the cost to complete the required work. In no event shall the structure be elevated, if it is formally determined that the structure is not physically sound and capable of being raised safely.

Structure elevation work that are eligible costs shall include actual costs (itemized costs for each task), including but not limited to: design costs, costs of obtaining all required permits (i.e., zoning or land use approvals; environmental permits or required certifications; historic preservation approvals; and building permits), and costs of title searches, surveys, appraisal fees, Louisiana state sales tax, and costs for the following tasks:

- raising the structure;
- raising the roof and extending the walls of a side structure attached to the main structure (i.e., garage);

- raising mechanical equipment (i.e., air conditioner, furnace, water heater, electrical panel, fuel storage, valves, or meters);
- connecting, disconnecting, and extending utility connections for electrical power, fuel, incoming potable water, wastewater discharge;
- meeting access requirements of applicable building codes (i.e., stairs with landings, guardrails);
- creating large vent openings in the foundation and walls to meet requirements for flood water entry and exit;
- completing an Elevation Certificate to verify the as-built relationship between the lowest habitable finished floor and the Base Flood Elevation;
- only trees which restrict the demolition and reconstruction work on any structure may be removed;
- relocation assistance funds for displaced tenants are available to cover some expenses incurred during the actual raising of the structure for a period of no more than 90 days;
- debris removal (all demolition debris (hazardous and non-hazardous) shall be removed and taken to an approved landfill);
- site grading and site restoration including restoring landscaping to its preconstruction condition; and
- temporary site protection measures such as temporary construction fencing.

Ineligible Costs. The costs associated with the following tasks are ineligible:

- any work not strictly necessary for the safe completion of the structure elevation;
- any repair of existing deficiencies, including structural and system deficiencies;
- modifications or improvements to a septic system except for extension of lines from the raised structure to the existing system;
- cost for elevation of more than one foot above Base Flood Elevation;
- modifications to structures that are not attached to the structure;
- modifications to tubs, pools, spas, hot tubs, and related structures or accessories;
- modifications to decks and patios except for modifications that are expressly required by building codes (i.e., stairways and landing modifications);
- environmental site remediation costs are not eligible;
- costs to bring a non-conforming structure into compliance with current building code, housing code and/or other applicable codes;
- unless a satisfactory medical opinion if provided by a duly licensed physician that special access is required for a handicapped or mobility challenge property owner or the property owner's family member residing in the home, costs associated with special access improvements such as elevators, lifts, ramps, etc.;
- structures not considered the primary residence (i.e., detached garage, shed and/or barns); and
- if the elevation or alteration through flood-proofing methods would preclude the structure's continued designation as an "historic structure" or would be damaging to the historical character or value of the structure as determined by the Louisiana State Historic Preservation Office.

Methods for Prioritizing Nonstructural Elevation Work

The method for scheduling or prioritizing the implementation of voluntary non-structural elevation work would be determined during the period of PED. Any implementation of a decision on scheduling or prioritization would be subject to the availability of Federal funds. Some of the methods for scheduling or prioritizing non-structural elevation work that would be considered are as follows; however, additional methods of scheduling or prioritizing such work may be considered:

Clustering. If numerous property owners in a contiguous neighborhood or subdivision agree to participate, that particular area could be targeted for priority in structure elevation implementation. A focus on clustered properties can create a ranking hierarchy of which properties to address first. The size of a cluster would need

to be defined but could consist of zip codes or neighborhoods. This approach would rank efficiency as the main factor in determining which eligible properties should be prioritized.

Risk-Level. Willing property owners may not exist in clusters. In such cases, an alternative option is to focus on the willing property owners that exhibit the highest risk for flood damages. For example, if 1,000 property owners execute Flood-Proofing Agreements, the owners who reside in the 0-5-year floodplain would be prioritized for construction. Once these properties are elevated, the next highest-risk properties (6-10-year floodplain) would be targeted. This approach would rank risk exposure as the main factor in determining which eligible properties should be prioritized.

First-Come, First-Served. This approach would involve creating a list of eligible property owners and ranking them by how quickly their contracts and eligibility documentation are processed. This approach would help ensure that resources would be used effectively by focusing on properties that have owner support for the flood-proofing measures.

NATIONAL ECOSYSTEM RESTORATION (NER) PLAN

The National Ecosystem Restoration Recommended Plan (Alternative CM-4) is the Small Integrated Restoration Alternative. The NER RP is a comprehensive ecosystem restoration plan addressing land loss problems and ecosystem degradation. The NER RP is cost effective, and is the least cost comprehensive best buy plan. The NER RP would minimize land loss, enhance plant productivity by reducing major stressors, and reinforce and protect critical landscape features. The NER RP includes hydraulic dredging and placement of dredged borrow sediments for marsh restoration, placement of geotextile fabric and rock for shoreline protection/stabilization, and planting trees for chenier reforestation. All of the project measures are independent, but would work synergistically together with other existing ecosystem restoration projects in the area and facilitate hydrologic and geomorphic stability and resilience in the project area. The NER RP would cost approximately $982 million. Marsh restoration measures would be constructed in Calcasieu, Cameron and Vermilion Parish at an approximate cost of $622 million. Shoreline protection/stabilization measures and chenier reforestation measures would both be constructed in Cameron and Vermilion Parishes at approximate costs of $360 million and $246,000, respectively.

Table 1 provides a brief description of NER RP measures. **Figures 3** and **4** depict the locations of NER RP measures in the project area. **Table 2** presents the major changes to the NER RP between what was reported in the Revised Integrated Draft Report Consistency Determination as compared to the Integrated Final Report Consistency Determination. **Tables 3**, **4,** and **5** provide details regarding quantities for each NER RP measure. **Table 6** provides borrow site dimensions for marsh restoration.

There are a total of 49 ecosystem restoration features or measures:

- 9 Marsh Restoration measures
- 35 Chenier Reforestation measures;
- 5 Shoreline Protection measures
- The Calcasieu Ship Channel Salinity Barrier measure is being recommended for long-term study.
- The Cameron-Creole Spillway Salinity Control Structure measure is being recommended for long-term study.
- Two marsh restoration measures, located partially on U.S. Fish and Wildlife Service (USFWS) properties, are recommended for construction by the USFWS. Measure 124d Marsh Restoration at Mud Lake would be located on Sabine National Wildlife Refuge (NWR). Measure 3c1 Beneficial Use of Dredged Material from Calcasieu Ship Channel would be located on the Cameron Prairie NWR (**Figure 5**).

Table 1. NER RP Measure Descriptions

Basin	Category	Measure	Description
Mermentau/Teche-Vermilion (Plan M-4)	Marsh Restoration	47a1	Marsh restoration using dredged material south of LA-82, about 4.5 miles east of Grand Chenier. 933 marsh acres would be restored and 88 acres (272 AAHUs) would be nourished from 3M cubic yards of dredged material with one nourishment cycle.
		47a2	Marsh restoration using dredged material south of LA-82, approximately 4.5 miles west of Grand Chenier. 1,297 marsh acres would be restored and 126 acres (381 AAHUs) would be nourished from 8.8M cubic yards of dredged material with one nourishment cycle.
		47c1	Marsh restoration using dredged material south of LA-82, approximately 4.5 miles west of Grand Chenier. 1,304 marsh acres (353 AAHUs) would be restored and 4 acres would be nourished from 8.6M cubic yards of dredged material with one nourishment cycle.
		127c3	Marsh restoration at Pecan Island, west of the Freshwater Bayou Canal and approximately 5 miles north of the Freshwater Bayou locks. 832 marsh acres would be restored and 62 acres (241 AAHUs) would be nourished from 7.3M cubic yards of dredged material with one nourishment cycle.
		306a1	Rainey marsh restoration at Christian Marsh, east of the Freshwater Bayou Canal and approximately 5 miles north of the Freshwater Bayou locks. 627 marsh acres would be restored and 1,269 acres (151 AAHUs) would be nourished from 8.1M cubic yards of dredged material with one nourishment cycle.
	Shoreline Protection/ Stabilization	6b1	Gulf shore protection/stabilization from Calcasieu River to Freshwater Bayou. 11.0 miles of Gulf shore protection consisting of a reef breakwater with a lightweight aggregate core. Located ~150 ft offshore consisting of geotextile fabric and stone built to an 18 ft crest width. Measure would protect 2,140 acres (625 AAHUs) of brackish marsh.
		6b2	Gulf shore protection/stabilization from Calcasieu River to Freshwater Bayou. 8.1 miles of Gulf shoreline protection consisting of a reef breakwater with a lightweight aggregate core. Located ~150 ft offshore using geotextile fabric and stone built to an 18 ft crest width. Measure would protect 1,583 acres (466 AAHUs) of brackish marsh
		6b3	Gulf shore protection/stabilization from Calcasieu River to Freshwater Bayou. 6.3 miles of Gulf shoreline protection consisting of a reef breakwater with a lightweight aggregate core. Located ~150 ft offshore using geotextile fabric and stone built to an 18 ft crest width. Measure would protect 1,098 acres (312 AAHUs) of brackish marsh.
		16b	Fortify spoil banks of Freshwater Bayou. Approximately 13.4 miles of rock revetment at three critical locations to prevent shoreline breaching. Rock revetment would be built to +3 ft with a 4 ft crown. Two maintenance lifts would be required. Measure would protect 1,288 acres (279 AAHUs) of brackish marsh.
	Chenier Reforestation	CR	13 separate chenier locations would be replanted. Approximately 435 seedlings per acre, at 10 ft x 10 ft spacing, with invasive species control incorporated.
Calcasieu/ Sabine (CM-4) (Includes all measures in this table)	Marsh Restoration	3a1	Beneficial use of dredged material from the Calcasieu Ship Channel. Located adjacent to the south shore of the GIWW west of the Calcasieu Ship Channel near Black Lake. Restore 599 marsh acres (191 AAHUs) with 5.3M cubic yards of dredged material with one renourishment cycle.
		3c1	Beneficial use of dredged material from the Calcasieu Ship Channel. Located adjacent to the eastern rim of Calcasieu Lake and situated within the Cameron-Creole Watershed area. 1,347 marsh acres would be restored and 743 acres would be nourished (607 AAHUs) from 9.4M cubic yards of dredged material with one renourishment cycle.
		124c	Marsh restoration at Mud Lake. Located adjacent and north of Highway 82 and east of Mud Lake. 1,908 marsh acres would be restored and 708 acres (500 AAHUs) would be nourished from 10.4M cubic yards of dredged material with one renourishment cycle.

Basin	Category	Measure	Description
		124d	Marsh restoration at Mud Lake. Located west of the Calcasieu Ship Channel and adjacent to the south rim of West Cove. 159 marsh acres would be restored and 448 acres would be nourished (4 AAHUs) from 1.4M cubic yards of dredged material with one renourishment cycle.
	Shoreline Protection/ Stabilization	5a	Holly Beach Shoreline Stabilization Breakwaters. Construction of 8.7 miles of rock and low action breakwaters and is a continuation of existing breakwaters. Crown elevation of +3.5 ft with a crown width of 24 ft. Two maintenance lifts would be required. Measure would protect 26 acres (56 AAHUs) of saline marsh
	Chenier Reforestation	CR	22 separate chenier locations would be replanted. Approximately 435 seedlings per acre, at 10 ft x 10 ft spacing, with invasive species control incorporated.



Figure 3. NER RP measures in western portion of study area.

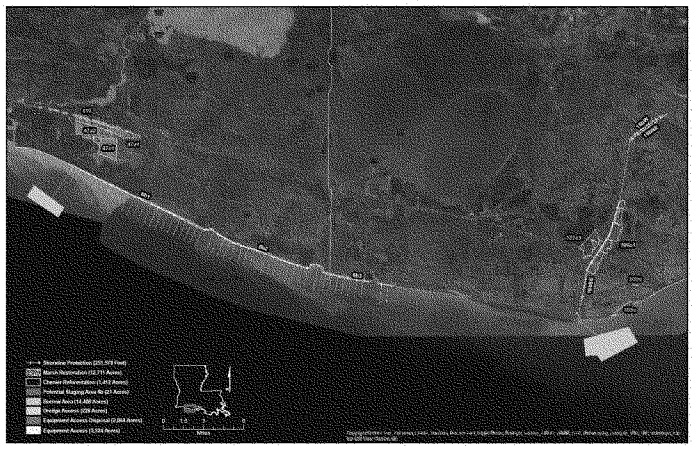


Figure 4. NER RP eastern portion of study area.

Table 2. Major Changes to NER RP

Item	Revised Integrated Draft Report & EIS	Integrated Final Report & EIS
General	Draft NED Plan recommended for programmatic authorization. Draft NER Plan recommended for construction authorization	Both Nonstructural NED and NER RP recommended for construction authorization.
Measure 7	Included	Recommended for separate analysis, and removed from RP.
Measure 74a	Included	Recommended for separate analysis, and removed from RP.
Measure 16b	156 AAHU; 662 net acres	Corrected to 279 AAHU; 1,288 net acres
Measure 306a1	645 AAHU	Corrected to 151 AAHU
Measure 3c1	607 AAHU; 1,324 net acres	Removed CWPPRA benefits; corrected to 607 AAHU & 1,324 net acres.
Measure 124c	472 AAHU; 1,245 net acres	Removed CWPPRA benefits; corrected to 500 AAHU & 1,228 net acres.
Salinity Patterns		Hydro-salinity measures which could influence salinity patterns are being recommended for additional separate study.
Sediment Transport		Hydro-salinity measures which could influence sediment transport are being recommended for additional separate study.
Pipeline Placement		Additional information on dredge pipeline placement and use of marsh buggies.
Impoundment		Additional information on retention/exclusion dikes provided.
Oil, Gas, and Other Mineral Activities		Additional information on oil, gas, other mineral activities in area.
Mitigation Areas		Additional information included lists and graphic displays of existing mitigation projects located near NER RP measures.

Table 3. Details of the marsh restoration features of the TSP (See Appendix K for fact sheets and maps detailing each NER TSP marsh restoration feature).

Measure Number	Measure Name	Basin	Marsh Type	Acres Restored	Acres Nourished	Total Acres	Net Benefits (acres)	Average Annual Habitat Units (AAHU)	Borrow Volume (cy)	Borrow Area (acres)	Renourishment Volume (cy)	Initial Construction Costs (US $)	TY 30 Renourishment (US $)
3a1	Beneficial Use of Dredged Material from Calcasieu Ship Channel	Calcasieu	Brackish	599	-	599	454	191	5,339,286	139	1,000,000	$66,593,748	$17,759,470
3c1	Beneficial Use of Dredged Material from Calcasieu Ship Channel	Calcasieu	Brackish	1,347	734	2,081	1,324	607	9,458,313	314	3,651,841	$168,194,346	$70,984,253
47a1	Marsh Restoration Using Dredged Material South of Highway 82	Mermentau	Brackish	933	88	1,021	895	272	3,022,782	1,716[4]	1,500,000	$105,234,982	$21,239,680
47a2	Marsh Restoration Using Dredged Material South of Highway 82	Mermentau	Brackish	1,297	126	1,423	1,218	381	8,831,084	1,716[4]	1,500,000	$97,348,440	$17,585,890
47c1	Marsh Restoration Using Dredged Material South of Highway 82	Mermentau	Brackish	1,304	4	1,308	1,135	353	8,557,120	1,716[4]	1,800,000	$95,372,834	$14,981,607
124c	Marsh Restoration at Mud Lake	Calcasieu	Saline	1,077	708	1,837	1,228	500	10,369,956	531	2,001,611	$112,219,520	$24,680,885
124d	Marsh Restoration at Mud Lake	Calcasieu	Brackish	159	448	607	168	4	1,420,943	378	1,200,000	$28,882,160	$17,636,205
127c3	Marsh Restoration at Pecan Island	Mermentau	Brackish	832	62	894	735	241	7,301,057	3,950[3]	781,000	$61,662,041	$15,683,451
306a1	Rainey Marsh Restoration Southwest Portion (Christian Marsh)	Mermentau	Brackish	627	1,269	1,896	743	151	8,128,181	3,950[3]	3,500,000	$75,885,692	$37,551,555
	Totals			8,175	3,439	11,666	7,900	2,700	62,428,722	7,028	16,934,452	$811,393,763	$238,102,996

3- This borrow source provides the sediment for all three restoration features but the full amount of available material will not be dredged each cycle. Therefore this total acreage is only counted once in the column total.
4- This borrow source provides the sediment for both restoration features but the full amount of available material will not be dredged each cycle. Therefore this total acreage is only counted once in the column total.

(Table 3 continued)

JA 37-899 334 10/04/2019

Measure Number	Measure Name	Impact to State Water Bottoms permanent (acres)	Floatation Footprint (acres)	Disposal Footprint (acres)	Dike Footprint (feet)	Dike Footprint (acres)	Impact to State Water Bottoms (temporary)	Dredge Pipeline Route (feet)	Dredge Pipeline Route (acres)	Piping Plover Critical Habitat (temporary impact acres)	Construction Period
3a1	Beneficial Use of Dredged Material from Calcasieu Ship Channel	139	132	-	44,700	30.8	-	43,942	30	-	16 months
3c1	Beneficial Use of Dredged Material from Calcasieu Ship Channel	314	182	-	97,250	51.4	-	61,497	42	-	33 months
47a1	Marsh Restoration Using Dredged Material South of Highway 82	1,716	47	-	68,300	47.0	-	35,519	24	0.14	23 months
47a2	Marsh Restoration Using Dredged Material South of Highway 82	1,716	47	-	41,000	28.2	-	30,898	21	0.14	24 months
47c1	Marsh Restoration Using Dredged Material South of Highway 82	1,716	47	-	35,200	24.2	-	29,858	21	0.14	23 months
124c	Marsh Restoration at Mud Lake	531	28	-	78,100	31.5	-	9,485	7	1.8	27 months
124d	Marsh Restoration at Mud Lake	314	182	-	32,500	22.4	-	21,452	15	-	9 months
127c3	Marsh Restoration at Pecan Island	3,950	110	-	46,000	31.7	-	37,074	26	-	12 months
306a1	Rainey Marsh Restoration Southwest Portion (Christian Marsh)	3,950	178	-	108,000	74.4	-	59,731	41	-	17 months
	Totals	14,347	953		551,50	341.6		329,456	227	2.2	---

JA
37-899
335
10/04/2019

Table 4. Details of the shoreline protection features of the TSP (See Appendix K for fact sheets and maps detailing each NER TSP shoreline protection feature).

Measure Number	Measure Name	Basin	Marsh Type	Net Benefits (acres)	Average annual habitat units (AAHU)	Shoreline Feature Length (ft)	Rock (tons)	Grade Rock (lbs)	Geotextile Fabric (sq yds)	Lightweight Aggregate (tons)	1st Maintenance Lift (tons)	2nd Maintenance Lift (tons)	Initial Construction Costs (US $)	TY15 Maintenance (US $)
5a	Holly Beach Shoreline Stabilization – Breakwaters	Calcasieu	Saline	26	56	46,014	860,540	250	386,460	0	129,081	86,054	$144,044,021	$16,786,222
6b1	Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou	Mermentau	Brackish	2,140	625	58,293	868,480	250	447,830	479,150	86,848	0	$198,480,921	NA
6b2	Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou	Mermentau	Brackish	1,583	466	42,883	687,140	250	363,270	357,010	68,714	0	$145,876,561	NA
6b3	Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou	Mermentau	Brackish	1,098	312	33,355	561,530	250	244,205	279,030	56,153	0	$115,270,890	NA
16b	Fortify Spoil Banks of the GIWW and Freshwater Bayou	Mermentau	Brackish	1,288	279	70,983	617,640	250	516,860	0	92,646	61,764	$36,018,600	$5,695,468
	Totals			6,135	1,738	251,528	3,595,330		1,958,625	1,115,190	433,442	147,818	$639,690,993	$22,481,690

JA 37-899 336 10/04/2019

(Table 4 continued)

Measure Number	Measure Name	TY 25 Maintenance (US $)	Impacts to State Water Bottoms (permanent)	Breakwater Footprint (feet)	Flotation Footprint* (acres)	Temporary Disposal Footprint* (acres)	Impact to State Water Bottoms (temporary acres)	Critical Habitat (acres)	Temporary Staging Area (acres)	Crown Elevation (feet NAVD88)	Crown Width (feet)	Slopes	Aprons (feet)	Construction Period
5a	Holly Beach Shoreline Stabilization – Breakwaters	$11,247,740	57.4	57.4	479	462	941	-	-	3.50	24	2:1	10-ft front & 6-ft back	19 months
6b1	Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou	$15,389,345	65.9	65.9	725	711	1436	-	21	3.25	18	2:1	10-ft front & 6-ft back	31 months
6b2	Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou	$11,343,672	40.2	40.2	507	497	1004	-	21	3.25	18	2:1	10-ft front & 6-ft back	23 months
6b3	Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou	$9,041,421	37.8	37.8	372	289	661	-	21	3.25	18	2:1	10-ft front & 6-ft back	18 months
16b	Fortify Spoil Banks of the GIWW and Freshwater Bayou	$3,966,404	77.1	77.1	358	-	-	-	-	3.00	4	4:1	none	13 months
	Totals	$50,988,582	278.4	278.4	2,441	1,959	4,042	-	63	-	-	-	-	---

**- Access for heavy equipment to construct shoreline stabilization features consists of dredging a channel in open water to allow construction equipment to reach shoreline areas and placing the dredged material alongside the channel so the necessary channel depth is maintained. This material stored adjacent to the channel will be returned to the access channel after construction. These impacts are temporary and will naturally revert to existing conditions over time.*

(Table 4 continued)

Linear Feet for Access and Temporary Disposal							
Measure	**5a**	**6b1**	**6b2**	**6b3**	**16b***	**Total Feet**	**Miles**
Disposal	159,741	239,001	168,533	98,683	0	665,958	126.1
Equipment Access	161,957	244,857	173,050	126,542	0	706,406	133.8

**- No dredging or temporary disposal is anticipated for Feature 16b since Freshwater Bayou has adequate water depths to allow the necessary construction equipment access.*

JA 37-899 337 10/04/2019

Table 5. Details of the chenier reforestation features of the TSP (see Appendix K for fact sheets and maps detailing the NER TSP chenier reforestation features).

Measure Name	Net Benefits (acres)	Benefits (AAHU)	Species	Total Fence Length (feet)	Fence Height (feet)	Planting Density (#/acre)	Spacing (feet)	Min. Survival % at Year 4*	Equip-ment Access Corridor (feet)	Equip-ment Access Corridor (acres)	State Water Bottoms (permanent)	State Water Bottoms (tempor-ary)	Critical Habitat (acres)	Staging Area (acres)
Chenier Reforestation (CR)	1,413	538	Live Oak; Hackberry	150,000	7.5	435	10 x 10	57%	13,867	10	0	0	0	0

**- For a given planting, a minimum of 250 seedlings/ saplings per acre must be present (with a 60 to 40 hard mast to soft mast ratio) at the end of the fourth year (i.e., Year 5) following successful attainment of the one-year survivorship criteria. Costs to ensure the minimum survival percent are considered 'construction' and will be cost-shared accordingly.*

JA
37-899
338
10/04/2019

Table 5. Southwest Coastal Louisiana Study Borrow Site Dimensions

Marsh Restoration Measures	Length by Width (ft)[1]	Borrow Area (acres)	Borrow Area Cut depth (ft)	Access Route Length by Width (ft)	Access Route Area (acres)	Access Route Cut Elevation (ft)[2]
3a1	USACE authorized channel dimensions			No dredging required for access		
3c1	USACE authorized channel dimensions			3,500 x 96	7.7	-8
47a1, 47a2, 47c1[3]	4,922 x 14,855	1,679	-15	10,000 x 96	22	-8
124c	2,937x7,880	531	-15	4,000 x 96	8.8	-8
124d	USACE authorized channel dimensions	USACE authorized channel dimensions		21,453 x 96	47.3	-8
127c3[4]	11,516 x 18,655	4,932	-15	1,400 x 96	2.2	-8
306a1[4]	11,516 x 18,655	4,932	-15	No dredging required for access		

[1]- Impacts to the shoreline due to the off shore borrow areas would be modeled in the PED Phase. Presently all off shore borrow areas were delineated, based on previous engineering experience, to have no significant impacts to the existing shoreline.
[2]-All excavated access routes would be backfilled upon construction completion.
[3]- These restoration features will utilize the same borrow source for construction but at different times.
[4]- These restoration features will utilize the same borrow source for construction but at different times.

Marsh Restoration Measures

Proposed marsh restoration measures are located in fragmented, degraded and low quality interior fragmented marshlands throughout the entire study area. Each of the nine marsh restoration measures involves dredging sediments and disposing into shallow open water and/or fragmented marsh areas (minimum of 100 acres) that have water levels of less than 2 feet and that have been optimized to preserve or restore critical geomorphologic features to create new vegetated wetlands. The nine marsh restoration measures would initially create (8,175 acres) and nourish (3,439 acres) a total of approximately 11,666 acres, resulting in an estimated 7,900 net acres and 2,700 average annual habitat units (AAHUs) restored and nourished over the 50 year period of analysis. Dredged borrow sediment sources would be the Calcasieu Ship Channel and other nearby sites located immediately offshore in the Gulf of Mexico (see **Figures 3** and **4,** attached Fact Sheets and Appendix K in the Integrated Final Report). The locations of the nine marsh restoration measures include:

- three areas on the south side of Highway 82 approximately 4.5 miles west of Grand Chenier;
- Pecan Island west of the Freshwater Bayou Canal approximately 5 miles north of the Freshwater Bayou locks;
- Christian Marsh located east of Freshwater Bayou Canal and approximately 5 miles north of Freshwater Bayou locks;
- southern shoreline of GIWW west of Calcasieu Ship Channel near Black Lake;
- eastern rim of Calcasieu Lake within the Cameron-Creole Watershed;
- east of Mud Lake and north of Highway 82; and
- Mud Lake west of Calcasieu Ship Channel adjacent to southern rim of West Cove.

Although the period of analysis for all NER RP measures is 50 years, the operation, maintenance, repair, replacement, and rehabilitation costs (OMRR&R), the responsibility of the non-Federal Sponsor, is for as long as a project remains authorized as a Federal project. The AAHUs estimated for the NER measures are based on maintenance cycles described in **Tables 3, 4** and **5**, and the attached Fact Sheets.

Existing Coastal Restoration Projects Directly Impacted by the NER RP Measures: Many of the NER RP measures would be constructed in the immediate vicinity of Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) projects (**Figure 5**). **Table 7** lists the names of existing coastal restoration projects within the Southwest Coastal Louisiana project area corresponding to **Figure 5**. The following existing coastal restoration projects would be impacted by the implementation of the NER RP.

- Shoreline protection Measure 5a (Holly Beach Shoreline Stabilization-Breakwaters) would be located immediately offshore of the projects CS-31 (Holly Beach Sand Management) and CS 33 (Cameron Parish Shoreline).
- Project CS-59 (Oyster Bayou Marsh Creation and Terracing) would be directly impacted by construction of marsh restoration NER RP measure 124c (**Figure 6**). Project CS-054 (Cameron-Creole Watershed Grand Bayou Marsh Creation) would be directly impacted by construction of marsh restoration NER RP measure 3c1 (**Figure 7**). When overlap occurs, proposed NER RP measures would be constructed to avoid existing coastal restoration projects by construction of temporary containment/exclusion dikes that would contain dredged borrow sediments used for construction of the NER RP measure and also prevent dredged effluents from entering the existing coastal restoration projects sites. Temporary containment/exclusion dikes would degrade naturally to restore connectivity with surrounding areas or would be degraded at three years after construction has been completed.

Mitigation Projects Directly Impacted by NER RP Measures: Existing mitigation projects are also located within areas proposed for restoration under the NER RP. Existing mitigation projects, identified by Mitigation Manger Kelley Templet with the LADNR, Office of Coastal Management, were constructed by various companies (e.g., oil and gas, Union Pacific, and others) and are designed and constructed to offset unavoidable anticipated losses to wetlands from permitted activities. **Figure 8** and **Table 8** contains information about mitigation projects that occur within the project area. In most instances, these mitigation projects were developed to provide a sustainable buffer from wave action and storm surge generated by tropical storms and hurricanes. Where overlap occurs, proposed NER RP measures would not be constructed until the mitigation projects satisfy their 20-year permitted obligations.

Fact Sheets located in Appendix K of the Integrated Final Report and EIS also contain additional NER RP measure details, description of construction equipment, and quantities and types of fill to be placed in wetlands.

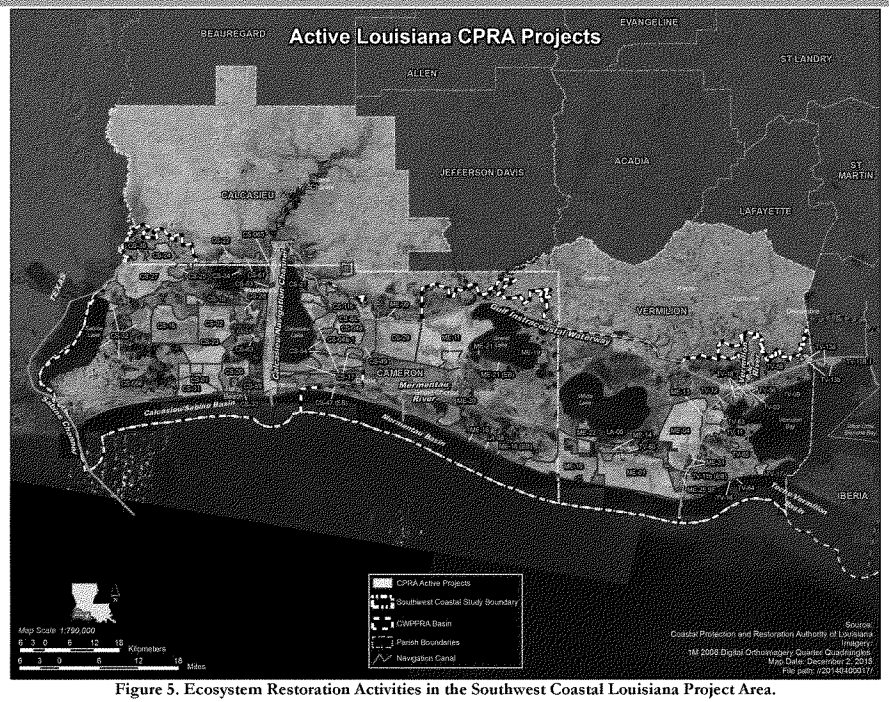


Figure 5. Ecosystem Restoration Activities in the Southwest Coastal Louisiana Project Area.

JA
37-899
341
10/04/2019

Table 7. List of Existing Coastal Restoration Projects Displayed in Figure 5.		
CS-01 Holly Beach Breakwaters Project	CS-19 West Hackberry Vegetative Planting Demo	TV-11 Freshwater Bayou Bank Protection
CS-28-1 Sabine Refuge Marsh Creation, Cycle 1	CS-32 East Sabine Lake Hydrologic Restoration	ME-14 Pecan Island Terracing
CS-27 Black Bayou Hydrologic Restoration	CS-BL Blind Lake LA-06 SP Foundation Improvements Demo	TV-11b (EB) EB - Freshwater Bayou Bank Stabilization
*CS-59 Oyster Bayou Marsh Creation and Terracing (impacted by NER RP Measure 124c)	CS-20 East Mud Lake Marsh Management	ME-16 Freshwater Introduction South of Highway 82
CS-02 Rycade Canal Marsh Management	CS-33* -impacted by NER RP Measure 5a Cameron Parish Shoreline Restoration	TV-11B.1 Acadiana Gulf of Mexico Access Channel
CS-28-2 Sabine Refuge Marsh Creation, Cycle 2	CS-ST Sabine Terraces LA-08 Bio-Engineered Oyster Reef Demo	ME-18 Rockefeller Refuge Gulf Shoreline Stabilization
CS-27 Black Bayou Hydrologic Restoration	CS-21 Highway 384 Hydrologic Restoration	TV-12 Little Vermilion Bay Sediment Trapping
CS-61 Brannon Ditch	CS-34 Marcantel Supplemental Beneficial Use Disposal Area	ME-18 (EB) EB - Rockefeller Shoreline Protection Demo
CS-04a Cameron-Creole Maintenance	LA-06 SP Foundation Improvements Demo ME-01 Pecan Island Freshwater Introduction	TV-13a Oaks/Avery Canal Hydrologic Restoration, Increment 1
CS-28-3 Sabine Refuge Marsh Creation, Cycle 3	CS-22 Clear Marais Bank Protection	ME-19 Grand-White Lakes Landbridge Protection
*CS-59 Oyster Bayou Marsh Creation and Terracing (impacted by NER RP Measure 124c)	CS-47 (EB) EB - Trosclair Road Repairs	TV-13b Oaks/Avery Structures
CS-63 Sabine Shellbank Stabilization	LA-08 Bio-Engineered Oyster Reef Demo	ME-20 South Grand Chenier Marsh Creation
CS-04a-1 Cameron-Creole Structure Automation	ME-04 Freshwater Bayou Wetland Protection	TV-16 Cheniere Au Tigre Sediment Trapping Demonstration
CS-28-4-5 Sabine Refuge Marsh Creation, Cycle 4-5	CS-23 Replace Sabine Refuge WCS	ME-21 Grand Lake Shoreline Protection
CS-61 Brannon Ditch	CS-49 Cameron-Creole Freshwater Introduction	TV-17 Lake Portage Land Bridge
CS-65 Calcasieu Ship Channel Salinity Controls	ME-01 Pecan Island Freshwater Introduction	ME-21 (EB) EB - Grand Lake Shoreline Protection
CS-11b Sweet Lake/Willow Lake Hydrologic Restoration	ME-09 Cameron Prairie National Wildlife Refuge SP	TV-18 Four Mile Canal Terracing and Sediment Trapping
CS-29 Black Bayou Culverts Hydrologic Restoration	CS-24 Perry Ridge Shore Protection	ME-22 South White Lake Shoreline Protection
CS-63 Sabine Shellbank Stabilization	CS-53 Kelso Bayou Marsh Creation	TV-56 Four-Mile Canal Storm Surge Reduction Construction
CS-66 Cameron Meadows Marsh Creation and Nourishment	ME-04 Freshwater Bayou Wetland Protection	ME-25 SF Marsh Creation Near Freshwater Bayou
CS-17 Cameron Creole Plugs	ME-11 Humble Canal Hydrologic Restoration	TV-58 Boston Canal
CS-30 GIWW - Perry Ridge West Bank Stabilization	CS-25 Plowed Terraces Demonstration	ME-31 Freshwater Bayou Marsh Creation
CS-65 Calcasieu Ship Channel Salinity Controls	*CS-54 Cameron-Creole Watershed Grand Bayou MC (impacted by NER RP Measure 3c1)	TV-60 Front Ridge Chenier Terracing/Protection
CS-BL Blind Lake	ME-09 Cameron Prairie National Wildlife Refuge SP	TV-03 Vermilion River Cutoff Bank Protection
CS-18 Sabine National Wildlife Refuge Erosion Protection	TV-65 Rainey Audubon Wildlife Sanctuary Earthen Terraces	TV-63 Cole's Bayou Restoration
*CS-31 Holly Beach Sand Management (impacted by NER RP Measure 5a)	ME-13 Freshwater Bayou Bank Stabilization	TV-09 Boston Canal/Vermilion Bay Bank Protection
CS-66 Cameron Meadows Marsh Creation and Nourishment		TV-64 Cheniere au Tigre
CS-ST Sabine Terraces		

JA 37-899 342 10/04/2019

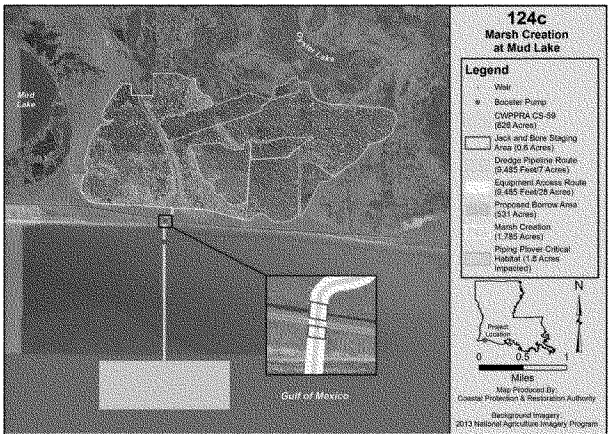


Figure 6. NER RP Measure 124c Overlap with Project CS-54 Cameron Creole Watershed Grand Bayou Marsh Creation.

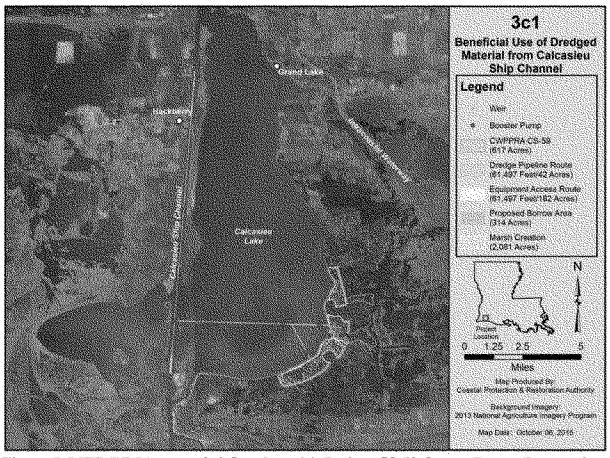


Figure 7. NER RP Measure 3c1 Overlap with Project CS-59 Oyster Bayou Restoration.

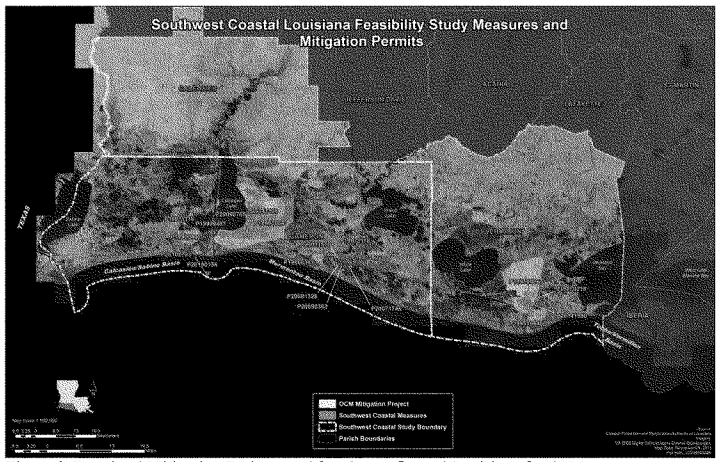


Figure 8. Permitted Mitigation Projects and Southwest Coastal Louisiana Study Measures.

Table 8: Mitigation Projects that Overlap with NER RP Features.

Permit #	Description	NER RP Feature	Permittee or Owner	Expiration Date (permit completion date + 20 years)	Mitigation Project Description
Tier I Features					
P20061888	Terraces at GIWW N of Black Lake	3a1	Gulfport Energy Corporation	11/30/2032	Proposed construction of 5,358 linear ft of terraces south of the GIWW and north of Black Lake.
P19900448	Marsh Management Plan area	124d	Apache Louisiana Minerals	11/13/2016	Install and maintain water control structures for CTU 1 and 2. In CTU 1, 64,000 linear ft of smooth cordgrass plantings. In CTU 2, 32,470 linear ft of boundary levee are to be repaired. Various water control structures are to be repaired or replaced.
P19971118	West Cove Planting Project	124d	Union Pacific Resources	7/28/2022	West Cove Planting Project; 5,000 ft of plantings of *Spartina alterniflora.*
P19950086	Marsh Management Plan area	127c3	Vermilion Corporation	4/1/2021	Eight water control structures will be installed; a riprap levee will be constructed; five double flapgated culverts and one earthen plug will be installed; two earthen plugs will be constructed.

Tier II Features					
P20141590	Spoil Placement	306a1	Hilcorp Energy Company	4/8/2040	Dredging of 15,430 cubic yards of native material to construct slip for the purpose of installing a drill rig, well protector and pilings. The dredged material will be pumped into a shallow pond adjacent to the proposed drill site using a temporary discharge pipe. An additional 301 cubic yards of material will be displaced to construct containment berms.
Tier III Features					
P20090785	Spoil disposal/levee restoration	3c1	Cameron Parish Drainage District #3	8/13/2034	Consists of five water control structures and 17.1 miles of earthen levee (CWPPRA Project CS-04A-L Phase II).
P20141138	Rip-rap Grand Bayou	3c1	CPRA	1/29/2040	Installation of 21,000 tons of riprap along the Calcasieu Lake Shoreline near the Peconi, Mangrove and Grand Bayou water control structures.
P19870422	Marsh Management Plan area	47a2	T. Bonsall	2/3/2023	Construction of a levee and multiple water control structures (South of Upper Mud Lake).
P20031576	Mitigation for P20031304	47a2	Kash Oil & Gas, Inc.	3/31/2029	Constructed 4,803 linear feet of terraces and planted with *Spartina alterniflora*.
P20081326	Mitigation for P20080132	47a2	PetroQuest Energy, L.L.C.	11/25/2033	Construct and plant 2,897 linear ft of wave dampening terraces that will capture re-suspended sediments and protect fragile shorelines by planting plugs of smooth cordgrass on both sides of constructed terraces.
P20071745	Mitigation for 20070883	47c1	Manti Operating Company	3/5/2025*	Construction of ten 500-foot terraces, eight 300-foot terraces, two 200-foot terraces and eight 400-foot terraces (6.1 acres). Plantings of *Spartina alterniflora* rows on each side of the terraces.

If project measures overlap with existing mitigation projects, the project measure would be constructed after the mitigation period of performance expires so that mitigation credits can be realized without interference. This would occur for measures 3a1, 47a1, and 47a2, which will be constructed in Tier III of the implementation plan, after the mitigation projects have concluded. All marsh restoration measures would have one future re-nourishment cycle at about year 30 following construction. The costs are included in the OMRR&R estimates and would be the responsibility of the local non-Federal Sponsor. OMRR&R plans have been developed for each restoration measure. The borrow areas and temporary access corridors for these activities would be the same as for initial construction, and the equipment used would be similar (hydraulic cutter-head dredge), although it may use a smaller dredge, since less material would be required. For shoreline protection, placement of additional rock in successive lifts would be required. This would use the same temporary access corridors as initial construction. Anticipated maintenance requirements are detailed in the attached Fact Sheets (see also Appendix K of the Integrated Final Report).

Monitoring results would be used to adjust anticipated maintenance cycles due to unanticipated changes in performance, especially within the first ten years, are determined. If a change in the anticipated maintenance cycles is warranted, modifications to this Consistency Determination would be submitted to the LDNR, Office of Coastal Management for consistency review. Coordination with LDNR and other appropriate regulatory agencies would be initiated prior to maintenance activities to ensure there were no deleterious impacts (e.g., to new nesting sites for bald eagles, etc.). See also attached Fact Sheets and Appendix K of the Integrated Final Report.

Shoreline Protection/Stabilization Measures

The five shoreline protection/stabilization measures, which span approximately 251,528 linear feet, would be located to reduce erosion of canal banks and shorelines in critical areas to protect adjacent wetlands and critical geomorphic measures. The shoreline protection/stabilization measures are anticipated to result in approximately 1,738 AAHUs and 6,135 net acres protected/stabilized. Construction of the five shoreline protection measures would require dredging floatation or access corridors to transport material to the shoreline protection site. Material dredged via mechanical dredge for access corridors for construction of the five shoreline protection features would be temporarily side-cast onto water bottoms immediately adjacent to the temporary access corridor. Following construction, the side-cast material would be returned to the temporary access corridor. Only measures associated with wetland areas capable of producing gains in excess of 100 net acres are included in the shoreline protection measures. See also attached Fact Sheets and Appendix K of the Integrated Final Report.

Chenier Reforestation

Chenier restoration consists of replanting of 435 seedlings per acre at 10 foot x 10 foot spacing, in 35 chenier locations. Approximately 1,413 net acres in Cameron and Vermilion Parishes would be reforested over the 50 year period of analysis, resulting in 538 AAHUs. Areas eligible for chenier restoration consist of areas greater than five feet in elevation and with low shoreline erosion rates, provided the existing canopy coverage is less than 50%, unless nearby development would prevent achieving study objectives. See also attached Fact Sheets and Appendix K of the Integrated Final Report.

Other Measure Recommendations

- The Calcasieu Ship Channel Salinity Barrier measure is being recommended for long-term study.
- The Cameron-Creole Spillway Salinity Control Structure measure is being recommended for long-term study.
- Two marsh restoration measures, located partially on USFWS properties, are recommended for construction by the USFWS, including: measure 124d Marsh Restoration at Mud Lake, located on Sabine National Wildlife Refuge (NWR) and measure 3c1 Beneficial Use of Dredged Material from Calcasieu Ship Channel located on the Cameron Prairie NWR (**Figure 9**). While USACE believes that these features are worthy of recommendation, USACE has determined that these features would more properly be implemented by USFWS. Therefore, USACE will not seek authorization and funding of these features. Rather USACE will recommend to USFWS that it consider seeking independent Congressional authorization and funding for implementation of these features by USFWS.

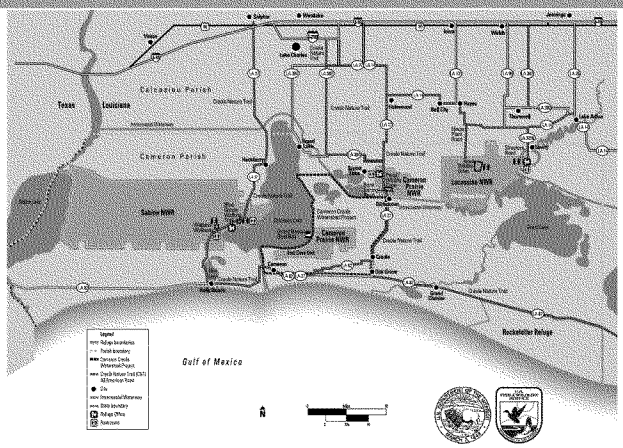


Figure 9. Sabine NWR and Cameron Prairie NWR.

NER RP Construction Tiering

NER RP measures were categorized into three tiers whereby Tier I measures would be constructed before Tier II, and Tier II measures constructed before Tier III. Tier I measures may be constructed simultaneously because they would not affect the construction of any nearby Tier I project measure. Shoreline protection measures would be constructed prior to marsh restoration to provide immediate protection of the storm-vulnerable marsh restoration measures. This approach contributes to the sustainability of the marsh restoration measures. Tier II project measures were so categorized because they utilize the same borrow or staging area, and/or construction of these measures would potentially interfere with construction of a Tier I project measure. Tier II project measures would be constructed contemporaneously as the construction of any one of these project measures would not affect any other project measure within this grouping. Tier III project measures were so categorized because they would utilize the same borrow or staging area, and/or interfered with construction of a Tier II project, and/or interfered with an existing mitigation project. Tier III project measures would be constructed contemporaneously if they would not affect construction of the other project measures within this grouping. In categorizing project measures, it was assumed that all construction funds would be available, multiple construction contracts could be let at one time, and an adequate supply of all materials to facilitate construction. More detailed design and analysis would be conducted during development of the Final EIS and during the Preconstruction Engineering and Design (PED) Phase. The construction schedule for completing all project measures is expected to last a total of about 60 months. Dredge spoil retention measures would be constructed prior to discharge of dredged material at marsh restoration sites. Timing and duration of construction for each measure is provided in **Tables 3, 4,** and **5**.

Tier I Projects:

- Holly Beach Shoreline Stabilization – Breakwaters (5a)
- Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou (6b1)
- Fortify Spoil Banks of the GIWW and Freshwater Bayou (16bSE)
- Fortify Spoil Banks of the GIWW and Freshwater Bayou (16bNE)

- Fortify Spoil Banks of the GIWW and Freshwater Bayou (16bW)
- Beneficial Use of Dredged Material from the Calcasieu Ship Channel (3a1)
- Marsh Restoration at Mud Lake (124d)[1]
- Marsh Restoration at Pecan Island (127c3)
- Chenier Ridges: Grand Chenier Ridge (416)[2]
- Restore Bill Ridge (509c)[2]
- Chenier Ridges: Cheniere au Tigre (509d)[2]
- Restore Blue Buck Ridge (510a)[2]
- Restore Hackberry Ridge (510b)[2]
- Restore Front Ridge (510d)[2]

Tier II Projects:
- Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou (6b2)
- Marsh Restoration at Mud Lake (124c)
- Rainey Marsh Restoration Southwest Portion (Christian Marsh) (306a1)

Tier III Projects:
- Beneficial Use of Dredged Material from the Calcasieu Ship Channel (3c1)[1]
- Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou (6b3)
- Marsh Restoration Using Dredged Material South of Highway 82 (47a1)
- Marsh Restoration Using Dredged Material South of Highway 82 (47a2)
- Marsh Restoration Using Dredged Material South of Highway 82 (47c1)

Recommended for Further Study:
- Calcasieu Ship Channel Salinity Control Structure
- Cameron-Creole Spillway Structure

[1]- *Recommended for USFWS independent Congressional authorization and appropriation for construction by USFWS*
[2]- *Individual features that comprise the chenier reforestation measure*

LOUISIANA COASTAL USE GUIDELINES

1. GUIDELINES APPLICABLE TO ALL USES

These and the following responses are at the feasibility level in nature and would be followed by more detailed analysis in subsequent NEPA documents and associated consistency determination(s).

Guideline 1.1 The guidelines must be read in their entirety. Any proposed use may be subject to the requirements of more than one guideline or section of guidelines and all applicable guidelines must be complied with.

Response: Acknowledged.

Guideline 1.2 Conformance with applicable water and air quality laws, standards and regulations, and with those other laws, standards and regulations which have been incorporated into the coastal resources program shall be deemed in conformance with the program except to the extent that these guidelines would impose additional requirements.

Response: Acknowledged.

Guideline 1.3 The guidelines include both general provisions applicable to all uses and specific provisions applicable only to certain types of uses. The general guidelines apply in all situations. The specific guidelines apply only to the situations they address. Specific and general guidelines should be interpreted to be consistent with each other. In the event there is an inconsistency, the specific should prevail.

Response: Acknowledged.

Guideline 1.4 These guidelines are not intended to nor shall they be interpreted so as to result in an involuntary acquisition or taking of property.

Response: Acknowledged.

Guideline 1.5 No use or activity shall be carried out or conducted in such a manner as to constitute a violation of the terms of a grant or donation of any lands or water-bottoms to the State or any subdivision thereof. Revocations of such grants and donations shall be avoided.

Response: No violations or revocations of such grants or donations are expected.

Guideline 1.6 Information regarding the following general factors shall be utilized by the permitting authority in evaluating whether the proposed use is in compliance with the guidelines.

a) type, nature and location of use.

Response: Acknowledged.

b) elevation, soil and water conditions and flood and storm hazard characteristics of site.

Response: Acknowledged.

c) techniques and materials used in construction, operations and maintenance of use.

Response: Acknowledged.

d) existing drainage patterns and water regimes of surrounding area including flow, circulation, quality, quantity and salinity; and impacts on them.

Response: Acknowledged.

e) availability of feasible alternative sites or methods – for implementing the use.

Response: Acknowledged.

f) designation of the area for certain uses as part of a local program.

Response: Acknowledged.

g) economic need for use and extent of impacts of use on economy of locality.

Response: Acknowledged.

h) extent of resulting public and private benefits.

Response: Acknowledged.

i) extent of coastal water dependency of the use.

Response: Acknowledged.

j) existence of necessary infrastructure to support the use and public costs resulting from use.

Response: Acknowledged.

k) extent of impacts on existing and traditional uses of the area and on future uses for which the area is suited.

Response: Acknowledged.

l) proximity to, and extent of impacts on important natural features such as beaches, barrier islands, tidal passes, wildlife and aquatic habitats, and forest lands.

Response: Acknowledged.

m) the extent to which regional, state and national interests are served including the national interest in resources and the siting of facilities in the coastal zones as identified in the coastal resources program.

Response: Acknowledged.

n) proximity to, and extent of impacts on, special areas, particular areas, or other areas of particular concern of the state program or local programs.

Response: Acknowledged.

o) likelihood of, and extent of impacts of, resulting secondary impacts and cumulative impacts.

Response: Acknowledged.

p) proximity to and extent of impacts on public lands or works, or historic, recreational or cultural resources.

Response: Acknowledged.

q) extent of impacts on navigation, fishing, public access, and recreational opportunities.

Response: Acknowledged.

r) extent of compatibility with natural and cultural setting.

Response: Acknowledged.

s) extent of long term benefits or adverse impacts.

Response: Acknowledged.

Guideline 1.7 It is the policy of the coastal resources program to avoid the following adverse impacts. To this end, all uses and activities shall be planned, sited, designed, constructed, operated and maintained to avoid to the maximum extent practicable significant:

a) reductions in the natural supply of sediment and nutrients to the coastal system by alterations of freshwater flow.

Response: The Nonstructural NED RP would not alter freshwater flows and would have no reductions in the natural supply of sediments or nutrients to the coastal system. Rather, the Nonstructural NED RP would reduce the risk of damages resulting from hurricane and storm surge by 1) elevating eligible residential structures; 2) dry flood proofing of eligible non-residential structures, excluding large warehouses and industrial complexes; and 3) construction of flood proofing barriers or berms less than 6 feet in height around non-residential structures, primarily industrial complexes and warehouses. Best available practical techniques and best management practices (BMPs) would be used to avoid, minimize and reduce the potential for affecting or reducing the natural supply of sediments and nutrients into the coastal system.

The NER RP measures would restore and nourish transitional estuarine marsh, provide shoreline protection for back marsh areas, and reforest natural chenier ridges. The NER RP would use the best available practical techniques and BMPs for restoration would be used to avoid, minimize and reduce the potential for affecting or reducing the natural supply of sediments and nutrients into the coastal system.

b) adverse economic impacts on the locality of the use and affected governmental bodies.

Response: The Nonstructural NED and NER RP are not expected to have any adverse economic impacts on the locality of the use or on nearby governmental bodies. No industries, jobs, or other economic activities are likely to be adversely impacted by the proposed action.

The Nonstructural NED RP would use the best available practical techniques and BMPs to avoid, minimize and reduce the potential for adverse economic impacts of providing risk reduction of hurricane and storm surge flood damage for a total of 3,961 impacted structures consisting of 3,462 eligible residential structures; 342 eligible commercial structures and public buildings; and 157 eligible industrial complexes and warehouses. Implementing the Nonstructural NED RP would reduce adverse economic impacts by reducing administrative costs and claims to the Federal Flood Insurance Program, under the FEMA, for repetitive flood insurance claims. This estimate is based upon present information and could change during implementation of the Nonstructural NED RP.

The NER RP would use the best available practical techniques and BMPs for implementing each measure. NER RP measure sites, dredge borrow sites, and temporary access corridors would be temporarily unavailable and restricted from human uses during construction, dredging and implementation. However, any restrictions of human use would be temporary and only during dredging and construction. Following construction, the NER RP measures would be available for human uses. The NER RP would reforest cheniers which provide important stopover habitat for migrating Neotropical birds that are sought by birdwatchers. Restoring, nourishing and protecting important, essential and in some instances critical transitional, estuarine marsh habitats used by various terrestrial and aquatic organisms for shelter, nesting, feeding, roosting, cover, nursery, EFH and other life requirements would likely lead to localized increased use by these organisms as well as potential localized increase in productivity. Consequently, localized increases in estuarine aquatic organisms could be utilized for recreational and commercial fishing which could have localized positive economic effects. The NER RP would utilize the best available practical techniques and BMPs during dredging and construction

to avoid and minimize potential adverse economic impacts on the locality of use and affected government bodies.

c) detrimental discharges of inorganic nutrient compounds into coastal waters.

Response: The Nonstructural NED RP would not discharge inorganic nutrient compounds into coastal waters because of the remoteness of identified structures from coastal waters. Rather, the Nonstructural NED RP would reduce damages resulting from hurricane and storm surge by 1) elevating eligible residential structures; 2) dry flood proofing of eligible non-residential structures, excluding large warehouses and industrial complexes; and 3) construction of flood proofing barriers or berms less than 6 feet in height around non-residential structures, primarily industrial complexes and warehouses. Construction methods would employ the use of the best available practical techniques and BMPs to avoid, minimize and reduce the potential for detrimental discharges of inorganic nutrient compounds into coastal waters.

Activities associated with implementing the NER RP measures includes dredging temporary access corridors, dredging and placement of borrow sediments at the nine marsh restoration measures, and placement of geotextile fabric and rock for the five shoreline protection measures could cause temporary and localized increases in turbidity and total suspended sediments, which may contain inorganic nutrient compounds. **Tables 3, 4,** and **5** provide estimated construction time frames for each NER RP measure. However, the best available practical techniques and BMPs would be used to avoid, minimize and reduce the potential for detrimental discharges of inorganic nutrient compounds into coastal waters. Coastal waters at each NER RP measure site would return to levels of inorganic nutrient compounds similar to those exhibited prior to construction. Chenier reforestation would have no such effects as these sites are located away from coastal waters.

d) alterations in the natural concentration of oxygen in coastal waters.

Response: The Nonstructural NED RP would not result in alterations in the natural concentration of oxygen in coastal waters because of the remoteness of identified structures from coastal waters. Rather, the Nonstructural NED RP would reduce damages from hurricane and storm surge by 1) elevating eligible residential structures; 2) dry flood proofing of eligible non-residential structures, excluding large warehouses and industrial complexes; and 3) construction of flood proofing barriers or berms less than 6 feet in height around non-residential structures, primarily industrial complexes and warehouses. In addition, the use of the best available practical techniques and BMPs to avoid, minimize and reduce the potential for alterations in the natural concentration of oxygen in coastal waters.

Activities associated with implementing the NER RP measures includes dredging and construction of temporary access corridors, dredging and placement of sediments for nine marsh restoration and nourishment measures, and construction of the five shoreline protection measures could result in a localized, but temporary, decrease in dissolved oxygen concentrations when the biological and the chemical content of the suspended material reacts with the dissolved oxygen in the water. This may result in oxygen depletion. The extent and persistence of these adverse impacts caused by discharges depend upon the relative increase in suspended particulates above the amount occurring naturally, the duration of the higher levels, the current patterns, water level, and fluctuations present when such discharges occur, the volume, rate, and duration of the discharge, particulate deposition, and the seasonal timing of the discharge. However, any such effects are expected to be minor and would occur only during actual dredging and construction activities. **Tables 3, 4,** and **5** provide estimated construction time frames for each NER RP measure. Shortly after dredging and construction is completed, dissolved gases and dissolved oxygen levels would return to levels similar to those before construction. The best available practical techniques and BMPs would be used to avoid, minimize and reduce the potential adverse alterations of dissolved gases such as dissolved oxygen in coastal waters. Chenier reforestation measures would have no effects or alterations to the natural concentration of oxygen in coastal waters due to location of these measures from coastal waters and use of the best available practical techniques and BMPs during construction activities.

e) destruction or adverse alterations of streams, wetland, tidal passes, inshore waters and water bottoms, beaches, dunes, barrier islands, and other natural biologically valuable areas or protective coastal features.

Response: The Nonstructural NED RP would not destroy or adversely alter streams, wetlands, tidal passes, inshore waters and water bottoms, beaches, dunes, barrier islands, or other natural biologically valuable areas or protective coastal features because of the remoteness of identified structures from coastal waters. Rather, the Nonstructural NED RP would reduce damages resulting from hurricane and storm surge by 1) elevating eligible residential structures; 2) dry flood proofing of eligible non-residential structures, excluding large warehouses and industrial complexes; and 3) construction of flood proofing barriers or berms less than 6 feet in height around non-residential structures, primarily industrial complexes and warehouses. In addition, the use of the best available practical techniques and BMPs to avoid, minimize and reduce the potential for destruction or adverse alterations of streams, wetland, tidal passes, inshore waters and water bottoms, beaches, dunes, barrier islands, or other natural biologically valuable areas or protective coastal features. The best available practical techniques and BMPs would be used to avoid, minimize and reduce the potential destruction or adverse alteration of biologically valuable or protective coastal features.

Water bottoms at the NER RP dredge borrow sites would temporarily be altered due to dredging. However, these areas would naturally refill due to the high energy Gulf of Mexico, navigation channel dynamics and other natural processes of sediment movement throughout the ecosystem. Shallow open water bottoms at the nine marsh restoration sites would be converted to transitional estuarine marsh habitat which is currently being eroded and lost throughout coastal Louisiana and the project area. Placement of geotextile fabric and rock for shoreline protection measures, by design, would permanently alter water bottoms in these areas to reduce wave erosion. Chenier reforestation would have no destructive or adverse alterations to the natural biologically valuable or protective coastal features. Rather, chenier reforestation would use the best available practical techniques and BMPs for reforestation which would provide ecologically important habitat to migrating neotropic birds, resident bird populations as well as other wildlife that utilize chenier forest habitats. In addition, chenier reforestation would help maintain natural chenier coastal features thereby restoring the protective nature of these features. The NER RP would use the best available practical techniques and BMPs would be used to avoid, minimize and reduce potential adverse destruction or alterations of natural biologically valuable areas or protective coastal features.

f) adverse disruption of existing social patterns.

Response: Disruptions of existing social patterns due to implementing the Nonstructural NED RP would be primarily associated with the construction activities:

1. Elevating identified structures to the 100-year base flood elevation based on year 2075 hydrology of eligible residential structures. If the required elevation is greater than 13 feet above ground level, the structure would be identified for voluntary acquisition.
2. Dry flood-proofing to the BFE generally means the use of a various techniques that make a structure waterproof and substantially impenetrable to floodwaters. For example, the walls, doors, windows, and other openings of eligible non-residential structures are made impermeable to water penetration.
3. Construction of localized storm surge risk reduction measures of less than 6 feet in height around industrial complexes and warehouses.

The voluntary nature of implementing the Nonstructural NED RP is anticipated to result in construction on a structure-by-structure basis. This would help to avoid, minimize and reduce the potential for disruption of existing social patterns. Nevertheless, construction activities could cause localized, but in most instances temporary impacts including: disruption and congestion of vehicular traffic patterns in the immediate vicinity of structures undergoing risk reduction; noise; dust; diesel and gas engine fumes emissions; vibration; emissions of construction wastes; greenhouse gas emissions; increased local electricity and fuel consumption; and local increases in the number of vehicles, construction equipment and workers in the vicinity of those structures undergoing risk reduction. However, the best available practical techniques and BMPs would be used to avoid,

minimize and reduce potential adverse disruption of social patterns. Following temporary construction of voluntary flood risk reduction measures, these areas would once again be available for social patterns similar to pre-construction social patterns.

The NER RP measure sites would temporarily and locally be unavailable for social patterns (primarily water-related activates) during construction and dredging activates. This would include: dredging activities at the borrow sites, dredging temporary access corridors and placement of dredged sediments at the nine marsh restoration sites, construction associated with the five shoreline protection sites and planting and invasive species control activities during the chenier reforestation. The NER RP would use the best available practical techniques and BMPs would be used to avoid and minimize adverse disruption of existing social patterns from implementing the NER RP measures. Following construction, these areas would once again be available for social patterns similar to pre-construction social patterns.

g) alterations of the natural temperature regime of coastal waters.

Response: Implementing the Nonstructural NED RP measures would not alter the natural temperature regime of coastal waters due to the remoteness of the Nonstructural NED RP measures from coastal waters. Rather, the Nonstructural NED RP would reduce damages resulting from hurricane and storm surge by 1) elevating eligible residential structures; 2) dry flood proofing of eligible non-residential structures, excluding large warehouses and industrial complexes; and 3) construction of flood proofing barriers or berms less than 6 feet in height around non-residential structures, primarily industrial complexes and warehouses. The use of the best available practical techniques and BMPs to avoid, minimize and reduce the potential for alterations of the natural temperature regime of coastal waters.

Implementing the NER RP measures would not result in long-term alterations of the natural temperature regime. However, dredging and construction of the temporary access corridors, the nine marsh restoration measures, placement of geotextile fabric and rock for the five shoreline protection measures could cause temporary increases in turbidity and total suspended sediments which could lead to temporary and localized increases in water temperatures at the dredging and construction sites. **Tables 3, 4,** and **5** provide estimated construction time frames for each NER RP measure. However, temperatures would return to pre-construction conditions following construction and dredging activities. Chenier reforestation and implementing the Nonstructural NED RP would have no effects or alterations to the natural concentration of oxygen in coastal waters. The 35 chenier restoration measures would not involve dredging or placement of materials into coastal waters. The NER RP would utilize the best available practical techniques and BMPs during dredging and construction to avoid and minimize potential adverse impacts to the natural temperature regime of coastal waters.

h) detrimental changes in existing salinity regimes.

Response: Implementing the Nonstructural NED RP measures would not result in any detrimental changes in existing salinity regimes due to the remoteness of the Nonstructural NED RP measures from coastal waters. Rather, the Nonstructural NED RP would reduce hurricane and storm surge by 1) elevating eligible residential structures; 2) dry flood proofing of eligible non-residential structures, excluding large warehouses and industrial complexes; and 3) construction of flood proofing barriers or berms less than 6 feet in height around non-residential structures, primarily industrial complexes and warehouses. The use of the best available practical techniques and BMPs to avoid, minimize and reduce the potential for detrimental changes in existing salinity regimes.

The NER RP has a total of 49 ecosystem restoration measures. Dredging the temporary access corridors would not result in detrimental changes in existing salinity regimes. The nine marsh restoration measures would initially create (8,175 acres) and nourish (3,439 acres) a total of approximately 11,666 acres, resulting in an estimated 7,900 net acres and 2,700 AAHUs restored and nourished over the 50 year period of analysis. Dredged borrow sediment sources would be the Calcasieu Ship Channel and other nearby sites located immediately offshore in the Gulf of Mexico (see **Figures 3** and **4,** attached Fact Sheets and Appendix K in the Integrated Final Report).

The location and size of these marsh restoration measures is not sufficient to change existing salinity regimes. Six of the NER RP marsh restoration measures would utilize borrow material from offshore in the Gulf of Mexico. Measure 124c would restore marsh in a saline marsh zone, therefore no adverse short or long-term impacts are anticipated. Measures 47a1, 47a2, 47c1, 127c3 and 306a1 would restore marsh in a brackish marsh zone. There may be a temporary and localized increase in the salinity of the surrounding areas from the use of more dredged saline offshore waters and sediments used for marsh restoration. However, the proposed borrow area for 127c3 and 306a1 is between the mouth of Freshwater Bayou and Southwest Pass, where freshwater influences, especially in the spring, would keep the salinity lower than typical Gulf of Mexico salinity (≈35.6 ppt). Brackish and saline marsh vegetation typically overlap their respective zones throughout coastal Louisiana. Although, initial marsh re-vegetation may be more saline species, as conditions freshen to a brackish regime, the vegetation would likely transition to those species typical of brackish marsh assemblages.

The five shoreline protection measures would provide a total 251,528 linear feet of protection for 6,135 net acres of marsh with 1,738 AAHUs over the 50 year period of analysis. The locations, size and configuration of the five shoreline protection measures is not sufficient to result in any detrimental changes in existing salinity regimes.

The 35 chenier reforestation measures would not impact waters of the United States and therefore would not change existing salinity regimes.

The Calcasieu Ship Channel Salinity Barrier measure and the Cameron-Creole Spillway Salinity Control Structure measure are both being recommended for long-term study. Part of the reasoning for recommending these measures for long-term study is because of their potential for altering salinity regimes. These measures would not be constructed without the authority for additional study, NEPA analysis and associated environmental compliance coordination and permits. The NER RP would utilize the best available practical techniques and BMPs during dredging and construction to avoid and minimize potential adverse impacts to existing salinity regimes.

i) detrimental changes in littoral and sediment transport processes.

Response: Implementing the Nonstructural NED RP measures would not result in any detrimental changes in littoral or sediment transport processes due to the remoteness of the Nonstructural NED RP measures from coastal waters. Rather, the Nonstructural NED RP would reduce damages resulting from hurricane and storm surge by: 1) elevating eligible residential structures; 2) dry flood proofing of eligible non-residential structures, excluding large warehouses and industrial complexes; and 3) construction of flood proofing barriers or berms less than 6 feet in height around non-residential structures, primarily industrial complexes and warehouses. In addition, the use of the best available practical techniques and BMPs to avoid, minimize and reduce the potential for detrimental changes in littoral and sediment transport processes.

The NER RP has a total of 49 ecosystem restoration measures. Dredging the temporary access corridors would not result in detrimental changes in littoral or sediment transport processes. The nine marsh restoration measures would initially restore (8,175 acres) and nourish (3,439 acres) for a total of approximately 11,666 acres, resulting in an estimated 7,900 net acres and 2,700 AAHUs restored and nourished over the 50 year period of analysis. Dredged borrow sediment sources would be taken from the Calcasieu Ship Channel and other nearby sites located immediately offshore in the Gulf of Mexico (see **Figures 3** and **4,** attached Fact Sheets and Appendix K in the Integrated Final Report). The location and size of offshore borrow sites for marsh restoration measures 124c, 47a1, 47a2, 47c1, 127c3, and 306a1 is not anticipated to affect the wave climate at the shoreline. Research conducted for the LCA – Maintain Land Bridge between Caillou Lake and Gulf of Mexico and LCA – Stabilize Shoreline at Point Au Fer Island studies using the STWAVE model indicated that no significant impacts from wave refraction would occur.

The five shoreline protection measures would provide a total 251,528 linear feet of protection for 6,135 net acres of marsh with 1,738 AAHUs over the 50 year period of analysis. The locations, size and configuration of the five shoreline protection measures is not sufficient to result in any detrimental changes in existing salinity regimes. However, often of concern with regard to potential to cause changes in littoral or sediment transport

processes is the design of offshore breakwater measures (e.g., shoreline protection measures 5a, 6b1, 6b2, and 6b3). Shoreline Measure 5a would extend from the western Calcasieu Ship Channel jetty to the existing breakwaters of the existing coastal restoration project CS-31 Holly Beach Sand Management project. The introduction of sands for the project CS-33 Cameron Parish Shoreline Restoration project increased the sediment budget for this area, so that downstream sediment starvation is not expected to be a problem. Additionally, the existing jetty and shipping channel already cause disruption to the littoral and sediment transport in this area from the east. Shoreline protection measures 6b1, 6b2, and 6b3 would be constructed offshore from the Gulf of Mexico shoreline near Rockefeller Refuge. The Refuge is characterized as fine-grained marsh sediment, with a veneer of crushed shell. The fine-grained sediment does not contribute to the littoral sediment transport.

The 35 chenier reforestation measures would not impact waters of the United States and therefore would not change existing salinity regimes.

However, the Calcasieu Ship Channel Salinity Barrier measure and the Cameron-Creole Spillway Salinity Control Structure measure are both being recommended for long-term study. Part of the reasoning for recommending these measures for long-term study is because of their potential for altering salinity regimes. These measures would not be constructed without the authority for additional study, NEPA analysis and associated environmental compliance coordination and permits. The NER RP would utilize the best available practical techniques and BMPs during dredging and construction to avoid and minimize potential adverse impacts to littoral and sediment transport processes.

j) adverse effects of cumulative impacts.

Response: Cumulative impacts represent the effects of implementing the proposed action (both the Nonstructural NED RP and the NER RP) on significant resources when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions.

Nonstructural NED RP Cumulative Impacts: The Nonstructural NED RP would provide reduced risk of hurricane and storm surge flood damage for a total of 3,961 impacted structures consisting of 3,462 eligible residential structures; 342 eligible commercial structures and public buildings; and 157 eligible industrial complexes and warehouses. These incremental impacts would be in addition to the direct and indirect impacts attributable to other existing, and authorized for construction, non-structural hurricane and storm surge damage risk reduction (HSDRRS) existing and authorized for construction projects throughout the Sabine, Calcasieu, Mermentau, and Teche-Vermilon basins; the State and the Nation.

The National Nonstructural Flood Proofing Committee (NNFPC) describe nonstructural flood proofing measures as permanent or contingent measures applied to a structure and/or its contents that prevent or provide resistance to damage from flooding. Nonstructural flood proofing measures differ from structural measures in that they focus on reducing the consequences of flooding instead of focusing on reducing the probability of flooding, and include: elevation, relocation, buyout/acquisition, dry flood proofing, wet flood proofing, and berms or floodwalls. Nonphysical nonstructural measures include: flood warning systems, flood insurance, floodplain mapping, flood emergency preparedness plans, land use regulation, zoning, evacuation plans, and risk communication (source: http://www.usace.army.mil/Missions/CivilWorks/ProjectPlanning/nfpc.aspx; accessed December 3, 2015). The following selection of non-structural risk reduction projects are provided as part of the cumulative impacts analysis.

- The following selection of non-structural projects is taken from a more complete list of non-structural risk reduction projects involving the USACE is available upon request (source: personal

communication Keven Lovetro, USACE National Nonstructural Flood proofing Committee, December 7, 2015):

- Pineville, KY, permanent evacuation, raising in place, demolish and replacement, flood warning, 72 structures, estimated cost $4M, complete in early 1990's
- Harlan, KY, permanent evacuation, raising in place, demolish and replacement, flood warning, 180 structures, estimated cost $17.2M, complete in early 1990's
- Barbourville, KY, permanent evacuation, raising in place, demolish and replacement, flood warning, 51 structures, estimated cost $3.9M, complete in early 1990's
- Matewan, KY, elevation, buyouts, flood warning and preparedness, 57 structures, estimated cost $10M, Completed 1995
- South Williamson, KY, elevation, buyouts, flood warning and preparedness, 100 structures, estimated costs $15M, completed
- Williamson, Mingo County, WV, elevation, buyouts, relocation, flood warning and preparedness, 178 structures, estimated cost $24M, completed 1994
- McDowell County, WV, elevation, buyouts, flood warning and preparedness, 1000 structures, estimated cost $200M, being implemented
- Upper Mingo County, WV, elevation, buyouts, flood warning and preparedness, 125 structures, estimated costs $16M, completed 2007
- Wayne County, WV, elevation, buyouts, flood warning and preparedness, 95 structures, estimated costs $9M, completed 2006
- Grundy, VA, elevation, buyouts, relocation, flood warning and preparedness, 228 structures, estimated costs $131M, being implemented
- Hatfield Bottom, WV, elevation, buyouts, flood warning and preparedness, 75 structures, estimated cost $8M, completed 2000

- The following nonstructural projects were identified in a planning conference at Buffalo, New York in 2009 http://wleb.org/watersheds/WLEB%207%20Aug%2009/Buffalo%20District%20Planning%20Part%202.pdf; accessed December 3, 2015):
  - Johnson Creek, Arlington, Texas consists of the nonstructural acquisition and removal of 140 residential structures; vacated areas would be redeveloped for recreation (source: http://planning.usace.army.mil/toolbox/library/ChiefReports/Johnson%20Creek,%20Arlington,%20TX%2011%20Aug%2099.pdf; accessed December 3, 2015).
  - Temama, Tehama, California elevation, flood warnings/evacuation.
  - Reclamation Districts 2099, 2100 2192, Stanislaus County, California, acquisition, flowage easement, ring levee.
  - Missouri River, Pierre/Fort Pierre, South Dakota acquisition, relocation, elevation, and wet flood proofing.
  - Mill Creek, Baltimore, Maryland, acquisition is in feasibility stage.
  - Paxton Creek, Baltimore, Maryland, flood warning system.
  - Cypress Creek, Galveston, Texas, acquisition.
  - MsCIP, Mississippi, relocation, buyout, elevation, flood proofing.
  - Onion Creek, Austin, Texas, buyout.
  - Yellowstone River Glendive, Montana, relocation, acquisition
- West Shore Lake Pontchartrain, St. Charles, St. John the Baptist and St. James Parishes, Louisiana, berm around the small ring berms and elevation; signed Chiefs Report, (source: http://www.mvn.usace.army.mil/Portals/56/docs/PAO/Matt/West%20Shore%20Lake%20Pontchartrain%20Chiefs%20Report_signed_12June2015.pdf; December 3, 2015).
- Dallas Floodway Extension, Trinity River buyouts, and levee structures within floodplain, wetlands http://www.swf.usace.army.mil/Missions/WaterSustainment/DallasFloodwayExtension.aspx; accessed December 3, 2015).

- Upper Des Plaines River and Tributaries, Illinois and Wisconsin, Non-structural flood risk management measures would include elevating structures, dry flood-proofing, filling basements in combination with dry flood-proofing, wet flood proofing, constructing engineered low-level ring levees at large commercial or public building sites, and evacuating portions of floodplains.
- Red River of the North (Fargo-Moorhead Study), berm, raise existing berm, elevate, buyout, wet and dry flood proof (source: http://www.floods.org/Files/Conf2013_ppts/G1/G1_Behm.pdf; accessed December 3, 2015).
- The Green Brook Flood Control Project Middlesex, Somerset and Union Counties, New Jersey (source: http://www.nan.usace.army.mil/Media/FactSheets/FactSheetArticleView/tabid/11241/Article/487324/fact-sheet-green-brook-sub-basin.aspx; accessed December 3, 2015) includes flood proofing, volunteer buyout and demolition of homes.
- Project: Tug Fork Basin, McDowell County, West Virginia Nonstructural Flood Control Project elevation, dry flood proofing, acquisition, flood warning, wet flood proofing are underway 54 acquisitions and 10 flood proofings complete (source: http://www.wvcommerce.org/App_Media/assets/download/ndrc/WV_External_Data/Adapt/McDowell202.pdf; and accessed December 3, 2015).
- The conceptual 2012 State Master Plan recommends a comprehensive nonstructural program as part of its strategy to reduce the flood risk for Louisiana citizens. Nonstructural projects include raising a building's elevation, flood proofing structures, and voluntary acquisition or relocation. These measures are key components of protecting communities through a "multiple lines of defense approach" (http://coastal.la.gov/project-content/ccrp/; accessed March 12, 2013).
- The FEMA Hazard Mitigation Assistance (HMA) grants programs (http://www.fema.gov/hazard-mitigation-assistance; accessed December 3, 2015) provide funding for eligible mitigation activities that reduce disaster losses and protect life and property from future disaster damages. Currently, FEMA administers the following HMA grant programs:
  - Hazard Mitigation Grant Program (HMGP) assists in implementing long-term hazard mitigation measures following Presidential disaster declarations. Funding is available to implement projects in accordance with State, Tribal, and local priorities.
  - Pre-Disaster Mitigation (PDM) provides funds for hazard mitigation planning and to implement mitigation projects before disasters. The program goal is to reduce overall risk to the population and structures, while at the same time, also reducing reliance on Federal funding from disaster declarations.
  - Flood Mitigation Assistance (FMA) provides annual funds so that measures can be taken to reduce or eliminate risk of flood damage to buildings insured under the NFIP.

NER RP Cumulative Impacts: Over the 50-year period of analysis, the NER RP would protect, restore, and nourish a net total of 14,035 net acres of emergent marsh (including 7,900 net acres from the nine marsh restoration measures and 6,135 net acres from the five shoreline protection measures). At the end of the 50 year period of analysis, the marsh restoration and shoreline protection measures together would achieve a total net ecological benefit of 4,430 AAHUs; with 2,700 AAHUs from the nine marsh restoration measures, and 1,738 AAHUs from the five shoreline protection measures. Whereas the chenier restoration measures would restore a net total of 1,413 net acres with 538 AAHUs. The positive cumulative impacts of implementing the NER RP would be the additive, and in some instances the synergistic, effects of restoring and nourishing sites over the 50 year period of analysis, an estimated 7,900 net acres and 2,700 AAHUs. The five shoreline protection measures would span approximately 251,528 linear feet, and are anticipated to protect/stabilize approximately 6,135 net acres and 1,738 AAHUs. Although not impacting waters of the United States, the approximately 1,413 net acres from 35 reforestation sites in Cameron and Vermilion Parishes would be reforested over the 50 year period of analysis, resulting in 538 AAHUs.

The primary cumulative impacts of the NER RP would be related to dredging and construction of the nine marsh restoration measures and the five shoreline protection measures and the reforestation of the 35 chenier reforestation measures. Dredging and construction related impacts are generally temporary and localized and

include: increased turbidity and total suspended sediments, organic enrichment, chemical leaching, reduced dissolved oxygen, and elevated carbon dioxide levels. Following construction, these temporary and localized effects would return to pre-construction levels. The only significant long term adverse cumulative effects expected from implementing the NER RP measures would be associated with the conversion of existing fragmented marsh and shallow water bottom habitats to transitional estuarine marsh habitat and rocked shoreline protection habitats. However, conversion of fragmented marsh and shallow water bottoms to these transitional estuarine marsh habitat and shoreline protection habitat would provide greater long-term positive benefits when considered within the context of the ongoing extensive land loss throughout coastal Louisiana and the project area which is converting extensive areas of marsh to shallow open water.

Additional long term positive cumulative impacts would be related to restoring and protecting important, essential and in some instances critical habitats used by various terrestrial and aquatic organisms for shelter, nesting, feeding, roosting, cover, nursery, EFH and other life requirements; as well as local increases in productivity. The NER RP breakwater measures would provide protection to designated critical wintering habitat for piping plover which would work synergistically with other barrier shoreline restoration and protection features (e.g., State of Louisiana Caminada Headland Beach and Dune Restoration, CWPPRA projects TE-27 and TE-50 Whiskey Island restoration and other barrier restoration projects. Increased recreational and commercial fishing opportunities provided by marsh restoration measures that would provide important, critical and essential habitats as well as protection of recreational marsh lands from wave erosion effects by the shoreline protection measures. The cumulative impacts of the proposed action would be a positive increasing the visual resources, especially the viewscape, in the form of providing additional acres of marsh wetlands (and chenier ridge) in an area that is otherwise being degraded, fragmented and lost throughout the southwest coastal basin, coastal Louisiana, and the Nation. Restoration of marsh would convert existing view sheds of open water into marsh wetlands interspersed with large bodies of open water and use the basic design elements of form, line, texture, color, and repetition to create an aesthetically pleasing view shed. These NER RP impacts would be in addition to, and often synergistic with, the impacts and benefits from marsh acres restored, nourished and protected by other Federal, state, local, and private restoration efforts within or near the Southwest Coastal Louisiana Study Area, the Louisiana state coastal area, and the nation's coastal areas. Some of these other efforts include the following:

- CWPPRA Program – There are currently 149 active CWPPRA projects throughout coastal Louisiana. In September 2015, 101 projects were completed, benefiting over 97,401 acres. 21 projects are currently under active construction with 22 additional projects approved and in the engineering and design phase of development (source: https://lacoast.gov/new/About/FAQs.aspx; accessed November 23, 2015). There are 8 CWPPRA projects within Calcasieu Parish, 39 CWPPRA projects within Cameron Parish, and 12 CWPPRA projects within Vermilion Parish. **Table 9** provides a cumulative impacts comparison by listing the potential direct and indirect impacts of NER RP measures on existing coastal restoration projects, including CWPPRA projects, in Calcasieu, Cameron and Vermilion Parishes.

Table 9. Potential Direct and Indirect Impacts of Southwest Coastal Louisiana NER RP Measures on Existing Coastal Restoration Projects in Calcasieu, Cameron and Vermilion Parishes (source: https://lacoast.gov/new/Projects/List.aspx; accessed November 23, 2015)

Project Number	Project Name	Project Types	Net Acres Benefited	Southwest Coastal Louisiana NER RP Measure Impacts
Calcasieu Parish Existing Coastal Restoration Projects				
CS-09	Brown Lake Hydrologic Restoration (Deauthorized)	Hydrologic Restoration	37	NER RP measures would have no potential direct or secondary impacts on this deauthorized project.
CS-22	Clear Marais Bank Protection	Shoreline Protection	1,067	No potential impacts by NER RP restoration and protection measures.
CS-24	Perry Ridge Shore Protection	Shoreline Protection	1,203	No potential impacts by NER RP restoration and protection measures.

Table 9. Potential Direct and Indirect Impacts of Southwest Coastal Louisiana NER RP Measures on Existing Coastal Restoration Projects in Calcasieu, Cameron and Vermilion Parishes
(source: https://lacoast.gov/new/Projects/List.aspx; accessed November 23, 2015)

Project Number	Project Name	Project Types	Net Acres Benefited	Southwest Coastal Louisiana NER RP Measure Impacts
CS-27	Black Bayou Hydrologic Restoration	Hydrologic Restoration	3,594	No potential impacts by NER RP restoration and protection measures.
CS-30	GIWW - Perry Ridge West Bank Stabilization	Shoreline Protection	83	No potential impacts by NER RP restoration and protection measures.
LA-03a	Nutria Harvest for Wetland Restoration Demonstration	Demonstration, Herbivory Control	0	No potential impacts by NER RP restoration and protection measures.
LA-03b	Coastwide Nutria Control Program	Herbivory Control	14,963	No potential impacts by NER RP restoration and protection measures.
LA-30	Coastwide Reference Monitoring System	Monitoring	--	No potential impacts by NER RP restoration and protection measures.
Cameron Parish Existing Coastal Restoration Projects				
CS-04a	Cameron-Creole Maintenance	Hydrologic Restoration	2,602	NER RP measure 3c1 could provide some indirect benefits to the CS-04a project, completed in 1997, by reducing the tidal prism in the Cameron-Creole Watershed. This would reduce the velocities through the water control structures by reducing fetch in the open water areas thereby providing some protection from wind-driven wave erosion.
CS-09	Brown Lake Hydrologic Restoration (Deauthorized)	Hydrologic Restoration	37	NER RP measures would have no potential direct or secondary impacts on this deauthorized project.
CS-11b	Sweet Lake/Willow Lake Hydrologic Restoration	Shoreline Protection	247	No potential impacts by NER RP restoration and protection measures.
CS-17	Cameron Creole Plugs	Hydrologic Restoration	865	No potential impacts by NER RP restoration and protection measures.
CS-18	Sabine National Wildlife Refuge Erosion Protection	Shoreline Protection	5,542	No potential impacts by NER RP restoration and protection measures.
CS-19	West Hackberry Vegetative Planting Demonstration	Demonstration, Sediment Trapping, Vegetative Planting	0	No potential impacts by NER RP restoration and protection measures.
CS-20	East Mud Lake Marsh Management	Marsh Management	1,520	NER RP measure 124c could provide secondary benefits to the CS-20 water control structures by reducing open water fetch and tidal prism which would reduce erosion from wind-driven waves and tidal velocities through the water control structures.
CS-21	Highway 384 Hydrologic Restoration	Hydrologic Restoration	150	No potential impacts by NER RP restoration and protection measures.
CS-23	Replace Sabine Refuge Water Control Structures at Headquarters Canal, West Cove Canal, and Hog Island Gully	Marsh Management	953	No potential impacts by NER RP restoration and protection measures.
CS-25	Plowed Terraces Demonstration	Demonstration, Sediment and Nutrient Trapping	0	No potential impacts by NER RP restoration and protection measures.
CS-26	Compost Demonstration (Deauthorized)	Demonstration	0	No potential impacts by NER RP restoration and protection measures.

Table 9. Potential Direct and Indirect Impacts of Southwest Coastal Louisiana NER RP Measures on Existing Coastal Restoration Projects in Calcasieu, Cameron and Vermilion Parishes
(source: https://lacoast.gov/new/Projects/List.aspx; accessed November 23, 2015)

Project Number	Project Name	Project Types	Net Acres Benefited	Southwest Coastal Louisiana NER RP Measure Impacts
CS-27	Black Bayou Hydrologic Restoration	Hydrologic Restoration	3,594	No potential impacts by NER RP restoration and protection measures.
CS-28-1	Sabine Refuge Marsh Creation, Cycle 1	Marsh Creation	214	No potential impacts by NER RP restoration and protection measures.
CS-28-2	Sabine Refuge Marsh Creation, Cycle 2	Marsh Creation	261	No potential impacts by NER RP restoration and protection measures.
CS-28-3	Sabine Refuge Marsh Creation, Cycle 3	Marsh Creation	187	No potential impacts by NER RP restoration and protection measures.
CS-28-4-5	Sabine Refuge Marsh Creation, Cycles 4 and 5	Marsh Creation	331	No potential impacts by NER RP restoration and protection measures.
CS-29	Black Bayou Culverts Hydrologic Restoration	Hydrologic Restoration	540	No potential impacts by NER RP restoration and protection measures.
CS-31	Holly Beach Sand Management	Shoreline Protection	330	NER RP Measure 5a would provide shoreline protection and stabilization that would secondarily benefit this existing project, which was completed in 2003.
CS-32	East Sabine Lake Hydrologic Restoration	Hydrologic Restoration	225	No potential impacts by NER RP restoration and protection measures.
CS-49	Cameron-Creole Freshwater Introduction	Freshwater Diversion	473	This authorized project, is scheduled to begin construction in September 2016. NER RP measure 3c1 would create marsh within and adjacent to the vegetative planting areas at the westernmost reaches of CS-49, which would increase the resiliency and habitat function of the wetlands in the area.
CS-53	Kelso Bayou Marsh Creation	Marsh Creation	274	No potential impacts by NER RP restoration and protection measures.
CS-54	Cameron-Creole Watershed Grand Bayou Marsh Creation	Marsh Creation	476	NER RP measure 3c1 would secondarily impact this project, authorized for construction in January 2015, by creating marsh adjacent to the westernmost reaches of CS-54 and providing some indirect protection from wave-induced erosion.
CS-59	Oyster Bayou Marsh Creation and Terracing	Marsh Creation, Terracing	433	NER RP 124c measure would create marsh adjacent to CS-59, scheduled to be completed in October 2016, which would increase the resiliency and habitat function of the wetlands in the area.
CS-66	Cameron Meadows Marsh Creation and Terracing	Marsh Creation, Terracing	264	No potential impacts by NER RP restoration and protection measures.
CS-78	No Name Bayou Marsh Creation	Marsh Creation	497	No potential impacts by NER RP restoration and protection measures.
LA-03a	Nutria Harvest for Wetland Restoration Demonstration	Demonstration, Herbivory Control	0	No potential impacts by NER RP restoration and protection measures.
LA-03b	Coastwide Nutria Control Program	Herbivory Control	14,963	No potential impacts by NER RP restoration and protection measures.
LA-08	Bio-Engineered Oyster Reef Demonstration	Demonstration	0	NER RP shoreline protection measure 6b1 would provide positive direct effects for the existing LA-08 oyster reef CWPPRA demonstration project by installing a lightweight aggregate core breakwater field thereby protecting LA-08 from high energy Gulf of Mexico wind-driven wave erosion
LA-30	Coastwide Reference Monitoring System	Monitoring	--	No potential impacts by NER RP restoration and protection measures.

Table 9. Potential Direct and Indirect Impacts of Southwest Coastal Louisiana NER RP Measures on Existing Coastal Restoration Projects in Calcasieu, Cameron and Vermilion Parishes (source: https://lacoast.gov/new/Projects/List.aspx; accessed November 23, 2015)

Project Number	Project Name	Project Types	Net Acres Benefited	Southwest Coastal Louisiana NER RP Measure Impacts
ME-09	Cameron Prairie National Wildlife Refuge Shoreline Protection	Shoreline Protection	247	No potential impacts by NER RP restoration and protection measures.
ME-11	Humble Canal Hydrologic Restoration	Hydrologic Restoration	378	No potential impacts by NER RP restoration and protection measures.
ME-16	Freshwater Introduction South of Highway 82	Hydrologic Restoration	296	The SWC shoreline protection measures 6b2 and 6b3 would provide direct benefits to the outfall area of the ME-16 hydrologic restoration project, completed in 2006, by reducing Gulf of Mexico shoreline erosion through the installation of lightweight aggregate core breakwater fields.
ME-17	Little Pecan Bayou Hydrologic Restoration (Deauthorized)	Hydrologic Restoration	56	This hydrologic restoration project was deauthorized prior to construction, so would have no potential impacts on or by NER RP restoration and protection measures.
ME-18	Rockefeller Refuge Gulf Shoreline Stabilization	Shoreline Protection	256	The ME-18 project would be constructed from 2016 to 2018, and would consist of a lightweight aggregate core breakwater field extending from Joseph Harbor approximately 3 miles west. This would preclude the need to install the lightweight aggregate core breakwater field in this section as part of the 6b1measure, but the 6b1 measure would construct a lightweight aggregate core breakwater field from the western end of the ME-18 project to a point approximately 8 miles to the west.
ME-19	Grand-White Lakes Landbridge Protection	Shoreline Protection	213	No potential impacts by NER RP restoration and protection measures.
ME-20	South Grand Chenier Marsh Creation	Hydrologic Restoration	414	This project, which is expected to be completed in 2016, would provide indirect protection to SWC marsh restoration measure 47c3 by reducing erosion from the eastern direction in the southern area. The 3c1 measure would create marsh adjacent to the westernmost reach of the marsh restoration cells, which would provide some indirect protection from erosion.
ME-21	Grand Lake Shoreline Protection	Shoreline Protection	45	No potential impacts by NER RP restoration and protection measures.
ME-24	Southwest LA Gulf Shoreline Nourishment and Protection (Transferred)	Shoreline Protection	888	This project has not been authorized for construction. However, the NER RP shoreline protection measure 6b3 would protect ME-24 project from wind-driven wave erosion from the Gulf of Mexico once authorized and constructed.
ME-32	South Grand Chenier Marsh Creation - Baker Tract	Marsh Creation	393	No potential impacts by NER RP restoration and protection measures.
Vermilion Parish Existing Coastal Restoration Projects				
LA-03a	Nutria Harvest for Wetland Restoration Demonstration	Demonstration, Herbivory Control	0	No potential impacts by NER RP restoration and protection measures.
LA-03b	Coastwide Nutria Control Program	Herbivory Control	14,963	No potential impacts by NER RP restoration and protection measures.
LA-06	Shoreline Protection Foundation Improvements Demonstration	Demonstration, Shoreline Stabilization	0	No potential impacts by NER RP restoration and protection measures.

Table 9. Potential Direct and Indirect Impacts of Southwest Coastal Louisiana NER RP Measures on Existing Coastal Restoration Projects in Calcasieu, Cameron and Vermilion Parishes (source: https://lacoast.gov/new/Projects/List.aspx; accessed November 23, 2015)

Project Number	Project Name	Project Types	Net Acres Benefited	Southwest Coastal Louisiana NER RP Measure Impacts
LA-30	Coastwide Reference Monitoring System	Monitoring	--	No potential impacts by NER RP restoration and protection measures.
ME-04	Freshwater Bayou Wetland Protection	Hydrologic Restoration, Shoreline Protection	1,593	Although NER RP measure 127c3 is located nearby there would be no potential impacts by NER RP measures on ME-04, which was constructed in 1998.
ME-08	Dewitt-Rollover Vegetative Plantings Demonstration (Deauthorized)	Demonstration	0	No potential impacts by NER RP restoration and protection measures on this deauthorized project.
ME-12	Southwest Shore White Lake Demonstration (Deauthorized)	Demonstration	0	No potential impacts by NER RP restoration and protection measures on this deauthorized project
ME-13	Freshwater Bayou Bank Stabilization	Shoreline Protection	511	No potential impacts by NER RP restoration and protection measures.
ME-14	Pecan Island Terracing	Sediment and Nutrient Trapping	442	No potential impacts by NER RP restoration and protection measures.
ME-22	South White Lake Shoreline Protection	Shoreline Protection	844	No potential impacts by NER RP restoration and protection measures.
ME-23	South Pecan Island Freshwater Introduction (Deauthorized)	Hydrologic Restoration	98	No potential impacts by NER RP restoration and protection measures.
ME-24	Southwest LA Gulf Shoreline Nourishment and Protection (Transferred)	Shoreline Protection	888	NER RP shoreline protection measure 6b3 would provide secondary benefits for the ME-24 project by installing a lightweight aggregate core breakwater field, which would protection it from wind-driven wave erosion from the Gulf of Mexico.
ME-31	Freshwater Bayou Marsh Creation	Marsh Creation	279	No potential impacts of NER RP measure 127c3 because this project has not been authorized for construction.
TV-03	Vermilion River Cutoff Bank Protection	Shoreline Protection	65	No potential impacts by NER RP restoration and protection measures.
TV-09	Boston Canal/Vermilion Bay Bank Protection	Shoreline Protection, Vegetative Planting	378	No potential impacts by NER RP restoration and protection measures.
TV-11b	Freshwater Bayou Bank Stabilization - Belle Isle Canal to Lock (Inactive)	Shoreline Stabilization	241	NER RP 16b would construct a foreshore rock dike along a reach proposed by TV-11b, which has not been constructed. If TV-11b is constructed, the NER RP 16b reach of shoreline protection would not be required under TV-11b.
TV-12	Little Vermilion Bay Sediment Trapping	Shoreline Protection, Sediment Trapping	441	No potential impacts by NER RP restoration and protection measures.
TV-13a	Oaks/Avery Canal Hydrologic Restoration, Increment 1	Hydrologic Restoration	160	No potential impacts by NER RP restoration and protection measures.
TV-16	Chenicre Au Tigre Sediment Trapping Demonstration	Demonstration, Sediment and Nutrient Trapping	0	No potential impacts by NER RP restoration and protection measures.
TV-17	Lake Portage Land Bridge	Shoreline Protection	24	No potential impacts by NER RP restoration and protection measures.
TV-18	Four Mile Canal Terracing and Sediment Trapping	Sediment and Nutrient Trapping	167	No potential impacts by NER RP restoration and protection measures.
TV-63	Cole's Bayou Marsh Restoration	Hydrologic Restoration, Marsh Creation	398	No potential impacts by NER RP restoration and protection measures.

- Project CS-59 (Oyster Bayou Marsh Creation and Terracing) would be directly impacted by construction of marsh restoration NER RP measure 124c (**Figure 6**). Project CS-054 (Cameron-Creole Watershed Grand Bayou Marsh Creation) would be directly impacted by construction of marsh restoration NER RP measure 3c1 (**Figure 7**). Project CS-59 is on Priority Project List 20 with Phase 1 funding approval for engineering and design work to restore 609 acres and nourish about 7 acres of brackish marsh. Project CS-54 is on Project Priority List 21 with specific goals to create 510 acres of saline marsh, nourish 90 acres of existing saline marsh; create 17,500 linear feet of terraces; and, reduce wave/wake erosion. When overlap occurs, proposed NER RP measures would be constructed to avoid existing coastal restoration projects. This would generally include construction of temporary containment/exclusion dikes to contain dredged borrow sediments used for construction of the NER RP measure and also prevent dredged effluents from entering the existing project sites. Temporary containment/exclusion dikes would degrade naturally to restore connectivity with surrounding areas or would be degraded at three years after construction has been completed.
- NER RP shoreline protection measure 5a (Holly Beach Shoreline Stabilization-Breakwaters) would be located immediately offshore of the projects CS-31 (Holly Beach Sand Management) and CS 33 (Cameron Parish Shoreline) indirectly benefiting these existing projects by providing shoreline protection and stabilization from high energy Gulf wave erosion.
- Project TV-11b, a bank stabilization project, could be impacted by NER RP marsh restoration measure 3c1, but this project is presently inactive.

- Louisiana Coastal Area (LCA), Ecosystem Restoration Study (2004 USACE) recommends 15 near-tem measures aimed at addressing the critical restoration needs. The components recommended for authorization include five critical near-term ecosystem restoration measures, a demonstration program consisting of a series of demonstration projects, a beneficial use of dredged material (BUDMAT) program, and a science and technology program. The five critical near-term ecosystem restoration measures, demonstration projects, and BUDMAT projects are all subject to the approval of feasibility level of detail decision documents by the Secretary of the Army. The January 31, 2005 Chief's Report approved the Near-Term Plan substantially in accordance with the 2004 LCA Study. Title VII of the Water Resources Development Act of 2007 (WRDA 2007) (Public Law 110-114) authorized an ecosystem restoration Program for the Louisiana Coastal Area substantially in accordance with the Near-Term Plan.
  - The Chenier Plain Freshwater Management and Allocation Reassessment Study (Chenier Plain Study), recommended in the 2005 Chief's Report was one of six large-scale restoration concepts that were purported to have the ability to "significantly restore environmental conditions that existed prior to large-scale alteration of the natural ecosystem" upon construction. Guidance provided by the Director of Civil Works on December 19, 2008 states that "the coastal restoration components proposed as part of the LCA Chenier Plain study would be evaluated as part of the Southwest Coastal Louisiana feasibility study". Although several of these projects have been authorized for construction, there is presently no willing local non-Federal Sponsor. Consequently, the authorized projects without an identified local non-Federal Sponsor are not considered reasonably foreseeable and are therefore not considered part of either the No Action Alternative (future without project conditions [FWOP]) or the future with project conditions. Nevertheless, the LCA Program is mentioned here since there is some potential that a willing local non-Federal Sponsor may be determined and these projects could therefore become part of the cumulative impacts assessment under the FWOP and future with project conditions.
  - The CEMVN and its local non-Federal Sponsor, Plaquemines Parish, recently completed the 44-acre West Bay Marsh Creation Tier 1 project, part of the LCA's Beneficial Use of Dredged Material (BUDMAT) Program.
  - BUDMAT project (Environmental Assessment #535). Plaquemines Parish is also the non-Federal Sponsor for two additional LCA BUDMAT projects: Ridge Restoration at Tiger Pass, and Restoration of Cat Island. These two projects are still in the study phase.

- An ongoing effort by CPRAB is development of the 2012 Louisiana's Comprehensive Master Plan for a Sustainable Coast (source: http://issuu.com/coastalmasterplan/docs/coastal_master_plan-v2?e=3722998/2447530; accessed November 23, 2015). However, the unauthorized and unfunded conceptual projects are not reasonably foreseeable under the FWOP conditions or the future with project conditions. Nevertheless, the Louisiana State Master Plan is mentioned here since there is some potential that these projects would become funded and therefore considered as part of a cumulative impacts assessment under the FWOP and future with project conditions. The 2012 State Master Plan indicates that the CPRAB has, since 2007:
    - Built or improved 159 miles of levees
    - Benefited 19,405 acres of coastal habitat
    - Secured approximately $17 billion in state and Federal funding for protection and restoration projects
    - Identified and used dozens of different Federal, state, local and private funding sources of projects
    - Moved over 150 projects into design and construction
    - Constructed projects in 20 parishes
    - Constructed 32 miles of barrier islands/berms
    - The 2012 State Master Plan developed and evaluated a total of 397 projects, with each project having its own timeline and budget, including:
        - 248 restoration projects,
        - 33 structural risk reduction (protection) projects, and
        - 116 conceptual nonstructural flood risk reduction projects
    - The 2012 State Master Plan developed for the Southwest Coast, a total of 42 projects with 36 projects to be constructed in the 1st Implementation Period (2012 -2032) including: 5 bank stabilization, 11 hydrologic restoration, 8 marsh creation, 4 ridge restoration, 6 shoreline protection, and 1 each structural protection and multiple protection measure; a total of 6 projects would be constructed in the 2nd Implementation Period (2032-2051) including: 2 each marsh creation and shoreline protection, and 1 each ridge restoration and multiple protection measures.
    - However, the Tulane Institute on Water Resources Law & Policy 2014 Issue Paper "Turning Coastal Restoration and Protection Plans Into Realities: The Cost of Comprehensive Coastal Restoration and Protection" indicates that the 2012 State Master Plan has not come to terms with the true costs of saving coastal Louisiana and how to finance it:

        > *…the cost of implementing those measures will exceed the $50 billion figure set forth in the Plan, in all likelihood by a factor of at least two. When one includes the anticipated costs of the Urban Water Plan, federal flood protection, and other factors excluded from the 2012 Master Plan, the cost of restoring this coast and protecting its people can be expected to exceed $100 billion over 50 years.30 The reasons for this lie primarily in the 2012 Master Plan's use of 2010 dollars instead of inflation adjusted dollars and the exclusion of a range of projects and programs from the Plan's cost estimates. The use of present value dollars in the 2012 Master Plan and the Urban Water Plan was neither hidden nor inappropriate as a methodology, and no criticism of that methodology is intended. However, when looking forward to the challenge of financing everything that is planned and necessary, a more comprehensive approach must be used. The value of keeping this coast ecologically and economically in business has been repeatedly demonstrated to be immense and well in excess of the adjusted price of the 2012 Master Plan. The price of putting the pieces of coastal Louisiana and the Gulf Coast back together after Hurricanes Katrina and Rita alone approached $100 billion. Knowing what is at stake and coming to terms with the true costs of saving coastal Louisiana are prerequisites for a robust civic conversation about how best to finance it. It will require engagement at the local, state, and national levels from a broad range of public and private stakeholders, and answers will not come easily.*
- Restoration of injuries to natural resources damaged by the 2010 Deepwater Horizon oil spill:

- The Natural Resource Damage Assessment (NRDA) is a legal process under the Oil Pollution Act of 1990 (OPA) and the Louisiana Oil Spill Prevention and Response Act of 1991 (LOSPRA) whereby designated trustees represent the public to ensure that natural resources injured in an oil spill are restored (source: http://la-dwh.com/AboutNRDA.aspx; accessed November 25, 2015). Both federal and state NRDA regulations provide a step-by-step process for trustees to determine injuries, to assess damages, and to develop and implement restoration projects that compensate the public for injuries to natural resources impacted by an incident. In general, the NRDA process involves three steps: (1) pre-assessment; (2) restoration planning; and (3) restoration implementation.
- On July 11, 2011, Governor Bobby Jindal unveiled the "Louisiana Plan" which outlines 13 initial proposed early restoration projects (source: http://la-dwh.com/LouisianaPlanProjects.aspx; accessed November 25, 2015). The proposed projects come in many forms including marsh restoration, barrier island restoration, shoreline projection measures, resource-specific projects, and projects aimed at addressing impacts to our citizens' ability to use Louisiana's natural resources (**Table 5**). The projects are consistent with Louisiana's Coastal Master Plan; they are consistent with the criteria outlined in the early restoration framework agreement and applicable regulations; and they support the goal of compensating the public for natural resource injuries resulting from the Deepwater Horizon Oil Spill.

Table 5. "Louisiana Plan" proposed early restoration projects

Project Name	Approximate Cost ($)
Oyster Reestablishment Program (Louisiana Oyster Cultch Project)	$15 M
Saltwater Hatchery	$48 M
Shell Island - Larger Lobe	$110 M
Chandeleur Islands Restoration	$65 M
Biloxi Marsh Shoreline Protection Phase 2	$45 M
Lake Hermitage Additional Increment - (Lake Hermitage Marsh Creation – NRDA Early Restoration Project)	$13.9 M
Grand Liard Marsh & Ridge Restoration	$31.3 M
Cheniere Ronquille Barrier Island Restoration	$44 M
Bay Side Segmented Breakwater at Grand Isle	$3.3 M
West Grand Terre Beach	$9 M
West Grand Terre Stabilization	$3 M
Barataria Basin Barrier Shoreline Restoration - Caminada Headland	$75 M
Maintain Land bridge between Caillou Lake and Gulf of Mexico	$71 M

- On October 5, 2015, the Deepwater Horizon Natural Resource Damage Assessment Trustees released the Deepwater Horizon Oil Spill Draft Programmatic Damage Assessment and Restoration Plan and Programmatic Environmental Impact Statement (PDARP/PEIS) for public review and comment (source: http://la-dwh.com/PDARP_PEIS/Draft_PDARP_PEIS.aspx; accessed November 25, 2015). The Trustees identified Alternative A as their preferred alternative. Alternative A (described in Section 5.5) is an integrated restoration portfolio that emphasizes the broad ecosystem benefits that can be realized through coastal habitat restoration in combination with resource-specific restoration in the ecologically interconnected northern Gulf of Mexico ecosystem. **Table 6** is a copy of Table 5.10-1 from the PDARP/PEIS, and shows the Trustees' allocations by goal and restoration type (rows) and restoration area (columns). This table also highlights where investments have already been made through the Trustees' Early Restoration efforts (source: http://www.gulfspillrestoration.noaa.gov/wp-

content/uploads/Chapter-5_Restoring-Natural-Resources1.pdf; accessed November 25, 2015). Under the PDARP/PEIS, the State of Louisiana would receive $5 billion of the total $8.1 billion restoration funding allocation for the Early Restoration work. Due to the large proportion of the wetlands and coastal and nearshore habitat funding allocated to Louisiana, wetland projects identified in the Louisiana Master Plan were used to evaluate the potential magnitude of benefits achievable here. However, as described in Section 5.5.2 of the PDARP/PEIS, the restoration dollars could be used for a variety of restoration approaches. For illustration purposes only, the approximately $4 billion allocated to Louisiana for this restoration type could be sufficient to create 20,000 to 40,000 acres of coastal marsh in Louisiana (LA Master Plan) along hundreds of miles of shoreline, supporting the diversity of fish, birds, and animals that depend on coastal marsh.

- The EPA, reporting on the Nation, states the number of restoration projects grows yearly. Current Federal initiatives call for a wide range of restoration actions, including improving or restoring 25,000 miles of stream corridor; achieving a net increase of 100,000 acres of wetlands each year and establishing two million miles of conservation buffers (source: http://water.epa.gov/type/wetlands/restore/principles.cfm; accessed March 12, 2015).

Table 6. Settlement of NRD claims and final allocations (source: http://www.gulfspillrestoration.noaa.gov/wp-content/uploads/Chapter-5_Restoring-Natural-Resources1.pdf; accessed November 25, 2015).

Major Restoration Categories	Unknown Conditions	Regionwide	Open Ocean	Alabama	Florida	Louisiana	Mississippi	Texas	Total Restoration Funding*
1. Restore and Conserve Habitat									
Wetlands, Coastal, and Nearshore Habitats				65,000,000	5,000,000	4,009,062,700	55,500,000	100,000,000	4,234,562,700
Habitat Projects on Federally Managed Lands				3,000,000	17,500,000	50,000,000	5,000,000		75,500,000
Early Restoration (through Phase IV)				28,110,000	15,629,367	259,625,700	80,000,000		383,365,067
2. Restore Water Quality									
Nutrient Reduction (Nonpoint Source)				5,000,000	35,000,000	20,000,000	27,500,000	22,500,000	110,000,000
Water Quality (e.g., Stormwater Treatments, Hydrologic Restoration, Reduction of Sedimentation, etc.)					300,000,000				300,000,000
3. Replenish and Protect Living Coastal and Marine Resources									
Fish and Water Column Invertebrates			380,000,000						380,000,000
Early Restoration Fish and Water Column Invertebrates			20,000,000						20,000,000
Sturgeon			15,000,000						15,000,000
Sea Turtles		60,000,000	55,000,000	5,500,000	20,000,000	10,000,000	5,000,000	7,500,000	163,000,000
Early Restoration Turtles		29,256,165						19,965,000	49,221,165
Submerged Aquatic Vegetation						22,000,000			22,000,000
Marine Mammals		19,000,000	55,000,000	5,000,000	5,000,000	50,000,000	10,000,000		144,000,000
Birds		70,400,000	70,000,000	30,000,000	40,000,000	148,500,000	25,000,000	20,000,000	403,900,000
Early Restoration Birds		1,823,100		145,000	2,835,000	71,957,300		20,603,770	97,344,170
Mesophotic and Deep Benthic Communities			273,300,000						273,300,000
Oysters		84,372,413		10,000,000	20,000,000	26,000,000	20,080,000	22,500,000	182,872,413
Early Restoration Oysters				3,329,000	5,370,596	14,374,300	13,600,000		37,173,896
4. Provide and Enhance Recreational Opportunities									
Provide and Enhance Recreational Opportunities				25,000,000	63,274,513	38,000,000	5,000,000		131,274,513
Early Restoration Recreational Opportunities			22,397,916	85,505,305	120,543,167	22,000,000	18,957,000	18,582,688	287,986,076
5. Monitoring, Adaptive Management, Administrative Oversight									
Monitoring and Adaptive Management		65,000,000	200,000,000	10,000,000	10,000,000	225,000,000	7,500,000	2,500,000	520,000,000
Administrative Oversight and Comprehensive Planning		40,000,000	150,000,000	20,000,000	20,000,000	33,000,000	22,500,000	4,000,000	289,500,000
Adaptive Management NRD Payment for Unknown Conditions	700,000,000								700,000,000
Total NRD Funding	$700,000,000	$349,851,678	$1,240,697,916	$295,589,305	$680,152,643	$5,000,000,000	$295,557,000	$238,151,458	

*The total restoration funding allocation for the Early Restoration work, each restoration type, and monitoring, adaptive management, and administrative oversight is $8.1 billion (plus up to an additional $700 million for adaptive management and unknown conditions).

- The NOAA Restoration Center has restored 2,812 projects nationwide and its programs provide funding and technical assistance for coastal habitat restoration projects throughout the United States and territories. In Louisiana, the Restoration Center is planning, implementing or has restored 100 projects including CWPPRA and community-based restoration projects (source: https://restoration.atlas.noaa.gov/src/html/index.html; accessed November 25, 2015). In Southwest Coastal Louisiana, the NOAA Restoration Center has 20 restoration projects (**Table 7**):

Table 7. NOAA Restoration Center projects in Southwest Coastal Louisiana (source: https://restoration.atlas.noaa.gov/src/html/index.html; accessed November 25, 2015)

Project	Program	Partner	Status	Habitat
Black Bayou Hydrologic Restoration Project	CWPPRA	LDNR	completed	*2960 acres tidal wetland habitat restored *634 acres tidal wetland habitat protected
Cameron Meadows Marsh Creation and Terracing	CWPPRA	CPRA	implementation	tidal wetland
Cameron Shoreline Vegetation Planting Phase II	Community-based	Cameron Parish, Cheniere Energy, Gulf Coast Soil & Water Conservation Service, State Farm Insurance Co., Lonnie G. Harper	completed	6.5 acres of dune habitat restored by installing a sand fence and shoreline planting

Table 7. NOAA Restoration Center projects in Southwest Coastal Louisiana (source: https://restoration.atlas.noaa.gov/src/html/index.html; accessed November 25, 2015)

Project	Program	Partner	Status	Habitat
		and Associates, LLC, Coalition to Restore Coastal Louisiana, America's Wetlands, Restore America's Estuaries, Disney, LDNR, 143 volunteers contributed 920 hours to this project.		
Peveto Beach Sand Fencing	Community-based	Imperial Calcasieu Resource Conservation and Development Council, Inc., 48 volunteers contributed 238 hours to this project.	completed	10 acres of dune habitat restored
Peveto Sand Fencing and Vegetation Project 2	Community-based	Gulf of Mexico Foundation, Imperial Calcasieu Resource Conservation and Development Council, Inc., 12 volunteers contributed 372 hours to this project.	completed	1.72 acres of dune habitat restored
Oyster Bayou Marsh Creation	CWPPRA	Office of Coastal Protection and Restoration (LA OCPR), CPRA	implementation	tidal wetland
Bayou Verdine CERCLA –Sabine 1999 Unit Hydrologic Restoration and Marsh Creation	DARRP	Contributed to this project	completed	Create 14.7 acres of marsh in open water areas. Additionally, a 260-acre area of marsh and shallow mud flats will be restored to tidal hydrology
Cameron-Creole Watershed Mottled Duck Research and Terracing Project	Community-based	National Fish and Wildlife Foundation, Ducks Unlimited, Miami Corporation, Black Lake Land and Oil, LLC, British Petroleum (BP) America, Louisiana Department of Natural Resources	completed	Ducks Unlimited is working to construct 70,000 linear feet of earthen terraces benefiting 900 acres of fisheries habitat located in the Cameron-Creole Watershed in southwest Louisiana. 530 acres of tidal wetland habitat restored and 100 acres of tidal wetland habitat restored
Bio-Engineered Oyster Reef Demonstration	CWPPRA	CPRA, LDNR	implementation	The demonstration project consisted of an Oysterbreak, approximately 1000 feet long to provide oyster reef/shell bottom
Rockefeller Refuge Gulf Shoreline Stabilization Project	CWPPRA	LDNR	implementation	the construction of a continuous rock breakwater extending approximately

Table 7. NOAA Restoration Center projects in Southwest Coastal Louisiana (source: https://restoration.atlas.noaa.gov/src/html/index.html; accessed November 25, 2015)

Project	Program	Partner	Status	Habitat
				50,691 feet from the west bank of Joseph Harbor to the east bank of Beach Prong to protect tidal wetlands
Pecan Island Terrace Creation Project	CWPPRA	LDNR	completed	constructed 198,400 linear feet of adjacent terrace cells; 425 acres of soft bottom mud/sand habitat restored 145 acres of tidal wetland habitat restored
Christian Marsh Terracing Project	Community-based	Coalition to Restore Coastal Louisiana, Randy Moertle and Associates, CPRA, McIlhenney Corporation, Restore America's Estuaries, Louisiana State University, Vermilion Corporation, Cargill, Incorporated, COYPU Foundation, Vermilion Soil and Water Conservation District, National Audubon Society, 87 volunteers contributed 696 hours to this project	Completed	Created over 25,000 linear feet of terraces, enhancing and protecting an additional 300 acres of adjacent marsh.
Louisiana Acadiana Bay Oyster Reef Construction and Gulf-wide Oyster Planning	Community-based	State of Louisiana, Louisiana State University Agriculture Extension Service, National Fish and Wildlife Foundation, The Nature Conservancy	Completed	installed ~670 linear feet of bioengineered oyster reef along the coastal shoreline of the Paul J. Rainey Wildlife Sanctuary in Vermilion Bay in southwest Louisiana; 0.15 acres of oyster/shell bottom habitat restored
Vermilion Bay Oyster Reef Restoration and Shoreline Protection	Community-based	LDWF, Louisiana Wetlands Association, 30 volunteers contributed 200 hours	Completed	This project implemented the first large-scale shell recycling program in Louisiana. A 600-foot oyster reef was constructed, which protected the adjacent shoreline, renewed oyster productivity in the bay, and benefited marine habitat.
Coles Bayou Marsh Restoration	CWPPRA	Office of Coastal Protection and Restoration (LA OCPR), Louisiana Coastal Protection and Restoration Authority	Planning	Objective of this project is to create and nourish brackish marsh and improve hydrology in order to increase freshwater and sediment inflow into the interior wetlands, the latter through culvert installation.

Table 7. NOAA Restoration Center projects in Southwest Coastal Louisiana (source: https://restoration.atlas.noaa.gov/src/html/index.html; accessed November 25, 2015)

Project	Program	Partner	Status	Habitat
Little Vermilion Bay Sediment Trapping Project	CWPPRA	LDNR	Completed	390 acres of tidal wetland habitat restored 51 acres of tidal wetland habitat protected
McIlhenney Planting Program- Little White Lake	Community-based	Louisiana State Agricultural Center, McIlhenney Corporation, Randy Moertle and Associates, Boy Scouts of America, Coalition to Restore Coastal Louisiana, 91 volunteers contributed 910 hours to this project.	Completed	5 acres of tidal wetland habitat restored
Four Mile Canal Terracing and Sediment Trapping	CWPPRA	LDNR	Completed	214 acres of tidal wetland habitat restored 113 acres of tidal wetland habitat protected
Rainey Wildlife Sanctuary Terrace Project	Community-based	LDNR, Coalition to Restore Coastal Louisiana, 20 volunteers contributed 400 hours to this project	Completed	640 acres of tidal wetland habitat restored
M/V Formosa Six	DARRP	LDNR, LDWF, National Fish and Wildlife Foundation, LDEQ, NRCS	Completed	142 acres of tidal wetland habitat restored

- Some other large scale ecosystem restoration projects affecting coastal waters of the United States include the following:
    - The CALFED Environmental Restoration Program, approved by the California state legislature in fall 2000, has been successfully acquiring and protecting important lands in the Delta and along its tributaries. To date, more than 130,000 acres of habitat targeted for species of import to the Delta have been enhanced, protected and restored, mostly through easements obtained by working with local land owners and communities (source: http://calwater.ca.gov/calfed/objectives/ecosystem_restoration.html#EcoHistory; accessed December 2, 2015).
    - The Chesapeake Bay Program is a unique regional partnership that has led and directed the restoration of the Chesapeake Bay since 1983. The Chesapeake Bay Program partners include the states of Maryland, Pennsylvania and Virginia; the District of Columbia; the Chesapeake Bay Commission, a tri-state legislative body; the Environmental Protection Agency, representing the federal government; and participating citizen advisory groups (source: http://www.chesapeakebay.net/about; accessed December 2, 2015)
    - The Comprehensive Everglades Restoration Program (CERP), provides a framework and guide to restore, protect and preserve the water resources of central and southern Florida, including the Everglades. It covers 16 counties over an 18,000-square-mile area and centers on an update of the Central & Southern Florida (C&SF) Project also known as the Restudy (source: http://141.232.10.32/about/about_cerp_brief.aspx; accessed December 2, 2015).

- The Mississippi Coastal Improvements Program Comprehensive Plan (MsCIP) is a system wide approach linking structural and nonstructural hurricane and storm damage risk reduction with ecosystem restoration with the goal of providing a coastal community more resilient to hurricanes and storms (source: http://www.sam.usace.army.mil/Portals/46/docs/program_management/mscip/docs/MSCIP%20Chief%20Report.pdf; accessed December 2, 2015).
- The Coastal Texas Protection and Restoration Project a comprehensive plan to determine the feasibility of carrying out projects for flood damage reduction, hurricane and storm damage reduction, and ecosystem restoration in the coastal areas of the State of Texas (source: http://www.swg.usace.army.mil/Portals/26/docs/PAO/0827%20Hou-Galv%20Coastal%20TX%20Public%20mtg%20August%2027%202014.pdf; accessed December 2, 2015).

- The Cameron Parish Master Plan for Coastal Restoration & Protection identifies a total of 253 priority projects including: 150 hydrologic restoration, 17 beneficial use/marsh creation, 2 oyster reef preservation projects, 9 shoreline/embankment maintenance projects, and 75 canal maintenance projects. The intent is to have the parish projects looked at in a holistic way to be considered for the 2017 State Master Plan. These conceptual projects are not authorized or funded for construction and are therefore not considered reasonably foreseeable in the FWOP or future with project conditions. They are included at the request of Cameron Parish.
- Calcasieu Parish's priority project is the Rabbit Island Project and then the entire Cameron Parish Project list at this time. Calcasieu Parish believes that protecting Cameron Parish would protect Calcasieu Parish. Calcasieu Parish anticipates updating their coastal plan which would include a priority projects list. Those projects would be viable projects for consideration of funding for protecting Lake Charles to the 500 year level of protection as deemed necessary by the Coastal Master Plan for Louisiana 2012. These conceptual projects are not authorized or funded for construction and are therefore not considered reasonably foreseeable in the FWOP or future with project conditions. They are included at the request of Cameron Parish.
- The Vermilion Parish Coastal Priority Project list identifies a total of 42 priority projects including: 10 hurricane protection projects, 17 shoreline protection and bank stabilization projects, 6 marsh creation projects, 7 hydrologic restoration projects, and 2 ridge restoration projects. These conceptual projects are not authorized or funded for construction and are therefore not considered reasonably foreseeable in the FWOP or future with project conditions. They are included at the request of Vermilion Parish.
- Other Gulf shore protection and restoration projects have been constructed along the Gulf shoreline through other funding sources. Segmented breakwaters have been constructed under at least two separate projects to the west of the proposed Holly Beach Shoreline Stabilization (5a) measure. The proposed breakwater would provide shoreline protection from the eastern end of the existing breakwaters eastward to the Calcasieu Pass jetty and compliment that existing project. The shoreline where the proposed Holly Beach measure would be built has been nourished with material dredged from the bottom of the Gulf of Mexico to help ensure that shoreline erosion did not compromise Louisiana Highways 27/82. Rock and riprap have also been placed at critical locations where shoreline erosion has threatened the highway. The proposed Holly Beach measure is compatible with and would augment these prior efforts. There have been proposals to construct shore protection measures along the Gulf where the proposed Gulf shoreline restoration [Calcasieu River to Freshwater Bayou (6b1, 6b2, and 6b3)] measures are located, but no projects have been built.

The NER RP would utilize the best available practical techniques and BMPs during dredging and construction to avoid and minimize potential adverse cumulative impacts.

k) detrimental discharges of suspended solids into coastal waters, including turbidity resulting from dredging.

Response: Implementing the Nonstructural NED RP measures would not result in any detrimental discharges of suspended solids into coastal waters. Rather, the Nonstructural NED RP would reduce damages

resulting from hurricane and storm surge by: 1) elevating eligible residential structures; 2) dry flood proofing of eligible non-residential structures, excluding large warehouses and industrial complexes; and 3) construction of flood proofing barriers or berms less than 6 feet in height around non-residential structures, primarily industrial complexes and warehouses. In addition, the use of the best available practical techniques and BMPs to avoid, minimize and reduce the potential for detrimental changes in littoral and sediment transport processes. The Nonstructural NED RP measures are typically far removed from coastal waters and discharges into coastal waters is not part of the planned nonstructural construction. In addition, the best available practical techniques and the best available practical techniques and BMPs would be used for all, but especially those structures located adjacent to waterways, to avoid and minimize potential detrimental discharges of suspended solids and turbidity.

Implementing the NER RP measures would have temporary and localized effects primarily due to disturbance of waterbottoms during dredging and construction activities (dredging temporary access corridors, dredging and placement operations for marsh restoration, and placement of rock and geotextile fabric for shoreline protection measures). However, these temporary and localized impacts would be minimized and reduced by the best available practical techniques and BMPs during construction. During marsh restoration, effluent from the dredge discharge pipe would be directed to adjacent fragmented marsh for nourishment. The placement of rock for the shoreline protection measures is expected to result in the disturbance of water bottom, causing a minor, temporary, and localized increase in suspended particulate/turbidity levels. Following construction activities, turbidity levels in the vicinity of measures would return to those which existed prior to construction activities. **Tables 3, 4,** and **5** provide estimated construction intervals for each NER RP measure. Reforestation of cheniers would not involve discharges of suspended solids into coastal waters. The NER RP would utilize the best available practical techniques and BMPs during dredging and construction to avoid and minimize potential adverse impacts of discharges of suspended sediments into coastal waters.

l) reductions or blockage of water flow or natural circulation patterns within or into an estuarine system or a wetland forest.

Response: Implementation of the Nonstructural NED RP measures would not reduce or block water flows or natural circulation patterns. Rather, the Nonstructural NED RP would reduce damages resulting from hurricane and storm surge by: 1) elevating eligible residential structures; 2) dry flood proofing of eligible non-residential structures, excluding large warehouses and industrial complexes; and 3) construction of flood proofing barriers or berms less than 6 feet in height around non-residential structures, primarily industrial complexes and warehouses. The Nonstructural NED RP measures are typically far removed from coastal waters and reductions or blockage of water flow or natural circulation patterns within an estuarine or wetland forest is not part of the planned nonstructural construction. In addition, the best available practical techniques and the best available practical techniques and BMPs would be used especially for those structures located nearby estuarine or wetland forests.

The NER RP dredging and construction of temporary access corridors, the nine marsh restoration measures and the five shoreline protection measures would have little, if any, significant reductions or blockages of water flows or natural circulation patterns within or into an estuarine or wetland forest. The higher substrate elevations resulting from marsh restoration of shallow open water and fragmented marsh areas may slightly change or modify, at a local scale, throughput (current patterns and flow) of water over the footprint of each of these measures. The five shoreline protection measures are specifically designed to reduce the erosive effects of wind-driven waves, tidal and storm surges that cause erosion of shorelines. However, overall basin current patterns and flows would be similar to that which existed prior to the widespread coastal marsh fragmentation, degradation, and loss we are currently experiencing. In addition shoreline protection measures would include fish dips which would allow tidal and other water flows to proceed unimpeded by these measures. These impacts are considered positive and would provide protection of back marsh lands in an otherwise degrading marsh area. Chenier reforestation would not involve any activities that could potentially reduce or block water flows or natural circulation patterns.

However, the Calcasieu Ship Channel Salinity Barrier measure and the Cameron-Creole Spillway Salinity Control Structure measure are both being recommended for long-term study. Part of the reasoning for recommending these measures for long-term study is because of their potential for altering salinity regimes. These measures would not be constructed without the authority for additional study, NEPA analysis and associated environmental compliance coordination and permits. The NER RP would utilize the best available practical techniques and BMPs during dredging and construction to avoid and minimize potential adverse impacts or blockage of water flows or natural circulation patterns within the estuarine and wetland forest systems.

m) Discharges of pathogens or toxic substances into coastal waters.

Response: The Nonstructural NED RP would not discharge pathogens or toxic substances into coastal waters. Rather, the Nonstructural NED RP property owners must execute an authorization for entry which would grant USACE and the NFS authorization to enter in and upon the structure and land for purposes of investigating, inspecting, surveying, performing limited environmental testing and a hazardous, toxic, and radioactive waste (HTRW) assessment, evaluating the condition of the structure, determining elevation requirements, verifying the current elevation, performing an appraisal, and conducting other activities necessary for USACE to make a determination of structure eligibility. The property owner must submit satisfactory proof of ownership and a current Elevation Certificate. Title research and appraisals would be completed by the NFS. The property must have clear title. The property owner would be responsible to clear the title of all ownership issues and obtain any necessary subordination agreements from holders of liens, encumbrances, or third party interests at the property owner's sole expense; the failure to provide clear title shall result in a determination of ineligibility. An ASTM Phase I HTRW/Asbestos investigation (and if warranted, may be accompanied by additional HTRW investigations), inspections, surveys, and boundary monumentations would be completed. The land and the structure must be certified as "clean" by the appropriate State office before any Project funds may be expended. All asbestos must be abated and disposed of properly. Asbestos impacted by flood proofing would be removed at Project cost, while HTRW impacted by flood proofing must be remediated by the property owner prior to the initiation of the flood proofing work. After all inspections, investigations, assessments, and other activities are completed, a determination of eligibility for elevation would be made by USACE. The best available practical techniques and the best available practical techniques and BMPs would be used especially for avoiding, reducing and minimizing potential discharges of pathogens or toxic substances into coastal waters.

A Phase I environmental site assessment of the NER RP project area was conducted in accordance with applicable sections of the American Society for Testing and Materials (ASTM) Standard E1527-13, Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process; ASTM Standard E2247-08, Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process for Forestland or Rural Property; the U.S. Environmental Protection Agency (USEPA) 40 CFR Part 312 Standards and Practices for All Appropriate Inquiry, Final Rule; and BEM's scope of work dated 16 December 2014 to assess for the presence of HTRW within the ASTM E1527-13 recommended approximate minimum search distance of 1 mile from the NER RP restoration measures. The majority of the recognized environmental conditions and areas of environmental concern within the project area are located: 1) adjacent to Highway 82 on the east side of Grand Chenier and from the right descending bank of the Calcasieu Ship Channel east to Highway 27 and in the northern vicinity of Hackberry adjacent to Highway 27; 2) along Freshwater Bayou. However, records indicate that the majority of these sites have been cleaned, remediated, and closed. Based on the Phase I environmental site assessment, the proposed restoration activities within the NER RP project area would likely result in the "capping" of any potentially impacted areas through the placement of overlying materials that may include dredged sand and sediment, rocks, and placement of reinforced structures. This action would potentially minimize future recognized environmental conditions and environmental concerns from existing petroleum or metal-impacted sediment through the placement of the overlying dredged materials. The NER RP would utilize the best available practical techniques and BMPs during

dredging and construction to avoid and minimize potential adverse impacts or discharges of pathogens or toxic substances into coastal waters.

n) adverse alteration or destruction of archaeological, historical, or other cultural resources.

Response: The CEMVN released a 30-day public notice as part of its responsibilities under 36 CFR Part 800, the regulations implementing Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended (54 U.S.C. § 306108). USACE has determined that implementation of the Southwest Coastal Louisiana Study would result in undertakings that have the potential to cause effects on properties listed in or eligible for listing in the National Register of Historic Places (NRHP), and has elected to fulfill its Section 106 obligations through execution and implementation of two Programmatic Agreements as provided for in 36 CFR § 800.14(b). Interested persons were notified by public notice and are hereby notified that the USACE, in consultation with the Advisory Council on Historic Preservation (ACHP), the Louisiana State Historic Preservation Officer (SHPO), the Louisiana Coastal Protection and Restoration Authority Board (CPRAB), and federally-recognized Indian Tribes, has developed two Draft PAs for the SWC Study, one for the Nonstructural NED RP and one for the NER RP.

The Draft PAs contain Stipulations to include: Consultation and Coordination; Standards, Identification and Evaluation of Historic Properties; Historic Properties Affected; Resolution of Adverse Effects; Curation; Discovery of Human Remains; Unanticipated Discoveries and Effects; Dispute Resolution; Administration, Effect, and Duration; Comprehensive Review; and Amendment and Termination. The NER RP would utilize the best available practical techniques and BMPs during dredging and construction to avoid and minimize potential adverse impacts or adverse alteration or destruction of archeological, historical, or other cultural resources.

o) fostering of detrimental secondary impacts in undisturbed or biologically highly productive wetland areas.

Response: There would be no likely potential detrimental secondary impacts in undisturbed or biologically highly productive wetland areas associated with implementing the Nonstructural NED RP. Rather, implementing the Nonstructural NED RP would include: 1) elevating eligible residential structures; 2) dry flood proofing of eligible non-residential structures, excluding large warehouses and industrial complexes; and 3) construction of flood proofing barriers or berms less than 6 feet in height around non-residential structures, primarily industrial complexes and warehouses. These areas are characterized as previously disturbed residential and business areas that are not biologically productive or undisturbed wetland areas. Potential detrimental secondary impacts of implementing the Nonstructural NED RP would generally be short term and localized impacts associated with construction activities involved with elevating, dry flood proofing, and construction of flood proofing barriers or berms less than 6 foot in height. Secondary impacts in most instances would be temporary and localized and include: disruption and congestion of vehicular traffic patterns in the immediate vicinity of structures undergoing risk reduction; noise; dust; diesel and gas engine fumes emissions; vibration; emissions of construction wastes; greenhouse gas emissions; increased local electricity and fuel consumption; and local increases in the number of vehicles, construction equipment and workers in the vicinity of those structures undergoing risk reduction. However, the best available practical techniques and BMPs would be used to avoid, minimize and reduce potential adverse disruption of social patterns. Following construction, these areas would once again be available for social patterns and human habitations and uses similar to pre-construction social patterns. The Nonstructural NED RP would use the best available practical techniques and the best available practical techniques and BMPs to avoid, reduce and minimize the potential for adverse secondary impacts on undisturbed or biologically highly productive wetland areas.

Implementation of the NER RP would significantly and positively effect, increase and protect estuarine wetlands in the project area and, in turn, provide and protect important, essential and in some instances critical habitats used by various terrestrial and aquatic organisms for shelter, nesting, feeding, roosting, cover, nursery, EFH and other life requirements; as well as increase productivity. Nevertheless, potential adverse secondary impacts of implementing the NER RP could be effects on aquatic ecosystems and organisms, including

plankton, would be primarily associated with construction activities and would include increased turbidity and total suspended solids, increased water temperatures and lower dissolved oxygen. These temporary and localized effects would occur only during construction of the nine marsh restoration measures and five shoreline protection measures. Potential temporary and localized impacts would be minimized and controlled by utilizing the best available practical techniques and BMPs during construction.

During marsh restoration, effluent from dredge discharge pipe would be directed to adjacent fragmented marsh for nourishment. Following construction plankton conditions would return to those observed prior to construction. The restored and protected marsh would provide increased estuarine habitat suitable for re-colonization. The 35 chenier reforestation measures would have no impacts on plankton as they are removed from water areas. Adverse secondary effects on benthos would primarily be associated with construction activities and include smothering and permanent loss of sessile and slower moving benthic organisms during placement of borrow sediments for marsh restoration as well as during placement of geotextile fabric and rock for shoreline protection. More mobile benthic organisms could move out of the immediate construction areas. Following construction activities, marsh bottoms would be rapidly recolonized by benthic organisms within 1-3 years (Wilber et al. 2008). Rocks for shoreline protection measures would provide substrate and micro habitats suitable for some smaller organisms and benthos. Other impacts would include temporary and localized increases in turbidity and total suspended solids, increased water temperatures and decreased dissolved oxygen that would occur only during construction of the nine marsh restoration measures and five shoreline protection measures. These temporary and localized impacts can inhibit photosynthesis and affect respiration of benthic organisms by silt deposition on respiratory structures. However, these temporary and localized impacts would be minimized and controlled by utilizing the best available practical techniques and BMPs during construction. During construction of marsh restoration measures, effluent from dredge discharge pipe would be directed to adjacent fragmented marsh for nourishment. It is not anticipated that the 35 chenier reforestation measures would have any impacts on benthos.

Sessile and slow-moving nekton would be smothered and permanently lost by placement of borrow sediments during dredging and marsh restoration as well as during placement of geotextile fabric and rock for shoreline protection. However, most nekton are mobile and would be displaced from nine marsh restoration measures and five shoreline protection measures. Much of the marsh restoration sites would be temporarily unavailable for nekton or other aquatic organisms during construction and until containment/exclusion dikes degrade naturally or as part of project construction at three years following construction, after which nekton would have access to the newly restored marsh. The open water areas where shoreline protection sites would be constructed would be permanently unavailable for use by nekton. However, gaps in the shoreline protection would allow aquatic organism access to back marsh areas. Construction activities would be temporary and localized increases in turbidity and total suspended solids, increased water temperatures and decreased dissolved oxygen that would occur only during construction of the nine marsh restoration measures and five shoreline protection measures. These temporary and localized impacts can inhibit predator-prey interactions and affect respiration of nekton by silt deposition on respiratory structures. However these temporary impacts would not likely impact most nekton, which are generally mobile enough to avoid areas during construction. In addition, these temporary and localized impacts would be minimized and controlled by utilizing the best available practical techniques and BMPs during construction. During construction of marsh restoration measures, effluent from dredge discharge pipe would be directed to adjacent fragmented marsh for nourishment. It is not anticipated that the 35 chenier reforestation measures would have any impacts on benthos. Sediments in marsh restoration areas would differentially settle following construction into higher and lower lying lands enabling reestablishment of natural water connections for access of aquatic organisms from nearby and adjacent waters. Marsh restoration measures would also provide essential fish habitat for Federally-managed species. Rock placed for shoreline protection would provide a variety of micro-habitats and substrates for various prey species that could be utilized by nekton. It is not anticipated that the 35 Chenier reforestation measures would have any impacts on nekton.

Secondary effects on the aquatic food web would be temporary and localized increases in turbidity and total suspended solids, increased water temperatures and decreased dissolved oxygen that would occur only during construction of the nine marsh restoration measures and five shoreline protection measures. Although these temporary and localized impacts can disrupt and inhibit predator-prey interactions, they would be minimized and controlled by utilizing the best available practical techniques and BMPs during construction. During construction of marsh restoration measures, effluent from dredge discharge pipe would be directed to adjacent fragmented marsh for nourishment. The aquatic food web would benefit from both short and long term changes to the marsh restoration disposal areas, including additions in energy to basal elements of the food web, habitat preservation, and increased habitat complexity. Nutrients and detritus released during the discharge of dredged sediments into marsh restoration areas would be added to the existing food web. It is not anticipated that the 35 chenier reforestation measures would have any impacts on aquatic food web.

Some existing vegetated shallows would be significantly and permanently impacted by marsh restoration and nourishment of nine marsh restoration measures and five shoreline protection measures around Calcasieu Lake. Permanent impacts to state waterbottoms through the conversion to marsh or the placement of rock include 14,346 acres from the nine marsh restoration measures and 278.4 acres from the five shoreline protection measures. This would result in the vegetation being covered by fill material. Not all of these shallow-water areas are vegetated (range of 0 to 40% coverage). In addition, proposed measures would encourage the growth of submerged aquatic vegetation such as through the reduction in water fetch and wave energy by shoreline protection measures.

As demonstrated through Wetland Value Assessments, the proposed action would improve the quality of wetlands. Compared to the No Action Alternative and future without project conditions, implementing the NER RP would result in an overall net gain marsh acres and AAHUs. The NER RP would utilize the best available practical techniques and BMPs during dredging and construction to avoid and minimize potential adverse secondary impacts in undisturbed or biologically highly productive wetland areas.

p) adverse alteration or destruction of unique or valuable habitats, critical habitat for endangered species, important wildlife or fishery breeding or nursery areas, designated wildlife management or sanctuary areas, or forestlands.

Response: The CEMVN has determined that the proposed action "may affect but will not likely adversely affect" the piping plover or it's critical habitat, red knot, Sprague's pipit, West Indian manatee, Gulf sturgeon, loggerhead and Kemps Ridley sea turtles; would have no effect on the Red-cockaded woodpecker, green, leatherback, and hawksbill sea turtles or loggerhead critical habitat and would not adversely impact other species of concern that could potentially be found in the project area. No unique or valuable habitats would be adversely affected. The Migratory Bird Treaty Act (MBTA) and the Migratory Bird Conservation Act (MBCA) protect migratory birds and their habitat. Many important habitats in the project area provide migratory bird shelter, nesting, feeding and roosting habitat. All construction activities shall observe a buffer of 1,000 feet for any colonial-nesting waterbird colonies (e.g., egrets, herons, ibis, pelicans, etc.), 1,300 feet for any shorebird nesting colonies (e.g., terns, gulls, plovers, skimmers, etc.), and 2,000 feet for any brown pelican nesting colonies near the project measure. Based upon a field survey conducted in June 2015 for active colonial-nesting waterbird colonies, one active colonial-nesting waterbird colony was observed within 1,000 feet of the proposed construction limits of NER RP marsh restoration measure 3a1 within the Calcasieu restoration area. Additionally, a shorebird nesting colony was recorded within 1,300 feet of the proposed construction limits of breakwater measure 6b2 within the Rockefeller restoration area. USFWS and USACE biologists would survey the area before construction to confirm active rookery locations. If colonial-nesting waterbird colonies exist within 1,000 feet, if shorebird colonies exist within 1,300 feet, or if brown pelican nesting colonies exist within 2,000 feet of the proposed action, this could be a project constraint. USFWS guidelines would be followed to avoid adverse impacts to these species.

Temporary and localized increases in turbidity and total suspended solids, increased water temperatures and decreased dissolved oxygen would occur only during dredging and construction of the nine marsh restoration

measures and the five shoreline protection measures. Although these temporary and localized impacts can disrupt and preclude wildlife from using the marsh restoration and shoreline protection areas, they would be minimized and controlled by utilizing the best available practical techniques and BMPs during construction. Also during construction of marsh restoration measures, effluent from dredge discharge pipe would be directed to adjacent fragmented marsh for nourishment. However, these temporary and localized adverse effects would be offset by the proposed action restoration and protection of estuarine marsh habitats which can provide an array of foraging, breeding, and cover habitat for a variety of birds, mammals, reptiles and other wildlife species.

Two marsh restoration measures, located partially on USFWS properties, are recommended for construction by the USFWS. Measure 124d Marsh Restoration at Mud Lake would be located on Sabine NWR. Measure 3c1 Beneficial Use of Dredged Material from Calcasieu Ship Channel would be located on the Cameron Prairie NWR (**Figure 9**). NER RP measure 124d would initially restore (159 acres), nourish (448 acres) a total of 607 acres that would provide over the 50 year period of analysis 168 net acres and 4 AAHUs which would synergistically benefit the Sabine NWR. NER RP Measure 3c1 would initially create (1,347 acres) and nourish (734 acres) a total of 2,081 acres that would provide over the 50 year period of analysis 1,324 net acres and 607 AAHU which would synergistically benefit the Cameron Prairie NWR. The implementation of three of the five shoreline protection measures (6b1, 6b2, and 6b3) would have a significant and long-term positive effect on wetlands in the Rockefeller State Wildlife Refuge and Game Preserve (Rockefeller Refuge). The installation of a field of light-weight aggregate core rock breakwaters offshore of the Gulf of Mexico shoreline of the Rockefeller Refuge would decrease the wave energy reaching the shoreline, which would reduce background erosion rates, protecting existing saline wetlands. The other NER RP measures would not impact other parks, national historic monuments, national seashores, wilderness areas, research sites, and similar preserves.

Many of the NER RP measures would be constructed in the immediate vicinity of other existing coastal restoration projects, including CWPPRA projects (**Figure 5**). However, NER RP measure 124c—Marsh Restoration at Mud Lake) and 3c1—Beneficial Use of Dredged Material from Calcasieu Ship Channel) would directly overlap projects CS-59—Oyster Bayou Marsh Creation and Terracing (**Figure 6**) and CS-54—Cameron-Creole Watershed Grand Bayou Marsh Creation (**Figure 7**), respectively. Figure 124c would overlap CS-59 by 821 acres. Measure 3c1 would overlap CS-54 by 65 acres. When overlap occurs, NER RP measures would be constructed to avoid the existing projects. This would generally include construction of temporary containment/exclusion dikes that would not only contain dredged borrow effluent sediments until it has dewatered and consolidated, but would also function to exclude any dredged effluents from entering existing project sites. These temporary containment/exclusion dikes would either naturally degrade to restore connectivity with surrounding areas, or they do not naturally degraded, they would be degraded three years after construction has been completed if to allow hydrologic connectivity to the surrounding area.

In addition to directly impacting the above cited projects, existing mitigation projects also located within areas proposed for restoration under the NER RP would be directly impacted. Mitigation projects are designed and constructed to offset anticipated losses from permitted activities. **Figure 8** and **Table 6** contains information about mitigation projects that occur within the project area. In most instances, these mitigation projects were developed to provide a sustainable buffer from wave action and storm surge generated by tropical storms and hurricanes. When overlap occurs, proposed NER RP measures would not be constructed until the mitigation projects satisfy their 20-year permitted obligations.

Actions to Minimize Impacts: Dredged sediments would be placed for the nine marsh restoration sites to achieve a post-construction target elevation following dewatering that would be suitable for natural colonization by marsh vegetation. During construction, effluent from dewatering would be discharged into adjacent wetlands via spill box weirs. Temporary earthen containment/exclusion dikes would be constructed from in-situ material located within the marsh restoration/nourishment area using a mechanical (clamshell or bucket) dredge. Temporary access for the mechanical dredge would be via the pipeline corridor. The borrow area used for construction of the earthen containment dike would be refilled during the placement of dredged material. One foot of freeboard would be maintained at all times during dredge discharge operations. Containment/exclusion

dikes would be breached in multiple places at three years post construction if necessary to restore connectivity and fish access if natural degradation is not sufficient. Breach locations would correspond to weir locations. The Nonstructural NED RP and NER RP would utilize the best available practical techniques and BMPs during construction to avoid and minimize potential adverse impacts special aquatic sites and to surrounding aquatic and terrestrial environment.

q) adverse alteration or destruction of public parks, shoreline access points, public works, designated recreation areas, scenic rivers, or other areas of public use and concern.

Response: See above response to "p) adverse alteration or destruction of unique or valuable habitats, critical habitat for endangered species, important wildlife or fishery breeding or nursery areas, designated wildlife management or sanctuary areas, or forestlands." No other public parks, shoreline access points, public works, or designated recreation areas would be adversely altered by either the Nonstructural NED RP or NER RP. The Nonstructural NED RP and NER RP would utilize the best available practical techniques and BMPs during construction to avoid and minimize potential adverse impacts on public parks, shoreline access points, public works, designated recreation areas, scenic rivers, or other areas of public use and concern

r) adverse disruptions of coastal wildlife and fishery migratory patterns.

Response: The Nonstructural NED RP measures include: elevating eligible residential structures; dry flood proofing of eligible non-residential structures, excluding large warehouses and industrial complexes; and construction of flood proofing barriers or berms less than 6 feet in height around non-residential structures, primarily industrial complexes and warehouses. The Nonstructural NED RP measures are located in previously disturbed residential and business areas far removed from coastal wildlife and fish. Hence, the Nonstructural NED RP would not adversely disrupt coastal wildlife or fishery migratory patterns. The Nonstructural NED RP would utilize the best available practical techniques and BMPs during construction to avoid and minimize potential adverse impacts on coastal wildlife and fishery migratory patterns.

Over the 50-year period of analysis, the NER RP would protect, restore, and nourish a total of 14,035 net acres of emergent marsh (including 7,900 net acres from the nine marsh restoration measures and 6,135 net acres from the five shoreline protection measures). At the end of the 50 year period of analysis, the marsh restoration (2,700 AAHUs) and shoreline protection measures (1,738 AAHUs) together would achieve a total net ecological benefit of 4,430 AAHUs. Whereas the chenier reforestation measures would restore a net total of 1,413 net acres with 538 AAHUs. The implementation and operation of the NER RP measures would not disrupt coastal wildlife or fishery migratory patterns in the long term. However, during construction and dredging operations of the access corridors, the borrow sites, the nine marsh restoration sites, the five shoreline protection sites and the 35 chenier reforestation sites would temporarily be unavailable for use by fish and wildlife. Following construction, these areas would return to availability for use by fish and wildlife. By design, the five shoreline protection measures would no longer be available to fish. Shoreline protection measures would, however, include fish dips which would allow tidal and other water flows, fish and other aquatic organisms to proceed unimpeded by these measures into back marsh areas. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid and minimize potential adverse impacts on coastal wildlife and fishery migratory patterns.

s) land loss, erosion and subsidence.

Response: The Nonstructural NED RP measures, by design, would reduce damages resulting from hurricane and storm surge by elevating eligible residential structures; dry flood proofing of eligible non-residential structures, excluding large warehouses and industrial complexes; and construction of flood proofing barriers or berms less than 6 feet in height around non-residential structures, primarily industrial complexes and warehouses. The Nonstructural NED RP measures are located in previously disturbed residential and business areas and would not cause significant land loss, erosion or subsidence. The Nonstructural NED RP

would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts regarding land loss, erosion and subsidence.

The NER RP measures would not cause land loss, erosion, or subsidence. Rather, The NER RP nine mash restoration measures would introduce borrow sediments from the Calcasieu Ship Channel and the Gulf of Mexico designated borrow sites for the purpose of marsh restoration. At the end of the 50 year period of analysis, the nine marsh restoration measures reducing local land loss by restoring (creating and nourishing) a total of 7,900 net acres with 2,700 AAHUs. The NER RP five shoreline protection measures would provide 251,528 linear feet of shoreline protection that over the 50 year period of analysis would protect 6,135 net acres with 1,738 AAHUs. The chenier restoration measures analysis, would restore a net total of 1,413 net acres with 538 AAHUs. The NER RP would utilize the best available practical techniques and BMPs for ecosystem restoration and shoreline protection to avoid, minimize and reduce potential adverse impacts regarding land loss, erosion and subsidence.

t) increases in the potential for flood, hurricane or other storm damage, or increases in the likelihood that damage will occur from such hazards.

Response: The Nonstructural NED RP would not increase the potential for flood, hurricane, or other storm damage, or increase the likelihood of damage from such hazards. Rather, the Nonstructural NED RP would reduce flood risk for residential and non-residential structures that have first floor elevations at or below the 0-25-year floodplain, based on hydrologic conditions predicted to occur in 2025 (the beginning of the 50 year period of analysis). The Nonstructural NED RP would provide reduced risk of damages resulting from hurricane and storm surge flood for a total of 3,961 impacted structures consisting of 3,462 eligible residential structures; 342 eligible commercial structures and public buildings; and 157 eligible industrial complexes and warehouses. The Nonstructural NED RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts regarding potential for flood, hurricane or other storm damage, or increases in the likelihood that damage would occur from such hazards.

The NER RP would not increase the potential for flood, hurricane, or other storm damage, or increase the likelihood of damage from such hazards. Rather, over the 50-year period of analysis the NER RP would restore, nourish and protect a net total of 14,035 net acres of transitional estuarine marsh, including 7,900 net acres from the nine marsh restoration measures and 6,135 net acres from the five shoreline protection measures. At the end of the 50 year period of analysis, the marsh restoration (2,700 AAHUs) and shoreline protection measures (1,738 AAHUs) together would achieve a total net ecological benefit of 4,430 AAHUs. Whereas the chenier restoration measures analysis, would restore a net total of 1,413 net acres with 538 AAHUs. In addition, the nine marsh restoration measures and the five shoreline protection measures would provide an unquantified roughness factor that would help reduce, to some undetermined extent, the adverse effects of flood, hurricane and other storm damages. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts regarding potential for flood, hurricane or other storm damage, or increases in the likelihood that damage would occur from such hazards.

u) reductions in the long-term biological productivity of the coastal ecosystem.

Response: The Nonstructural NED RP measures are located in previously disturbed residential and business areas and would not reduce long-term biological productivity of the coastal ecosystem. Rather, the Nonstructural NED RP would reduce flood risk for residential and non-residential structures that have first floor elevations at or below the 0-25-year floodplain, based on hydrologic conditions predicted to occur in 2025 (the beginning of the 50 year period of analysis). The Nonstructural NED RP would provide reduced risk of damages resulting from hurricane and storm surge flood for a total of 3,961 impacted structures consisting of 3,462 eligible residential structures; 342 eligible commercial structures and public buildings; and 157 eligible industrial complexes and warehouses. The Nonstructural NED RP would utilize the best available practical

techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts regarding potential for reductions in the long-term biological productivity of the coastal ecosystem.

The NER RP would not reduce long-term biological productivity of the coastal ecosystem. Rather over the 50-year period of analysis the NER RP would restore, nourish and protect a net total of 14,035 net acres of transitional estuarine marsh, including 7,900 net acres from the nine marsh restoration measures and 6,135 net acres from the five shoreline protection measures. At the end of the 50 year period of analysis, the marsh restoration (2,700 AAHUs) and shoreline protection measures (1,738 AAHUs) together would achieve a total net ecological benefit of 4,430 AAHUs. Whereas the chenier restoration measures analysis, would restore a net total of 1,413 net acres with 538 AAHUs. The NER RP, as determined by the Wetland Value Assessment and quantified AAHUs, would improve the biological productivity of the ecosystem in the project area. There would be an overall net gain of AAHUs (see **Tables 4**, **5**, and **6**). The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts regarding potential for reductions in the long-term biological productivity of the coastal ecosystem.

Guideline 1.8 In those guidelines in which the modifier "maximum extent practicable" is used, the proposed use is in compliance with the guideline if the standard modified by the term is complied with. If the modified standard is not complied with, the use will be in compliance with the guideline if the permitting authority finds, after a systematic consideration of all pertinent information regarding the use, the site and the impacts of the use as set forth in guideline 1.6, and a balancing of their relative significance, that the benefits resulting from the proposed use would clearly outweigh the adverse impacts resulting from non compliance with the modified standard and there are no feasible and practical alternative locations, methods and practices for the use that are in compliance with the modified standard and: a) significant public benefits will result from the use, or; b) the use would serve important regional, state or national interests, including the national interest in resources and the siting of facilities in the coastal zone identified in the coastal resources program, or; the use is coastal water dependent. The systematic consideration process shall also result in a determination of those conditions necessary for the use to be in compliance with the guideline. Those conditions shall assure that the use is carried out utilizing those locations, methods and practices which maximize conformance to the modified standard; are technically, economically, environmentally, socially and legally feasible and practical and minimize or offset those adverse impacts listed in guideline 1.7 and in the guideline at issue.

Response: Acknowledged.

Guideline 1.9 Uses shall to the maximum extent practicable be designed and carried out to permit multiple concurrent uses which are appropriate for the location and to avoid unnecessary conflicts with other uses of the vicinity.

Response: The Nonstructural NED RP measures are located in previously disturbed residential and business areas and would only be unavailable for multiple concurrent uses during flood risk reduction construction activities. Following construction, areas subjected to construction impacts would be restored at least to their natural pre-construction condition using the best available restoration techniques, the best available practical techniques and BMPs to avoid, minimize and reduce potential adverse impacts to multiple concurrent uses Natural waterways would not be closed.

During dredging and construction activities, the NER RP nine marsh restoration and five shoreline protection measure sites, temporary access corridors and borrow sites would not be available for multiple concurrent uses. However, following dredging and construction activities and over the 50-year period of analysis, the NER RP measures would be available for, and provide even greater opportunities for multiple concurrent uses. The NER RP would restore, nourish and protect a net total of 14,035 net acres of transitional estuarine marsh, including 7,900 net acres from the nine marsh restoration measures and 6,135 net acres from the five shoreline protection measures. At the end of the 50 year period of analysis, the marsh restoration (2,700 AAHUs) and

shoreline protection measures (1,738 AAHUs) together would achieve a total net ecological benefit of 4,430 AAHUs. Whereas the chenier restoration measures analysis, would restore a net total of 1,413 net acres with 538 AAHUs. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts regarding potential for multiple concurrent uses which are appropriate for the location and to avoid unnecessary conflicts with other uses of the vicinity.

Guideline 1.10 These guidelines are not intended to be, nor shall they be, interpreted to allow expansion of governmental authority beyond that established by La. R.S. 49: 213.1 through 213.21, as amended; nor shall these guidelines be interpreted so as to require permits for specific uses legally commenced or established prior to the effective date of the coastal use permit program nor to normal maintenance or repair of such uses.

Response: Acknowledged.

1. GUIDELINES FOR LEVEES

Guideline 2.1 The leveeing of unmodified or biologically productive wetlands shall be avoided to the maximum extent practicable.

Response: Implementation of the Nonstructural NED RP and the NER RP would not involve the construction of levees. However, the Nonstructural NED RP includes construction of localized hurricane and storm surge risk reduction measures less than 6 feet in height around industrial complexes and warehouses that are eligible for the Project. These measures are intended to reduce the frequency of flooding but not eliminate floodplain management and flood insurance requirements. These risk reduction measures can be constructed of earth, concrete, masonry, or steel and placed around a single structure or a contiguous group of structures. Some local governments may have adopted floodplain management rules that exceed the minimum requirements of the NFIP, and may limit the ability of certain flood-proofing measures to be constructed if the effects of the localized storm surge risk reduction measures create the potential for drainage problems by displacing flood storage. The use of berms is for individual structures only and would not levee unmodified or biologically productive wetlands. The Nonstructural NED RP would provide reduced risk of hurricane and storm surge flood damage for a total of 3,961 impacted structures consisting of 3,462 eligible residential structures; 342 eligible commercial structures and public buildings; and 157 eligible industrial complexes and warehouses.

The NER RP would construct temporary containment/exclusion dikes at the nine marsh restoration sites to temporarily contain dredged sediments for marsh restoration and prevent dredged effluent from adversely impacting adjacent existing coastal restoration projects and other areas not designed to be restored or nourished. However, following de-watering and consolidation the temporary containment/exclusion dikes are expected to naturally degrade or they would be degraded at three years post-construction to allow for tidal exchange and aquatic organism access. The NER RP would also construct 251,528 linear feet of shoreline protection that could would reduce wave induced shoreline erosion to 6,135 net acres. The Nonstructural NED and NER RPs would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts regarding potential for leveeing of unmodified or biologically productive wetlands shall be avoided to the maximum extent practicable.

Guideline 2.2 Levees shall be planned and sited to avoid segmentation of wetland areas and systems to the maximum extent practicable.

Response: Implementation of the Nonstructural NED RP and the NER RP would not involve the construction of levees. However, the Nonstructural NED RP includes construction of localized storm surge risk reduction measures less than 6 feet in height around industrial complexes and warehouses that are eligible for the Project. However, this proposed action would not involve the construction of levees. The use of berms is for individual structures only and have been planned and sited to avoid segmentation of wetland areas and systems to the maximum extent practicable. The Nonstructural NED RP would utilize the best available

practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts regarding the potential to segment wetland areas and systems.

The NER RP would construct temporary containment/exclusion dikes at the nine marsh restoration sites to temporarily contain dredged sediments for marsh restoration and prevent dredged effluent from adversely impacting adjacent existing coastal restoration projects and other areas not designed to be restored or nourished. However, following de-watering and consolidation the temporary containment/exclusion dikes are expected to naturally degrade or they would be degraded at three years post-construction to allow for tidal exchange and aquatic organism access. The NER RP would also construct 251,528 linear feet of shoreline protection that could would reduce wave induced shoreline erosion to 6,135 net acres. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts regarding potential to segment wetland areas and systems.

Guideline 2.3 Levees constructed for the purpose of developing or otherwise changing the use of a wetland area shall be avoided to the maximum extent practicable.

Response: Implementation of the Nonstructural NED RP and the NER RP would not involve the construction of levees. However, the Nonstructural NED RP include construction of localized storm surge risk reduction measures less than 6 feet in height around industrial complexes and warehouses that are eligible for the Project. The proposed action would not involve the construction of levees. The use of berms is for individual structures and would not be constructed for the purpose of developing or otherwise changing the use of a wetland area. The Nonstructural NED RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts regarding the potential of developing or otherwise changing the use of a wetland area.

The NER RP would construct temporary containment/exclusion dikes at the nine marsh restoration sites to temporarily contain dredged sediments for marsh restoration and prevent dredged effluent from adversely impacting adjacent existing coastal restoration projects and other areas not designed to be restored or nourished. However, following de-watering and consolidation the temporary containment/exclusion dikes are expected to naturally degrade or they would be degraded at three years post-construction to allow for tidal exchange and aquatic organism access. The NER RP would also construct 251,528 linear feet of shoreline protection that could would reduce wave induced shoreline erosion to 6,135 net acres. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts regarding the potential of developing or otherwise changing the use of a wetland area.

Guideline 2.4 Hurricane and flood protection levees shall be located at the non-wetland/wetland interface or landward to the maximum extent practicable.

Response: Implementation of the Nonstructural NED RP and the NER RP would not involve the construction of levees. However, the Nonstructural NED RP include construction of localized storm surge risk reduction measures less than 6 feet in height around industrial complexes and warehouses that are eligible for the Project. The proposed action would not involve the construction of levees. The use of berms is for individual structures would typically be constructed landward of wetland areas; or, if necessary at the non-wetland/wetland interface. The Nonstructural NED RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to wetland areas.

By design, the NER RP would construct temporary containment/exclusion dikes at the nine marsh restoration sites to temporarily contain dredged sediments for marsh restoration and prevent dredged effluent from adversely impacting adjacent existing coastal restoration projects and other areas not designed to be restored or nourished. However, following de-watering and consolidation the temporary containment/exclusion dikes are expected to naturally degrade or they would be degraded at three years post-construction to allow for tidal exchange and aquatic organism access. By design, the NER RP would also construct 251,528 linear feet of shoreline protection that could would reduce wave induced shoreline erosion

to 6,135 net acres. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to wetland areas.

Guideline 2.5 Impoundment levees shall only be constructed in wetland areas as part of approved water or marsh management projects or to prevent release of pollutants.

Response: Implementation of the Nonstructural NED RP and the NER RP would not involve the construction of permanent impoundment levees or water or marsh management projects. However, the Non-structural NED RP include construction of localized storm surge risk reduction measures less than 6 feet in height around industrial complexes and warehouses that are eligible for the Project. The use of berms is for individual structures would typically be constructed landward of wetland areas; or, if necessary at the non-wetland/wetland interface. The Nonstructural NED RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to wetland areas and prevent the release of pollutants.

By design, the NER RP would construct temporary containment/exclusion dikes at the nine marsh restoration sites to temporarily contain dredged sediments for marsh restoration and prevent dredged effluent from adversely impacting adjacent existing coastal restoration projects and other areas not designed to be restored or nourished. However, following de-watering and consolidation the temporary containment/exclusion dikes are expected to naturally degrade or they would be degraded at three years post-construction to allow for tidal exchange and aquatic organism access. By design, the NER RP would also construct 251,528 linear feet of shoreline protection that could would reduce wave induced shoreline erosion to 6,135 net acres. However, the five shoreline protection measures would not function as impoundment levees. Rather, shoreline protection measures would reduce wave induced erosion to marsh. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to wetland areas and prevent the release of pollutants.

Guideline 2.6 Hurricane or flood protection levee systems shall be designed, built and thereafter operated and maintained utilizing best practical techniques to minimize disruptions of existing hydrologic patterns, and the interchange of water, beneficial nutrients and aquatic organisms between enclosed wetlands and those outside the levee system.

Response: Implementation of the Nonstructural NED RP and the NER RP would not involve the construction of hurricane or flood protection levee systems. However, by design the Nonstructural NED RP includes construction of localized storm surge risk reduction measures less than 6 feet in height around industrial complexes and warehouses that are eligible for the Project. The use of berms is for individual structures only and would be designed, built and thereafter operated and maintained utilizing best practical techniques to minimize disruptions of existing hydrologic patterns, and the interchange of water, beneficial nutrients and aquatic organisms between enclosed wetlands and those outside the proposed berm system. The Nonstructural NED RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to minimize disruptions of existing hydrologic patterns, the interchange of water, beneficial nutrients and aquatic organisms and wetlands.

By design, the NER RP would construct temporary containment/exclusion dikes at the nine marsh restoration sites to temporarily contain dredged sediments for marsh restoration and prevent dredged effluent from adversely impacting adjacent existing coastal restoration projects and other areas not designed to be restored or nourished. However, following de-watering and consolidation the temporary containment/exclusion dikes are expected to naturally degrade or they would be degraded at three years post-construction to allow for tidal exchange and aquatic organism access. By design, the NER RP would also construct 251,528 linear feet of shoreline protection that could would reduce wave induced shoreline erosion to 6,135 net acres. However, the five shoreline protection measures would not function as hurricane or flood protection levee systems. Rather, shoreline protection measures would reduce wave induced erosion to marsh. The NER RP would utilize the best available practical techniques and BMPs during dredging and construction to avoid and minimize potential

adverse impacts and to minimize disruptions of existing hydrologic patterns, the interchange of water, beneficial nutrients and aquatic organisms and wetlands.

2. GUIDELINES FOR LINEAR FACILITIES

Guidelines 3.1 through 3.16: **Guideline 3.1 Linear use alignments shall be planned to avoid adverse impacts on areas of high biological productivity or irreplaceable resource areas.**

Response: By design, the Nonstructural NED RP includes construction of flood proofing barriers or berms less than 6 feet in height around non-residential structures, primarily industrial complexes and warehouses. The use of berms is for individual structures only and have been planned to avoid adverse impacts on areas of high biological productivity or irreplaceable resource areas. These berms would be constructed in previously disturbed areas characterized as residential or businesses and would not adversely impact areas of high biological productivity or irreplaceable resource areas. The Nonstructural NED RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to avoid adverse impacts of high biological productivity or irreplaceable resource areas.

By design, the NER RP nine marsh restoration measures would include construction of temporary containment/exclusion dikes to contain dredged sediment and allow them to dewater and consolidate into marsh habitat. Following de-watering and consolidation, the temporary containment/exclusion dikes are expected to naturally degrade or would be degraded, if necessary, three years following construction to allow for tidal exchange and aquatic organism access. These temporary containment/exclusion dikes would not adversely impact areas of high biological productivity or irreplaceable resource areas. Rather, the nine marsh restoration measures would restore a net total of 7,900 net acres with 2,700 AAHUs. By design, the five shoreline protection/stabilization measures are designed to be linear facilities that would provide a total 251,528 linear feet of shoreline stabilization and protection of approximately 6,135 net acres and 1,738 AAHUs of marsh wetlands that are typically high in biological productivity in an area that is presently experiencing significant rates of land loss. The 35 chenier reforestation sites in Cameron and Vermilion Parishes would provide approximately 1,413 net acres over the 50 year period of analysis resulting in 538 AAHUs. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to avoid adverse impacts of high biological productivity or irreplaceable resource areas.

Guideline 3.2 Linear facilities involving the use of dredging or filling shall be avoided in wetland and estuarine areas to the maximum extent practicable.

Response: By design, the Nonstructural NED RP would not include dredging or filling in wetlands or estuarine areas. However, the Nonstructural NED RP includes construction of flood proofing barriers or berms less than 6 feet in height around non-residential structures, primarily industrial complexes and warehouses. The use of berms is for individual structures only and would be constructed in previously disturbed areas characterized as residential or businesses and are designed to avoid adverse impacts on wetlands and estuarine areas. The Nonstructural NED RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to avoid adverse impacts to wetlands and estuarine areas to the maximum extent practicable.

By design, the NER RP nine marsh restoration measures include the construction of temporary containment/exclusion dikes. Following de-watering and consolidation, the temporary containment/exclusion dikes are expected to naturally degrade or they would be degraded at three years following construction, if necessary, to allow for tidal exchange and aquatic organism access. By design the linear shoreline protection/stabilization measures are specifically designed to provide 251,528 linear feet of shoreline protection and stabilization for approximately 6,135 net acres and 1,738 AAHUs. Although not impacting wetlands or estuarine areas, the 35 chenier reforestation sites in Cameron and Vermilion Parishes would reforest approximately 1,413 net acres over the 50 year period of analysis, resulting in 538 AAHUs. The Nonstructural NED RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize

and reduce potential adverse impacts to avoid adverse impacts to wetlands and estuarine areas to the maximum extent practicable.

Guideline 3.3 Linear facilities involving dredging shall be of the minimum practical size and length.

Response: Acknowledged.

Guideline 3.4 To the maximum extent practicable, pipelines shall be installed through the "push ditch" method and the ditch backfilled.

Response: The NED and NER RP would not entail installation of any permanent pipelines. However, for NER RP marsh restoration measure 124c, the temporary dredge pipeline would be bored under Louisiana Highway 82. Following dredging and construction, the temporary pipeline boring would be refilled and the area restored to pre-construction conditions. All of the NER RP marsh restoration measures would involve the temporary use of hydraulic dredge pipelines to move sediments dredged from identified borrow sites to the identified nine marsh restoration sites. The dredge pipelines would be located along identified pipeline corridors that would be returned to pre-construction conditions following completion of marsh restoration activities. For the NER RP five shoreline protection measures, identified temporary access corridors would be dredged and then backfilled following completion of construction activities for the five shoreline protection measures. The Nonstructural NED RP and the NER RP would utilize the best available practical techniques and BMPs during construction to avoid and minimize potential adverse impacts to the surrounding aquatic and terrestrial environment.

Guideline 3.5 Existing corridors, rights of way, canals, and streams shall be utilized to the maximum extent practicable for linear facilities.

Response: Acknowledged. The Nonstructural NED RP measures of elevating, dry flood proofing, and construction of flood proofing barriers or berms of less than 6 feet in height would be constructed on previously disturbed residential and business areas. The Nonstructural NED RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts.

By design, dredging and construction of the NER RP measures would utilize, to the maximum extent practicable, existing corridors, rights of way, canals, and streams in construction of the nine marsh restoration measures, the five shoreline protection measures and the 35 chenier reforestation measures. Designated access routes (see Fact Sheets) would be repeatedly reused to the maximum extent practicable. During subsequent renourishment of the nine marsh restoration sites and maintenance of the shoreline protection measures, the initial access corridors would be re-utilized to the maximum extent practicable. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts.

Guideline 3.6 Linear facilities and alignments shall be, to the maximum extent practicable, designed and constructed to permit multiple uses consistent with the nature of the facility.

Response: By design, the only permanent linear measures of the Nonstructural NED RP would be construction of flood proofing barriers or berms less than 6 feet in height around non-residential structures, primarily industrial complexes and warehouses. During construction, the berm measures would be temporarily unavailable for multiple uses. Following construction, the berms would permit multiple uses consistent with the design purpose and nature of the berms and permit multiple uses.

By design, the NER RP nine marsh restoration measures include the construction of temporary containment/exclusion dikes. Following de-watering and consolidation, the temporary containment/exclusion dikes are expected to naturally degrade or they would be degraded at three years following construction, if necessary, to allow for tidal exchange and aquatic organism access. By design, the five linear shoreline protection/stabilization measures are specifically designed to provide 251,528 linear feet of shoreline protection

and stabilization for approximately 6,135 net acres and 1,738 AAHUs. These linear NER RP measures would be unavailable for multiple uses during dredging and construction activities. Following dredging and construction, these areas would permit multiple uses consistent with their design purpose and nature. Although not impacting wetlands or estuarine areas, the 35 chenier reforestation sites in Cameron and Vermilion Parishes would reforest approximately 1,413 net acres over the 50 year period of analysis, resulting in 538 AAHUs. The Nonstructural NED RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to avoid adverse impacts to wetlands and estuarine areas to the maximum extent practicable and permit multiple uses.

Guideline 3.7 Linear facilities involving dredging shall not traverse or adversely affect any barrier island.

Response: The Nonstructural NED RP and NER RP measures would not occur on or near any barrier islands. However, the NER RP marsh restoration measures 47a1, 47a2, 47c1, 124c, 127c3, and 306a1 would involve dredging borrow from the Gulf of Mexico and transporting, via dredge pipeline, to inland marsh restoration sites. Dredge pipelines used for restoration of measures 127c3 and 306a1 would generally follow existing canals and waterways. However, the dredge pipelines used for restoring measures 47a1, 47a2, 47c1, and 124c would cross barrier beach shoreline.

- Dredged material for construction of marsh restoration NER RP measure 47a1 material would be transported from the designated Gulf borrow site directly to the disposal site via hydraulic dredge pipeline, for a distance of approximately 6.7 miles (see Fact Sheet for Measure 47a1). Access for the pipeline would require a temporary designated access corridor approximately 30 feet wide, and would be placed along existing open-water canals to the extent practicable. Navigation traffic is not anticipated to be impacted. Any changes in beach topography resulting from placement of the dredge pipeline would be restored at least to their natural condition following construction, which would use the best available restoration techniques which improve the traversed area's ability to serve as a shoreline following pipeline removal.
- The following is applicable to NER RP measures 47a1, 47a2, and 47c1. The pipeline corridor is approximately 35,519 feet long (24 acres), and would require no dredging. Any changes in beach topography resulting from placement of the pipeline would be restored at least to their natural condition following construction, which would use the best available restoration techniques which improve the traversed area's ability to serve as a shoreline following pipeline removal. Piping plover critical habitat includes intertidal sand beaches (including sand flats) or mud flats (between the mean lower low water line and annual high tide) with no or very sparse emergent vegetation for feeding. Per USFWS protocol, the shoreline to vegetation line was digitized as a polygon, then buffered (on the water side) by 56 meters (184 feet) to approximate the mean lower-low water (MLLW) line. If necessary, a 100-foot wide bird abatement corridor across the beach would be maintained during construction to deter foraging, sheltering, and roosting of all potential migratory bird species. All construction activities shall observe a buffer zone of 1,000 feet for any colonial-nesting waterbird colonies (e.g., egrets, herons, ibis, pelicans, etc.), 1,300 feet for any shorebird nesting colonies (e.g., terns, gulls, plovers, skimmers, etc.), and 2,000 feet for any brown pelican nesting colonies near the project measure. USFWS and USACE biologists would survey the area before construction to confirm active nesting bird locations. A nesting bird abatement plan would be developed if one of the aforementioned nesting colonies falls within its respective buffer zone. Additionally, USFWS guidelines would be followed to avoid adverse impacts to the nesting colonies. Approximately 0.14 acres (200 feet long by 30 feet wide) of critical habitat is expected to be impacted temporarily by this measure. Conservation Measures would include: 1) Pipeline alignment and associated construction activities may be modified to reduce impacts to foraging, sheltering, and roosting. 2) Avoid impacts to the primary constituent elements (PCEs) of piping plover Critical Habitat to the maximum extent practicable; and 3) Evaluate the project area prior to design and construction for the presence of piping plover PCEs as a basis for minimizing potential impacts.
- Dredged material for construction of marsh restoration measure 47a2 would be transported from the designated Gulf borrow site directly to the disposal site via hydraulic dredge pipeline, for a distance of approximately 5.9 miles (see Fact Sheet for Measure 47a2). Access for the pipeline would require a

temporary designated access corridor approximately 30 feet wide, and would be placed along existing open-water canals to the extent practicable. Navigation traffic is not anticipated to be impacted. The pipeline corridor is approximately 30,898 feet long (21 acres), and would require no dredging. Any changes in beach topography resulting from placement of the pipeline would be restored at least to their natural condition following construction, which would use the best available restoration techniques which improve the traversed area's ability to serve as a shoreline following pipeline removal. Approximately 0.14 acres (200 feet long by 30 feet wide) of critical habitat for piping plover is expected to be impacted temporarily by this measure. See above description regarding beach topography, critical habitat, buffer zone and nesting bird abatement program and conservation measures.

- Dredged material for construction of marsh restoration measure 47c1 would be transported from the designated Gulf borrow site directly to the disposal site via hydraulic dredge pipeline, transported directly to the site via pipeline, for a distance of approximately 5.7 miles. Access for the pipeline would require a corridor approximately 30 feet wide, and would be placed along existing open-water canals to the extent practicable. Navigation traffic is not anticipated to be impacted. The pipeline corridor is approximately 29,858 feet long (21 acres), and would require no dredging. Any changes in beach topography resulting from placement of the pipeline would be restored at least to their natural condition following construction, which would use the best available restoration techniques which improve the traversed area's ability to serve as a shoreline following pipeline removal. See above description regarding beach topography, critical habitat, buffer zone and nesting bird abatement program and conservation measures.
- Dredged material for construction measure 124c would be transported directly to the site via pipeline, for a distance of approximately 1.8 miles. The pipeline access corridor would be approximately 30 feet wide, and would follow existing waterways to the extent possible. Navigation traffic is not anticipated to be impacted. The pipeline corridor is approximately 9,485 feet long (7.0 acres), and would require no dredging. The pipeline would cross approximately 500 feet (0.34 acres) of beach. The pipeline would be bored under Louisiana Highway 82. If necessary, a 100-foot wide bird abatement corridor across the beach would be maintained during construction to deter foraging, sheltering, and roosting of all potential migratory bird species. All construction activities shall observe a buffer zone of 1,000 feet for any colonial-nesting waterbird colonies (e.g., egrets, herons, ibis, pelicans, etc.), 1,300 feet for any shorebird nesting colonies (e.g., terns, gulls, plovers, skimmers, etc.), and 2,000 feet for any brown pelican nesting colonies near the project measure. USFWS and USACE biologists would survey the area before construction to confirm active nesting bird locations. A nesting bird abatement plan would be developed if one of the aforementioned nesting colonies falls within its respective buffer zone. Additionally, USFWS guidelines would be followed to avoid adverse impacts to the nesting colonies. Approximately 1.8 acres of critical habitat is expected to be temporarily impacted temporarily during construction of measure 124c. The best available practical techniques and BMPs would be used during construction to avoid and minimize potential adverse impacts to the barrier beach. See above description regarding beach topography, critical habitat, buffer zone and nesting bird abatement program and conservation measures.

NER RP shoreline protection measures 5a, 6b1, 6b2, and 6b3 located immediately offshore of the Gulf of Mexico barrier beach would provide a total of 180,545 linear feet of Gulf shoreline protection and stabilization to 4,847 net acres of back barrier marsh and 1,459 AAHUs over the 50 year period of analysis. The NER RP would utilize the best available practical techniques and BMPs during dredging and construction to avoid, minimize and reduce potential adverse impacts to barrier islands or other barrier features.

Guideline 3.8 Linear facilities involving dredging shall not traverse beaches, tidal passes, protective reefs or other natural gulf shoreline unless no other alternative exists. If a beach, tidal pass, reef or other natural gulf shoreline must be traversed for a non navigation canal, they shall be restored at least to their natural condition immediately upon completion of construction. Tidal passes shall not be permanently widened or deepened except when necessary to conduct the use. The best available restoration techniques which improve the traversed area's ability to serve as a shoreline shall be used.

Response: See response to Guideline 3.7 above. The Nonstructural NED RP would not involve dredging or traversing beaches, tidal passes, protective reefs or other natural gulf shoreline features. The NER

RP impacts to barrier beaches described above for Guideline 3.7, are anticipated. The NER RP would not impact any other beaches, tidal passes, protective reefs or natural gulf shorelines. As described in response to Guideline 3.7 above, any dredging and construction impacts would be restored at least to their natural pre-construction condition, and this action would use the best available restoration techniques. The NER RP would utilize the best available practical techniques and BMPs to avoid, minimize and reduce potential adverse impacts to natural beaches, tidal passes, protective reefs or other natural gulf shorelines.

Guideline 3.9 Linear facilities shall be planned, designed, located and built using the best practical techniques to minimize disruption of natural hydrologic and sediment transport patterns, sheet flow, and water quality, and to minimize adverse impacts on wetlands.

Response: Acknowledged. See also above responses to linear facilities guidelines, especially for 1.7(h) and 1.7(i). The Nonstructural NED RP would provide reduced risk of hurricane and storm surge flood damage for a total of 3,961 impacted structures consisting of 3,462 eligible residential structures; 342 eligible commercial structures and public buildings; and 157 eligible industrial complexes and warehouses. The Nonstructural NED RP would utilize the best available practical techniques and BMPs to avoid, minimize and reduce potential adverse impacts to minimize disruption of natural hydrologic and sediment transport patterns, sheet flow, and water quality, and to minimize adverse impacts on wetlands.

The NER RP would protect, restore, and nourish a net total of 14,035 net acres of transitional estuarine marsh (including 7,900 net acres from the nine marsh restoration measures and 6,135 net acres from the five shoreline protection measures). At the end of the 50 year period of analysis, the marsh restoration and shoreline protection measures together would achieve a total net ecological benefit of 4,430 AAHUs; with 2,700 AAHUs from the nine marsh restoration measures, and 1,738 AAHUs from the five shoreline protection measures. The chenier restoration measures would reforest, in Cameron and Vermilion Parishes, a net total of 1,413 net acres with 538 AAHUs. The NER RP would utilize the best available practical techniques and BMPs to avoid, minimize and reduce potential adverse impacts to minimize disruption of natural hydrologic and sediment transport patterns, sheet flow, and water quality, and to minimize adverse impacts on wetlands.

Guideline 3.10 Linear facilities shall be planned, designed, and built using the best practical techniques to prevent bank slumping and erosion, saltwater intrusion, and to minimize the potential for inland movement of storm generated surges. Consideration shall be given to the use of locks in navigation canals and channels which connect more saline areas with fresher areas.

Response: Acknowledged. See also above responses to linear facilities guidelines, especially for 1.7(h). By design, the Nonstructural NED RP would provide reduced risk of hurricane and storm surge flood damage for a total of 3,961 impacted structures consisting of 3,462 eligible residential structures; 342 eligible commercial structures and public buildings; and 157 eligible industrial complexes and warehouses. The Nonstructural NED RP would utilize the best available practical techniques and BMPs to avoid, minimize and reduce potential adverse impacts and to prevent bank slumping and erosion, saltwater intrusion, and to minimize the potential for inland movement of storm generated surges.

By design, the NER RP would protect, restore, and nourish a net total of 14,035 net acres of transitional estuarine marsh (including 7,900 net acres from the nine marsh restoration measures and 6,135 net acres from the five shoreline protection measures). At the end of the 50 year period of analysis, the marsh restoration and shoreline protection measures together would achieve a total net ecological benefit of 4,430 AAHUs; with 2,700 AAHUs from the nine marsh restoration measures, and 1,738 AAHUs from the five shoreline protection measures. The chenier restoration measures would reforest, in Cameron and Vermilion Parishes, a net total of 1,413 net acres with 538 AAHUs. The NER RP would utilize the best available practical techniques and BMPs to avoid, minimize and reduce potential adverse impacts and to prevent bank slumping and erosion, saltwater intrusion, and to minimize the potential for inland movement of storm generated surges.

Guideline 3.11 All non-navigation canals, channels and ditches which connect more saline areas with fresher areas shall be plugged at all waterway crossings and at intervals between crossings in order to compartmentalize them. The plugs shall be properly maintained.

Response: The Nonstructural NED RP and NER RP would not construct any permanent channels or canals that would adversely affect salinity patterns. By design, however, the NER RP would construct temporary access corridors for dredge pipeline to construct the nine marsh restoration measures. In addition, construction of the five shoreline protection measures would require dredging floatation access for construction equipment and material barges.

- Measure 5a flotation access channels are anticipated for access to the site for construction equipment and material barges. Flotation access along the alignment would be limited to an 80-foot bottom width channel not to exceed an elevation of -7.0 feet (NAVD88), with a top width of 130 feet and 3:1 side slopes. Floatation access channels would be dredged perpendicular to the shoreline out to the -7.0 foot (NAVD88) contour every 2,500 feet. Approximately 479 acres are anticipated to be dredged for the access channels. Material removed from the access channel via mechanical dredge would be sidecast adjacent to the channel, and returned after construction. Approximately 462 acres are anticipated to be impacted by material removed from the access channels.
- Measure 6b1 flotation access channels are anticipated for access to the site for construction equipment and material barges. Flotation access along the alignment would be limited to an 80-foot bottom width channel not to exceed an elevation of -7.0 feet (NAVD88), with a top width of 130 feet and 3:1 side slopes. Floatation access channels would be dredged perpendicular to the shoreline out to the -7.0 foot (NAVD88) contour every 2,500 feet. Approximately 725 acres are anticipated to be dredged for the access channels. Material removed from the access channel via mechanical dredge (clamshell or bucket) would be sidecast adjacent to the channel, and returned after construction. Approximately 711 acres are anticipated to be impacted by material removed from the access channels.
- Measure 6b2 flotation access channels are anticipated for access to the site for construction equipment and material barges. Flotation access along the alignment would be limited to an 80-foot bottom width channel not to exceed an elevation of -7.0 feet (NAVD88), with a top width of 130 feet and 3:1 side slopes. Floatation access channels would be dredged perpendicular to the shoreline out to the -7.0 foot (NAVD88) contour every 2,500 feet. Approximately 507 acres are anticipated to be dredged for the access channels. Material removed from the access channel via mechanical dredge (clamshell or bucket) would be sidecast adjacent to the channel, and returned after construction. Approximately 497 acres are anticipated to be impacted by material removed from the access channels.
- Measure 6b3 flotation dredging is anticipated for access to the site for construction equipment and material barges. Flotation excavation along the alignment would be limited to an 80-foot bottom width channel not to exceed an elevation of -7.0 feet (NAVD88), with a top width of 130 feet and 3:1 side slopes. Floatation access channels would be dredged perpendicular to the shoreline out to the -7.0 foot (NAVD88) contour every 2,500 feet. Approximately 372 acres are anticipated to be dredged for the access channels. Material removed from the access channel via mechanical dredge (clamshell or bucket) would be sidecast adjacent to the channel, and returned after construction. Approximately 289 acres are anticipated to be impacted by material removed from the access channels.

The NER RP would utilize the best available practical techniques and BMPs to avoid, minimize and reduce potential adverse impacts and to ensure, if necessary, that connections between more saline areas with fresher areas shall be plugged and properly maintained, to the maximum extent practicable.

Guideline 3.12 The multiple use of existing canals, directional drilling and other practical techniques shall be utilized to the maximum extent practicable to minimize the number and size of access canals,

to minimize changes of natural systems and to minimize adverse impacts on natural areas and wildlife and fisheries habitat.

Response: The Nonstructural NED RP would not entail using canals, directional drilling or access canals. Rather, the Nonstructural NED RP would include: 1) elevating eligible residential structures; 2) dry flood proofing of eligible non-residential structures, excluding large warehouses and industrial complexes; and 3) construction of flood proofing barriers or berms less than 6 feet in height around non-residential structures, primarily industrial complexes and warehouses. These areas are characterized as previously disturbed residential and business areas that are not natural areas or wildlife and fishery habitats. The Nonstructural NED RP would utilize the best available practical techniques and BMPs to avoid, minimize and reduce potential adverse impacts by the multiple by using existing canals, directional drilling and other practical techniques to the maximum extent practicable to minimize the number and size of access canals, to minimize changes of natural systems and to minimize adverse impacts on natural areas and wildlife and fisheries habitat.

Construction of the NER RP marsh restoration measures 47a1, 47a2, 47c1 would, by design, entail the use of the same access routes and natural canals for routing dredge pipelines from the borrow sites to the marsh restoration sites. Any areas subjected to construction impacts would be restored at least to their natural pre-construction condition, and this action would use the best available restoration techniques and BMPs to avoid changes of natural systems and adverse impacts on wildlife and fisheries habitat. In some instances, directing the dredge pipeline along the retention/exclusion dike borrow canal would allow the pipeline to avoid impacts to existing ridges and other significant landscape features. Where such features would need to be crossed, the best available practical techniques and BMPs for marsh buggy use would be applied (LDNR & LDWF 2000) and the area would be restored to pre-construction condition. Although it is anticipated that a marsh buggy would be used to place the dredge pipeline across the barrier beach for construction of marsh restoration measures 47a1, 47a2, 47c1, and 124c, the use of alternative techniques would also be considered to further avoid and minimize adverse impacts to natural areas and wildlife and fisheries habitat. The NER RP would utilize the best available practical techniques and BMPs to avoid, minimize and reduce potential adverse impacts by the multiple by using existing canals, directional drilling and other practical techniques to the maximum extent practicable to minimize the number and size of access canals, to minimize changes of natural systems and to minimize adverse impacts on natural areas and wildlife and fisheries habitat.

Guideline 3.13 All pipelines shall be constructed in accordance with parts 191, 192, and 195 of Title 49 of the Code of Federal Regulations, as amended, and in conformance with the Commissioner of Conservation's Pipeline Safety Rules and Regulations and those safety requirements established by La. R. S. 45:408, whichever would require higher standards.

Response: Acknowledged. The Nonstructural NED RP and NER RP would not entail using permanent pipelines. Rather, the nonstructural NED RP would include: 1) elevating eligible residential structures; 2) dry flood proofing of eligible non-residential structures, excluding large warehouses and industrial complexes; and 3) construction of flood proofing barriers or berms less than 6 feet in height around non-residential structures, primarily industrial complexes and warehouses. These areas are characterized as previously disturbed residential and business areas that are not natural areas or wildlife and fishery habitats. The Nonstructural NED RP would utilize the best available practical techniques and BMPs to avoid, minimize and reduce potential adverse impacts and insure safety requirements are at the highest standards consistent with existing laws, rules, and regulations.

The NER RP would, by design, temporarily use dredge pipelines to move sediments from designated borrow sites to the designated nine marsh restoration sites. For NER RP marsh restoration measure 124c, the temporary dredge pipeline would be bored under Louisiana Highway 82. Following dredging and construction, the temporary pipeline boring would be refilled and the area restored to pre-construction conditions. All of the NER RP marsh restoration measures would involve the temporary use of hydraulic dredge pipelines to move sediments dredged from identified borrow sites to the identified nine marsh restoration sites. The dredge pipelines would be located along identified pipeline corridors that would be returned to pre-construction

conditions following completion of marsh restoration activities. The NER RP would utilize the best available practical techniques and BMPs to avoid, minimize and reduce potential adverse impacts and insure safety requirements are at the highest standards consistent with existing laws, rules, and regulations.

Guideline 3.14 Areas dredged for linear facilities shall be backfilled or otherwise restored to the preexisting conditions upon cessation of use for navigation purposes to the maximum extent practicable.

Response: Acknowledged. The Nonstructural NED RP would not entail dredging for linear facilities. By design, however, the NER RP would construct temporary access corridors for dredge pipeline to construct the nine marsh restoration measures. In addition, construction of the five shoreline protection measures would require dredging floatation access for construction equipment and material barges.

- Measure 5a flotation access channels are anticipated for access to the site for construction equipment and material barges. Flotation access along the alignment would be limited to an 80-foot bottom width channel not to exceed an elevation of -7.0 feet (NAVD88), with a top width of 130 feet and 3:1 side slopes. Floatation access channels would be dredged perpendicular to the shoreline out to the -7.0 foot (NAVD88) contour every 2,500 feet. Approximately 479 acres are anticipated to be dredged for the access channels. Material removed from the access channel via mechanical dredge would be sidecast adjacent to the channel, and returned after construction. Approximately 462 acres are anticipated to be impacted by material removed from the access channels.
- Measure 6b1 flotation access channels are anticipated for access to the site for construction equipment and material barges. Flotation access along the alignment would be limited to an 80-foot bottom width channel not to exceed an elevation of -7.0 feet (NAVD88), with a top width of 130 feet and 3:1 side slopes. Floatation access channels would be dredged perpendicular to the shoreline out to the -7.0 foot (NAVD88) contour every 2,500 feet. Approximately 725 acres are anticipated to be dredged for the access channels. Material removed from the access channel via mechanical dredge (clamshell or bucket) would be sidecast adjacent to the channel, and returned after construction. Approximately 711 acres are anticipated to be impacted by material removed from the access channels.
- Measure 6b2 flotation access channels are anticipated for access to the site for construction equipment and material barges. Flotation access along the alignment would be limited to an 80-foot bottom width channel not to exceed an elevation of -7.0 feet (NAVD88), with a top width of 130 feet and 3:1 side slopes. Floatation access channels would be dredged perpendicular to the shoreline out to the -7.0 foot (NAVD88) contour every 2,500 feet. Approximately 507 acres are anticipated to be dredged for the access channels. Material removed from the access channel via mechanical dredge (clamshell or bucket) would be sidecast adjacent to the channel, and returned after construction. Approximately 497 acres are anticipated to be impacted by material removed from the access channels.
- Measure 6b3 flotation dredging is anticipated for access to the site for construction equipment and material barges. Flotation excavation along the alignment would be limited to an 80-foot bottom width channel not to exceed an elevation of -7.0 feet (NAVD88), with a top width of 130 feet and 3:1 side slopes. Floatation access channels would be dredged perpendicular to the shoreline out to the -7.0 foot (NAVD88) contour every 2,500 feet. Approximately 372 acres are anticipated to be dredged for the access channels. Material removed from the access channel via mechanical dredge (clamshell or bucket) would be sidecast adjacent to the channel, and returned after construction. Approximately 289 acres are anticipated to be impacted by material removed from the access channels.

The NER RP would utilize the best available practical techniques and BMPs to avoid, minimize and reduce potential adverse impacts by backfilling or otherwise restoring work sites to the pre-existing conditions upon cessation of dredging and construction to the maximum extent practicable.

Guideline 3.15 The best practical techniques for site restoration and re-vegetation shall be utilized for all linear facilities.

Response: Acknowledged. The Nonstructural NED RP and the NER RP would utilize the best available practical techniques and BMPs during dredging and construction to avoid, minimize and reduce potential adverse impacts and restore and re-vegetate for all linear project measures (e.g., berms of less than 6 foot elevation and temporary containment/exclusion dikes). Marsh restoration sites are anticipated to naturally revegetate. Shoreline protection measures, by design, would not revegetate. Any areas subjected to dredging or construction impacts would be restored based upon their design intent, at least to their natural pre-construction condition, and this action would utilize the best available practical techniques for site restoration and re-vegetation and BMPs to avoid, minimize and reduce potential adverse impacts.

Guideline 3.16 Confined and dead end canals shall be avoided to the maximum extent practicable. Approved canals must be designed and constructed using the best practical techniques to avoid water stagnation and eutrophication.

Response: Acknowledged. The Nonstructural NED RP would not entail design or use of confined or dead end canals. By design, however, the NER RP would construct temporary access corridors for dredge pipelines to construct the nine marsh restoration measures. In addition, construction of the five shoreline protection measures would require dredging floatation access for construction equipment and material barges.

- Measure 5a flotation access channels are anticipated for access to the site for construction equipment and material barges. Flotation access along the alignment would be limited to an 80-foot bottom width channel not to exceed an elevation of -7.0 feet (NAVD88), with a top width of 130 feet and 3:1 side slopes. Floatation access channels would be dredged perpendicular to the shoreline out to the -7.0 foot (NAVD88) contour every 2,500 feet. Approximately 479 acres are anticipated to be dredged for the access channels. Material removed from the access channel via mechanical dredge would be sidecast adjacent to the channel, and returned after construction. Approximately 462 acres are anticipated to be impacted by material removed from the access channels.
- Measure 6b1 flotation access channels are anticipated for access to the site for construction equipment and material barges. Flotation access along the alignment would be limited to an 80-foot bottom width channel not to exceed an elevation of -7.0 feet (NAVD88), with a top width of 130 feet and 3:1 side slopes. Floatation access channels would be dredged perpendicular to the shoreline out to the -7.0 foot (NAVD88) contour every 2,500 feet. Approximately 725 acres are anticipated to be dredged for the access channels. Material removed from the access channel via mechanical dredge (clamshell or bucket) would be sidecast adjacent to the channel, and returned after construction. Approximately 711 acres are anticipated to be impacted by material removed from the access channels.
- Measure 6b2 flotation access channels are anticipated for access to the site for construction equipment and material barges. Flotation access along the alignment would be limited to an 80-foot bottom width channel not to exceed an elevation of -7.0 feet (NAVD88), with a top width of 130 feet and 3:1 side slopes. Floatation access channels would be dredged perpendicular to the shoreline out to the -7.0 foot (NAVD88) contour every 2,500 feet. Approximately 507 acres are anticipated to be dredged for the access channels. Material removed from the access channel via mechanical dredge (clamshell or bucket) would be sidecast adjacent to the channel, and returned after construction. Approximately 497 acres are anticipated to be impacted by material removed from the access channels.
- Measure 6b3 flotation dredging is anticipated for access to the site for construction equipment and material barges. Flotation excavation along the alignment would be limited to an 80-foot bottom width channel not to exceed an elevation of -7.0 feet (NAVD88), with a top width of 130 feet and 3:1 side slopes. Floatation access channels would be dredged perpendicular to the shoreline out to

the -7.0 foot (NAVD88) contour every 2,500 feet. Approximately 372 acres are anticipated to be dredged for the access channels. Material removed from the access channel via mechanical dredge (clamshell or bucket) would be sidecast adjacent to the channel, and returned after construction. Approximately 289 acres are anticipated to be impacted by material removed from the access channels.

The NER RP would utilize the best available practical techniques and BMPs to avoid, minimize and reduce potential adverse impacts by avoiding dredging confined or dead end canals, to the maximum extent practicable, and designing and constructing temporary floatation access canals using the best practical techniques to avoid water stagnation and eutrophication.

3. GUIDELINES FOR DREDGED MATERIAL DEPOSITION

Guideline 4.1 Spoil shall be deposited utilizing the best practical techniques to avoid disruption of water movement, flow, circulation and quality.

Response: The Nonstructural NED RP would not utilize or deposit dredged spoil. However the NER RP nine marsh restoration measures, by design, would require dredging a total of approximately 62,428,722 cy of borrow to initially create and restore a total of 11,666 acres of transitional estuarine marsh habitat. For all nine mash restoration measures, dredged sediments would be deposited utilizing the best practical techniques to avoid disruption of water movement, flow, circulation and quality. Temporary floatation and access corridors would be dredged for not only the nine marsh restoration measures but also the five shoreline protection measures (see response to Guideline 3.16, above). Dredged material would be initially side cast and then, following completion of dredging and construction activities, the side cast material would be returned to the temporary floatation and access corridor. Dredging and construction could cause temporary and localized disruption of water movement, flows, circulation and quality. These temporary and localized impacts could include increased turbidity and total suspended sediments, organic enrichment, chemical leaching, reduced dissolved oxygen, and elevated carbon dioxide levels, among others. Construction of temporary containment/exclusion dikes for the nine marsh restoration measures would prevent dredged effluent from entering nearby areas such as existing coastal restoration projects restoration projects. The NER RP would utilize the best available practical techniques for dredged material deposition and BMPs to avoid, minimize and reduce potential adverse impacts and avoid disruption of water movement, flow, circulation and quality.

Guideline 4.2 Spoil shall be used beneficially to the maximum extent practicable to improve productivity or create new habitat, reduce or compensate for environmental damage done by dredging activities, or prevent environmental damage. Otherwise, existing spoil disposal areas or upland disposal shall be utilized to the maximum extent practicable rather than creating new disposal areas.

Response: The Nonstructural NED RP would not utilize dredged spoil. Construction of the NER RP nine marsh restoration measures, by design, would require dredging a total of approximately 62,428,722 cy of borrow to initially create and restore a total of 11,666 acres of transitional estuarine marsh habitat. This action would help reduce and compensate for the widespread coastal land loss, due to both natural and human causes, currently being experienced in the Southwest Coastal Louisiana project area and throughout coastal Louisiana. No environmental damage is anticipated from proposed dredging activities. Upland disposal is not anticipated. The NER RP would utilize the best available practical techniques for dredged material deposition and BMPs to avoid, minimize and reduce potential adverse impacts.

Guideline 4.3 Spoil shall not be disposed of in a manner which could result in the impounding or draining of wetlands or the creation of development sites unless the spoil deposition is part of an approved levee or land surface alteration project.

Response: The Nonstructural NED RP would not utilize dredged spoil. Construction of the NER RP nine marsh restoration measures, by design, would require dredging a total of approximately 62,428,722 cy of borrow to initially create and restore a total of 11,666 acres of transitional estuarine marsh habitat. Permanent

impounding or draining of wetlands or the creation of development sites is not anticipated. For marsh restoration measures, temporary earthen containment/exclusion dikes would be constructed from in-situ material located within the marsh restoration/nourishment area using a mechanical dredge. The in-situ borrow area used for construction of the earthen containment/exclusion dikes would be refilled during placement of dredged material for construction of the nine marsh restoration measures. The temporary containment/exclusion dikes would naturally degrade or would be breached in multiple places at three years following construction, if necessary, to restore fish access if natural degradation is not sufficient. Breach locations would correspond to weir locations. Any areas subjected to construction impacts would be restored at least to their natural pre-construction condition, and this action would use the best available restoration techniques. The NER RP would utilize the best available practical techniques for dredged material deposition and BMPs to avoid, minimize and reduce potential adverse impacts and prevent impounding or draining of existing wetlands.

Guideline 4.4 Spoil shall not be disposed of on marsh, known oyster or clam reefs or in areas of submersed vegetation to the maximum extent practicable.

Response: The Nonstructural NED RP would not utilize dredged spoil. Construction of the NER RP nine marsh restoration measures, by design, would require dredging a total of approximately 62,428,722 cy of borrow to initially create and restore a total of 11,666 acres of transitional estuarine marsh habitat. Dredged sediments would be used to restore existing fragmented and degraded marsh and shallow open water areas to create new transitional estuarine marsh. Dredged material would not be disposed of on known oyster or clam reefs or in areas of submersed vegetation, to the maximum extent practicable. Coordination with the Louisiana Department of Wildlife and Fisheries has been initiated for determining potential impacts to oyster and clam resources managed by LDWF. At the time of construction, additional coordination with LDWF would be conducted to ensure no new oyster or clam reefs have developed in the project measure area. Although the temporary access corridor for measure 3c1crosses the Calcasieu Lake Public Oyster Area, no dredging is anticipated to be required. The dredge pipeline temporary access corridors would follow the previously approved temporary access corridor used for repairing the Cameron-Creole Watershed levee after Hurricane Rita. The NER RP would utilize the best available practical techniques for dredged material deposition and BMPs to avoid, minimize and reduce potential adverse impacts.

Guideline 4.5 Spoil shall not be disposed of in such a manner as to create a hindrance to navigation or fishing, or hinder timber growth.

Response: The Nonstructural NED RP would not utilize dredged spoil. Construction of the NER RP nine marsh restoration measures, by design, would require dredging a total of approximately 62,428,722 cy of borrow to initially create and restore a total of 11,666 acres of transitional estuarine marsh habitat. The placement of dredged material for purposes of marsh restoration and the dredging of temporary floatation and access corridors would not create a hindrance to navigation or fishing, or hinder timber growth. The NER RP would utilize the best available practical techniques for dredged material deposition and BMPs to avoid, minimize and reduce potential adverse impacts and not create a hindrance to navigation, fishing or hinder timber growth.

Guideline 4.6 Spoil disposal areas shall be designed and constructed and maintained using the best practical techniques to retain the spoil at the site, reduce turbidity, and reduce shoreline erosion when appropriate.

Response: The Nonstructural NED RP would not utilize dredged spoil. Construction of the NER RP nine marsh restoration measures, by design, would require dredging a total of approximately 62,428,722 cy of borrow to initially create and restore a total of 11,666 acres of transitional estuarine marsh habitat. Best management practices would be employed to retain dredged material and minimize turbidity resulting from dredging activities. Outflow weir locations are indicated on the Fact Sheet maps. Turbidity control measures are not anticipated to be required, since the outflow weirs are located to direct dredged effluent outflow into

existing fragmented marsh areas to be entrained and nourish these fragmented and degrading marshes. Any areas subjected to construction impacts would be restored at least to their natural pre-construction condition, and this action would use the best available restoration techniques. For temporary access corridor dredging and refilling, if needed, the use of a mechanical dredge (e.g., clam-shell dredge) rather that a hydraulic dredge would reduce the resuspension of sediments. No additional turbidity reduction measures are anticipated to be required for this activity. By design, the five shoreline protection measures would provide 251,528 linear feet of shoreline protection and stabilization resulting over the 50 year period of analysis protection of 6,135 net acres and 1,738 AAHUs. The NER RP would utilize the best available practical techniques for dredged material deposition and BMPs to avoid, minimize and reduce potential adverse impacts and retain spoil at the site, reduce turbidity, and reduce shoreline erosion.

Guideline 4.7 The alienation of state owned property shall not result from spoil deposition activities without the consent of the Department of Natural Resources.

Response: The Nonstructural NED RP and the NER RP would not result in the alienation of state owned property.

4. GUIDELINES FOR SHORELINE MODIFICATION

Guideline 5.1 Nonstructural methods of shoreline protection shall be utilized to the maximum extent practicable.

Response: Acknowledged. The Nonstructural NED RP would not involve shoreline modification. The NER RP five shoreline protection measures, by design, would utilize non-structural methods of shoreline protection and stabilization to the maximum extent practicable. Approximately 3,595,330 tons of rock, 1,958,625 square yards of geotextile fabric, and 1,115,190 tons of lightweight aggregate would be used to create 251,528 linear feet of shoreline protection/stabilization that would benefit a total of 6,135 net acres and 1,738 AAHUs over the 50 year period of analysis. For shoreline protection measure 16b, a foreshore rock dike would be constructed at the -2.0 foot NAVD88 contour, and would not be connected to the shoreline. For shoreline protection measures 5a, 6b1, 6b2, and 6b3, offshore breakwaters would be constructed, which would not be connected to the shoreline. The NER RP would utilize the best available practical techniques for shoreline modification and BMPs to avoid, minimize and reduce potential adverse impacts.

Guideline 5.2 Shoreline modification structures shall be designed and built using best practical techniques to minimize adverse environmental impacts.

Response: Acknowledged. The Nonstructural NED RP would not involve shoreline modification. The NER RP, by design, would utilize non-structural methods of shoreline protection to the maximum extent practicable. Approximately 3,595,330 tons of rock, 1,958,625 square yards of geotextile fabric, and 1,115,190 tons of lightweight aggregate would be used to create 251,528 linear feet of shoreline protection that would benefit a total of 6,135 net acres and 1,738 AAHUs over the 50 year period of analysis. Shoreline protection structures would be designed and built using best practical techniques to minimize adverse environmental impacts. Temporary construction and floatation access for the shoreline protection measures (measures 16b, 5a, 6b1, 6b2, and 6b3) would be from offshore to avoid impacts to existing beach and wetland habitat. Side cast spoil from dredging the floatation and access corridor would be returned following completion of construction. The NER RP would utilize the best available practical techniques for shoreline modification and BMPs to avoid, minimize and reduce potential adverse impacts and minimize adverse environmental impacts.

Guideline 5.3 Shoreline modification structures shall be lighted or marked in accordance with U.S. Coast Guard regulations, not interfere with navigation, and should foster fishing, other recreational opportunities, and public access.

Response: Acknowledged. The Nonstructural NED RP would not involve shoreline modification. There are no NER RP shoreline modification structures which would require lighting or marking in accordance

with U.S. Coast Guard regulations. Signage would be included if and where necessary to alert boaters to the presence of measures, such as breakwaters. The proposed shoreline modification measures would not interfere with navigation, and would foster fishing, other recreational opportunities, and public access to the maximum extent practicable. The NER RP would utilize the best available practical techniques for shoreline modification and BMPs to avoid, minimize and reduce potential adverse impacts and not interfere with navigation, foster fishing and other recreational opportunities, and public access.

Guideline 5.4 Shoreline modification structures shall be built using best practical materials and techniques to avoid the introduction of pollutants and toxic substances into coastal waters.

Response: Acknowledged. The Nonstructural NED RP would not involve shoreline modification. The NER RP five shoreline protection measures, by design, shall be designed and built using best practical materials and techniques to avoid the introduction of pollutants and toxic substances into coastal waters. Approximately 3,595,330 tons of rock, 1,958,625 square yards of geotextile fabric, and 1,115,190 tons of lightweight aggregate would be used to create 251,528 linear feet of shoreline protection that would benefit a total of 6,135 net acres and 1,738 AAHUs over the 50 year period of analysis. The NER RP would be constructed using the best available practical techniques for shoreline modification and BMPs to avoid, minimize and reduce potential introduction of pollutants and toxic substances into coastal waters.

Guideline 5.5 Piers and docks and other harbor structures shall be designed and built using best practical techniques to avoid obstruction of water circulation.

Response: The Nonstructural NED RP and NER RP do not propose any piers, docks, or other harbor structures that would obstruct water circulation. The NER RP five shoreline protection measures, by design, shall be designed and built using best practical materials and techniques to avoid the introduction of pollutants and toxic substances into coastal waters. Approximately 3,595,330 tons of rock, 1,958,625 square yards of geotextile fabric, and 1,115,190 tons of lightweight aggregate would be used to create 251,528 linear feet of shoreline protection that would benefit a total of 6,135 net acres and 1,738 AAHUs over the 50 year period of analysis. The NER RP would be designed and built using the best available practical techniques for shoreline modification and BMPs to avoid, minimize and reduce the potential obstruction of water circulation.

Guideline 5.6 Marinas, and similar commercial and recreational developments shall to the maximum extent practicable not be located so as to result in adverse impacts on open productive oyster beds, or submersed grass beds.

Response: The Nonstructural NED RP and NER RP do not propose any marinas, or commercial or recreational developments. For NER RP measure 306a1, the dredge pipeline temporary access corridor for marsh restoration would cross the Calcasieu Lake Public Oyster Area. However, no dredging is anticipated to be required for this temporary dredge pipeline access. Rather, the dredge pipeline temporary access corridors would follow the previously approved temporary access corridor used for repairing the Cameron-Creole Watershed levee after Hurricane Rita. The Nonstructural NED RP and NER RP would utilize the best available practical techniques for dredging and construction and BMPs to avoid, minimize and reduce potential adverse impacts to open productive oyster beds and submersed grass beds.

Guideline 5.7 Neglected or abandoned shoreline modification structures, piers, docks, mooring and other harbor structures shall be removed at the owner's expense, when appropriate.

Response: The Nonstructural NED RP would not create or remove neglected or abandoned shoreline modification structures, piers, docks, mooring and other harbor structures. It is not anticipated that dredging and construction of the NER RP measures would require neglected or abandoned shoreline modification structures, piers, docks, mooring and other harbor structures to be removed. However, if such need should arise, the removal of any such structures would be at the owner's expense, if and when appropriate. The Nonstructural NED RP and NER RP would utilize the best available practical techniques for shoreline modification and BMPs to avoid, minimize and reduce potential adverse impacts and to remove neglected or

abandoned shoreline modification structures, piers, docks, mooring and other harbor structures at the owner's expense, when appropriate.

Guideline 5.8 Shoreline stabilization structures shall not be built for the purpose of creating fill areas for development unless part of an approved surface alteration use.

Response: The Nonstructural NED RP and the NER RP would not construct or operate any shoreline stabilization structures for the purpose of creating fill areas for development. The NER RP nine marsh restoration measures, by design, would utilize in=situ material to create temporary containment/exclusion dikes used to temporarily contain dredged sediments used to initially create 8,175 acres and nourish 3,430 for a total 11,666 acres restored resulting in 7,900 net acres over the 50 year period of analysis. The NER RP five shoreline protection measures would place 251,528 linear feet of shoreline protection that would protection 6,135 net acres over the 50 years of analysis. The NER RP would utilize the best available practical techniques for shoreline modification and BMPs to avoid, minimize and reduce potential adverse impacts to create marsh restoration and shoreline protection measures.

Guideline 5.9 Jetties, groins, breakwaters and similar structures shall be planned, designed and constructed so as to avoid to the maximum extent practicable downstream land loss and erosion.

Response: The Nonstructural NED RP would not plan, design, construct or otherwise implement any jetties, groins, breakwaters or similar structures. However, the NER RP includes four shoreline protection/stabilization measures using breakwaters that would prevent land loss and shoreline erosion.

- Measure 6b1 is 58,293 feet of Gulf shoreline protection consisting of a reef breakwater with a lightweight aggregate core; located approximately 150 feet offshore consisting of geotextile fabric and stone built to an 18-foot crest width.
- Measure 6b2 is 42,883 feet of Gulf shoreline protection consisting of a reef breakwater with a lightweight aggregate core; located approximately 150 feet offshore using geotextile fabric and stone built to an 18-foot crest width.
- Measure 6b3 is 33,355 feet of Gulf shoreline protection consisting of a reef breakwater with a lightweight aggregate core; located approximately 150 feet offshore using geotextile fabric and stone built to an 18-foot crest width.

No sediment starvation is expected to occur with the Gulf shoreline breakwater fields. Shoreline protection measures 6b1, 6b2, and 6b3 are located along the Gulf of Mexico shoreline of Rockefeller Refuge, which is a shell veneer covering marsh sediments. There is little long-shore movement of sediment in this type of system. Shoreline protection measure 5a would connect with the existing breakwater field west of Holly Beach, providing continuous protection to the shoreline from that existing breakwater field to the western Calcasieu Ship Channel jetty. The introduction of sands for the CS-33 project increased the sediment budget for this area, so that downstream sediment starvation is not expected to be a problem. The NER RP would utilize the best available practical techniques for ecosystem restoration and BMPs to avoid, minimize and reduce potential adverse impacts to avoid, to the maximum extent practicable downstream land loss and erosion.

5. GUIDELINES FOR SURFACE ALTERATIONS

Guideline 6.1 Industrial, commercial, urban, residential, and recreational uses are necessary to provide adequate economic growth and development. To this end, such uses will be encouraged in those areas of the coastal zone that are suitable for development. Those uses shall be consistent with the other guidelines and shall, to the maximum extent practicable, take place only:

a) on lands five feet or more above sea level or within fast lands; or

b) on lands which have foundation conditions sufficiently stable to support the use, and where flood and storm hazards are minimal or where protection from these hazards can be reasonably well achieved, and where the public safety would not be unreasonably endangered; and

1) the land is already in high intensity of development use, or

2) there is adequate supporting infrastructure, or
3) the vicinity has a tradition of use for similar habitation or development

Response: The Nonstructural NED RP would include: 1) elevating eligible residential structures; 2) dry flood proofing of eligible non-residential structures, excluding large warehouses and industrial complexes; and 3) construction of flood proofing barriers or berms less than 6 feet in height around non-residential structures, primarily industrial complexes and warehouses. These areas are characterized as previously disturbed residential and business areas that are not biologically productive or wetland areas. The Nonstructural NED RP would use the best available practical techniques and BMPs to avoid, minimize and reduce the potential for adverse economic or development impacts by providing risk reduction of hurricane and storm surge flood damage for a total of 3,961 impacted structures consisting of 3,462 eligible residential structures; 342 eligible commercial structures and public buildings; and 157 eligible industrial complexes and warehouses. Implementing the Nonstructural NED RP would reduce adverse economic impacts by reducing administrative costs and claims to the Federal Flood Insurance Program, under the FEMA, for repetitive flood insurance claims. This estimate is based upon present information and could change during implementation of the Nonstructural NED RP. The construction of the non-structural risk reduction measures would include encouragement of industrial, commercial, urban, residential, and recreational uses which provide adequate economic growth and development. Those uses would be consistent with the other guidelines.

The NER RP nine marsh restoration measures and five shoreline protection measures would restore, nourish and protect a total of 14,035 net acres (4,430 AAHUs) of transitional estuarine marsh over the 50 year period of analysis. The 35 chenier reforestation measures would reforest approximately 1,413 net acres (538 AAHUs) in Cameron and Vermilion Parishes over the 50 year period of analysis. These areas would be available for recreational uses and commercial and recreational fishing. The NER RP would utilize the best available practical techniques for ecosystem restoration and BMPs to avoid, minimize and reduce potential adverse impacts would be utilized.

Guideline 6.2 Public and private works projects such as levees, drainage improvements, roads, airports, ports, and public utilities are necessary to protect and support needed development and shall be encouraged. Such projects shall, to the maximum extent practicable, take place only when:
a) they protect or serve those areas suitable for development pursuant to Guideline 6.1; and b) they are consistent with the other guidelines; and c) they are consistent with all relevant adopted state, local and regional plans.

Response: The Nonstructural NED RP would, to the maximum extent practicable, protect and severe those areas suitable for development by implementing hurricane and storm surge risk reduction measures to a total of 3,961 impacted structures consisting of 3,462 eligible residential structures; 342 eligible commercial structures and public buildings; and 157 eligible industrial complexes and warehouses. This action would support existing development and shall, to the maximum extent practicable, take place only when they protect or serve those areas suitable for development pursuant to Guideline 6.1; and are consistent with the other guidelines; and are consistent with all relevant adopted state, local and regional plans. The Nonstructural NED RP would utilize the best available practical techniques for hurricane and storm surge risk reduction and BMPs to avoid, minimize and reduce potential adverse impacts and protect and support needed development.

The NER RP measures, by design, would not support or encourage development. Rather, the NER RP measures would protect, restore, and nourish a net total of 14,035 net acres of emergent marsh (including 7,900 net acres from the nine marsh restoration measures and 6,135 net acres from the five shoreline protection measures). At the end of the 50 year period of analysis, the marsh restoration and shoreline protection measures together would achieve a total net ecological benefit of 4,430 AAHUs; with 2,700 AAHUs from the nine marsh restoration measures, and 1,738 AAHUs from the five shoreline protection measures. Whereas the chenier restoration measures would restore a net total of 1,413 net acres with 538 AAHUs. The NER RP would utilize the best available practical techniques for ecosystem restoration and BMPs to avoid, minimize and reduce potential adverse impacts.

Guideline 6.3 BLANK (Deleted by Louisiana Department of Natural Resources)

Guideline 6.4 To the maximum extent practicable wetland areas shall not be drained or filled. Any approved drain or fill project shall be designed and constructed using best practical techniques to minimize present and future property damage and adverse environmental impacts.

Response: The Nonstructural NED RP would not drain or fill any wetlands. The Nonstructural NED RP measures are located on previously disturbed residential and business properties.

Permanent impounding or draining of wetlands or the creation of development sites is not proposed for the NER RP. Rather, the NER RP would protect, restore, and nourish a net total of 14,035 net acres of emergent marsh, including 7,900 net acres from the nine marsh restoration measures and 6,135 net acres from the five shoreline protection measures. Approximately 1,413 net acres from the 35 reforestation sites in Cameron and Vermilion Parishes would be reforested over the 50 year period of analysis. For marsh restoration measures, temporary earthen containment/exclusion dikes would be constructed from in-situ material located within the marsh restoration/nourishment area using a mechanical dredge. The borrow area used for construction of the earthen containment dike would refill during the placement of dredged material. Containment/exclusion dikes would be breached in multiple places at three years following construction, if necessary, to restore fish access if natural degradation is not sufficient. Breach locations would correspond to weir locations. Any areas subjected to construction impacts would be restored at least to their natural pre-construction condition, and this action would use the best available restoration techniques. The introduction of sediments using a hydraulic dredge to create a marsh platform would increase the acreage of wetlands in the project area, converting open water to transitional estuarine wetland habitat. The NER RP would utilize the best available practical techniques for ecosystem restoration and BMPs to avoid, minimize and reduce potential adverse impacts to minimize present and future property damage and adverse environmental impacts.

Guideline 6.5 Coastal water dependent uses shall be given special consideration in permitting because of their reduced choice of alternatives.

Response: Acknowledged. The Nonstructural NED RP does not include coastal water dependent uses. The NER RP would protect, restore, and nourish a total of 14,035 net acres of emergent marsh (including 7,900 net acres from the nine marsh restoration measures and 6,135 net acres from the five shoreline protection measures). Once constructed, the nine marsh restoration and five shoreline protection measures would enhance both the human and natural coastal water dependent uses. The approximately 35 reforestation sites in Cameron and Vermilion Parishes would reforest about 1,413 net acres over the 50 year period of analysis, resulting in 538 AAHUs. The NER RP would utilize the best available practical techniques for ecosystem restoration and BMPs to avoid, minimize and reduce potential adverse impacts.

Guideline 6.6 Areas modified by surface alteration activities shall, to the maximum extent practicable, be re-vegetated, refilled, cleaned and restored to their predevelopment condition upon termination of the use.

Response: The Nonstructural NED RP, by design, would include: 1) elevating eligible residential structures; 2) dry flood proofing of eligible non-residential structures, excluding large warehouses and industrial complexes; and 3) construction of flood proofing barriers or berms less than 6 feet in height around non-residential structures, primarily industrial complexes and warehouses. These areas are characterized as previously disturbed residential and business areas that are not biologically productive or wetland areas. Construction debris from elevated structures and flood proofed structures would be removed and the site cleaned and restored to pre-construction conditions or better upon completion of construction activities. By design, the less than 6 foot in height flood proofing barriers or berms would remain around non-residential structures, primarily industrial complexes and warehouses. Any construction debris would be removed and the site cleaned and restored to pre-construction conditions or better upon completion of construction activities. The Nonstructural NED RP would utilize the best available practical techniques for nonstructural hurricane

and storm damage risk reduction and BMPs to avoid, minimize and reduce potential adverse impacts and return the area to preconstruction conditions.

The NER RP 35 chenier reforestation measures would not involve surface alterations. The NER RP nine marsh restoration measures would, to the maximum extent practicable, be constructed to insure the restoration sites would naturally revegetate. The five shoreline protection measures, by design, would remain unvegetated and function to reduce wave induced shoreline erosion. Any areas subjected to dredging and construction impacts would be restored at least to their natural pre-construction condition, and this action would use the best available restoration techniques. The NER RP would utilize the best available practical techniques for ecosystem restoration and BMPs to avoid, minimize and reduce potential adverse impacts.

Guideline 6.7 Site clearing shall to the maximum extent practicable be limited to those areas immediately required for physical development.

Response: The Nonstructural NED RP measures include elevating structures and dry flood proofing structures would generally not involve site clearing. However, construction of the less than 6 foot in height flood proofing barriers or berms could involve site clearing. Site clearing, to the maximum extent practicable, would be limited to those areas immediately required for elevating, flood proofing, building berms, or other similar project related construction of the Nonstructural NED RP structures. Any areas subjected to construction impacts would be restored at least to their natural pre-construction condition, and this action would use the best available restoration techniques. The Nonstructural NED RP would use the best available practical techniques for nonstructural hurricane and storm surge damage reduction and BMPs to avoid, minimize and reduce potential adverse impacts and shall, to the maximum extent practicable limit site clearing to those areas immediately required for physical development.

Site clearing is not part of implementing the NER RP nine marsh restoration measures and five shoreline protection measures that, by design, would involve dredge disposal and construction for marsh restoration, and placement of geotextile fabric and stone for shoreline protection. However, the NER RP 35 chenier reforestation measures would include control of invasive plant species. Prior to planting, an application of 64 ounces of Clearcast® would be sprayed over the top of hardwoods to control invasive species, primarily Chinese tallow (*Triadica sebifera*), if needed. The NER RP would use the best available practical techniques for ecosystem restoration and BMPs to avoid, minimize and reduce potential adverse impacts and shall, to the maximum extent practicable limit site clearing to those areas immediately required for physical development.

Guideline 6.8 Surface alterations shall, to the maximum extent practicable, be located away from critical wildlife areas and vegetation areas. Alterations in wildlife preserves and management areas shall be conducted in strict accord with the requirements of the wildlife management body.

Response: The Nonstructural NED RP surface alterations related primarily to construction of the less than 6 foot in height flood proofing barriers or berms, could involve site clearing. However, the Nonstructural NED RP would not involve surface alterations near any critical wildlife or vegetation areas. The Nonstructural NED RP would use the best available practical techniques for nonstructural hurricane and storm surge risk reduction and BMPs to avoid, minimize and reduce potential adverse impacts to wildlife preserves and management areas in strict accord with the requirements of the wildlife management body.

Surface alterations of the NER RP 35 chenier reforestation measures would be minimal and involve planting trees and controlling invasive species (primarily tallow trees). Whereas, the NER RP nine marsh restoration measures and the five shoreline protection measures would, by design, require surface alterations that could, and in some instances are necessarily located near critical wildlife areas and vegetation areas. Two marsh restoration measures, located partially on USFWS properties, are recommended for construction by the USFWS. Measure 124d Marsh Restoration at Mud Lake would be located on Sabine NWR. NER RP measure 3c1 Beneficial Use of Dredged Material from Calcasieu Ship Channel would be located on the Cameron Prairie NWR. In addition, project CS-59 (Oyster Bayou Marsh Creation and Terracing) would be directly impacted by

construction of NER RP marsh restoration measure 124c. Project CS-054 (Cameron-Creole Watershed Grand Bayou Marsh Creation) would be directly impacted by construction of NER RP marsh restoration measure 3c1. When overlap occurs, proposed NER RP measures would be constructed to avoid existing coastal restoration projects by construction of temporary containment/exclusion dikes that would contain dredged borrow sediments used for construction of the NER RP measure and also prevent dredged effluents from entering the existing coastal restoration project sites. Temporary containment/exclusion dikes would degrade naturally to restore connectivity with surrounding areas or would be degraded at three years after construction has been completed. In addition, existing mitigation projects are also located within areas proposed for restoration under the NER RP. Mitigation projects are designed and constructed to offset anticipated losses from permitted activities. **Figure 8** and **Table 4** contains information about mitigation projects that occur within the project area. In most instances, mitigation projects were developed to provide a sustainable buffer from wave action and storm surge generated by tropical storms and hurricanes. When overlap occurs, proposed NER RP measures would not be constructed until the mitigation projects satisfy their 20-year permitted obligations.

NER RP alterations in wildlife refuges/preserves or management areas would be conducted in strict accord with the requirements of the wildlife management body. Coordination with the USFWS, CWPPRA and the LDWF has been initiated for potential impacts to resources managed by the USFWS and LDWF (e.g., oysters, bald eagles, sandhill cranes, state and national wildlife refuges, etc.). Any areas subjected to construction impacts would be restored at least to their natural pre-construction condition, and this action would use the best available restoration techniques. The NER RP would use the best available practical techniques for ecosystem restoration and BMPs to avoid, minimize and reduce potential adverse impacts, to the maximum extent practicable, for critical wildlife areas and vegetation areas, wildlife preserves and management areas.

Guideline 6.9 Surface alterations which have high adverse impacts on natural functions shall not occur, to the maximum extent practicable, on barrier islands and beaches, isolated cheniers, isolated natural ridges or levees,' or in wildlife and aquatic species breeding or spawning areas, or in important migratory routes.

Response: The Nonstructural NED RP measures of elevating and dry flood proofing would not entail surface alterations. However, it is not anticipated that any Nonstructural NED RP or NER RP measures would adversely impact natural functions. Construction of flood proofing barriers or berms less than 6 feet in height around non-residential structures, primarily industrial complexes and warehouses, would entail surface alterations. However, these surface alterations would be on previously disturbed lands characterized as residential and business lands and would not adversely impact natural functions and would not occur on barrier islands and beaches, isolated cheniers, isolated natural ridges or levees,' or in wildlife and aquatic species breeding or spawning areas, or in important migratory routes. The Nonstructural NED RP would use the best available practical techniques for hurricane and storm damage risk reduction and BMPs to avoid, minimize and reduce potential adverse impacts, to the maximum extent practicable, to barrier islands and beaches, isolated cheniers, isolated natural ridges and levees, wildlife and aquatic species breeding and spawning areas and important migratory routes.

Surface alterations by the NER RP nine marsh restoration measures and five shoreline protection measures, by design, are significant surface alteration features. The nine marsh restoration measures would entail using over 62,000,000 cy of borrow material to initially create about 8,175 acres and nourish about 3,439 acres for a total of 11,666 acres of transitional estuarine marsh. Whereas, the five shoreline protection measures would result in surface alterations by placing over 1.9 million square yards of geotextile fabric, over 1.1 million tons of lightweight aggregate, and over 3.5 million tons of rock that would provide over 251,000 linear feet of shoreline protection/stabilization. Over the 50-year period of analysis, the NER RP marsh and shoreline protection measures would protect, restore, and nourish a net total of 14,035 net acres of emergent marsh (including 7,900 net acres from the nine marsh restoration measures and 6,135 net acres from the five shoreline protection measures). At the end of the 50 year period of analysis, the marsh restoration and shoreline protection measures together would achieve a total net ecological benefit of 4,430 AAHUs; with 2,700 AAHUs from the nine marsh

restoration measures, and 1,738 AAHUs from the five shoreline protection measures. The NER RP nine marsh restoration measures and five shoreline protection measures would, by design, involve surface alterations that would help restore and protect barrier shorelines, beaches, cheniers, wildlife, and aquatic species breeding and spawning areas, and important bird migratory routes.

The 35 NER RP chenier reforestation measures would involve minimal surface alterations of planting trees and destroying invasive plant species (primarily tallow trees). The 35 chenier reforestation measures would restore a net total of 1,413 net acres with 538 AAHUs and provide important stopover habitat for Neotropical migratory birds. Highway 82 would provide vehicular access to the chenier reforestation measures. Fence posts would be installed in concrete with a small tractor using an auger bit and portable cement mixer. For planting seedlings, an ATV with a trailer would be used to deliver seedlings to the planting sites, which would be planted by hand using a spade or similar tool. In those more remote locations not accessible via Highway 82, the equipment would be delivered to the sites via large airboat or barge. Additional temporary access corridors from waterways are indicated on the Fact Sheet maps. Since the goal of the chenier reforestation measure is 50% canopy coverage, the identified plots would need to be planted in their entirety. Coordination with the Louisiana Department of Transportation and Development would be initiated to ensure that the planting plan would maintain a safe distance from existing roadways to avoid future impacts to them. Also, see response for 1.7(h). The NER RP would use the best available practical techniques for hurricane and storm damage risk reduction and BMPs to avoid, minimize and reduce potential adverse impacts, to the maximum extent practicable, to barrier islands and beaches, isolated cheniers, isolated natural ridges and levees, wildlife and aquatic species breeding and spawning areas and important migratory routes.

Guideline 6.10 The creation of low dissolved oxygen conditions in the water or traps for heavy metals shall be avoided to the maximum extent practicable.

Response: The Nonstructural NED RP measures of elevating; dry flood proofing; and construction of flood proofing barriers or berms less than 6 feet in height around non-residential structures, primarily industrial complexes and warehouses would not entail creation of low dissolved oxygen conditions. The Nonstructural NED RP would use the best available practical techniques for hurricane and storm damage risk reduction and BMPs to avoid, minimize and reduce potential adverse impacts and the creation of low dissolved oxygen conditions or traps for heavy metals, to the maximum extent practicable.

Construction activities, hydraulic dredging and placement of sediments and other fill materials for implementation of the NER RP marsh restoration and shoreline protection measures could result in localized and temporary increases in turbidity and total suspended sediments and other particulates in the water column. The suspended sediments and particulates may react with dissolved oxygen in the water, resulting in reduction of dissolved oxygen and release of ammonia in receiving area waters. There could also be reduction in pH toward more acidic conditions, organic enrichment, chemical leaching, and elevated carbon dioxide levels. The introduction of organic material to the water column as a result of discharge can lead to temporary and localized, but minor, high biochemical oxygen demand (BOD) which in turn can lead to temporary and localized, but minor, reduced dissolved oxygen thereby potentially affecting the survival of many aquatic organisms. Decomposition of organic material within the nine marsh restoration measures following discharges of dredged sediments may result in temporary and localized, but minor, reduction in dissolved oxygen and a release of ammonia. Following completion of construction activities, dissolved gas levels in the vicinity of these measures would return to that which existed prior to construction activities. Tidal currents present in the project measure areas would serve to disperse and thereby dilute these localized and temporary changes. Following construction, levels of turbidity and total suspended sediments and particulates would return to pre-construction conditions resulting in levels of dissolved oxygen and other constituents in the area returning to those observed prior to construction. The creation of low dissolved oxygen conditions would be avoided to the maximum extent practicable. Any effects are expected to be minor and would occur only during actual dredging activities. Dissolved oxygen levels would return to ambient levels following construction operations. The NER RP would use the best available practical techniques for marsh restoration and shoreline protection and BMPs to avoid,

minimize and reduce potential adverse impacts and the creation of low dissolved oxygen conditions or traps for heavy metals, to the maximum extent practicable.

Guideline 6.11 Surface mining and shell dredging shall be carried out utilizing the best practical techniques to minimize adverse environmental impacts.

Response: Surface mining and shell dredging are not part of either the Nonstructural NED RP or the NER RP.

Guideline 6.12 The creation of underwater obstructions which adversely affect fishing or navigation shall be avoided to the maximum extent practicable.

Response: The Nonstructural NED RP measures of elevating; dry flood proofing; and construction of flood proofing barriers or berms less than 6 feet in height around non-residential structures, primarily industrial complexes and warehouses would not entail creation of underwater obstructions.

The NER RP nine marsh restoration measures and five shoreline protection measures would, by design, help restore and protect transitional estuarine marsh which would positively affect fishing by restoring transitional estuarine marsh which would provide essential fish habitat. Over the 50-year period of analysis, the NER RP would protect, restore, and nourish a net total of 14,035 net acres of emergent marsh (including 7,900 net acres from the nine marsh restoration measures and 6,135 net acres from the five shoreline protection measures). At the end of the 50 year period of analysis, the marsh restoration and shoreline protection measures together would achieve a total net ecological benefit of 4,430 AAHUs; with 2,700 AAHUs from the nine marsh restoration measures, and 1,738 AAHUs from the five shoreline protection measures. The chenier restoration measures would restore a net total of 1,413 net acres with 538 AAHUs and provide important stopover habitat for migratory Neotropical birds. Shoreline protection measures 5a, 6b1, 6b2, and 6b3 include construction of offshore breakwaters, not connected to the shoreline, which would act as underwater obstructions. However, the breakwaters would be constructed such that adverse effects on fishing and/or navigation would be avoided to the maximum extent practicable. Breakwater crests would be above mean water level (elevations of 3.0 to 3.5 feet NAVD88), so would be visible under normal conditions. Additionally, signage would be included, if and where necessary, to alert boaters to their presence. The NER RP would use the best available practical techniques for marsh restoration and shoreline protection and BMPs to avoid, minimize and reduce potential adverse impacts and the creation of underwater obstructions which may adversely affect fishing or navigation shall be avoided to the maximum extent practicable.

Guideline 6.13 Surface alteration sites and facilities shall be designed, constructed, and operated using the best practical techniques to prevent the release of pollutants or toxic substances into the environment and minimize other adverse impacts.

Response: Surface alterations for the Nonstructural NED RP measures would be primarily related to flood proofing barriers or berms less than 6 feet in height around non-residential structures, primarily industrial complexes and warehouses; and acquisition. These Nonstructural NED RP measures would be designed, constructed and operated using the best practical techniques and BMPs to prevent the release of pollutants or toxic substances into the environment and avoid, minimize and reduce other adverse impacts.

Surface alterations by the NER RP 35 chenier reforestation measures would be minimal and primarily involve planting trees and controlling invasive plant species (primarily tallow trees). Whereas, the NER RP nine marsh restoration measures and five shoreline protection measures, by design, are significant surface alteration measures. The nine marsh restoration measures would entail using over 62,000,000 cy of borrow material to initially create about 8,175 acres and nourish about 3,439 acres for a total of 11,666 acres of transitional estuarine marsh. Over the 50 year period of analysis, this would result in surface alterations of about 7,900 net acres and 2,700 AAHUs of transitional estuarine marsh. Whereas, the five shoreline protection measures would result in surface alterations by placing over 1.9 million square yards of geotextile fabric, over 1.1 million tons of lightweight aggregate, and over 3.5 million tons of rock that would provide over 251,000 linear feet of shoreline

protection/stabilization. NER RP measures would be designed, constructed and operated using the best practical techniques and BMPs to prevent the release of pollutants or toxic substances into the environment and avoid, minimize and reduce other adverse impacts.

Guideline 6.14 To the maximum extent practicable only material that is free of contaminants and compatible with the environmental setting shall be used as fill.

Response: To the maximum extent practicable only material that is free of contaminants and compatible with the environmental setting shall be used as fill.

6. GUIDELINES FOR HYDROLOGIC AND SEDIMENT TRANSPORT MODIFICATIONS:

Guideline 7.1 The controlled diversion of sediment laden waters to initiate new cycles of marsh building and sediment nourishment shall be encouraged and utilized whenever such diversion will enhance the viability and productivity of the outfall area. Such diversions shall incorporate a plan for monitoring and reduction and/or amelioration of the effects of pollutants present in the freshwater source.

Response: The restoration measures do not contain any diversions of freshwater or sediments.

Guideline 7.2 Sediment deposition systems may be used to offset land loss, to create or restore wetland areas or enhance building characteristics of a development site. Such systems shall only be utilized as part of an approved plan. Sediment from these systems shall only be discharged in the area that the proposed use is to be accomplished.

Response: The Nonstructural NED RP measures would not involve sediment deposition systems to offset land loss, to create or restore wetland areas or enhance building characteristics for a building site. Rather, by design, the Nonstructural NED RP measures of elevating; dry flood proofing; and construction of flood proofing barriers or berms less than 6 feet in height around non-residential structures, primarily industrial complexes and warehouses floodway would provide nonstructural hurricane and storm surge damage risk reduction for a total of 3,961 impacted structures consisting of 3,462 eligible residential structures; 342 eligible commercial structures and public buildings; and 157 eligible industrial complexes and warehouses. The Nonstructural NED RP would utilize the best available practical techniques and BMPs to avoid, minimize and reduce potential adverse impacts.

The NER RP 35 chenier reforestation measures and five shoreline protection measures would not involve sediment deposition systems. Whereas, the NER RP nine marsh restoration measures would utilize a hydraulic dredge to dispose of over 62,000,000 cy of borrow material to initially create about 8,175 acres and nourish about 3,439 acres for a total of 11,666 acres of transitional estuarine marsh. Over the 50 year period of analysis, this sediment deposition would result in about 7,900 net acres and 2,700 AAHUs of transitional estuarine marsh. Temporary containment/exclusion dikes would be constructed to contain dredged sediments and allow them to dewater and consolidate into marsh. Dewatering of the sediment slurry would take place through weirs in the containment dikes to direct water into adjacent marshes, to maximize retention of sediment in the system. The containment/exclusion dikes would prevent dredge slurry from entering into adjacent areas not intended to receive sediment nourishment. Containment/exclusion dikes would naturally degrade or would be degraded at multiple sites three years following construction to allow hydrologic exchange with adjacent areas. The NER RP would utilize the best available practical techniques and BMPs to avoid, minimize and reduce potential adverse impacts

Guideline 7.3 Undesirable deposition of sediments in sensitive habitat or navigation areas shall be avoided through the use of the best preventive techniques.

Response: The Nonstructural NED RP measures would not involve sediment deposition in sensitive habitat or navigation areas. Rather, by design, the Nonstructural NED RP measures of elevating; dry flood proofing; and construction of flood proofing barriers or berms less than 6 feet in height around non-residential

structures, primarily industrial complexes and warehouses would provide nonstructural hurricane and storm surge damage risk reduction for a total of 3,961 impacted structures consisting of 3,462 eligible residential structures; 342 eligible commercial structures and public buildings; and 157 eligible industrial complexes and warehouses. The Nonstructural NED RP would utilize the best available practical techniques and BMPs to avoid, minimize and reduce potential adverse impacts to sensitive habitat and navigation areas.

The NER RP 35 chenier reforestation measures would not would involve sediment deposition in sensitive habitat or navigation areas. Whereas, the NER RP nine marsh restoration measures, by design, would utilize a hydraulic dredge to dispose of over 62,000,000 cy of borrow material to initially create about 8,175 acres and nourish about 3,439 acres for a total of 11,666 acres of transitional estuarine marsh adjacent and within fragmented sensitive transitional estuarine marsh and navigational areas. Over the 50 year period of analysis, this sediment deposition would result in about 7,900 net acres and 2,700 AAHUs of transitional estuarine marsh in a coastal ecosystem that is experiencing widespread coastal wetland loss. Temporary containment/exclusion dikes would be constructed to contain dredged sediments and allow them to dewater and consolidate into marsh. Dewatering of the sediment slurry would take place through weirs in the containment dikes to direct water into adjacent marshes, to maximize retention of sediment in the system. The containment/exclusion dikes would prevent dredge slurry from entering into adjacent sensitive areas and navigation channels not intended to receive sediment nourishment. Containment/exclusion dikes would naturally degrade or would be degraded at multiple sites three years following construction to allow hydrologic exchange with adjacent areas. Whereas, the five shoreline protection measures would result in material depositions and surface alterations by placing over 1.9 million square yards of geotextile fabric, over 1.1 million tons of lightweight aggregate, and over 3.5 million tons of rock that would provide over 251,000 linear feet of shoreline protection/stabilization within and adjacent to sensitive transitional estuarine marsh and navigation areas and benefit a total of 6,135 net acres and 1,738 AAHUs over the 50 year period of analysis The NER RP would utilize the best available practical techniques and BMPs to avoid, minimize and reduce potential adverse impacts to sensitive habitat and navigation areas. Areas subjected to construction impacts would be restored at least to their natural pre-construction condition, and this action would use the best available restoration techniques and BMPs.

Guideline 7.4 The diversion of freshwater through siphons and controlled conduits and channels, and overland flow to offset saltwater intrusion and to introduce nutrients into wetlands shall be encouraged and utilized whenever such diversion will enhance the viability and productivity of the outfall area. Such diversions shall incorporate a plan for monitoring and reduction and/or amelioration of the effects of pollutants present in the freshwater source.

Response: The Nonstructural NED RP and NER RP do not include diversions of any type.

Guideline 7.5 Water or marsh management plans shall result in an overall benefit to the productivity of the area.

Response: The Nonstructural NED RP does not entail water or marsh management plans or any actions that could affect productivity in the area. Rather the Nonstructural NED RP would provide nonstructural hurricane and storm surge damage risk reduction for a total of 3,961 impacted structures consisting of 3,462 eligible residential structures; 342 eligible commercial structures and public buildings; and 157 eligible industrial complexes and warehouses.

However, the NER RP nine marsh restoration measures, five shoreline protection measures and 35 chenier reforestation measures would result in net positive benefits to the productivity of the area. The NER RP nine marsh restoration measures would initially create about 8,175 acres and nourish about 3,439 acres for a total of 11,666 acres of transitional estuarine marsh. Over the 50 year period of analysis, this would result in about 7,900 net acres and 2,700 AAHUs of transitional estuarine marsh thereby increasing local productivity in a coastal ecosystem that is experiencing widespread coastal wetland loss. The NER RP five shoreline protection measures would place 251,528 linear feet of shoreline protection that would benefit 6,135 net acres and 1,738 AAHUs over the 50 years of analysis. The 35 chenier reforestation measures would reforest

approximately 1,413 net acres and 538 AAHUs in Cameron and Vermilion Parishes over the 50 year period of analysis. The NER RP would utilize the best available practical techniques and BMPs to avoid, minimize and reduce potential adverse impacts to productivity of the areas.

Guideline 7.6 Water control structures shall be assessed separately based on their individual merits and impacts and in relation to their overall water or marsh management plan of which they are a part.

Response: The Nonstructural NED RP does not include water control structures. However, the Calcasieu Ship Channel Salinity Barrier measure and the Cameron-Creole Spillway Salinity Control Structure measure are both being recommended for individual long-term study.

Guideline 7.7 Weirs and similar water control structures shall be designed and built using the best practical techniques to prevent "cut arounds," permit tidal exchange in tidal areas, and minimize obstruction of the migration of aquatic organisms.

Response: The Nonstructural NED RP does not include water control structures. However, the Calcasieu Ship Channel Salinity Barrier measure and the Cameron-Creole Spillway Salinity Control Structure measures are both being recommended for long-term study. The NER RP nine marsh restoration measures would include the use of temporary weirs in the containment/exclusion dikes to move dredge effluent to adjacent areas for marsh nourishment. These weirs would be temporary and would be designed and built using the best practical techniques to prevent "cut arounds," permit tidal exchange in tidal areas (after a three-year settlement period), and minimize obstruction of the migration of aquatic organisms. The NER RP would utilize the best available practical techniques and BMPs to avoid, minimize and reduce potential adverse impacts to prevent "cut arounds," permit tidal exchange in tidal areas, and minimize obstruction of the migration of aquatic organisms, sensitive habitat and navigation areas.

Guideline 7.8 Impoundments which prevent normal tidal exchange and/or the migration of aquatic organisms shall not be constructed in brackish and saline areas to the maximum extent practicable.

Response: The Nonstructural NED RP measures would not involve impoundments which prevent normal tidal exchange or the migration of aquatic organisms in brackish or saline areas. The NER RP 35 chenier reforestation measures and the NER RP five shoreline protection measures would not involve impoundments, not prevent normal tidal exchange and not prevent the migration of aquatic organisms in brackish or saline areas. Rather, the NER RP five shoreline protection measures would, by design, result in reducing wave induced shoreline erosion by depositing material and altering surfaces with placement over 1.9 million square yards of geotextile fabric, over 1.1 million tons of lightweight aggregate, and over 3.5 million tons of rock that would provide over 251,000 linear feet of shoreline protection/stabilization within transitional estuarine marsh and benefit a total of 6,135 net acres and 1,738 AAHUs over the 50 year period of analysis.

The NER RP nine marsh restoration measures, by design, would entail the use of impoundments, in this case temporary containment/exclusion dikes, for up to three years to contain to contain over 62,000,000 cy of dredged borrow sediments to allow for dewaterment, settlement and consolidation of the sediment slurry into substrate suitable for colonization by marsh plants. Dewatering of the sediment slurry would take place through weirs in the containment dikes to direct water into adjacent degraded and fragmented marshes, to maximize retention of sediment in the system. The containment/exclusion dikes would prevent dredge slurry from entering into adjacent areas not intended to receive sediment nourishment. Containment/exclusion dikes would naturally degrade or would be degraded at multiple sites three years following construction to allow hydrologic exchange with adjacent areas until it dewaters and consolidates for marsh restoration. This action would initially create about 8,175 acres and nourish about 3,439 acres for a total of 11,666 acres of transitional estuarine marsh restored. Over the 50 year period of analysis, this sediment deposition would result in about 7,900 net acres and 2,700 AAHUs of transitional estuarine marsh. The containment/exclusion dikes would naturally degrade to allow hydrologic connectivity or would be degraded at three years following construction. There would be no permanent impoundments that would prevent normal tidal exchange or the migration of aquatic organisms

in brackish or saline waters. The NER RP would utilize the best available practical techniques and BMPs to avoid, minimize and reduce potential adverse impacts.

Guideline 7.9 Withdrawal of surface and ground water shall not result in saltwater intrusion or land subsidence to the maximum extent practicable.

Response: The proposed action would not entail withdrawal of surface or ground waters. Therefore, this guideline is not applicable to the Nonstructural NED RP or NER RP.

GUIDELINES FOR DISPOSAL OF WASTES:

Response: The proposed action would not involve the disposal of wastes. Therefore, these guidelines are not applicable to the Nonstructural NED RP or the NER RP.

7. GUIDELINES FOR USES THAT RESULT IN THE ALTERATION OF WATERS DRAINING INTO COASTAL WATERS:

Response: The proposed action would not involve the alteration of waters draining into coastal waters. Therefore, these guidelines are not applicable to the Nonstructural NED RP or the NER RP.

8. GUIDELINES FOR OIL, GAS, AND OTHER MINERAL ACTIVITIES:

Response: The proposed action would not involve oil, gas or other mineral activities. During PED Phase, the inventory of wells within the measure areas would be examined. Inactive wells would be capped in place. Active wells would have access maintained either through a flotation channel or via boardwalk, in coordination with the landowner and well owner.

OTHER STATE POLICIES INCORPORATED INTO THE PROGRAM

Section 213.8A of Act 361 directs the Secretary of Department of Transportation and Development (DOTD), in developing the Louisiana Coastal resources Program (LCRP), to include all applicable legal and management provisions that affect the coastal zone or are necessary to achieve the purposes of Act 361 or to implement the guidelines effectively. It states:

> *The Secretary shall develop the overall state coastal management program consisting of all applicable constitutional provisions, laws and regulations of this state which affect the coastal zone in accordance with the provisions of this Part and shall include within the program such other applicable constitutional or statutory provisions, or other regulatory or management programs or activities as may be necessary to achieve the purposes of this Part or necessary to implement the guidelines hereinafter set forth.*
>
> *The constitutional provisions and other statutory provisions, regulations, and management and regulatory programs incorporated into the LCRP are identified and described in Appendix 1. A description of how these other authorities are integrated into the LCRP and coordinated during program implementation is presented in Chapter IV. Since all of these policies are incorporated into the LCRP, Federal agencies must ensure that their proposed actions are consistent with these policies as well as the coastal use guidelines (CZMA, Section 307).*

CONSISTENCY DETERMINATION

The Southwest Coastal Louisiana Nonstructural NED RP measures would provide nonstructural hurricane and storm surge damage risk reduction for a total of 3,961 impacted structures consisting of 3,462 eligible residential structures; 342 eligible commercial structures and public buildings; and 157 eligible industrial complexes and warehouses. The NER RP measures would create, nourish, reforest and protect 15,448 net acres and 4,776 AAHUs over the 50 year period of analysis in the 4,700 square mile study area located in Calcasieu, Cameron, and Vermilion Parishes in southwest Louisiana. Based on this evaluation of the proposed action to the Coastal Use Guidelines, the U. S. Army Corps of Engineers, Mississippi Valley Division, New Orleans

District, has determined that what has been proposed is consistent, to the maximum extent practicable, with the State of Louisiana's Coastal Resources Program.

Questions regarding this determination should be addressed to Dr. William Klein Jr.; U.S. Army Corps of Engineers; Regional Planning and Environment Division South; New Orleans Environmental Branch; CEMVN-PDN-CEP; P.O. Box 60267; New Orleans, Louisiana 70160-0267. Dr. Klein may be contacted at (504) 862-2540, if questions arise. Please review the enclosed documents and provide comments within 45 days of the date

Joan M. Exnicios
Chief, Environmental Planning Branch

SOUTHWEST COASTAL LOUISIANA
INTEGRATED FINAL FEASIBILITY REPORT
AND
ENVIRONMENTAL IMPACT STATEMENT

APPENDIX A

Annex C

Louisiana State Department of Wildlife and Fisheries Scoping Letter

BOBBY JINDAL
GOVERNOR

State of Louisiana

ROBERT J. BARHAM
SECRETARY

DEPARTMENT OF WILDLIFE AND FISHERIES
OFFICE OF SECRETARY

14 April 2009

Ms. Sandra Stiles
U.S. Army Corps of Engineers, CEMVNPM–RS,
P.O. Box 60267,
New Orleans, LA 70160–0267,

RE: Notice of Intent to Prepare a Draft Environmental Impact Statement for the Southwest Coastal Louisiana Feasibility Study

Dear Ms. Stiles

The Louisiana Department of Wildlife and Fisheries is the state agency with responsibility for protecting and enbancing the wildlife and aquatic resources of the state and their dependent habitats. The department also manages over 240, 000 acres is in the southwest portion of the state through the Rockefeller, White Lake, State Wildlife, and Marsh Island refuges. As such, we urge the US Army Corps of Engineers (USACE) and the Office of Coastal Protection and Restoration (OCPR) to minimize enclosure of additional wetlands behind hurricane protection levees.

The EIS shall thoroughly consider and evaluate the potential impacts of hurricane protection features on existing and planned coastal restoration projects. Coordination is required with Louisiana Coastal Area (LCA) Program managers, Coastal Wetlands Planning, Protection and Restoration Act agencies, Coastal Impact Assistance Program (CIAP) representatives and others to insure that ongoing coastal restoration projects are not compromised by the hurricane protection features.

The EIS shall undertake a comprehensive alternatives analysis. Before identifying a preferred hurricane protection alternative the alternatives analysis should evaluate and consider direct and indirect wetland impacts and impacts to rare, threatened and endangered species, natural communities, colonial nesting waterbirds, publicly owned and/or managed lands, and authorized wetland mitigation banks.

The EIS shall develop a comprehensive mitigation plan designed to off-set all impacts to fish and wildlife resources. The mitigation plan shall be developed in coordination with, and be approved by, the resource and regulatory agencies.

LDWF staff attended public scoping meetings in Abbeville and Cameron regarding this project. The general public at those meetings expressed concern about storm drainage issues in the western coastal parishes, saltwater intrusion into the Mermentau basin, and the desire for hurricane protection levees in

P.O. BOX 98000 • BATON ROUGE, LOUISIANA 70898-9000 • PHONE (225) 765-2800
AN EQUAL OPPORTUNITY EMPLOYER

the areas surrounding western Vermilion Bay. We understand that the USACE and the OCPR have retained Dr. Ehab Meselhe to model hydrologic processes in these areas. This is a positive development as historical changes in hydrology in the region coupled with rising sea levels are the major environmental drivers in the system. We urge that the findings of these models be in such a form to be comprehensible to the general public so that the potential consequences of different courses of action are clearly defined. In addition, we urge that the environmental modeling include storm surge and exchange through Atchafalaya, and East and West Cote Blanche Bays to the east of Marsh Island. This is clearly an important physical driver in the Vermilion Bay system.

Further, we urge the USACE and the OCPR to include some consideration of logistical issues that arise with installation/construction of additional culverts, water control structures, gates, etc. We believe a regional approach to water management is the most productive way to reconcile all the needs of the residents of the area.

Thank you for the opportunity to comment on this project.

Sincerely,

J. Heather Warner-Finley
Research and Assessment Division

SOUTHWEST COASTAL LOUISIANA
INTEGRATED FINAL FEASIBILITY REPORT
AND
ENVIRONMENTAL IMPACT STATEMENT

APPENDIX A
Annex D
National Marine Fisheries Service Scoping Letter
Planning Aid Letter
Comment Letter on Revised Integrated Draft Report & EIS
USACE Comment Response Letter

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, NEW ORLEANS DISTRICT
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO ATTENTION OF

JAN 28 2016

Regional Planning and Environment
Division South
Environmental Planning Branch

Ms Virginia M. Fay
Assistant Regional Administrator
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701

Dear Ms Fay:

Thank you for your April 29, 2015, comment letter on the March 2015 revised Integrated Draft Feasibility Report and Environmental Impact Statement. Please note the following changes to be reported in the Final Integrated Feasibility Report and Environmental Impact Statement (Final Integrated Report & EIS):

The National Economic Development (NED) Recommended Plan (RP) is the Nonstructural 0-25-Year Floodplain Plan – Modified Plan 8, which proposes implementing nonstructural measures across the 4,700 square mile study area to reduce coastal storm damages to 3,462 residential structures, 342 commercial structures and public buildings, and 157 warehouses. This will be achieved by elevating residential structures, dry flood proofing non-residential structures, and constructing localized storm surge risk reduction measures around warehouses and industrial facilities. Residential structures will be elevated to the base flood elevation (BFE) predicted to occur in the year 2075. Non-residential structures will have flood proofing measures applied generally up to 3 feet (ft) above ground level. Localized storm surge risk reduction measures will be less than 6 ft in height. Acquisition and relocation will be offered to owners whose structure requires raising more than 13 ft above ground level. The NED RP is 100% voluntary.

The National Ecosystem Restoration (NER) Recommended Plan (RP) is "Small Integrated Restoration", also known as NER Plan CM-4, consists of 49 ecosystem restoration features recommended for construction (9 marsh restoration features; 35 chenier reforestation features; and 5 shoreline protection features). The NER RP is the least-cost, cost-effective, comprehensive ecosystem restoration plan that addresses land loss and ecosystem degradation. The NER RP contains features to restore 15,448 acres of wetlands; restore and protect 335 acres of designated critical habitat (for threatened piping plover and red knot); enhance plant productivity; and reinforce and protect critical landscape features. The Calcasieu Ship Channel Salinity Barrier and the Cameron-Creole Watershed Spillway are recommended as additional long-range studies. Two marsh restoration measures, located partially on U.S. Fish and Wildlife

Service (USFWS) properties are recommended for construction by the USFWS. Measure 124d Marsh Restoration at Mud Lake would be located on Sabine National Wildlife Refuge (NWR). Measure 3c1 Beneficial Use of Dredged Material from Calcasieu Ship Channel would be located on the Cameron Prairie NWR.

Responses to General Comments

Marsh Restoration Features. Consistent with your suggestions regarding dredge pipeline right-of-ways, the Final Integrated Report and EIS includes description that the Corps would utilize the best available practical techniques and best management practices (BMPs) during construction to avoid, minimize and reduce potential adverse impacts to marsh and temporary construction-related impacts, such as placement of dredge pipelines and staging areas would be restored to pre-existing conditions, to the maximum extent practicable, prior to completion of construction activities.

Responses to Specific Comments

The Essential Fish Habitat section has been updated to reflect the list attached to your April 29, 2015, comment letter.

Regarding your EFH Conservation Recommendation, the Final Integrated Report and EIS contains the following language in section 3.3.6 Fisheries and Aquatic Resources:

> *The best available practical techniques and BMPs would be utilized during construction to avoid, minimize and reduce potential adverse impacts to all terrestrial and aquatic organisms, including fishery and aquatic organisms. Temporary construction related impacts, such as placement of dredge pipelines and staging areas would be restored to pre-existing conditions, to the maximum extent practicable, prior to completion of construction activities.*

Details describing best available practical techniques and BMP's regarding pipelines, borrow areas and staging areas are also included in the Biological Assessment and the "Protected Marine Species Entrapment Prevention Measures" and "Marsh Buggy" BMPs" developed for ecosystem restoration projects.

The U.S. Army Corps of Engineers is committed to working cooperatively with the NMFS, USFWS and other natural resource agencies. For further information please contact William P. Klein, Jr. at (504) 862-2540 or via e-mail at william.p.klein.jr@usace.army.mil

Sincerely,

Joan M. Exnicios

Joan M. Exnicios
Chief, Environmental Planning Branch

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701

April 29, 2015 F/SER46/LA:jk
225/389-0508

Ms. Joan Exnicios, Chief
Environmental Planning and Compliance Branch
New Orleans District, U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Ms. Exnicios:

The NOAA's National Marine Fisheries Service (NMFS) has reviewed the Southwest Coastal Louisiana Revised Integrated Draft Feasibility Report and Draft Environmental Impact Statement (EIS). The draft EIS evaluates alternatives which provide storm damage reduction and ecosystem restoration measures within the 4,700 square mile study area in Louisiana's Chenier plain, encompassing Cameron, Calcasieu, and Vermilion Parishes.

As described in the draft EIS and Feasibility Report, the Tentatively Selected Plan (TSP) is a combination of non-structural storm surge protection measures and an array of different types of ecosystem restoration features. The TSP for the non-structural storm surge protection features include: (1) elevation of residential structures, (2) dry-flood proofing non-residential structures, (3) construction of barriers or berms around non-residential structures, (4) floodplain management plans, (5) more stringent local floodplain regulations, and (6) more restrictive parish and municipal building codes, land use and zoning regulations, and other developmental controls. The TSP for the ecosystem restoration features includes one hydrology/salinity control measure, nine marsh creation measures, five shoreline protection measures, and eight chenier restoration measures.

The NMFS has the following general and specific comments to make regarding information provided in the draft EIS:

General Comments

Marsh Restoration Features. While the majority of the pipeline routes from borrow to marsh creation areas are in open water, some are proposed to pass through marsh. The NMFS is concerned marsh in pipeline rights-of-way (ROWs) and staging areas could be adversely impacted by construction related activities. While NMFS understands such adverse impacts would be offset by the creation of marsh, we believe efforts are warranted to ensure the ROWs and staging areas impacted by construction are restored to pre-existing elevations. In general, such efforts include requiring contractors to pump dredged material into the ROW and staging areas as pipelines are removed, and armoring of ROWs with rip-rap where they intersect with open water areas. The NMFS recommends the Feasibility Report and final EIS include these potential construction-related adverse impacts, as well as a description of measures to be taken to ensure wetlands impacted by construction of marsh creation features are restored to the maximum extent practicable.

Specific Comments

Section 1.4.8 Essential Fish Habitat
Page 1-19 and Appendix A. The Essential Fish Habitat section of the draft EIS incorrectly lists some federally managed species potentially found in the project area. The species and life stages should up updated to reflect the attached list.

The NMFS has a "findings" with the New Orleans District (NOD) on the fulfillment of coordination requirements under provisions of the Magnuson-Stevens Fishery Conservation and Management Act. In those findings, the NOD and NMFS agreed to complete EFH coordination requirements for federal civil works projects through our review and comment on National Environmental Policy Act documents prepared for those projects. Therefore, NMFS recommends the following to ensure the conservation of EFH and associated fishery resources:

EFH Conservation Recommendation

The final EIS and Record of Decision for this project should include measures to ensure pipeline ROW and staging areas are restored to pre-existing conditions, to the maximum extent practicable, prior to completion of construction activities.

Consistent with Section 305(b)(4)(B) of the Magnuson-Stevens Fishery Conservation and Management Act and NMFS' implementing regulation at 50 CFR 600.920(k), your office is required to provide a written response to our EFH conservation recommendation within 30 days of receipt. Your response must include a description of measures to be required to avoid, mitigate, or offset the adverse impacts of the proposed activity. If your response is inconsistent with our EFH conservation recommendation, you must provide a substantive discussion justifying the reasons for not implementing the recommendation. If it is not possible to provide a substantive response within 30 days, the USACE should provide an interim response to NMFS, to be followed by the detailed response. The detailed response should be provided in a manner to ensure it is received by NMFS at least 10 days prior to the signing of a Record of Decision for this action.

The NMFS is committed to working cooperatively with the USACE, the State and other natural resource agencies to facilitate planning on this effort. We appreciate the opportunity to provide these comments for consideration in finalizing the Feasibility Report and EIS.

Sincerely,

Virginia M. Fay
Assistant Regional Administrator
Habitat Conservation Division

Enclosure

2

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701

November 22, 2013 F/SER46/RS:jk
225/389-0508

Colonel Richard L. Hansen
District Engineer, New Orleans District
Department of the Army, Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-2067

Dear Colonel Hansen:

NOAA's National Marine Fisheries Service (NMFS) is submitting this letter due to recent information provided by the U.S. Army Corps of Engineers' (USACE) Project Delivery Team (PDT) for the Southwest Coastal Louisiana (SWCLA) Feasibility Study, which has transitioned to the SMART (smart, measurable, attainable, risk-informed, and timely) planning process. Based on information provided in PDT meetings, NMFS is concerned insufficient information may be used to assess project effects and select alternatives, and the level of analysis for some measures may not be commensurate with the scale and scope of potential impacts. Some project measures under consideration have the possibility to directly affect wetland health, commercially and recreationally important fisheries resources and user groups, and essential fish habitat (EFH). The NMFS is providing this letter to identify potential concerns regarding sufficiency of the alternatives analysis and the assessment of potential environmental effects which may result from many of the alternatives currently under evaluation.

The study area covers over 4,700 square miles in Louisiana's Chenier plain and encompasses Cameron, Calcasieu, and Vermilion Parishes. The study area includes a wide variety of fishery habitat types ranging from saline to fresh marsh and open water. The study goals are extremely broad in scope, including both National Economic Development (NED) and National Environmental Restoration (NER) objectives. Specific study objectives are to: (1) provide hurricane and storm damage risk reduction, (2) reduce flooding induced by storm surge, and (3) provide ecosystem restoration to achieve ecosystem sustainability. Ecosystem restoration objectives are further defined as: (1) manage tidal flows to improve drainage and prevent salinity from exceeding two parts per thousand (ppt) for fresh marsh and six ppt for intermediate marsh, (2) increase wetland productivity in fresh and intermediate marshes to maintain function by reducing the time water levels exceed marsh surfaces, (3) reduce shoreline erosion and stabilize canal banks to protect adjacent wetlands, and (4) restore critical geomorphologic features, such as marshes and cheniers to maintain their function as wildlife habitat and as protective barriers to inland areas.

To date, the identification, screening and analysis of potential NER measures has relied largely on outputs from predictive models previously developed in conjunction with the Louisiana State Master Plan (SMP). The outputs from the SMP models were used to: (1) screen potential NER measures for further analysis, (2) drive the formulation of alternative arrays, and (3) inform the upcoming selection of a tentatively selected plan (TSP). The SMP model outputs will be used to drive TSP formulation and more detailed future analysis of environmental effects of various measures. We are unaware of any plans by the USACE to utilize additional methods to evaluate the performance of project components prior to the selection of a TSP. Although the SMP model may prove to be a valuable tool for large-scale planning efforts, NMFS cautions the model has not been reviewed by independent scientists or certified by the USACE. It is our understanding the USACE's policies require the use of certified models for all planning studies to ensure the models are technically and theoretically sound, compliant with policy, computationally accurate, and based on reasonable assumptions. Planning models are defined as any models and analytical tools which are used to: (1) define water resources problems and opportunities, (2) formulate potential alternatives to address the problems and take advantage of the opportunities, (3) evaluate potential effects of alternatives, and (4) support decision making. To the contrary, we are unaware of supporting information which would indicate the SMP modeling framework reliably predicts short or long term changes in hydrology, habitat type, vegetative cover, and other information needed to complete a variety of other impact analyses. Therefore, NMFS recommends the USACE either independently assess and certify the SMP models or use a previously USACE certified model for the SWCLA study.

The study currently features seven project alternatives. Hydrology and salinity control measures are included in all but the "No Action Alternative". However, the USACE has not provided data supporting the assumption that hydrologic and salinity control measures are actually effective at reducing wetlands loss rates or are critical components of sustainable ecosystem restoration in the Chenier Plain. Contrarily, there are a large number of studies which demonstrate the installation and operation of water control structures associated with hydrologic and salinity control measures do adversely impact marine fishery productivity. Other studies of areas impacted by the installation of water control structures suggest such actions could also adversely impact wetland health and sustainability. Because such hydrologic control measures are combined with other components which may be more effective in providing ecosystem restoration, their inclusion in every future with project alternative could result in the selection of a TSP which may adversely impact marine fishery production and wetland sustainability while providing limited environmental benefits. The NMFS recommends the USACE conduct further detailed analyses of all hydrological and salinity control measures prior to finalization of the TSP. The analyses should assess site specific hydrology effects of proposed measures, as well as anticipated wetland responses to verify assessed project benefits.

Further, NMFS is concerned there is not sufficient data to fully assess many of the proposed measures. Based on information provided by the PDT, there does not appear to be adequate detail regarding design and future operation of the majority of the hydrologic and salinity control measures. The NMFS believes these measures, designed to affect thousands of acres of aquatic habitats, cannot be assessed for either environmental benefits or impacts without hydraulic and

2

hydrology information, such as current and future hydroperiod (timing, depth and duration of flooding), salinity, and velocity projections at water control structures. The NMFS recommends more in-depth hydrology and salinity modeling be used to evaluate the proposed structures' impacts on the environment.

The NMFS is also concerned potential environmental impacts may not be revealed through the proposed assessment methods. For example, the Wetland Value Assessment (WVA) model was developed to evaluate and compare relatively small scale coastal restoration projects, rather than support large scale civil works alternatives analyses and impact assessments. Therefore, we believe it is inappropriate to utilize WVA models to determine the effects of basin-wide salinity reductions and reduced water exchange on marine fishery production. Any reduction in fisheries production could have secondary socioeconomic effects, which are also not being quantified to assist in the selection of a TSP. We believe these concerns should be incorporated into the decision-making process regarding the selection of the TSP, as well as addressed in any environmental impact statement (EIS) for the SWCLA project.

Some measures potentially to be included in the TSP, such a flood protection levees and ridge construction on marsh, could result in the destruction of wetlands. While it is possible for some environmental restoration measures to serve as compensatory mitigation for adverse impacts, it does not obviate the need for an evaluation of less damaging alternatives required by the Clean Water Act. The mitigation sequence established by the Clean Water Act Section 404(b)(1) Guidelines states impacts must be avoided, then minimized to the maximum extent practicable prior to the consideration of compensatory mitigation. The SWCLA study, on its current path, does not evaluate potential less damaging alternatives as required by the Clean Water Act.

The NMFS believes these and other issues potentially affecting NOAA trust resources should be thoroughly evaluated prior to selection of the TSP. To be in compliance with the National Environmental Policy Act (NEPA), evaluations of direct, indirect and cumulative impacts would be necessary for incorporation into a draft EIS for the project. Lacking such information in an EIS, NMFS does not believe it would be possible to move TSP directly into Pre-construction Engineering and Design (PED) without additional NEPA evaluations.

We do note the NED and some NER measures (i.e., marsh creation and shoreline protection) may be adequately evaluated as envisioned in the current study plan. As such, it may be appropriate to split off such measures, potentially allowing for full environmental compliance to be achieved within the SMART study schedule and furthering those critical measures to PED. The USACE could then reserve the more complex hydrology and salinity control measures for additional analyses. Due to the scope and diversity of measures under consideration, a Programmatic EIS may also be an alternative means to further the study objectives in this important region, while providing opportunity for more detailed evaluations in the future.

NMFS has findings with the USACE New Orleans District (NOD) describing procedures for EFH consultation during the NOD's review of planning and operations activities subject to compliance with provisions of the Magnuson-Stevens Fishery Conservation and Management

Act and NEPA. Under those procedures, the NOD must produce documents containing: (1) a description of the proposed action, (2) an analysis of individual and cumulative effects on EFH, Federally managed fisheries, including major prey species, (3) the NOD's views regarding effects, and (4) proposed mitigation, if applicable. These documents constitute the basis of an EFH assessment. This finding indicates the document required pursuant to NEPA will incorporate all the necessary requirements of an EFH assessment. Based on information provided to us to-date, NMFS does not believe sufficient analyses will be included in an EIS to adequately fulfill the requirements of an EFH assessment.

There is a potential for various project components to impact other NOAA trust resources managed through our Protected Resources Division. As such, we suggest your staff initiate coordination with Mr. David Bernhart by electronic mail at David.Bernhart@noaa.gov or by telephone at (727) 824-5312.

We look forward to receiving your response regarding these concerns in an effort to proceed with completion of this important study effort. If you wish to discuss this project further or have questions concerning our recommendations, please contact Lisa Abernathy at (225) 389-0508, extension 209.

Sincerely,

Virginia M. Fay
Assistant Regional Administrator
Habitat Conservation Division

c:
NOD, Exnicios, Klein
FWS, Walther, Paille
EPA, Ettinger
LDWF, Balkum
LA DNR, Haydel
F/SER3, Bernhart
F/SER4, Dale, Rolfes
F/SER46, Swafford
Files

4

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701

October 9, 2009 F/SER46/RH:jk
225/389-0508

Colonel Alvin B. Lee, Commander
New Orleans District
Department of the Army, Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Colonel Lee:

NOAA's National Marine Fisheries Service (NMFS) has received your letter dated September 29, 2009, stating the intent of the New Orleans District (NOD) to prepare an environmental impact statement (EIS) for the Southwest Coastal Louisiana Protection and Restoration Feasibility Study. The purpose of the study is to determine the feasibility of providing coastal protection and restoration measures to the parishes of Calcasieu, Cameron and Vermilion, and to recommend an implementation plan.

In your letter, you requested NMFS participate as a cooperating agency in the preparation of the EIS for this study. As per provisions of the National Environmental Policy Act, NMFS accepts the NOD's invitation to become a cooperating agency on the EIS for this project. It should be noted that, due to staffing and travel constraints, our participation in the preparation of the EIS for this project may be limited to our review and comment on the draft EIS, participation on teleconferences, and occasional travel to meetings and field inspections. NMFS staff are unable to take an active role in drafting sections of the EIS.

We appreciate your invitation to serve as a cooperating agency on the EIS for this project. Ms. Rachel Sweeney of our Baton Rouge office should be the point of contact for this effort as she has already been coordinating with NOD staff on project issues and alternatives.

Sincerely,

for Miles M. Croom
Assistant Regional Administrator
Habitat Conservation Division

c:
FWS, Lafayette, Soileau
EPA, Ettinger
LA OCPR, Johnson
F/SER46, Swafford
F/SER4, Dale
Files

Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701

April 7, 2009 F/SER46/RH:jk
225/389-0508

Ms. Sandra Stiles
Environmental Planning and Compliance Branch
Planning, Programs, and Management Division
New Orleans District, Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160

Dear Ms. Stiles:

NOAA's National Marine Fisheries Service (NMFS) has received the Public Scoping Announcement and the Notice of Intent to prepare a Draft Environmental Impact Statement (DEIS) for the **Southwest Coastal Louisiana Feasibility Study for Calcasieu, Cameron and Vermilion Parishes, Louisiana.** The Committee on Transportation and Infrastructure, U.S. House of Representatives, Resolution Docket 2747, Southwest Coastal Louisiana, LA authorized the Secretary of the Army to survey the coast of Louisiana in Cameron, Calcasieu and Vermilion Parishes in reference to the advisability of providing hurricane protection and storm damage reduction, including the feasibility of constructing an armored 12-ft high levee along the Gulf Intracoastal Waterway.

According to the document, alternatives being considered include multi-parish levee alignments, ring levees, ridges and breakwaters to provide multiple lines of defense. Coastal restoration measures, including creation of barrier islands, large-scale marsh creation, salinity control, and hydrologic restoration also are being considered. Non-structural measures to be evaluated include raising structures in-place, property buy-outs, relocating communities and hardening infrastructure.

NMFS understands the desires of the affected public for storm surge risk reduction and is supportive of many of the alternatives being evaluated under this study. NMFS recommends the DEIS include and evaluate potential project impacts to the below identified resources and issues. This should include alternatives to avoid, minimize, and mitigate environmental impacts.

Essential Fish Habitat
This study will evaluate and may propose actions in areas identified as essential fish habitat (EFH) for a variety of federally managed species (see attached table for species, life stages and subcategories of EFH). Detailed information on federally managed fisheries and their EFH is provided in the 2005 generic amendment of the Fishery Management Plans for the Gulf of Mexico prepared by the Gulf of Mexico Fishery Management Council (GMFMC). The generic amendment was prepared as required by the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). The DEIS should include an EFH Assessment that includes: (1) a description of the proposed action; (2) an analysis of the effects, including

cumulative effects of the action, on various categories of EFH, the managed species, and associated life history stage; (3) the federal agency's views regarding the effects of the action on EFH; and, (4) proposed mitigation. While some alternatives may include wetland restoration components, all adverse impacts to various categories of EFH should be identified in the DEIS and a mitigation plan should be developed to fully offset those impacts.

Marine Fishery Resources

Wetlands in the project area consist of fresh, intermediate, brackish, and saline marsh. In addition to being designated as EFH for the species identified in the attached table, these wetlands provide nursery, foraging, and predator refugia habitats that support numerous economically important marine fishery species such as spotted seatrout, sand seatrout, black drum, southern flounder, gulf menhaden, striped mullet, Atlantic croaker, and blue crab. Some of these species also serve as prey for other fish species managed under the Magnuson-Stevens Act by the GMFMC (e.g., mackerels, snappers, and groupers) and highly migratory species managed by NMFS (e.g., billfishes and sharks). The importance of fishery resources to the state of Louisiana and the national economy is shown by the fact that during 2007, 951,240 pounds of seafood was landed at Louisiana ports totaling $259 million dollars in dockside value[4]. To demonstrate the value of the project area to commercial seafood production, ports at Intracoastal City and Cameron placed fifth and seventh, respectively, in the quantity (pounds) of landings as compared to the rest of the nation. More than 85% of these commercial landings are related to the harvest of estuarine dependent species (i.e., species that depend on access to coastal marsh during one or more life stage). NMFS recommends the DEIS fully describe and quantify the value of marine fishery resources in the study area to Louisiana and the nation and the dependence of those resources on access to, and the continued health of, coastal wetlands.

Alternatives Analysis

Sufficient information should be provided in the DEIS to demonstrate compliance with the Clean Water Act Section 404 regulations in determining the least environmentally damaging practicable alternative to provide the authorized project purpose. That project purpose is hurricane protection and storm damage risk reduction. Under the project authority, hurricane protection, storm surge risk reduction, and restoration are to be identified as measures to achieve the project purpose. To that end, a fully informed alternatives analysis should be prepared before indentifying a tentatively selected plan. Such an analysis should include direct and indirect wetland, EFH, and fishery resource impacts; risk and reliability; borrow material sources; cost; and time to construct for all alternatives, including the fulfillment of requisite compensatory mitigation needs. Whether for storm protection or habitat restoration, sediment sources for construction are a limiting resource and therefore represent a programmatic challenge. As with the ongoing updated 100-year protection for the Greater New Orleans Hurricane and Storm Damage Risk Reduction System, NMFS encourages alternatives analyzed for this study fully consider avoiding all wetland impacts for mining fill material.

NMFS agrees that information developed for the Louisiana Coastal Protection and Restoration Project, Final Technical Report would be a starting point for this authority. However, we are concerned that Report did not include wetland restoration measures in this area for a similar

[4] http://www.st.nmfs.noaa.gov/st1/publications.html

project purpose. NMFS recommends the Corps of Engineers (COE) re-evaluate some of the assumptions that resulted in a determination that wetland restoration efforts provided no storm surge risk reduction benefits.

NMFS also is concerned that some levee alternatives could prohibit the identification of a cost-effective project that would meet the objectives of providing hurricane and storm surge protection to the most developed areas while maintaining a natural system in areas where such protection may be less warranted. Combining levee alignments and wetland restoration features that stretch across the study area could result in the identification and selection of a project that is so expensive that funding would be prohibitive. Therefore, NMFS believes an alternative that includes construction of ring levees only around large population centers or important infrastructure, combined with more critical wetland restoration activities, should be included in the list of alternatives for in-depth evaluation.

Secondary Impacts

NMFS is concerned with the potential magnitude of secondary, or indirect, impacts to tidal wetlands that could result from the proposed construction of levees and installation of water control structures. Extensive secondary impacts to wetlands and fishery productivity could occur from enclosing wetlands and from mining sediment for levee construction. Considering the potentially large amount of tidally influenced wetlands and water bodies which would be enclosed within levees for certain alternatives, and the value of those wetlands to Louisiana's recreational and commercial marine fishery harvest, this issue is of paramount importance. Construction of levees and water control structures can impede fishery access to critical nursery and foraging habitats and result in the impoundment or semi-impoundment of those wetlands. The DEIS should quantify the acres of all categories of EFH to be enclosed within the levees or behind structures for all alternatives evaluated. The DEIS also should identify means to minimize the adverse impacts of those actions. This includes designing water control structures and developing operational plans to maximize passage of marine fishery organisms. Structure designs and operational plans should be developed in coordination with the natural resource agencies prior to the completion of the DEIS and described in specific detail in the document.

Enclosing wetlands under potential alternatives could result in landscape level alterations of wetland hydrology. This includes ponding of water on the marsh surface and interruption of the frequency and duration of tidal exchange necessary to help maintain plant health. If sufficient cross-sectional area is not provided at all necessary locations within a leveed system, introduced water from rainfall, runoff drainage or from storm overtopping could take an excessive amount of time to drain, which would increase soil anoxia and decrease plant health. Additionally, levees and water control structures could block the flow of sediments, detritus, and nutrients, which are important for maintaining plant health and soil elevations in a subsiding environment, to wetlands both within and outside the impounded system. This would result in an increase in the loss of wetlands in the affected systems. The DEIS should identify and discuss these issues and identify measures for each alternative necessary to maintain the health of enclosed or adjacent wetlands. NMFS believes that an in-depth, comprehensive hydrologic model will have to be developed to adequately evaluate potential hydrologic impacts and the need for drainage pathways. The DEIS should discuss the need for hydrologic modeling to identify the locations



of necessary drainage sites and to quantify the cross-sectional area required to rapidly remove rainfall and storm waters from enclosed wetlands.

The DEIS should evaluate the indirect impacts from the creation of borrow sources. For example, this should include an assessment of impacts on the regional sedimentation processes, impacts on wave refraction/diffraction (if applicable), slope stability, and water quality. Particularly concerning to NMFS would be excavation of continuous borrow pits adjacent to levees. Such an alternative source for fill material would contribute substantially to landscape level alterations to hydrology and likely adversely impact marsh health. If the borrow pits were located outside of the levee, these features can become navigational and hydrologic pathways that could result in erosion of adjacent banklines. While plugs can be constructed in continuous borrow pits to keep this from occurring, such plugs usually are only temporary features in a subsiding and deteriorating environment. The DEIS should address this issue, identify the most likely sources of fill for levee construction, and discuss measures necessary to ensure borrow site locations don't result in adverse impacts to wetland hydrology and marsh health.

Mitigation

The DEIS should contain sufficient information to support a determination of compliance with the Clean Water Act (CWA) Section 404(b)(1) Guidelines. The potential that wetland restoration efforts could offset some or all of the adverse impacts to marsh should not preclude required sequencing to first avoid and then minimize impacts of the proposed action on wetlands. Mitigation requirements for proposed hurricane levee alignments that impact wetlands also should comply with Section 2036 of the Water Resources Development Act (WRDA) of 2007 which requires mitigation for water resources project to comply with the mitigation standards and policies established by the COE regulatory program. In the case of this project, mitigation assessed should be in compliance with the April 10, 2008, CWA Section 404 mitigation regulations, which were issued jointly by the COE and the Environmental Protection Agency. Of primary pertinence is the requirement that mitigation plans include 12 components: objectives, site selection (rationale), site protection instrument, baseline information, determination of credits, mitigation work plan, maintenance plan, performance standards, monitoring requirements, long-term management plan, adaptive management plan, and financial assurances. The need for compensatory mitigation should be recognized in the DEIS, including a discussion of mitigation, and a draft mitigation plan that fully complies with the CWA and WRDA 2007 should be described in the Mitigation section of the document.

In addition to this, wetland restoration and/or flood protection activities are underway under the Louisiana Coastal Protection and Restoration project; the Coastal Wetlands Planning, Protect and Restoration Act; the Louisiana Coastal Area Feasibility Study; the Coastal Protection and Restoration Authority Master Plan; and the Coastal Impact Assessment Program. Additionally, regional sediment management efforts are underway that this study should utilize and adhere to in terms of identifying sediment quantity and quality and priority of its use relative to other programs. The DEIS should identify and discuss all programs that are involved in wetland restoration and flood protection efforts. Furthermore, the COE should make every effort necessary to coordinate planning under this project with those other efforts to facilitate the

exchange of information and ensure that activities being undertaken do not compromise the efforts of each.

NMFS is committed to working cooperatively with the COE, the State and other natural resource agencies to facilitate planning on this effort. We appreciate the opportunity to provide these comments for consideration in preparing this DEIS.

Sincerely,

Miles Croom
Assistant Regional Administrator
Habitat Conservation Division

Enclosure

c:
FWS, Lafayette
EPA, Dallas
LA DWF
LA DNR, Consistency
F/SER4
F/SER46, Swafford
Files

EFH Requirements for Species Managed by the Gulf of Mexico Fishery Management Council: Ecoregion 4, Mississippi River Delta (South Pass) to Freeport, Tx, that occur in the study area.

Species	Life Stage	System	EFH
Brown shrimp	larvae/postlarvae	M/E	<82 m; planktonic, sand/shell/soft bottom, SAV, emergent marsh, oyster reef
	juvenile	E	<18 m; SAV, sand/shell/soft bottom, SAV, emergent marsh, oyster reef
White shrimp	larvae/postlarvae	M/E	<82 m; soft bottom, emergent marsh
	juvenile	E	<30 m; soft bottom, emergent marsh
Gulf stone crab	eggs	E/M	<18 m; sand/shell/soft bottom
	larvae/postlarvae	E/M	<18 m; planktonic/oyster reefs, soft bottom
	juvenile	E	<18 m; sand/shell/soft bottom, oyster reef
Red drum	larvae/postlarvae	E	all estuaries planktonic, SAV; sand/shell/soft bottom, emergent marsh
	juvenile	E/M	GOM <5 m Vermilion Bay; all estuaries; SAV;, and/shell/soft/hard bottom, emergent marsh
	adults	E/M	GOM 1-46 m; Vermilion Bay; all estuaries; SAV; sand/shell/soft/hard bottom, emergent marsh
lane snapper	larvae	E/M	4-132 m; reefs; SAV
	juvenile	E/M	<20 m; SAV; mangrove; reefs; sand/shell/soft bottom
bonnethead shark	juvenile/adult	M	inlets; estuaries; coastal waters <25 m; Louisiana to Texas

M=marine, E=estuarine

SOUTHWEST COASTAL LOUISIANA
INTEGRATED FINAL FEASIBILITY REPORT
AND
ENVIRONMENTAL IMPACT STATEMENT

APPENDIX A
Annex E
Natural Resources Conservation Service Prime and Unique Farmlands Coordination

United States Department of Agriculture

NRCS

Natural Resources Conservation Service
3737 Government Street
Alexandria, LA 71302

(318) 473-7751
Fax: (318) 473-7626

December 13, 2013

U.S. Army Corps of Engineers
Regional Planning and Environmental Division South
New Orleans Environmental Branch
CEMVN-PDC-CEC
Attn: Eric M. Williams
P.O. Box 60267
New Orleans, Louisiana 70160-0267

RE: Southwest Coastal Louisiana Study – Chenier Ridge Reforestation Project

Dear Mr. Williams:

I have reviewed the above referenced project for potential requirements of the Farmland Protection Policy Act (FPPA) and potential impact to Natural Resources Conservation Service projects in the immediate vicinity.

Projects are subject to FPPA requirements if they may irreversibly convert farmland (directly or indirectly) to nonagricultural use and are completed by a federal agency or with assistance from a federal agency. For the purpose of FPPA, farmland includes prime farmland, unique farmland, and land of statewide or local importance. Farmland subject to FPPA requirements can be forest land, pastureland, cropland, or other land, but not water or urban built-up land.

The project narrative and maps submitted with your request indicates that the proposed construction areas will not "irreversibly" impact prime farmland and therefore is exempt from the rules and regulations of the Farmland Protection Policy Act (FPPA)—Subtitle I of Title XV, Section 1539-1549. Furthermore, we do not predict impacts to NRCS work in the vicinity.

For specific information about the soils found in the project area, please visit our Web Soil Survey at the following location: http://websoilsurvey.nrcs.usda.gov/

Please direct all future correspondence to me at the address shown above.

Respectfully,

Kevin D. Norton
State Conservationist

ACTING FOR

Attachment

Helping People Help the Land

An Equal Opportunity Provider and Employer

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I (To be completed by Federal Agency)		Date Of Land Evaluation Request 11/22/2013	
Name of Project Southwest Coastal Louisiana Study		Federal Agency Involved US Army Corp of Engineers	
Proposed Land Use Chenier Ridge Reforestation		County and State Cameron and Vermilion Parishes, Louisiana	
PART II (To be completed by NRCS)		Date Request Received By NRCS 11-22-2013	Person Completing Form: M. Lindsey
Does the site contain Prime, Unique, Statewide or Local Important Farmland? (If no, the FPPA does not apply – do not complete additional parts of this form)	YES ☐ NO ☑	Acres Irrigated	Average Farm Size
Major Crop(s)	Farmable Land In Govt. Jurisdiction Acres: %	Amount of Farmland As Defined in FPPA Acres: %	
Name of Land Evaluation System Used	Name of State or Local Site Assessment System	Date Land Evaluation Returned by NRCS	

PART III (To be completed by Federal Agency)	Alternative Site Rating			
	Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly	672.9	458.7	251.9	29.6
B. Total Acres To Be Converted Indirectly	0	0	0	0
C. Total Acres In Site	672.9	458.7	251.9	29.6

PART IV (To be completed by NRCS) Land Evaluation Information				
A. Total Acres Prime And Unique Farmland				
B. Total Acres Statewide Important or Local Important Farmland				
C. Percentage Of Farmland in County Or Local Govt. Unit To Be Converted				
D. Percentage Of Farmland in Govt. Jurisdiction With Same Or Higher Relative Value				

PART V (To be completed by NRCS) Land Evaluation Criterion Relative Value of Farmland To Be Converted (Scale of 0 to 100 Points)				

PART VI (To be completed by Federal Agency) Site Assessment Criteria (Criteria are explained in 7 CFR 658.5 b. For Corridor projects use form NRCS-CPA-106)	Maximum Points	Site A	Site B	Site C	Site D
1. Area In Non-urban Use	(15)				
2. Perimeter In Non-urban Use	(10)				
3. Percent Of Site Being Farmed	(20)				
4. Protection Provided By State and Local Government	(20)				
5. Distance From Urban Built-up Area	(15)				
6. Distance To Urban Support Services	(15)				
7. Size Of Present Farm Unit Compared To Average	(10)				
8. Creation Of Non-farmable Farmland	(10)				
9. Availability Of Farm Support Services	(5)				
10. On-Farm Investments	(20)				
11. Effects Of Conversion On Farm Support Services	(10)				
12. Compatibility With Existing Agricultural Use	(10)				
TOTAL SITE ASSESSMENT POINTS	160				

PART VII (To be completed by Federal Agency)					
Relative Value Of Farmland (From Part V)	100				
Total Site Assessment (From Part VI above or local site assessment)	160				
TOTAL POINTS (Total of above 2 lines)	260				

Site Selected:	Date Of Selection:	Was A Local Site Assessment Used? YES ☐ NO ☐	
Reason For Selection:			

Name of Federal agency representative completing this form: Eric M. Williams | Date: 11/22/2013

(See Instructions on reverse side) Form AD-1006 (03-02)

STEPS IN THE PROCESSING THE FARMLAND AND CONVERSION IMPACT RATING FORM

Step 1 - Federal agencies or Federally funded project(s) involved in proposed projects that may convert farmland, as defined in the Farmland Protection Policy Act (FPPA), to nonagricultural uses, will initially complete Parts I and III of the form. For Corridor type projects, the Federal agency shall use form NRCS-CPA-106 in place of form AD-1006. The Land Evaluation and Site Assessment (LESA) process may also be accessed by visiting the FPPA website, http://www.wcc.nrcs.usda.gov/ftp/.

Step 2 - Originator (Federal Agency) will send one original copy of the form together with appropriate scaled maps indicating location(s) of project site(s), to the Natural Resources Conservation Service (NRCS) local Field Office or USDA Service Center and retain a copy for their files. (NRCS has offices in most counties in the U.S. The USDA Office Information Locator may be found at http://offices.usda.gov/scripts/ndISAPI.dll?oip_public=yes, or the offices can usually be found in the Phone Book under U.S. Government, Department of Agriculture. A list of field offices is available from the NRCS State Conservationist and State Office in each State.)

Step 3 - NRCS will, within 10 working days after receipt of the completed form, make a determination as to whether the site(s) of the proposed project contains prime, unique, statewide or local important farmland. (When a site visit or land evaluation system design is needed, NRCS will respond within 30 working days.

Step 4 - For sites where farmland covered by the FPPA will be converted by the proposed project, NRCS will complete Parts II, IV and V of the form.

Step 5 - NRCS will retain the original copy of the form in the Federal agency involved in the project, and return a file copy for NRCS records.

Step 6 - The Federal agency involved in the proposed project will complete Parts VI and VII of the form and return the form with the final selected site to the servicing NRCS office.

Step 7 - The Federal agency providing financial or technical assistance to the proposed project will make a determination as to whether the proposed conversion is consistent with the FPPA.

INSTRUCTIONS FOR COMPLETING THE FARMLAND CONVERSION IMPACT RATING FORM
(For Federal Agency)

Part I: When completing the "County and State" questions, list all the local governments that are responsible for local land use controls where site(s) are to be evaluated.

Part III: When completing item B (Total Acres To Be Converted Indirectly), include the following:

1. Acres not being directly converted but that would no longer be capable of being farmed after the conversion, because the conversion would restrict access to them or other major change in the ability to use the land for agriculture.
2. Acres planned to receive services from an infrastructure project as indicated in the project justification (e.g. highways utilities planned build out capacity) that will cause a direct conversion.

Part VI: Do not complete Part VI using the standard format if a State or Local site assessment is used. With local and NRCS assistance, use the local Land Evaluation and Site Assessment (LESA).

1. Assign the maximum points for each site assessment criterion as shown in § 658.5(b) of CFR. In cases of corridor-type project such as transportation, power line and flood control, criteria #5 and #6 will not apply and will be weighted zero, however, criterion #8 will be weighed a maximum of 25 points and criterion #11 a maximum of 25 points.

2. Federal agencies may assign relative weights among the 12 site assessment criteria other than those shown on the FPPA rule after submitting individual agency FPPA policy for review and comment to NRCS. In all cases where other weights are assigned, relative adjustments must be made to maintain the maximum total points at 160. For project sites where the total points equal or exceed 160, consider alternative actions, as appropriate, that could reduce adverse impacts (e.g. Alternative Sites, Modifications or Mitigation).

Part VII: In computing the "Total Site Assessment Points" where a State or local site assessment is used and the total maximum number of points is other than 160, convert the site assessment points to a base of 160.
Example: If the Site Assessment maximum is 200 points, and the alternative Site "A" is rated 160 points:

$$\frac{\text{Total points assigned Site A}}{\text{Maximum points possible}} = \frac{160}{200} \times 160 = 144 \text{ points for Site A}$$

For assistance in completing this form or FPPA process, contact the local NRCS Field Office or USDA Service Center.

NRCS employees, consult the FPPA Manual and/or policy for additional instructions to complete the AD-1006 form.

From: Williams, Eric MVN
To: "Walters, Cheryl - NRCS, Alexandria, LA"
Subject: AD-1006, Prime and Unique Farmlands Evaluation - Southwest Coastal Louisiana Study, U.S. Army Corps of Engineers, New Orleans District (UNCLASSIFIED)
Date: Friday, November 22, 2013 3:56:00 PM
Attachments: SW Coastal Louisiana Study_AD-1006.pdf
SW Coastal_AD-1006_Chenier Ridge Project Description.pdf
Site_A.dbf
Site_A.prj
Site_A.sbn
Site_A.sbx
Site_A.shp
Site_A.shp.xml
Site_A.shx
Site_B.dbf
Site_B.prj
Site_B.sbn
Site_B.sbx
Site_B.shp
Site_B.shp.xml
Site_B.shx
Site_C.dbf
Site_C.prj
Site_C.sbn
Site_C.sbx
Site_C.shp
Site_C.shp.xml
Site_C.shx
Site_D.dbf
Site_D.prj
Site_D.sbn
Site_D.sbx
Site_D.shp
Site_D.shp.xml
Site_D.shx

Classification: UNCLASSIFIED
Caveats: NONE

Ms. Walters,

Please see the attached form AD-1006 and project description for the subject. The U.S. Army Corps of Engineers is preparing an EIS for the subject project and request that the NRCS provide an evaluation of the prime and unique farmlands for proposed chenier ridge reforestation in southwest Louisiana. The proposed reforestation would convert approximately 1,431 acres of existing chenier ridge from future agricultural or grazing use. Shape files are attached for use in the evaluation. If you have questions regarding the project, the attached form AD-1006, or the shape files, please do not hesitate to contact me at (504) 862-2862.

Please advise if use of email is acceptable, or if in the future we should transmit these requests via another method.

Eric M. Williams

RPEDS, South/CEMVN-PDN-NCR

504/862-2862

Fax: 504/862-2088

eric.m.williams@usace.army.mil

Classification: UNCLASSIFIED
Caveats: NONE

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*	Date Of Land Evaluation Request 11/22/2013		
Name of Project Southwest Coastal Louisiana Study	Federal Agency Involved US Army Corp of Engineers		
Proposed Land Use Chenier Ridge Reforestation	County and State Cameron and Vermilion Parishes, Louisiana		
PART II *(To be completed by NRCS)*	Date Request Received By NRCS	Person Completing Form:	
Does the site contain Prime, Unique, Statewide or Local Important Farmland? YES ☐ NO ☐ *(If no, the FPPA does not apply - do not complete additional parts of this form)*		Acres Irrigated	Average Farm Size
Major Crop(s)	Farmable Land In Govt. Jurisdiction Acres: %	Amount of Farmland As Defined in FPPA Acres: %	
Name of Land Evaluation System Used	Name of State or Local Site Assessment System	Date Land Evaluation Returned by NRCS	

PART III *(To be completed by Federal Agency)*	Alternative Site Rating			
	Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly	672.9	458.7	251.9	29.6
B. Total Acres To Be Converted Indirectly	0	0	0	0
C. Total Acres In Site	672.9	458.7	251.9	29.6
PART IV *(To be completed by NRCS)* Land Evaluation Information				
A. Total Acres Prime And Unique Farmland				
B. Total Acres Statewide Important or Local Important Farmland				
C. Percentage Of Farmland in County Or Local Govt. Unit To Be Converted				
D. Percentage Of Farmland in Govt. Jurisdiction With Same Or Higher Relative Value				
PART V (To be completed by NRCS) Land Evaluation Criterion Relative Value of Farmland To Be Converted (Scale of 0 to 100 Points)				

PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(Criteria are explained in 7 CFR 658.5 b. For Corridor project use form NRCS-CPA-106)*	Maximum Points	Site A	Site B	Site C	Site D
1. Area In Non-urban Use	(15)				
2. Perimeter In Non-urban Use	(10)				
3. Percent Of Site Being Farmed	(20)				
4. Protection Provided By State and Local Government	(20)				
5. Distance From Urban Built-up Area	(15)				
6. Distance To Urban Support Services	(15)				
7. Size Of Present Farm Unit Compared To Average	(10)				
8. Creation Of Non-farmable Farmland	(10)				
9. Availability Of Farm Support Services	(5)				
10. On-Farm Investments	(20)				
11. Effects Of Conversion On Farm Support Services	(10)				
12. Compatibility With Existing Agricultural Use	(10)				
TOTAL SITE ASSESSMENT POINTS	160				
PART VII *(To be completed by Federal Agency)*					
Relative Value Of Farmland *(From Part V)*	100				
Total Site Assessment *(From Part VI above or local site assessment)*	160				
TOTAL POINTS *(Total of above 2 lines)*	260				

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? YES ☐ NO ☐
Reason For Selection:		
Name of Federal agency representative completing this form: Eric M. Williams		Date: 11/22/2013

(See Instructions on reverse side) **Form AD-1006 (03-02)**

STEPS IN THE PROCESSING THE FARMLAND AND CONVERSION IMPACT RATING FORM

Step 1 - Federal agencies (or Federally funded projects) involved in proposed projects that may convert farmland, as defined in the Farmland Protection Policy Act (FPPA) to nonagricultural uses, will initially complete Parts I and III of the form. For Corridor type projects, the Federal agency shall use form NRCS-CPA-106 in place of form AD-1006. The Land Evaluation and Site Assessment (LESA) process may also be accessed by visiting the FPPA website. http://fppa.nrcs.usda.gov/lesa/.

Step 2 - Originator (Federal Agency) will send one original copy of the form together with appropriate scaled maps indicating location(s)of project site(s), to the Natural Resources Conservation Service (NRCS) local Field Office or USDA Service Center and retain a copy for their files. (NRCS has offices in most counties in the U.S. The USDA Office Information Locator may be found at http://offices.usda.gov/scripts/ndISAPI.dll/oip_public/USA_map, or the offices can usually be found in the Phone Book under U.S. Government, Department of Agriculture. A list of field offices is available from the NRCS State Conservationist and State Office in each State.)

Step 3 - NRCS will, within 10 working days after receipt of the completed form, make a determination as to whether the site(s) of the proposed project contains prime, unique, statewide or local important farmland. (When a site visit or land evaluation system design is needed, NRCS will respond within 30 working days.

Step 4 - For sites where farmland covered by the FPPA will be converted by the proposed project, NRCS will complete Parts II, IV and V of the form.

Step 5 - NRCS will return the original copy of the form to the Federal agency involved in the project, and retain a file copy for NRCS records.

Step 6 - The Federal agency involved in the proposed project will complete Parts VI and VII of the form and return the form with the final selected site to the servicing NRCS office.

Step 7 - The Federal agency providing financial or technical assistance to the proposed project will make a determination as to whether the proposed conversion is consistent with the FPPA.

INSTRUCTIONS FOR COMPLETING THE FARMLAND CONVERSION IMPACT RATING FORM
(For Federal Agency)

Part I: When completing the "County and State" questions, list all the local governments that are responsible for local land use controls where site(s) are to be evaluated.

Part III: When completing item B (Total Acres To Be Converted Indirectly), include the following:

1. Acres not being directly converted but that would no longer be capable of being farmed after the conversion, because the conversion would restrict access to them or other major change in the ability to use the land for agriculture.
2. Acres planned to receive services from an infrastructure project as indicated in the project justification (e.g. highways, utilities planned build out capacity) that will cause a direct conversion.

Part VI: Do not complete Part VI using the standard format if a State or Local site assessment is used. With local and NRCS assistance, use the local Land Evaluation and Site Assessment (LESA).

1. Assign the maximum points for each site assessment criterion as shown in § 658.5(b) of CFR. In cases of corridor-type project such as transportation, power line and flood control, criteria #5 and #6 will not apply and will, be weighted zero, however, criterion #8 will be weighed a maximum of 25 points and criterion #11 a maximum of 25 points.

2. Federal agencies may assign relative weights among the 12 site assessment criteria other than those shown on the FPPA rule after submitting individual agency FPPA policy for review and comment to NRCS. In all cases where other weights are assigned, relative adjustments must be made to maintain the maximum total points at 160. For project sites where the total points equal or exceed 160, consider alternative actions, as appropriate, that could reduce adverse impacts (e.g. Alternative Sites, Modifications or Mitigation).

Part VII: In computing the "Total Site Assessment Points" where a State or local site assessment is used and the total maximum number of points is other than 160, convert the site assessment points to a base of 160.
Example: if the Site Assessment maximum is 200 points, and the alternative Site "A" is rated 180 points:

$$\frac{\text{Total points assigned Site A}}{\text{Maximum points possible}} = \frac{180}{200} \times 160 = 144 \text{ points for Site A}$$

For assistance in completing this form or FPPA process, contact the local NRCS Field Office or USDA Service Center.

NRCS employees, consult the FPPA Manual and/or policy for additional instructions to complete the AD-1006 form.

Project Description for the Chenier Reforestation Measure of the National Environmental Restoration Component of the Southwest Coastal Louisiana Study

The proposed activity would consist of planting trees for the reforestation of chenier ridges along the southwest Louisiana coast:

- Original measures included all cheniers and elevated features identified by the *Cheniers and Natural Ridges Study* (Providence Engineering and Environmental Group LLC 2009).
- From these, east/west-oriented cheniers with elevations generally greater than +5 feet NAVD 88 (from LIDAR) were selected. The +5 feet NAVD 88 target elevation is considered a conservative minimum elevation that could sustain tree plantings for the duration of the study period given relative sea level rise, and is taken from Didier (2007) and other professional opinions. The selected cheniers included: Measure 510a - Blue Buck Ridge; Measure 510b - Hackberry Ridge; Measure 510d - Front Ridge; Measure 416 - Grand Chenier Ridge; Measure 509c - Bill Ridge; and Measure 509d - Cheniere Au Tigre.
- Within these measures, reforestation focused specifically on large, continuous, sparsely wooded tracts greater than 5 acres, excluding: areas below +5 feet NAVD 88; areas with residential or industrial development; and sand borrow pits.
- For purposes of the prime and unique farmlands evaluation and to more easily correspond with Form AD-1006, the measures have been grouped as sites A – D. All of the measures discussed are part of the proposed action, and shape files for each *Site* are provided:
  - **Site A**
    - Measure 510a – Blue Buck Ridge: Eight tracts totaling 524.4 acres were identified (from west to east: 16.2, 40.4, 45.6, 141.2, 18.2, 20.4, 202.8, and 39.6- acre tracts).
    - Measure 510b – Hackberry Ridge: Three tracts totaling 148.5 acres were identified (from west to east: 62.7, 72.2, and 13.6-acre tracts). The western two miles (including the 62.7-acre tract) of this measure have been identified by the Louisiana Natural Heritage Program as "Remnant Chenier Forest", but appear to have been damaged by recent hurricanes.
  - **Site B**
    - Measure 510d – Front Ridge: The eastern 3.1 miles of this measure do not encompass large swaths of suitable elevation. Of the remainder, eleven tracts totaling 458.7 acres were identified (from west to east: 35.7, 47.1, 70.0, 125.6, 65.2, 12.3, 22.4, 15.0, 29.8, 13.0, 22.6-acre tracts).
  - **Site C**
    - Measure 416 – Grand Chenier Ridge: The eastern 5.8 miles of this measure do not encompass large swaths of suitable elevation. Of the remainder, nine tracts totaling 251.9 acres were identified (from west to east: 8.5, 11.0, 13.1, 19.4, 85.6, 46.7, 25.7, 29.1, and 12.8-acre tracts).

- **Site D**
  - Measure 509c – Bill Ridge: Three tracts were indentified that encompass 8.8 acres of the northern ridge, and 6.5 and 6.1 acres of the southern ridge. The middle section of the southern ridge was excluded due to insufficient elevation.
  - Measure 509d – Cheniere Au Tigre: The majority of this chenier is forested with the exception of an 8.2 acre tract on the western end. The eastern part of the measure along the Gulf shoreline was removed due to concerns about the sustainability of tree plantings in these exposed areas.



Figure 1. Selected reforestation tracts for Measures 509c, 509d, and 416.

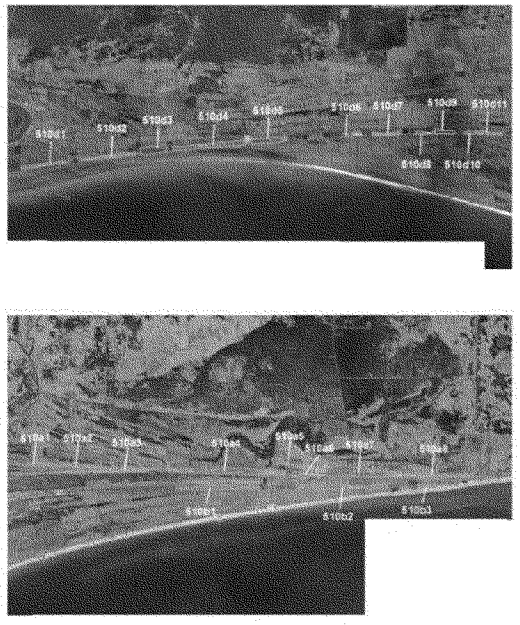


Figure 2. Selected reforestation tracts for Measures 510d, 510a, and 510b.

SOUTHWEST COASTAL LOUISIANA
INTEGRATED FINAL FEASIBILITY REPORT
AND
ENVIRONMENTAL IMPACT STATEMENT

APPENDIX A
Annex F
State Historic Preservation Officer (SHPO) and
Tribal Coordination Letters

Programmatic Agreement
National Economic Development/
National Ecosystem Restoration

**PROGRAMMATIC AGREEMENT
AMONG THE UNITED STATES ARMY CORPS OF ENGINEERS,
THE LOUISIANA STATE HISTORIC PRESERVATION OFFICER, AND
THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
REGARDING THE NATIONAL ECONOMIC DEVELOPMENT COMPONENT OF THE
SOUTHWEST COASTAL LOUISIANA STUDY**

WHEREAS, historically, the low elevation and proximity of the Calcasieu, Cameron and Vermilion Parishes to the Gulf of Mexico puts these southwest coastal Louisiana communities at risk of damages from storm surge flooding and coastal erosion; and

WHEREAS, the U.S. Congress through separate reciprocal authorizations, authorized the investigation of alternatives to: (1) provide hurricane and storm damage risk reduction measures; and (2) significantly restore environmental conditions that existed prior to the large scale alteration of the natural ecosystem in this three (3) parish area. This study, hereafter referred to as the Southwest Coastal Louisiana Study (SWC Study), focuses on a 4,700 square mile study area located in Calcasieu, Cameron, and Vermilion Parishes (the Study Area); and

WHEREAS, the Louisiana Coastal Protection and Restoration Authority Board (CPRAB) is the non-federal sponsor for SWC Study; and

WHEREAS, the hurricane and storm damage risk reduction component of the SWC Study, referred to as the National Economic Development (NED) plan (NED Plan), is the subject of this Programmatic Agreement (PA or this Agreement), and the ecosystem restoration component of the SWC Study, referred to as the National Ecosystem Restoration (NER) component, is the subject of a separate programmatic agreement; and

WHEREAS, the NED component of the SWC Study was authorized based on language in the River and Harbor Act of 1962 and a resolution of the Committee on Transportation and Infrastructure of the United States House of Representatives following the impact of Hurricane Rita in 2005, to wit:

"Surveys of the coastal areas of the United States and its possessions, including the shores of the Great Lakes, in the interest of beach erosion control, hurricane protection and related purposes: Provided, That surveys of particular areas shall be authorized by appropriate resolution of either the Committee on Public Works of the United States Senate or the Committee on Public Works of the House of Representatives."

AND

"Resolved by the Committee on Transportation and Infrastructure of the United States House of Representatives, that, in accordance with Section 110 of the River and Harbor Act of 1962, the Secretary of the Army is requested to survey the coast of Louisiana in Cameron, Calcasieu, and Vermilion parishes with particular reference to the advisability

of providing hurricane protection and storm damage reduction and related purposes to include the feasibility of constructing an armored 12-foot levee along the Gulf Intracoastal Waterway." (December 7, 2005 – Committee on Transportation and Infrastructure, U.S. House of Representatives, Resolution Docket 2747, Southwest Coastal Louisiana); and

WHEREAS, the NED Plan includes nonstructural hurricane and storm damage risk reduction measures for residential and non-residential structures that meet the eligibility criteria for the NED Plan located in the Study Area with first-floor elevations at or below the 25-year base flood elevation based on year 2025 hydrology (NED Structures); and

WHEREAS, pursuant to 36 CFR Part 800, the regulations implementing Section 106 of the National Historic Preservation Act (NHPA) (54 U.S.C. § 306108), the U.S. Army Corps of Engineers (USACE) has determined that implementation of the NED Plan will result in Undertakings that have the potential to cause effects on properties listed in or eligible for listing in the National Register of Historic Places (NRHP) and properties that have religious and cultural significance for federally-recognized Indian Tribes as defined in 36 CFR § 800.16(m) (Tribes) (collectively, "historic properties" as defined in 36 CFR § 800.16(l)(1)); and

WHEREAS, an Undertaking, as defined in 36 CFR § 800.16(y) may include any one of the following nonstructural hurricane and storm damage risk reduction measures and any related project activities that have the potential to cause effects on historic properties: 1. elevation of residential structures, 2. dry flood proofing of non-residential structures, 3. construction of localized storm surge risk reduction measures of less than 6 feet in height around non-residential structures, and 4. acquisition and demolition of residential and/or non-residential structures; and

WHEREAS, each Undertaking with its respective area of potential effects (APE) will be treated separately for the purposes of Section 106 consultation; and

WHEREAS, USACE has elected to fulfill its Section 106 obligations through execution and implementation of a programmatic agreement as provided for in 36 CFR § 800.14(b); and

WHEREAS, USACE has notified the Advisory Council on Historic Preservation (ACHP) of the potential for the Undertakings to affect historic properties and that a programmatic agreement will be prepared, and the ACHP has chosen to participate in consultation to develop this Agreement; and

WHEREAS, USACE has consulted with the Louisiana State Historic Preservation Officer (SHPO), Tribes, Tribal Historic Preservation Officers (THPOs), ACHP, CPRAB, and other appropriate consulting parties in developing this Agreement in order to define efficient and cost effective processes for taking into consideration the effects of the Undertakings upon historic properties; and

WHEREAS, USACE acknowledges Tribes as sovereign nations which have a unique government-to-government relationship with the federal government and its agencies; USACE further acknowledges its Trust Responsibility to those Tribes; and

WHEREAS, USACE has made a reasonable and good faith effort to identify any Tribes that may attach religious and cultural significance to historic properties that may be affected by the Undertakings; and

WHEREAS, USACE has invited the Alabama-Coushatta Tribe of Texas, Caddo Nation of Oklahoma, Chitimacha Tribe of Louisiana, Choctaw Nation of Oklahoma, Coushatta Tribe of Louisiana, Jena Band of Choctaw Indians, Mississippi Band of Choctaw Indians, Muscogee (Creek) Nation, Quapaw Tribe of Oklahoma, Seminole Nation of Oklahoma, Seminole Tribe of Florida, and the Tunica-Biloxi Tribe of Louisiana, Tribes for which historic properties located in the State of Louisiana have religious and cultural significance, to consult in the development of this Agreement; and

WHEREAS, the Quapaw Tribe of Oklahoma and the Muscogee (Creek) Nation have determined that the Undertakings are not within their geographic area of interest and have chosen not to participate in the development of this Agreement; and

WHEREAS, the Alabama-Coushatta Tribe of Texas, Caddo Nation of Oklahoma, Chitimacha Tribe of Louisiana, Choctaw Nation of Oklahoma, Coushatta Tribe of Louisiana, Jena Band of Choctaw Indians, Mississippi Band of Choctaw Indians, Seminole Nation of Oklahoma, and Seminole Tribe of Florida have chosen to participate in the development of this Agreement and have been invited to sign this Agreement as an Invited Signatory Party; and

WHEREAS, the Tunica-Biloxi Tribe of Louisiana and those Tribes that have not participated in the development of this Agreement but that may choose to participate in Section 106 consultation will be invited to sign this Agreement as a Concurring Party; and

WHEREAS, CPRAB has participated in the development of this Agreement and has been invited to sign this Agreement as an Invited Signatory Party; and

WHEREAS, USACE has taken appropriate measures to identify other consulting parties that may be interested in Section 106 consultation, by notification to the Parish Presidents of Calcasieu, Cameron, and Vermilion parishes, as well as the Abbeville Community and Historic Preservation Commission, Abbeville Main Street, Calcasieu Historical Preservation Society, Foundation for Historical Louisiana, Lake Charles Historic Preservation Commission, Louisiana Trust for Historic Preservation, National Trust for Historic Preservation, Vermilion Historical Society, and the Atakapa-Ishak Nation. Consulting parties that participate in Section 106 consultation may be invited to sign this Agreement as a Concurring Party; and

WHEREAS, USACE has involved the public through the National Environmental Policy Act (NEPA) process, which affords all persons, organizations, and government agencies the right to review and comment on proposed major federal actions that are

evaluated by a NEPA document. Public meetings to collect input during planning were held in March 2009, July 2009, February 2010, March 2010, July 2010, October 2011, April 2012, July 2013, and August 2013. On December 13, 2013, USACE released an Integrated Draft Feasibility Report and Environmental Impact Statement for the SWC Study (Draft Report) to the public for a review period of forty-five (45) calendar days, which was extended an additional fourteen (14) days until February 13, 2014. This document included a general discussion of cultural resources within the study area. Public hearings of the Draft Report were held on January 7 and 9, 2014. On March 20, 2015, USACE released a Revised Integrated Draft Feasibility Report and Environmental Impact Statement for the SWC Study (Revised Draft Report) to the public for a review period of forty-five (45) calendar days. Public hearings of the Revised Draft Report were held on April 14, 15, and 16, 2015. USACE has also notified the public of the development of this Agreement with newspaper announcements in the *Abbeville Meridional, American* Press, and *The Advocate*; and

NOW, THEREFORE, USACE, SHPO, and ACHP agree that the Undertakings shall be implemented in accordance with the following stipulations in order to take into account the effects of the Undertakings on historic properties.

STIPULATIONS

To the extent of its legal authority, USACE shall ensure that the following terms are carried out:

I. Consultation and Coordination

A. Following Congressional authorization and appropriation to implement the entirety or some portion of the NED Plan, USACE shall meet with Signatory and Invited Signatory parties to review the NED Nonstructural Implementation Plan and this Agreement.

B. USACE shall make a reasonable and good faith effort to identify any additional Tribes that might attach religious and cultural significance to historic properties in the APE for an Undertaking and invite those Tribes to participate in Section 106 consultation.

C. USACE shall consult with Tribes that are Invited Signatory Parties and Concurring Parties, as well as any other Tribe that requests in writing to be a consulting party (collectively, "Consulting Tribes").

D. USACE shall provide Consulting Tribes with an executed copy of this Agreement and with copies of all plans, determinations, and findings provided to the SHPO.

E. Owners of NED Structures (Property Owners) are entitled to participate as consulting parties in the Section 106 process as it relates to the property in which they hold an ownership interest.

F. Individuals or organizations with a demonstrated interest in an Undertaking, including certified local governments, may be invited to participate as consulting parties due to the nature of their legal or economic relations to an Undertaking or affected properties, or their concern with an Undertaking's effects on historic properties, if agreed upon by the USACE and SHPO.

G. To the extent permitted under applicable federal laws and regulations, for example, Section 304 of the NHPA (54 U.S.C. § 307103), 36 CFR § 800.11(c), and Section 9 of the Archaeological Resources Protection Act of 1979 (ARPA) (16 U.S.C. 470aa-mm; Public Law 96-95 and amendments to it), USACE will make available to the public documents developed pursuant to this Agreement.

H. Electronic mail (email) will serve as the official correspondence method for all communications regarding this Agreement and its provisions. See Appendix A for a list of contacts and email addresses. Contact information in Appendix A may be updated as needed without an amendment to this Agreement. It is the responsibility of each signatory to immediately inform the USACE of any change in name, address, email address, or phone number of any point-of-contact. USACE will forward this information to all signatories by email. Failure of any party to this Agreement to notify the USACE of any change to a point-of-contact's information shall not be grounds for asserting that notice of a proposed action was not received.

I. All standard response timeframes established by 36 CFR Part 800 will apply to this Agreement, unless an alternative response timeframe is agreed to by the SHPO and Consulting Tribes on a case-by-case basis.

J. All time designations will be in calendar days. If any party does not comment within the agreed upon timeframes, USACE may assume that party's concurrence with the USACE's determination, and will notify all consulting parties of the action and proceed in accordance with this Agreement.

II. Standards

A. All work carried out pursuant to this Agreement shall be done by or under the direct supervision of historic preservation professionals who meet the *Secretary of the Interior's Professional Qualifications Standards* (36 CFR Part 61).

B. All work carried out pursuant to this Agreement shall meet the *Secretary of the Interior's Standards for the Treatment of Historic Properties* (36 CFR Part 68).

C. The elevation of residential structures carried out pursuant to this Agreement that may affect historic properties shall meet the Louisiana Division of Historic Preservation's *Elevation Guidelines for Historic Buildings in the Louisiana GO Zone*.

D. All historic standing structures surveys carried out pursuant to this Agreement shall be completed in accordance with the Louisiana Historic Resource Inventory Guidelines of the Louisiana Division of Historic Preservation.

E. All archaeological investigations carried out pursuant to this Agreement shall be completed in accordance with the Field Standards and documented in accordance with the Report Standards of the Louisiana Division of Archaeology.

III. Identification and Evaluation of Historic Properties

A. USACE, in consultation with the SHPO and Consulting Tribes, will determine and document the geographic areas within which an Undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist, hereafter referred to as an APE. USACE will conduct a reasonable and good faith effort to identify historic properties located within an APE.

1. USACE shall seek input from consulting parties, as appropriate, concerning:

   a. the historic significance of structures that have not previously been evaluated for eligibility for listing in the National Register, either individually or as contributing to a historic district;

   b. the potential for archaeological properties to be present; and

   c. the potential for properties of religious and cultural significance to Tribes to be present.

   Any comments provided to the USACE shall be considered by the USACE and SHPO in evaluating National Register eligibility.

2. USACE shall ensure that a Louisiana Historic Resource Inventory (LHRI) Form will be completed for each eligible and participating NED Structure 50 years of age or older and for additional structures 50 years of age or older located within an APE that have not been previously surveyed in accordance with the guidelines for Intensive Level Survey of the Louisiana Division of Historic Preservation. An LHRI Update Addendum will be completed for each eligible and participating NED Structure and additional structures located within an APE that have been previously surveyed.

3. USACE will consult with the SHPO and Consulting Tribes to determine the level of effort necessary to identify the anticipated type and location of archaeological properties or properties of religious and cultural significance to Tribes. The level of survey to be conducted within an APE and the survey methodology will be developed in consultation with the SHPO and Consulting Tribes and completed in a manner that meets the standards for Reconnaissance or Phase I Investigations as defined by the Louisiana Division of Archaeology. These efforts will be documented in reports that

USACE will submit to SHPO and Consulting Tribes for review and comment. USACE will ensure that the comments provided by the SHPO and Consulting Tribes are addressed and incorporated into a final report.

4. USACE will consult with the SHPO on the eligibility of all structures located in an APE, and with the SHPO and Consulting Tribes on the eligibility of all archaeological properties and properties of religious and cultural significance to Tribes located in an APE. For properties already eligible or listed in the National Register, USACE will consult to determine whether or not the property retains the characteristics that make it eligible for listing in the National Register.

B. Consultation under this Agreement for an Undertaking will be concluded for USACE findings of *no historic properties affected* when the SHPO and Consulting Tribes have been provided the opportunity to review and comment on the documentation specified in 36 CFR § 800.11(d) and either concur or do not object within the agreed upon response timeframe. USACE shall notify any additional consulting parties and make documentation of the finding available to the public. This shall complete the USACE's Section 106 responsibilities for these properties.

C. In the event of disagreement between the USACE, SHPO, and/or Consulting Tribes concerning the eligibility of a property for listing in the NRHP under 36 CFR Part 60, USACE shall request a formal determination of eligibility for that property from the Keeper of the NRHP (Keeper). The determination by the Keeper will serve as the final decision regarding the NRHP eligibility of the property.

IV. Historic Properties Affected

A. USACE shall notify the SHPO, Consulting Tribes, and other consulting parties, as appropriate, that an Undertaking may affect historic properties and shall continue consultation with the aforementioned parties to apply the criteria of adverse effects to historic properties within an APE in accordance with 36 CFR § 800.5.

B. Consultation under this Agreement will be concluded for USACE findings of *no adverse effect* when the SHPO and Consulting Tribes have been provided the opportunity to review and comment on the documentation specified in 36 CFR § 800.11(e) and either concur or do not object within the agreed upon response timeframe.

C. In the event of an objection by the SHPO and/or Consulting Tribes regarding a USACE finding of *no adverse effect*, USACE shall seek to resolve such objection through consultation in accordance with procedures outlined in Stipulation IX.



V. Resolution of Adverse Effects

A. USACE shall continue consultation with the SHPO, Consulting Tribes, and other consulting parties, as appropriate, pursuant to 36 CFR § 800.6 to avoid, minimize, or mitigate adverse effects to historic properties.

B. USACE shall notify the ACHP and other consulting parties, as appropriate, and determine their participation. The notification of the adverse effect shall include the documentation specified in 36 CFR § 800.11(e), subject to the confidentiality provisions of 36 CFR § 800.11(c), and such other documentation as may be developed during the consultation to resolve adverse effects, including views and summaries of the consulting parties. If the project activity will affect a National Historic Landmark, USACE shall also notify the National Park Service (NPS).

C. Once the USACE, SHPO, Consulting Tribes, and ACHP, should they decide to participate in consultation, agree on how the adverse effects will be resolved, they shall execute and implement a Memorandum of Agreement (MOA) pursuant to 36 CFR § 800.6(c). USACE shall submit a copy of the executed MOA, along with the documentation specified in 36 CFR § 800.11(f), to the ACHP prior to approving an Undertaking. A copy of the executed MOA shall be forwarded to all Signatory, Invited Signatory, and Concurring Parties.

D. Should the USACE, SHPO, and Consulting Tribes disagree on how the adverse effects will be resolved, USACE shall seek to resolve such objection through consultation in accordance with procedures outlined in Stipulation IX.

VI. Curation

A. USACE shall ensure that all collections resulting from identification and evaluation surveys, data recovery operations, or other studies pursuant to this Agreement are maintained in accordance with 36 CFR Part 79 as long as there is a USACE interest in the collections, minimally until the analysis is complete and the final report is accepted by the Division of Archaeology. USACE shall be responsible for costs to process, catalog, and accession all collections in accordance with 36 CFR Part 79.

B. USACE shall be responsible for consulting with landowners regarding the curation of collections resulting from identification and evaluation surveys, data recovery operations, or other studies pursuant to this Agreement. USACE shall encourage non-federal landowners to donate collections to the Division of Archaeology or other facility meeting the standards of 36 CFR Part 79 for long-term curation. USACE shall be responsible for negotiating the return of collections to non-federal landowners should they elect not to donate the collections, including any costs required to return the collections.

C. USACE shall be responsible for costs to prepare federally-owned collections, including the associated records of non-federal collections, and any non-federal collections donated to the Division or Archaeology or other facility agreed upon



by SHPO and Consulting Tribes for long-term curation. Collections to be deposited with a curation facility shall be prepared in accordance with the standards of that facility.

D. USACE shall be responsible for costs to curate federally-owned collections, including the associated records of non-federal collections, long-term in accordance with 36 CFR Part 79 and the curation agreement in effect with the facility accepting the collections. For non-federal collections donated to the Division of Archaeology or other facility, USACE shall be responsible for the one-time accession fee assessed by the Division of Archaeology or other facility meeting the standards of 36 CFR Part 79.

VII. Discovery of Human Remains

A. The following language shall be included in construction plans and specifications:

When human remains, suspected human remains, or indications of a burial are discovered during the execution of an Undertaking, the individual(s) who made the discovery shall immediately notify the local law enforcement, coroner/medical examiner, and the USACE, New Orleans District, and make a reasonable effort to protect the remains from any harm. The human remains shall not be touched, moved, or further disturbed. All activities shall cease within a minimum of 50 feet from the area of the find (50-foot radius "no work" buffer) until authorized by the USACE.

B. Upon notification, USACE shall ensure that the area of the find is secured and protected from further disturbance. USACE shall ensure that the following procedures will be followed if the area of the find is located on private or state land, or federal or tribal land.

1. Private or State Land. In the event that the area of the find is located on private or state land, the procedures established by the Louisiana Unmarked Human Burial Sites Preservation Act (La. R.S. 8:671-681) are applicable.

a. USACE shall immediately notify the State Archaeologist of the discovery.

b. USACE shall continue consultation with SHPO, Consulting Tribes, and additional consulting parties, as appropriate.

c. USACE shall ensure that no remains will be removed from the area of the find until jurisdiction is established and the appropriate permits are obtained from the Division of Archaeology.

2. Federal or Tribal Land. In the event that the area of the find is located on federal or tribal land, the procedures established by the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA) (25 U.S.C. § 3001-3013, 18 U.S.C. § 1170) and the implementing regulations (43 CFR

Part 10), and ARPA and the implementing regulations (43 CFR Part 7) are applicable.

a. USACE shall immediately notify the responsible federal agency official or Indian tribe official with jurisdiction over the remains.

b. USACE shall continue consultation with SHPO, Consulting Tribes, and additional consulting parties, as appropriate.

c. If the USACE is the responsible federal agency, then the USACE shall ensure that the procedures established by NAGPRA and ARPA are followed, as applicable.

C. All Signatory and Invited Signatory Parties agree that the most appropriate treatment, if feasible, is to protect human remains and permanently preserve burial sites in situ.

VIII. Unanticipated Discoveries and Effects

A. The following language shall be included in construction plans and specifications:

When a previously unidentified cultural resource, including but not limited to archeological sites, standing structures, and properties of traditional religious and cultural significance to Tribes, is discovered during the execution of an Undertaking, the individual(s) who made the discovery shall immediately secure the vicinity, make a reasonable effort to avoid or minimize harm to the resource, and notify the USACE, New Orleans District. All activities shall cease within a minimum of 50 feet from the inadvertent discovery (50-foot radius "no work" buffer) until authorized by the USACE.

B. Upon notification, USACE shall implement any additional reasonable measures necessary to avoid or minimize effects to the resource. Any previously unidentified cultural resource will be treated as though it is eligible for the NRHP until such other determination may be made.

C. USACE shall immediately notify the SHPO, Consulting Tribes, and additional consulting parties, as appropriate, within 48 hours of the finding and request consultation to resolve potential adverse effects.

1. If consulting parties agree that the cultural resource is not eligible for the NRHP, then the suspension of work will end.

2. If consulting parties agree that the cultural resource is eligible for the NRHP, then the suspension of work will continue, and the USACE, in consultation with the SHPO and Consulting Tribes, will determine actions to avoid, minimize, or mitigate adverse effects to the historic property and will ensure that the appropriate actions are carried out.

D. In the event that the USACE is notified of the discovery of previously unidentified archaeological resources on federal or tribal land during the execution of an Undertaking, USACE shall ensure that procedures established by ARPA and implementing regulations (43 CFR Part 7) will be followed.

E. In the event that the USACE is notified of the discovery of funerary objects, sacred objects, or objects of cultural patrimony on federal or tribal land during the execution of an Undertaking, USACE shall ensure that procedures outlined in Stipulation VII will be followed.

F. In the event that effects to historic properties are identified following the completion of a project activity, any party may provide the USACE with evidence of such effects for a period of twelve (12) months from the completion of the affecting work. USACE shall review the evidence and consult with the SHPO, Consulting Tribes, and ACHP, as appropriate, to resolve any adverse effects.

G. If the USACE, SHPO, and Consulting Tribes cannot agree on an appropriate course of action to address an unanticipated discovery or effects situation, then the USACE shall initiate the dispute resolution process set forth in Stipulation IX.

IX. Dispute Resolution

A. Except for the resolution of eligibility issues as set forth in Stipulation III, should any Signatory, Invited Signatory, or Concurring Party object in writing to the USACE at any time to any actions proposed or the manner in which the terms of this Agreement are implemented, USACE shall consult with such party to resolve the objection.

B. If the USACE determines that such objection cannot be resolved, the USACE shall forward all documentation relevant to the dispute, including USACE's proposed resolution, to the ACHP.

C. The ACHP shall provide the USACE with its advice on the resolution of the objection within thirty (30) days of receiving adequate documentation. Prior to reaching a final decision on the dispute, USACE shall prepare a written response that takes into account any timely advice or comments regarding the dispute from the ACHP, Signatories, Invited Signatories, and Concurring Parties, and provide them with a copy of this written response. USACE will then proceed according to its final decision.

D. If the ACHP does not provide its advice regarding the dispute within the thirty (30) day time period, USACE may make a final decision on the dispute and proceed accordingly. Prior to reaching such a final decision, USACE shall prepare a written response that takes into account any timely comments regarding the dispute from the Signatories, Invited Signatories, and Concurring Parties, and provide them and the ACHP with a copy of such written response. USACE will then proceed according to its final decision.

E. USACE's responsibility to carry out all other actions subject to the terms of this Agreement that are not the subject of the dispute remain unchanged.

X. Administration, Effect, and Duration

A. This Agreement shall take effect upon execution by the ACHP, USACE, and SHPO. USACE shall provide Signatory, Invited Signatory, and Concurring Parties with a complete copy of this Agreement including all executed signature pages.

B. This Agreement will remain in effect for twenty (20) years from the date of execution unless the Signatory Parties agree that there is a need to extend the term. Prior to the end of the twenty-year term, USACE will consult with ACHP and SHPO to determine interest in extending this Agreement. This Agreement may be extended by written agreement negotiated by Signatory Parties and by amending this Agreement consistent with Stipulation XII.

C. Each year following the execution of this Agreement until it expires or is terminated, USACE shall provide all Signatory, Invited Signatory, and Concurring Parties a summary report detailing work undertaken pursuant to its terms. Such report shall include any scheduling changes proposed, any problems encountered, and any disputes and objections received in USACE's efforts to carry out the terms of this Agreement.

D. Following authorization and appropriation, USACE shall coordinate a meeting of the Signatory, Invited Signatory, and Concurring Parties to be held annually on a mutually agreed upon date to evaluate the effectiveness of this Agreement and discuss activities carried out pursuant to this Agreement during the preceding year and activities scheduled for the upcoming year. After five (5) years, USACE will initiate the discussion of cumulative effects as provided for in Stipulation XI. The meeting shall be held in a location agreed upon by consensus of the Signatory Parties.

XI. Comprehensive Review

A. Upon completion of the implementation of the NED Plan, USACE will analyze the Undertakings holistically to assess cumulative effects upon historic properties. Cumulative effects are those which result from the incremental impacts of an undertaking when added to other past, present, and reasonably foreseeable future federal or non-federal undertakings.

B. USACE, in consultation with the Signatory and Invited Signatory Parties, will identify and implement measures, as appropriate, to mitigate adverse cumulative effects on historic properties. If there is a disagreement that cannot be resolved, USACE shall initiate the dispute resolution process set forth in Stipulation IX.

C. Agreed upon measures to resolve adverse cumulative effects will be documented in a report that meets the standards of the Louisiana Division of Historic

Preservation and the Division of Archaeology and will be submitted to SHPO and Consulting Tribes for review and comment. The final cumulative report will be distributed to the Signatory, Invited Signatory, and Concurring Parties.

XII. Amendment and Termination

A. Notwithstanding any provision of this Agreement, Signatory and Invited Signatory Parties may request that it be amended, whereupon these parties will consult to consider such amendment. USACE shall facilitate such consultation within thirty (30) days of receipt of the written request. Where no consensus can be reached, this Agreement will not be amended. Any amendment to this Agreement will be in writing and will be signed by Signatory and Invited Signatory Parties, and shall be effective on the date of the final signature.

B. Any Invited Signatory Party may withdraw its participation in this Agreement by providing thirty (30) days advance written notification to all other Signatory and Invited Signatory Parties. In the event of withdrawal by an Invited Signatory Party, this Agreement will remain in effect for the other Signatory and Invited Signatory Parties.

C. This Agreement may be terminated in accordance with 36 CFR Part 800, provided that the Signatory and Invited Signatory Parties consult during the period prior to termination to seek agreement on amendments or other actions that could avoid termination. Any Signatory Party requesting termination of this Agreement shall provide thirty (30) days advance written notification to all other Signatory and Invited Signatory Parties.

D. Termination of this Agreement does not relieve USACE of any remaining obligations it may have, as of the date of termination, under 36 CFR Part 800.

Execution of this Agreement by the ACHP, USACE, and SHPO and implementation of its terms, evidences that the USACE has taken into account the effects of the NED Plan upon historic properties and has afforded the ACHP an opportunity to comment.

Programmatic Agreement
among
The United States Army Corps of Engineers,
Louisiana State Historic Preservation Officer,
and
The Advisory Council on Historic Preservation
regarding the
National Economic Development Component of the
Southwest Coastal Louisiana Study

Execution of this Agreement by the ACHP, USACE, and LA SHPO and implementation of its terms, evidences that the USACE has taken into account the effects of the SWC Study upon historic properties and has afforded the ACHP an opportunity to comment.

Signatory:

United States Army Corps of Engineers

By: _____ Date: 22 Feb 2016
Richard L. Hansen
Colonel, U.S. Army
District Commander

Programmatic Agreement
among
The United States Army Corps of Engineers,
Louisiana State Historic Preservation Officer,
and
The Advisory Council on Historic Preservation
regarding the
National Economic Development Component of the
Southwest Coastal Louisiana Study

Execution of this Agreement by the ACHP, USACE, and LA SHPO and implementation of its terms, evidences that the USACE has taken into account the effects of the SWC Study upon historic properties and has afforded the ACHP an opportunity to comment.

Signatory:

Louisiana State Historic Preservation Officer

By: Date: 2-19-16
Phil Boggan
Louisiana State Historic Preservation Officer
Louisiana Office of Cultural Development

Programmatic Agreement
among
The United States Army Corps of Engineers,
Louisiana State Historic Preservation Officer,
and
The Advisory Council on Historic Preservation
regarding the
National Economic Development Component of the
Southwest Coastal Louisiana Study

Execution of this Agreement by the ACHP, USACE, and LA SHPO and implementation of its terms, evidences that the USACE has taken into account the effects of the SWC Study upon historic properties and has afforded the ACHP an opportunity to comment.

Signatory:

Advisory Council on Historic Preservation

By: _____ Date: 2/24/16
John M. Fowler
Executive Director
Advisory Council on Historic Preservation

Programmatic Agreement
among
The United States Army Corps of Engineers,
Louisiana State Historic Preservation Officer,
and
The Advisory Council on Historic Preservation
regarding the
National Economic Development Component of the
Southwest Coastal Louisiana Study

Invited Signatory Party:

Chitimacha Tribe of Louisiana

By:_____ Date:_____
O'Neil J. Darden, Jr., Chairman

Programmatic Agreement
among
The United States Army Corps of Engineers,
Louisiana State Historic Preservation Officer,
and
The Advisory Council on Historic Preservation
regarding the
National Economic Development Component of the
Southwest Coastal Louisiana Study

Invited Signatory Party:

Choctaw Nation of Oklahoma

By:_____ Date:_____
Gary Batton, Chief

Programmatic Agreement
among
The United States Army Corps of Engineers,
Louisiana State Historic Preservation Officer,
and
The Advisory Council on Historic Preservation
regarding the
National Economic Development Component of the
Southwest Coastal Louisiana Study

Invited Signatory Party:

Coushatta Tribe of Louisiana

By:_____ Date:_____
Kevin Sickey, Chief

Programmatic Agreement
among
The United States Army Corps of Engineers,
Louisiana State Historic Preservation Officer,
and
The Advisory Council on Historic Preservation
regarding the
National Economic Development Component of the
Southwest Coastal Louisiana Study

Invited Signatory Party:

Mississippi Band of Choctaw Indians

By:_____ Date:_____
Phyliss J. Anderson, Chief

Programmatic Agreement
among
The United States Army Corps of Engineers,
Louisiana State Historic Preservation Officer,
and
The Advisory Council on Historic Preservation
regarding the
National Economic Development Component of the
Southwest Coastal Louisiana Study

Invited Signatory Party:

Alabama-Coushatta Tribe of Texas

By: _____ Date:_____
Carlos Bullock, Chairman

Programmatic Agreement
among
The United States Army Corps of Engineers,
Louisiana State Historic Preservation Officer,
and
The Advisory Council on Historic Preservation
regarding the
National Economic Development Component of the
Southwest Coastal Louisiana Study

Invited Signatory Party:

Caddo Nation of Oklahoma

By:_____ Date:_____
Tamara Francis-Fourkiller, Chairman/THPO

Programmatic Agreement
among
The United States Army Corps of Engineers,
Louisiana State Historic Preservation Officer,
and
The Advisory Council on Historic Preservation
regarding the
National Economic Development Component of the
Southwest Coastal Louisiana Study

Invited Signatory Party:

Jena Band of the Choctaw Indians

By:_____ Date:_____
B. Cheryl Smith, Principal Chief

Programmatic Agreement
among
The United States Army Corps of Engineers,
Louisiana State Historic Preservation Officer,
and
The Advisory Council on Historic Preservation
regarding the
National Economic Development Component of the
Southwest Coastal Louisiana Study

Invited Signatory Party:

Seminole Nation of Oklahoma

By:_____ Date:_____
Leonard M. Harjo, Principal Chief

Programmatic Agreement
among
The United States Army Corps of Engineers,
Louisiana State Historic Preservation Officer,
and
The Advisory Council on Historic Preservation
regarding the
National Economic Development Component of the
Southwest Coastal Louisiana Study

Invited Signatory Party:

Seminole Tribe of Florida

By:_____ Date:_____
James Billie, Chairman

Programmatic Agreement
among
The United States Army Corps of Engineers,
Louisiana State Historic Preservation Officer,
and
The Advisory Council on Historic Preservation
regarding the
National Economic Development Component of the
Southwest Coastal Louisiana Study

Concurring Party:

Tunica-Biloxi Tribe of Louisiana

By:_____ Date:_____
Joey Barbry, Chairman

Programmatic Agreement
among
The United States Army Corps of Engineers,
Louisiana State Historic Preservation Officer,
and
The Advisory Council on Historic Preservation
regarding the
National Economic Development Component of the
Southwest Coastal Louisiana Study

Concurring Party:

Coastal Protection and Restoration Authority Board

By:_____ Date:_____
Jerome Zeringue, Chair

PROGRAMMATIC AGREEMENT
AMONG THE UNITED STATES ARMY CORPS OF ENGINEERS,
THE LOUISIANA STATE HISTORIC PRESERVATION OFFICER, AND
THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
REGARDING THE NATIONAL ECOSYSTEM RESTORATION COMPONENT OF THE
SOUTHWEST COASTAL LOUISIANA STUDY

WHEREAS, historically, the low elevation and proximity of the Calcasieu, Cameron and Vermilion Parishes to the Gulf of Mexico puts these southwest coastal Louisiana communities at risk of damages from storm surge flooding and coastal erosion; and

WHEREAS, the U.S. Congress through separate reciprocal authorizations, authorized the investigation of alternatives to: (1) provide hurricane and storm damage risk reduction measures; and (2) significantly restore environmental conditions that existed prior to the large scale alteration of the natural ecosystem in this three (3) parish area. This study, hereafter referred to as the Southwest Coastal Louisiana Study (SWC Study), focuses on a 4,700 square mile study area located in Calcasieu, Cameron, and Vermilion Parishes (the Study Area); and

WHEREAS, the Louisiana Coastal Protection and Restoration Authority Board (CPRAB) is the non-federal sponsor for SWC Study; and

WHEREAS, the ecosystem restoration component of the SWC Study, referred to as the National Ecosystem Restoration (NER) plan (NER Plan), is the subject of this Programmatic Agreement (PA or this Agreement), and the hurricane and storm damage risk reduction component of the SWC Study, referred to as the National Economic Development (NED) component, is the subject of a separate programmatic agreement; and

WHEREAS, the NER component of the SWC Study was recommended in the 2005 Chief's Report for the Louisiana Coastal Area (LCA) Ecosystem Restoration Program, which was authorized in Title VII of the Water Resources Development Act (WRDA) of 2007.

SEC. 7003, LOUISIANA COASTAL AREA.
(a) IN GENERAL. – The Secretary may carry out a program for ecosystem restoration, Louisiana Coastal Area, Louisiana, substantially in accordance with the report of the Chief of Engineers, dated January 31, 2005.

Additional guidance is identified in Title V of WRDA 2007, SEC. 5007. EXPEDITED COMPLETION OF REPORTS AND CONSTRUCTION FOR CERTAIN PROJECTS. Guidance provided by the Director of Civil Works on December 19, 2008, states, "the coastal restoration components proposed as part of the LCA Chenier Plain study will be evaluated as part of the Southwest Coastal Louisiana feasibility study"; and

WHEREAS, the NER Plan comprises ecosystem restoration features that will be recommended for construction and ecosystem restoration features that will be recommended for additional study. Those recommended for construction are nine marsh restoration measures, five shoreline protection measures, and 35 chenier reforestation locations, and those recommended for additional study are two hydrologic and salinity control measures. Fact sheets prepared by CPRAB for the ecosystem restoration features are provided in Appendix A; and

WHEREAS, pursuant to 36 CFR Part 800, the regulations implementing Section 106 of the National Historic Preservation Act (NHPA) (54 U.S.C. § 306108), the U.S. Army Corps of Engineers (USACE) has determined that implementation of the NER Plan will result in Undertakings that have the potential to cause effects on properties listed in or eligible for listing in the National Register of Historic Places (NRHP) and properties that have religious and cultural significance for federally-recognized Indian Tribes as defined in 36 CFR § 800.16(m) (Tribes) (collectively, "historic properties" as defined in 36 CFR § 800.16(l)(1)); and

WHEREAS, an Undertaking, as defined in 36 CFR § 800.16(y) may include any one of the ecosystem restoration features recommended for construction and any related project activities that have the potential to cause effects on historic properties, as identified in Appendix A; and

WHEREAS, each Undertaking with its respective area of potential effects (APE) will be treated separately for the purposes of Section 106 consultation; and

WHEREAS, USACE has elected to fulfill its Section 106 obligations through execution and implementation of a programmatic agreement as provided for in 36 CFR § 800.14(b); and

WHEREAS, USACE has notified the Advisory Council on Historic Preservation (ACHP) of the potential for the Undertakings to affect historic properties and that a programmatic agreement will be prepared, and the ACHP has chosen to participate in consultation to develop this Agreement; and

WHEREAS, USACE has consulted with the Louisiana State Historic Preservation Officer (SHPO), Tribes, Tribal Historic Preservation Officers (THPOs), ACHP, CPRAB, and other appropriate consulting parties in developing this Agreement in order to define efficient and cost effective processes for taking into consideration the effects of the Undertakings upon historic properties; and

WHEREAS, USACE acknowledges Tribes as sovereign nations which have a unique government-to-government relationship with the federal government and its agencies; USACE further acknowledges its Trust Responsibility to those Tribes; and

WHEREAS, USACE has made a reasonable and good faith effort to identify any Tribes that may attach religious and cultural significance to historic properties that may be affected by the Undertakings; and

WHEREAS, USACE has invited the Alabama-Coushatta Tribe of Texas, Caddo Nation of Oklahoma, Chitimacha Tribe of Louisiana, Choctaw Nation of Oklahoma, Coushatta Tribe of Louisiana, Jena Band of Choctaw Indians, Mississippi Band of Choctaw Indians, Muscogee (Creek) Nation, Quapaw Tribe of Oklahoma, Seminole Nation of Oklahoma, Seminole Tribe of Florida, and the Tunica-Biloxi Tribe of Louisiana, Tribes for which historic properties located in the State of Louisiana have religious and cultural significance, to consult in the development of this Agreement; and

WHEREAS, the Quapaw Tribe of Oklahoma and the Muscogee (Creek) Nation have determined that the Undertakings are not within their geographic area of interest and have chosen not to participate in the development of this Agreement; and

WHEREAS, the Alabama-Coushatta Tribe of Texas, Caddo Nation of Oklahoma, Chitimacha Tribe of Louisiana, Choctaw Nation of Oklahoma, Coushatta Tribe of Louisiana, Jena Band of Choctaw Indians, Mississippi Band of Choctaw Indians, Seminole Nation of Oklahoma, and Seminole Tribe of Florida have chosen to participate in the development of this Agreement and have been invited to sign this Agreement as an Invited Signatory Party; and

WHEREAS, the Tunica-Biloxi Tribe of Louisiana and those Tribes that have not participated in the development of this Agreement but that may choose to participate in Section 106 consultation will be invited to sign this Agreement as a Concurring Party; and

WHEREAS, CPRAB has participated in the development of this Agreement and has been invited to sign this Agreement as an Invited Signatory Party; and

WHEREAS, USACE has taken appropriate measures to identify other consulting parties that may be interested in Section 106 consultation, by notification to the Parish Presidents of Calcasieu, Cameron, and Vermilion parishes, as well as the Atakapa-Ishak Nation. Consulting parties that participate in Section 106 consultation may be invited to sign this Agreement as a Concurring Party; and

WHEREAS, USACE has involved the public through the National Environmental Policy Act (NEPA) process, which affords all persons, organizations, and government agencies the right to review and comment on proposed major federal actions that are evaluated by a NEPA document. Public meetings to collect input during planning were held in March 2009, July 2009, February 2010, March 2010, July 2010, October 2011, April 2012, July 2013, and August 2013. On December 13, 2013, USACE released an Integrated Draft Feasibility Report and Environmental Impact Statement for the SWC Study (Draft Report) to the public for a review period of forty-five (45) calendar days, which was extended an additional fourteen (14) days until February 13, 2014. This document included a general discussion of cultural resources within the study area. Public hearings of the Draft Report were held on January 7 and 9, 2014. On March 20, 2015, USACE released a Revised Integrated Draft Feasibility Report and Environmental Impact Statement for the SWC Study (Revised Draft Report) to the public for a review period of forty-five (45) calendar days. Public hearings of the Revised Draft Report were

held on April 14, 15, and 16, 2015. USACE has also notified the public of the development of this Agreement with newspaper announcements in the *Abbeville Meridional*, *American Press*, and *The Advocate*; and

NOW, THEREFORE, USACE, SHPO, and ACHP agree that the Undertakings shall be implemented in accordance with the following stipulations in order to take into account the effects of the Undertakings on historic properties.

STIPULATIONS

To the extent of its legal authority, USACE shall ensure that the following terms are carried out:

I. Consultation and Coordination

A. Following Congressional authorization and appropriation to implement the entirety or some portion of the NER Plan, USACE shall meet with Signatory and Invited Signatory parties to review this Agreement.

B. USACE shall make a reasonable and good faith effort to identify any additional Tribes that might attach religious and cultural significance to historic properties in the APE for an Undertaking and invite those Tribes to participate in Section 106 consultation.

C. USACE shall consult with Tribes that are Invited Signatory Parties and Concurring Parties, as well as any other Tribe that requests in writing to be a consulting party (collectively, "Consulting Tribes").

D. USACE shall provide Consulting Tribes with an executed copy of this Agreement and with copies of all plans, determinations, and findings provided to the SHPO.

E. Individuals or organizations with a demonstrated interest in an Undertaking may be invited to participate as consulting parties due to the nature of their legal or economic relations to an Undertaking or affected properties, or their concern with an Undertaking's effects on historic properties, if agreed upon by the USACE and SHPO.

F. To the extent permitted under applicable federal laws and regulations, for example, Section 304 of the NHPA (54 U.S.C. § 307103), 36 CFR § 800.11(c), and Section 9 of the Archaeological Resources Protection Act of 1979 (ARPA) (16 U.S.C. 470aa-mm; Public Law 96-95 and amendments to it), USACE will make available to the public documents developed pursuant to this Agreement.

G. Electronic mail (email) will serve as the official correspondence method for all communications regarding this Agreement and its provisions. See Appendix B for a list of contacts and email addresses. Contact information in Appendix B may be updated as needed without an amendment to this Agreement. It is the responsibility of each signatory to immediately inform the USACE of any change

in name, address, email address, or phone number of any point-of-contact. USACE will forward this information to all signatories by email. Failure of any party to this Agreement to notify the USACE of any change to a point-of-contact's information shall not be grounds for asserting that notice of a proposed action was not received.

H. All standard response timeframes established by 36 CFR Part 800 will apply to this Agreement, unless an alternative response timeframe is agreed to by the SHPO and Consulting Tribes on a case-by-case basis.

I. All time designations will be in calendar days. If any party does not comment within the agreed upon timeframes, USACE may assume that party's concurrence with the USACE's determination, and will notify all consulting parties of the action and proceed in accordance with this Agreement.

II. Standards

A. All work carried out pursuant to this Agreement shall be done by or under the direct supervision of historic preservation professionals who meet the *Secretary of the Interior's Professional Qualifications Standards* (36 CFR Part 61).

B. All work carried out pursuant to this Agreement shall meet the *Secretary of the Interior's Standards for the Treatment of Historic Properties* (36 CFR Part 68).

C. All historic standing structures surveys carried out pursuant to this Agreement shall be completed in accordance with the Louisiana Historic Resource Inventory Guidelines of the Louisiana Division of Historic Preservation.

D. All archaeological investigations carried out pursuant to this Agreement shall be completed in accordance with the Field Standards and documented in accordance with the Report Standards of the Louisiana Division of Archaeology.

III. Identification and Evaluation of Historic Properties

A. USACE, in consultation with the SHPO and Consulting Tribes, will determine and document the geographic areas within which an Undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist, hereafter referred to as an APE. USACE will conduct a reasonable and good faith effort to identify historic properties located within an APE.

1. USACE shall seek input from consulting parties, as appropriate, concerning:

a. the historic significance of structures that have not previously been evaluated for eligibility for listing in the National Register, either individually or as contributing to a historic district;

b. the potential for archaeological properties to be present; and



c. the potential for properties of religious and cultural significance to Tribes to be present.

Any comments provided to the USACE shall be considered by the USACE and SHPO in evaluating National Register eligibility.

2. USACE shall complete cultural resources investigations following the recommendations provided in the *Cultural Resources Assessment and Research Design for the Southwest Coastal Louisiana Project, Calcasieu, Cameron, and Vermilion Parishes, Louisiana*, which shall be finalized in coordination with SHPO and consulting tribes prior to commencement of activities hereunder. For any portion of an APE not considered in the *Cultural Resources Assessment and Research Design*, the level of survey to be conducted and the survey methodology will be developed in consultation with the SHPO and Consulting Tribes. All surveys will be completed in a manner that meets the standards for Reconnaissance or Phase I Investigations as defined by the Louisiana Division of Archaeology. These efforts will be documented in reports that USACE will submit to SHPO and Consulting Tribes for review and comment. USACE will ensure that the comments provided by the SHPO and Consulting Tribes are addressed and incorporated into a final report.

3. USACE will consult with the SHPO on the eligibility of all structures located in an APE, and with the SHPO and Consulting Tribes on the eligibility of all archaeological properties and properties of religious and cultural significance to Tribes located in an APE. For properties already eligible or listed in the National Register, USACE will consult to determine whether or not the property retains the characteristics that make it eligible for listing in the National Register.

B. Consultation under this Agreement for an Undertaking will be concluded for USACE findings of *no historic properties affected* when the SHPO and Consulting Tribes have been provided the opportunity to review and comment on the documentation specified in 36 CFR § 800.11(d) and either concur or do not object within the agreed upon response timeframe. USACE shall notify any additional consulting parties and make documentation of the finding available to the public. This shall complete the USACE's Section 106 responsibilities for these properties.

C. In the event of disagreement between the USACE, SHPO, and/or Consulting Tribes concerning the eligibility of a property for listing in the NRHP under 36 CFR Part 60, USACE shall request a formal determination of eligibility for that property from the Keeper of the NRHP (Keeper). The determination by the Keeper will serve as the final decision regarding the NRHP eligibility of the property.

IV. Historic Properties Affected

A. USACE shall notify the SHPO, Consulting Tribes, and other consulting parties, as appropriate, that an Undertaking may affect historic properties and shall continue consultation with the aforementioned parties to apply the criteria of adverse effects to historic properties within an APE in accordance with 36 CFR § 800.5.

B. Consultation under this Agreement will be concluded for USACE findings of *no adverse effect* when the SHPO and Consulting Tribes have been provided the opportunity to review and comment on the documentation specified in 36 CFR § 800.11(e) and either concur or do not object within the agreed upon response timeframe.

C. In the event of an objection by the SHPO and/or Consulting Tribes regarding a USACE finding of *no adverse effect*, USACE shall seek to resolve such objection through consultation in accordance with procedures outlined in Stipulation IX.

V. Resolution of Adverse Effects

A. USACE shall continue consultation with the SHPO, Consulting Tribes, and other consulting parties, as appropriate, pursuant to 36 CFR § 800.6 to avoid, minimize, or mitigate adverse effects to historic properties.

B. USACE shall notify the ACHP and other consulting parties, as appropriate, and determine their participation. The notification of the adverse effect shall include the documentation specified in 36 CFR § 800.11(e), subject to the confidentiality provisions of 36 CFR § 800.11(c), and such other documentation as may be developed during the consultation to resolve adverse effects, including views and summaries of the consulting parties. If the project activity will affect a National Historic Landmark, USACE shall also notify the National Park Service (NPS).

C. Once the USACE, SHPO, Consulting Tribes, and ACHP, should they decide to participate in consultation, agree on how the adverse effects will be resolved, they shall execute and implement a Memorandum of Agreement (MOA) pursuant to 36 CFR § 800.6(c). USACE shall submit a copy of the executed MOA, along with the documentation specified in 36 CFR § 800.11(f), to the ACHP prior to approving an Undertaking. A copy of the executed MOA shall be forwarded to all Signatory, Invited Signatory, and Concurring Parties.

D. Should the USACE, SHPO, and Consulting Tribes disagree on how the adverse effects will be resolved, USACE shall seek to resolve such objection through consultation in accordance with procedures outlined in Stipulation IX.

VI. Curation

A. USACE shall ensure that all collections resulting from identification and evaluation surveys, data recovery operations, or other studies pursuant to this

Agreement are maintained in accordance with 36 CFR Part 79 as long as there is a USACE interest in the collections, minimally until the analysis is complete and the final report is accepted by the Division of Archaeology. USACE shall be responsible for costs to process, catalog, and accession all collections in accordance with 36 CFR Part 79.

B. USACE shall be responsible for consulting with landowners regarding the curation of collections resulting from identification and evaluation surveys, data recovery operations, or other studies pursuant to this Agreement. USACE shall encourage non-federal landowners to donate collections to the Division of Archaeology or other facility meeting the standards of 36 CFR Part 79 for long-term curation. USACE shall be responsible for negotiating the return of collections to non-federal landowners should they elect not to donate the collections, including any costs required to return the collections.

C. USACE shall be responsible for costs to prepare federally-owned collections, including the associated records of non-federal collections, and any non-federal collections donated to the Division or Archaeology or other facility agreed upon by SHPO and Consulting Tribes for long-term curation. Collections to be deposited with a curation facility shall be prepared in accordance with the standards of that facility.

D. USACE shall be responsible for costs to curate federally-owned collections, including the associated records of non-federal collections, long-term in accordance with 36 CFR Part 79 and the curation agreement in effect with the facility accepting the collections. For non-federal collections donated to the Division of Archaeology or other facility, USACE shall be responsible for the one-time accession fee assessed by the Division of Archaeology or other facility meeting the standards of 36 CFR Part 79.

VII. Discovery of Human Remains

A. The following language shall be included in construction plans and specifications:

When human remains, suspected human remains, or indications of a burial are discovered during the execution of an Undertaking, the individual(s) who made the discovery shall immediately notify the local law enforcement, coroner/medical examiner, and the USACE, New Orleans District, and make a reasonable effort to protect the remains from any harm. The human remains shall not be touched, moved, or further disturbed. All activities shall cease within a minimum of 50 feet from the area of the find (50-foot radius "no work" buffer) until authorized by the USACE.

B. Upon notification, USACE shall ensure that the area of the find is secured and protected from further disturbance. USACE shall ensure that the following procedures will be followed if the area of the find is located on private or state land, or federal or tribal land.

1. Private or State Land. In the event that the area of the find is located on private or state land, the procedures established by the Louisiana Unmarked Human Burial Sites Preservation Act (La. R.S. 8:671-681) are applicable.

   a. USACE shall immediately notify the State Archaeologist of the discovery.

   b. USACE shall continue consultation with SHPO, Consulting Tribes, and additional consulting parties, as appropriate.

   c. USACE shall ensure that no remains will be removed from the area of the find until jurisdiction is established and the appropriate permits are obtained from the Division of Archaeology.

2. Federal or Tribal Land. In the event that the area of the find is located on federal or tribal land, the procedures established by the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA) (25 U.S.C. § 3001-3013, 18 U.S.C. § 1170) and the implementing regulations (43 CFR Part 10), and ARPA and the implementing regulations (43 CFR Part 7) are applicable.

   a. USACE shall immediately notify the responsible federal agency official or Indian tribe official with jurisdiction over the remains.

   b. USACE shall continue consultation with SHPO, Consulting Tribes, and additional consulting parties, as appropriate.

   c. If the USACE is the responsible federal agency, then the USACE shall ensure that the procedures established by NAGPRA and ARPA are followed, as applicable.

C. All Signatory and Invited Signatory Parties agree that the most appropriate treatment, if feasible, is to protect human remains and permanently preserve burial sites in situ.

VIII. Unanticipated Discoveries and Effects

A. The following language shall be included in construction plans and specifications:

When a previously unidentified cultural resource, including but not limited to archeological sites, standing structures, and properties of traditional religious and cultural significance to Tribes, is discovered during the execution of an Undertaking, the individual(s) who made the discovery shall immediately secure the vicinity, make a reasonable effort to avoid or minimize harm to the resource, and notify the USACE, New Orleans District. All activities shall cease within a minimum of 50 feet from the inadvertent discovery (50-foot radius "no work" buffer) until authorized by the USACE.

B. Upon notification, USACE shall implement any additional reasonable measures necessary to avoid or minimize effects to the resource. Any previously unidentified cultural resource will be treated as though it is eligible for the NRHP until such other determination may be made.

C. USACE shall immediately notify the SHPO, Consulting Tribes, and additional consulting parties, as appropriate, within 48 hours of the finding and request consultation to resolve potential adverse effects.

1. If consulting parties agree that the cultural resource is not eligible for the NRHP, then the suspension of work will end.

2. If consulting parties agree that the cultural resource is eligible for the NRHP, then the suspension of work will continue, and the USACE, in consultation with the SHPO and Consulting Tribes, will determine actions to avoid, minimize, or mitigate adverse effects to the historic property and will ensure that the appropriate actions are carried out.

D. In the event that the USACE is notified of the discovery of previously unidentified archaeological resources on federal or tribal land during the execution of an Undertaking, USACE shall ensure that procedures established by ARPA and implementing regulations (43 CFR Part 7) will be followed.

E. In the event that the USACE is notified of the discovery of funerary objects, sacred objects, or objects of cultural patrimony on federal or tribal land during the execution of an Undertaking, USACE shall ensure that procedures outlined in Stipulation VII will be followed.

F. In the event that effects to historic properties are identified following the completion of a project activity, any party may provide the USACE with evidence of such effects for a period of twelve (12) months from the completion of the affecting work. USACE shall review the evidence and consult with the SHPO, Consulting Tribes, and ACHP, as appropriate, to resolve any adverse effects.

G. If the USACE, SHPO, and Consulting Tribes cannot agree on an appropriate course of action to address an unanticipated discovery or effects situation, then the USACE shall initiate the dispute resolution process set forth in Stipulation IX.

IX. Dispute Resolution

A. Except for the resolution of eligibility issues as set forth in Stipulation III, should any Signatory, Invited Signatory, or Concurring Party object in writing to the USACE at any time to any actions proposed or the manner in which the terms of this Agreement are implemented, USACE shall consult with such party to resolve the objection.

B. If the USACE determines that such objection cannot be resolved, the USACE shall forward all documentation relevant to the dispute, including USACE's proposed resolution, to the ACHP.

C. The ACHP shall provide the USACE with its advice on the resolution of the objection within thirty (30) days of receiving adequate documentation. Prior to reaching a final decision on the dispute, USACE shall prepare a written response that takes into account any timely advice or comments regarding the dispute from the ACHP, Signatories, Invited Signatories, and Concurring Parties, and provide them with a copy of this written response. USACE will then proceed according to its final decision.

D. If the ACHP does not provide its advice regarding the dispute within the thirty (30) day time period, USACE may make a final decision on the dispute and proceed accordingly. Prior to reaching such a final decision, USACE shall prepare a written response that takes into account any timely comments regarding the dispute from the Signatories, Invited Signatories, and Concurring Parties, and provide them and the ACHP with a copy of such written response. USACE will then proceed according to its final decision.

E. USACE's responsibility to carry out all other actions subject to the terms of this Agreement that are not the subject of the dispute remain unchanged.

X. Administration, Effect, and Duration

A. This Agreement shall take effect upon execution by the ACHP, USACE, and SHPO. USACE shall provide Signatory, Invited Signatory, and Concurring Parties with a complete copy of this Agreement including all executed signature pages.

B. This Agreement will remain in effect for twenty (20) years from the date of execution unless the Signatory Parties agree that there is a need to extend the term. Prior to the end of the twenty-year term, USACE will consult with ACHP and SHPO to determine interest in extending this Agreement. This Agreement may be extended by written agreement negotiated by Signatory Parties and by amending this Agreement consistent with Stipulation XII.

C. Each year following the execution of this Agreement until it expires or is terminated, USACE shall provide all Signatory, Invited Signatory, and Concurring Parties a summary report detailing work undertaken pursuant to its terms. Such report shall include any scheduling changes proposed, any problems encountered, and any disputes and objections received in USACE's efforts to carry out the terms of this Agreement.

D. Following authorization and appropriation, USACE shall coordinate a meeting of the Signatory, Invited Signatory, and Concurring Parties to be held annually on a mutually agreed upon date to evaluate the effectiveness of this Agreement and discuss activities carried out pursuant to this Agreement during the preceding

year and activities scheduled for the upcoming year. After five (5) years, USACE will initiate the discussion of cumulative effects as provided for in Stipulation XI. The meeting shall be held in a location agreed upon by consensus of the Signatory Parties.

XI. Comprehensive Review

A. Upon completion of the implementation of the NER Plan, USACE will analyze the Undertakings holistically to assess cumulative effects upon historic properties. Cumulative effects are those which result from the incremental impacts of an undertaking when added to other past, present, and reasonably foreseeable future federal or non-federal undertakings.

B. USACE, in consultation with the Signatory and Invited Signatory Parties, will identify and implement measures, as appropriate, to mitigate adverse cumulative effects on historic properties. If there is a disagreement that cannot be resolved, USACE shall initiate the dispute resolution process set forth in Stipulation IX.

C. Agreed upon measures to resolve adverse cumulative effects will be documented in a report that meets the standards of the Louisiana Division of Archaeology and will be submitted to SHPO and Consulting Tribes for review and comment. The final cumulative report will be distributed to the Signatory, Invited Signatory, and Concurring Parties.

XII. Amendment and Termination

A. Notwithstanding any provision of this Agreement, Signatory and Invited Signatory Parties may request that it be amended, whereupon these parties will consult to consider such amendment. USACE shall facilitate such consultation within thirty (30) days of receipt of the written request. Where no consensus can be reached, this Agreement will not be amended. Any amendment to this Agreement will be in writing and will be signed by Signatory and Invited Signatory Parties, and shall be effective on the date of the final signature.

B. Any Invited Signatory Party may withdraw its participation in this Agreement by providing thirty (30) days advance written notification to all other Signatory and Invited Signatory Parties. In the event of withdrawal by an Invited Signatory Party, this Agreement will remain in effect for the other Signatory and Invited Signatory Parties.

C. This Agreement may be terminated in accordance with 36 CFR Part 800, provided that the Signatory and Invited Signatory Parties consult during the period prior to termination to seek agreement on amendments or other actions that could avoid termination. Any Signatory Party requesting termination of this Agreement shall provide thirty (30) days advance written notification to all other Signatory and Invited Signatory Parties.

D. Termination of this Agreement does not relieve USACE of any remaining obligations it may have, as of the date of termination, under 36 CFR Part 800.

Execution of this Agreement by the ACHP, USACE, and SHPO and implementation of its terms, evidences that the USACE has taken into account the effects of the NER Plan upon historic properties and has afforded the ACHP an opportunity to comment.

Programmatic Agreement
among
The United States Army Corps of Engineers,
Louisiana State Historic Preservation Officer,
and
The Advisory Council on Historic Preservation
regarding the
National Ecosystem Restoration Component of the
Southwest Coastal Louisiana Study

Execution of this Agreement by the ACHP, USACE, and LA SHPO and implementation of its terms, evidences that the USACE has taken into account the effects of the SWC Study upon historic properties and has afforded the ACHP an opportunity to comment.

Signatory:

United States Army Corps of Engineers

By: _____ Date: 22 Feb 2016
Richard L. Hansen
Colonel, U.S. Army
District Commander

Programmatic Agreement
among
The United States Army Corps of Engineers,
Louisiana State Historic Preservation Officer,
and
The Advisory Council on Historic Preservation
regarding the
National Ecosystem Restoration Component of the
Southwest Coastal Louisiana Study

Execution of this Agreement by the ACHP, USACE, and LA SHPO and implementation of its terms, evidences that the USACE has taken into account the effects of the SWC Study upon historic properties and has afforded the ACHP an opportunity to comment.

Signatory:

Louisiana State Historic Preservation Officer

By: _____ Date: 2-19-16
Phil Boggan
Louisiana State Historic Preservation Officer
Louisiana Office of Cultural Development

Programmatic Agreement
among
The United States Army Corps of Engineers,
Louisiana State Historic Preservation Officer,
and
The Advisory Council on Historic Preservation
regarding the
National Ecosystem Restoration Component of the
Southwest Coastal Louisiana Study

Execution of this Agreement by the ACHP, USACE, and LA SHPO and implementation of its terms, evidences that the USACE has taken into account the effects of the SWC Study upon historic properties and has afforded the ACHP an opportunity to comment.

Signatory:

Advisory Council on Historic Preservation

By: for John M. Fowler
Executive Director
Advisory Council on Historic Preservation

Date: 2/24/16

Programmatic Agreement
among
The United States Army Corps of Engineers,
Louisiana State Historic Preservation Officer,
and
The Advisory Council on Historic Preservation
regarding the
National Ecosystem Restoration Component of the
Southwest Coastal Louisiana Study

Invited Signatory Party:

Chitimacha Tribe of Louisiana

By:_____ Date:_____
O'Neil J. Darden, Jr., Chairman

Programmatic Agreement
among
The United States Army Corps of Engineers,
Louisiana State Historic Preservation Officer,
and
The Advisory Council on Historic Preservation
regarding the
National Ecosystem Restoration Component of the
Southwest Coastal Louisiana Study

Invited Signatory Party:

Choctaw Nation of Oklahoma

By:_____ Date:_____
Gary Batton, Chief

Programmatic Agreement
among
The United States Army Corps of Engineers,
Louisiana State Historic Preservation Officer,
and
The Advisory Council on Historic Preservation
regarding the
National Ecosystem Restoration Component of the
Southwest Coastal Louisiana Study

Invited Signatory Party:

Coushatta Tribe of Louisiana

By:_____ Date:_____
Kevin Sickey, Chief

Programmatic Agreement
among
The United States Army Corps of Engineers,
Louisiana State Historic Preservation Officer,
and
The Advisory Council on Historic Preservation
regarding the
National Ecosystem Restoration Component of the
Southwest Coastal Louisiana Study

Invited Signatory Party:

Mississippi Band of Choctaw Indians

By:_____ Date:_____
Phyliss J. Anderson, Chief

Programmatic Agreement
among
The United States Army Corps of Engineers,
Louisiana State Historic Preservation Officer,
and
The Advisory Council on Historic Preservation
regarding the
National Ecosystem Restoration Component of the
Southwest Coastal Louisiana Study

Invited Signatory Party:

Alabama-Coushatta Tribe of Texas

By: _____ Date:_____
Carlos Bullock, Chairman

Programmatic Agreement
among
The United States Army Corps of Engineers,
Louisiana State Historic Preservation Officer,
and
The Advisory Council on Historic Preservation
regarding the
National Ecosystem Restoration Component of the
Southwest Coastal Louisiana Study

Invited Signatory Party:

Caddo Nation of Oklahoma

By:_____ Date:_____
Tamara Francis-Fourkiller, Chairman/THPO

Programmatic Agreement
among
The United States Army Corps of Engineers,
Louisiana State Historic Preservation Officer,
and
The Advisory Council on Historic Preservation
regarding the
National Ecosystem Restoration Component of the
Southwest Coastal Louisiana Study

Invited Signatory Party:

Jena Band of the Choctaw Indians

By:_____ Date:_____
B. Cheryl Smith, Principal Chief

Programmatic Agreement
among
The United States Army Corps of Engineers,
Louisiana State Historic Preservation Officer,
and
The Advisory Council on Historic Preservation
regarding the
National Ecosystem Restoration Component of the
Southwest Coastal Louisiana Study

Invited Signatory Party:

Seminole Nation of Oklahoma

By:_____ Date:_____
Leonard M. Harjo, Principal Chief

Programmatic Agreement
among
The United States Army Corps of Engineers,
Louisiana State Historic Preservation Officer,
and
The Advisory Council on Historic Preservation
regarding the
National Ecosystem Restoration Component of the
Southwest Coastal Louisiana Study

Invited Signatory Party:

Seminole Tribe of Florida

By:_____ Date:_____
James Billie, Chaiman

Programmatic Agreement
among
The United States Army Corps of Engineers,
Louisiana State Historic Preservation Officer,
and
The Advisory Council on Historic Preservation
regarding the
National Ecosystem Restoration Component of the
Southwest Coastal Louisiana Study

Concurring Party:

Tunica-Biloxi Tribe of Louisiana

By:_____ Date:_____
Joey Barbry, Chairman

Programmatic Agreement
among
The United States Army Corps of Engineers,
Louisiana State Historic Preservation Officer,
and
The Advisory Council on Historic Preservation
regarding the
National Ecosystem Restoration Component of the
Southwest Coastal Louisiana Study

Concurring Party:

Coastal Protection and Restoration Authority Board

By:_____ Date:_____
Jerome Zeringue, Chair

APPENDIX A: ECOSYSTEM RESTORATION FEATURE FACT SHEETS

The Ecosystem Restoration Feature Fact Sheets in Appendix A of this Agreement are the same as those found in Appendix K of the Integrated Final Feasibility Report and Environmental Impact Statement. Appendix A fact sheets can be provided upon request.

APPENDIX B: CONTACT INFORMATION

U.S. Army Corps of Engineers, New Orleans District
Richard L. Hansen
Colonel, U.S. Army
District Commander
P.O. Box 60267
New Orleans, LA 70160
(504) 862-2077

Trent Stockton – Project Archaeologist/Tribal Liaison
U.S. Army Corps of Engineers, RPEDS
P.O. Box 60267
New Orleans, LA 70160
(504) 862-2550
trent.c.stockton@usace.army.mil

Advisory Council on Historic Preservation
John Fowler, Executive Director
1100 Pennsylvania Avenue NW, Suite 803
Washington, DC 20004
(202) 606-8503
achp@achp.gov

State Historic Preservation Officer
Phil Boggan, SHPO
Department of Culture, Recreation and Tourism
Louisiana State Historic Preservation Office
1051 N. Third Street, Room 319
Baton Rouge, LA 70802
(225) 342-8170
section106@crt.la.gov

Chitimacha Tribe of Louisiana
John Paul Darden, Chairman
Chitimacha Tribe of Louisiana
P.O. Box 661
Charenton, LA 70523

Kimberly S. Walden
Cultural Director/Tribal Historic Preservation Officer
Chitimacha Tribe of Louisiana
P.O. Box 661
Charenton, LA 70523
(337) 923-9923
kswalden@chitimacha.gov

Choctaw Nation of Oklahoma
Gary Batton, Chief
Attn: Choctaw Nation Historic Preservation Department
Choctaw Nation of Oklahoma
P.O. Box 1210
Durant, Oklahoma 74702-1210

Ian Thompson
Director/Tribal Historic Preservation Officer
P.O. Box 1210
Durant, OK 74702-1210
(800) 522-6170, Ext. 2133
ithompson@choctawnation.com

Coushatta Tribe of Louisiana
Linda Langley
Tribal Historic Preservation Officer
Heritage Department
Coushatta Tribe of Louisiana
P.O. Box 10
Elton, LA 70532
(337) 584-1560
llangley@mcneese.edu

Michael Tarpley
Deputy Tribal Historic Preservation Officer
Heritage Department
Coushatta Tribe of Louisiana
P.O. Box 10
Elton, LA 70532
(318) 709-8488
kokua.aina57@gmail.com

Mississippi Band of Choctaw Indians
Phyliss J. Anderson, Chief
Mississippi Band of Choctaw Indians
P.O. Box 6257
Choctaw, MS 39350

Kenneth H. Carleton
Tribal Historic Preservation Officer/Archaeologist
Mississippi Band of Choctaw Indians
(601) 650-7316
kcarleton@choctaw.org

Alabama-Coushatta Tribe of Texas
Carlos Bullock, Chairman
Alabama-Coushatta Tribe of Texas
571 State Park Rd 56
Livingston, TX 77351

Bryant J. Celestine
Historic Preservation Officer
Alabama-Coushatta Tribe of Texas
571 State Park Rd 56
Livingston, TX 77351
(936) 563-1181
celestine.bryant@actribe.org

Caddo Nation of Oklahoma
Brenda Shemayme Edwards, Chairwoman
Caddo Nation of Oklahoma
P.O. Box 487
Binger, OK 73009

Robert Cast
Tribal Historic Preservation Officer
Caddo Nation of Oklahoma
P.O. Box 487
Binger, OK 73009
(405) 656-2344, Ext. 245
rcast@caddonation.org

Jena Band of Choctaw Indians
B. Cheryl Smith, Principal Chief
Jena Band of Choctaw Indians
P.O. Box 14
Jena, LA 71342

Dana Masters
Tribal Historic Preservation Officer
Jena Band of Choctaw Indians
P.O. Box 14
Jena, LA 71342
(318) 992-1205
jbc.thpo106@aol.com

Seminole Nation of Oklahoma
Leonard M. Harjo, Principal Chief
Seminole Nation of Oklahoma
P.O. Box 1498
Wewoka, OK 74884

Natalie Deere
Tribal Historic Preservation Officer
Historic Preservation Office
Seminole Nation of Oklahoma
P.O. Box 1498
Wewoka, OK 74884
(405) 303-2683, Ext. 7001
harjo.n@sno-nsn.gov

Seminole Tribe of Florida
James Billie
Chairman
6300 Sterling Road
Hollywood, FL 33024

Paul Backhouse
30290 Josie Billie Highway, PMB 1004
Clewiston, FL 33440
(863) 983-6549
paulbackhouse@semtribe.com

Tunica-Biloxi Tribe of Louisiana
Joey Barbry, Chairman
Tunica-Biloxi Tribe of Louisiana
P.O. Box 1589
Marksville, LA 71351

Earl J. Barbry, Jr.
Cultural Director
Tunica-Biloxi Tribe of Louisiana
P.O. Box 1589
Marksville, LA 71351
(318) 240-6451
earlii@tunica.org

Coastal Protection and Restoration Authority Board
Jerome Zeringue, Chair
P.O. Box 44027
Baton Rouge, LA 70804

Elizabeth Davoli
Coastal Resources Scientist Manager
Environmental Section, Planning & Research Division
Coastal Protection and Restoration Authority
450 Laurel Street
Baton Rouge, LA 70801
(225) 342-4616
Elizabeth.Davoli@la.gov

Correspondence

Milford Wayne Donaldson
Chairman

Clement A. Price
Deputy Chairman

John M. Fowler
Executive Director

Preserving America's Heritage

March 13, 2014

Lieutenant General Thomas P. Bostick
Commanding General
U.S. Army Corps of Engineers
441 G. Street, NW
Washington, DC 20314-1000

REF: Implementing hurricane and storm damage risk reduction measures in southwest coastal Louisiana

Dear Lieutenant General Bostick:

The Advisory Council on Historic Preservation (ACHP) has been invited by the New Orleans District of the Corps of Engineers to assist in the development of a Programmatic Agreement (PA) to help ensure that historic properties are fully considered in the development and implementation of the measures to reduce the risk of severe storm damage to life and property for coastal portions of southwestern Louisiana. Pursuant to the Criteria for Council Involvement in Reviewing Individual Section 106 Cases (Appendix A to our regulations, 36 CFR Part 800) we believe the criteria are met for our participation in this undertaking. Actions that may include residential structure elevation and flood proofing, marsh restoration, shoreline protection, reforestation, and preservation of the historic Sabine oyster reef all have the potential to have substantial impacts to important historic properties and may involve important questions of policy and interpretation. Accordingly, the ACHP will participate in consultation with the New Orleans District on this undertaking.

By copy of this letter we are also notifying Ms. Joan Exnicios, Chief of the New Orleans District's Environmental Planning Branch, of our decision to participate in consultation.

Our participation will be handled by Dr. Tom McCulloch, who can be reached at 202-606-8554 or at tmcculloch@achp.gov. We look forward to working with the Corps on this important project.

Sincerely,

John M. Fowler
Executive Director

ADVISORY COUNCIL ON HISTORIC PRESERVATION
1100 Pennsylvania Avenue NW, Suite 803 • Washington, DC 20004
Phone: 202-606-8503 • Fax: 202-606-8647 • achp@achp.gov • www.achp.gov

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

MARCH 7, 2014

REPLY TO
ATTENTION OF

Regional Planning and
Environment Division, South

Carlos Bullock, Chairman
Alabama-Coushatta Tribe of Texas
571 State Park Rd 56
Livingston, TX 77351

Dear Chairman Bullock:

The United States Army Corps of Engineers, New Orleans District (CEMVN), is continuing consultation to develop Programmatic Agreements (PAs) for two studies, the Southwest Coastal Louisiana (SWC LA) study and the West Shore Lake Pontchartrain (WSLP) study, in accordance with 36 CFR § 800.14(b) of the regulations implementing Section 106 of the National Historic Preservation Act. We invite you to participate in the consultation for the development of these two separate PAs.

The CEMVN has determined that implementation of the selected TSP for each study has the potential to cause effects on historic properties and proposes to develop two PAs to establish Section 106 consultation procedures tailored to the accelerated schedules required by the USACE SMART Feasibility Study Process. The undertakings have been summarized in previous Section 106 consultation correspondence and are detailed in the draft Integrated Feasibility Report and Programmatic Environmental Impact Statement for the SWC LA study, available electronically for review at http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx and the draft Integrated Feasibility Report and Environmental Impact Statement for the WSLP study, available electronically for review at http://www.mvn.usace.army.mil/About/Projects/WestShoreLakePontchartrain.

A teleconference has been scheduled for March 10, 2014, and the agenda and call-in information will be provided by email. We request that you inform us of your desire to participate as a consulting party in these PAs. Given the accelerated schedules, CEMVN requests that consultation for the development of the PAs utilize a combination of email and teleconferences.

As always, should you have any questions or concerns about the proposed action, you may contact Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; rebecca.hill@usace.army.mil. An electronic copy of this letter and all future correspondence pertaining to the development of the PAs will be provided electronically to Mr. Bryant J. Celestine, Historic Preservation Officer, Alabama Coushatta Tribe of Texas, celestine.bryant@actribe.org.

Sincerely,

Joan M. Exnicios

Joan M. Exnicios
Chief, Environmental Planning Branch

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

MARCH 7, 2014

REPLY TO
ATTENTION OF

Regional Planning and
Environment Division, South

Brenda Shemayme Edwards, Chairwoman
Caddo Nation of Oklahoma
P.O. Box 487
Binger, OK 73009

Dear Chairwoman Edwards:

The United States Army Corps of Engineers, New Orleans District (CEMVN), is continuing consultation to develop Programmatic Agreements (PAs) for two studies, the Southwest Coastal Louisiana (SWC LA) study and the West Shore Lake Pontchartrain (WSLP) study, in accordance with 36 CFR § 800.14(b) of the regulations implementing Section 106 of the National Historic Preservation Act. We invite you to participate in the consultation for the development of these two separate PAs.

The CEMVN has determined that implementation of the selected TSP for each study has the potential to cause effects on historic properties and proposes to develop two PAs to establish Section 106 consultation procedures tailored to the accelerated schedules required by the USACE SMART Feasibility Study Process. The undertakings have been summarized in previous Section 106 consultation correspondence and are detailed in the draft Integrated Feasibility Report and Programmatic Environmental Impact Statement for the SWC LA study, available electronically for review at http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx and the draft Integrated Feasibility Report and Environmental Impact Statement for the WSLP study, available electronically for review at http://www.mvn.usace.army.mil/About/Projects/WestShoreLakePontchartrain.

A teleconference has been scheduled for March 10, 2014, and the agenda and call-in information will be provided by email. We request that you inform us of your desire to participate as a consulting party in these PAs. Given the accelerated schedules, CEMVN requests that consultation for the development of the PAs utilize a combination of email and teleconferences.

As always, should you have any questions or concerns about the proposed action, you may contact Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; rebecca.hill@usace.army.mil. An electronic copy of this letter and all future correspondence pertaining to the development of the PAs will be provided electronically to Mr. Robert Cast, Tribal Historic Preservation Officer, Caddo Nation of Oklahoma, rcast@caddonation.org.

Sincerely,

Joan M. Exnicios

Joan M. Exnicios
Chief, Environmental Planning Branch

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

MARCH 7, 2014

REPLY TO
ATTENTION OF

Regional Planning and
Environment Division, South

John Paul Darden, Chairman
Chitimacha Tribe of Louisiana
P.O. Box 661
Charenton, LA 70523

Dear Chairman Darden:

The United States Army Corps of Engineers, New Orleans District (CEMVN), is continuing consultation to develop Programmatic Agreements (PAs) for two studies, the Southwest Coastal Louisiana (SWC LA) study and the West Shore Lake Pontchartrain (WSLP) study, in accordance with 36 CFR § 800.14(b) of the regulations implementing Section 106 of the National Historic Preservation Act. We invite you to participate in the consultation for the development of these two separate PAs.

The CEMVN has determined that implementation of the selected TSP for each study has the potential to cause effects on historic properties and proposes to develop two PAs to establish Section 106 consultation procedures tailored to the accelerated schedules required by the USACE SMART Feasibility Study Process. The undertakings have been summarized in previous Section 106 consultation correspondence and are detailed in the draft Integrated Feasibility Report and Programmatic Environmental Impact Statement for the SWC LA study, available electronically for review at http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx and the draft Integrated Feasibility Report and Environmental Impact Statement for the WSLP study, available electronically for review at http://www.mvn.usace.army.mil/About/Projects/WestShoreLakePontchartrain.

A teleconference has been scheduled for March 10, 2014, and the agenda and call-in information will be provided by email. We request that you inform us of your desire to participate as a consulting party in these PAs. Given the accelerated schedules, CEMVN requests that consultation for the development of the PAs utilize a combination of email and teleconferences.

As always, should you have any questions or concerns about the proposed action, you may contact Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; rebecca.hill@usace.army.mil. An electronic copy of this letter and all future correspondence pertaining to the development of the PAs will be provided electronically to Mrs. Kimberly Walden, M. Ed., Cultural Director/Tribal Historic Preservation Officer, Chitimacha Tribe of Louisiana, kwalden@chitimacha.gov.

Sincerely,

Joan M. Exnicios
Chief, Environmental Planning Branch

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO
ATTENTION OF

MARCH 7, 2014

Regional Planning and
Environment Division, South

Gregory E. Pyle, Chief
Choctaw Nation of Oklahoma
P.O. Box 1210
Durant, OK 74702-1210

Dear Chief Pyle:

The United States Army Corps of Engineers, New Orleans District (CEMVN), is continuing consultation to develop Programmatic Agreements (PAs) for two studies, the Southwest Coastal Louisiana (SWC LA) study and the West Shore Lake Pontchartrain (WSLP) study, in accordance with 36 CFR § 800.14(b) of the regulations implementing Section 106 of the National Historic Preservation Act. We invite you to participate in the consultation for the development of these two separate PAs.

The CEMVN has determined that implementation of the selected TSP for each study has the potential to cause effects on historic properties and proposes to develop two PAs to establish Section 106 consultation procedures tailored to the accelerated schedules required by the USACE SMART Feasibility Study Process. The undertakings have been summarized in previous Section 106 consultation correspondence and are detailed in the draft Integrated Feasibility Report and Programmatic Environmental Impact Statement for the SWC LA study, available electronically for review at http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx and the draft Integrated Feasibility Report and Environmental Impact Statement for the WSLP study, available electronically for review at http://www.mvn.usace.army.mil/About/Projects/WestShoreLakePontchartrain.

A teleconference has been scheduled for March 10, 2014, and the agenda and call-in information will be provided by email. We request that you inform us of your desire to participate as a consulting party in these PAs. Given the accelerated schedules, CEMVN requests that consultation for the development of the PAs utilize a combination of email and teleconferences.

As always, should you have any questions or concerns about the proposed action, you may contact Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; rebecca.hill@usace.army.mil. An electronic copy of this letter and all future correspondence pertaining to the development of the PAs will be provided electronically to Dr. Ian Thompson, Director/Tribal Historic Preservation Officer, Choctaw Nation of Oklahoma, ithompson@choctawnation.com.

Sincerely,

Joan M. Exnicios

Joan M. Exnicios
Chief, Environmental Planning Branch

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

MARCH 7, 2014

REPLY TO
ATTENTION OF

Regional Planning and
Environment Division, South

Kevin Sickey, Chief
Coushatta Tribe of Louisiana
P.O. Box 818
Elton, LA 70532

Dear Chief Sickey:

The United States Army Corps of Engineers, New Orleans District (CEMVN), is continuing consultation to develop Programmatic Agreements (PAs) for two studies, the Southwest Coastal Louisiana (SWC LA) study and the West Shore Lake Pontchartrain (WSLP) study, in accordance with 36 CFR § 800.14(b) of the regulations implementing Section 106 of the National Historic Preservation Act. We invite you to participate in the consultation for the development of these two separate PAs.

The CEMVN has determined that implementation of the selected TSP for each study has the potential to cause effects on historic properties and proposes to develop two PAs to establish Section 106 consultation procedures tailored to the accelerated schedules required by the USACE SMART Feasibility Study Process. The undertakings have been summarized in previous Section 106 consultation correspondence and are detailed in the draft Integrated Feasibility Report and Programmatic Environmental Impact Statement for the SWC LA study, available electronically for review at http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx and the draft Integrated Feasibility Report and Environmental Impact Statement for the WSLP study, available electronically for review at http://www.mvn.usace.army.mil/About/Projects/WestShoreLakePontchartrain.

A teleconference has been scheduled for March 10, 2014, and the agenda and call-in information will be provided by email. We request that you inform us of your desire to participate as a consulting party in these PAs. Given the accelerated schedules, CEMVN requests that consultation for the development of the PAs utilize a combination of email and teleconferences.

As always, should you have any questions or concerns about the proposed action, you may contact Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; rebecca.hill@usace.army.mil. An electronic copy of this letter and all future correspondence pertaining to the development of the PAs will be provided electronically to Dr. Linda Langley, Tribal Historic Preservation Officer, Coushatta Tribe of Louisiana, llangley@mcneese.edu, and Mr. Michael Tarpley, Deputy Tribal Historic Preservation Officer, Coushatta Tribe of Louisiana, kokua.aina57@gmail.com.

Sincerely,

Joan M. Exnicios
Chief, Environmental Planning Branch

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

MARCH 7, 2014

REPLY TO
ATTENTION OF

Regional Planning and
Environment Division, South

B. Cheryl Smith, Principal Chief
Jena Band of Choctaw Indians
P.O. Box 14
Jena, LA 71342

Dear Principal Chief Smith:

The United States Army Corps of Engineers, New Orleans District (CEMVN), is continuing consultation to develop Programmatic Agreements (PAs) for two studies, the Southwest Coastal Louisiana (SWC LA) study and the West Shore Lake Pontchartrain (WSLP) study, in accordance with 36 CFR § 800.14(b) of the regulations implementing Section 106 of the National Historic Preservation Act. We invite you to participate in the consultation for the development of these two separate PAs.

The CEMVN has determined that implementation of the selected TSP for each study has the potential to cause effects on historic properties and proposes to develop two PAs to establish Section 106 consultation procedures tailored to the accelerated schedules required by the USACE SMART Feasibility Study Process. The undertakings have been summarized in previous Section 106 consultation correspondence and are detailed in the draft Integrated Feasibility Report and Programmatic Environmental Impact Statement for the SWC LA study, available electronically for review at http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx and the draft Integrated Feasibility Report and Environmental Impact Statement for the WSLP study, available electronically for review at http://www.mvn.usace.army.mil/About/Projects/WestShoreLakePontchartrain.

A teleconference has been scheduled for March 10, 2014, and the agenda and call-in information will be provided by email. We request that you inform us of your desire to participate as a consulting party in these PAs. Given the accelerated schedules, CEMVN requests that consultation for the development of the PAs utilize a combination of email and teleconferences.

As always, should you have any questions or concerns about the proposed action, you may contact Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; rebecca.hill@usace.army.mil. An electronic copy of this letter and all future correspondence pertaining to the development of the PAs will be provided electronically to Ms. Dana Masters, Tribal Historic Preservation Officer, Jena Band of Choctaw Indians, jbc.thpo106@aol.com, and Ms. Lillie McCormick, Environmental Director, Jena Band of Choctaw Indians, lmmccormickjbc@centurytel.net.

Sincerely,

Joan M. Exnicios
Chief, Environmental Planning Branch

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

MARCH 7, 2014

REPLY TO
ATTENTION OF

Regional Planning and
Environment Division, South

Phyliss J. Anderson, Chief
Mississippi Band of Choctaw Indians
P.O. Box 6257
Choctaw, MS 39350

Dear Chief Anderson:

The United States Army Corps of Engineers, New Orleans District (CEMVN), is continuing consultation to develop Programmatic Agreements (PAs) for two studies, the Southwest Coastal Louisiana (SWC LA) study and the West Shore Lake Pontchartrain (WSLP) study, in accordance with 36 CFR § 800.14(b) of the regulations implementing Section 106 of the National Historic Preservation Act. We invite you to participate in the consultation for the development of these two separate PAs.

The CEMVN has determined that implementation of the selected TSP for each study has the potential to cause effects on historic properties and proposes to develop two PAs to establish Section 106 consultation procedures tailored to the accelerated schedules required by the USACE SMART Feasibility Study Process. The undertakings have been summarized in previous Section 106 consultation correspondence and are detailed in the draft Integrated Feasibility Report and Programmatic Environmental Impact Statement for the SWC LA study, available electronically for review at http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx and the draft Integrated Feasibility Report and Environmental Impact Statement for the WSLP study, available electronically for review at http://www.mvn.usace.army.mil/About/Projects/WestShoreLakePontchartrain.

A teleconference has been scheduled for March 10, 2014, and the agenda and call-in information will be provided by email. We request that you inform us of your desire to participate as a consulting party in these PAs. Given the accelerated schedules, CEMVN requests that consultation for the development of the PAs utilize a combination of email and teleconferences.

As always, should you have any questions or concerns about the proposed action, you may contact Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; rebecca.hill@usace.army.mil. An electronic copy of this letter and all future correspondence pertaining to the development of the PAs will be provided electronically to Mr. Kenneth H. Carleton, Tribal Historic Preservation Officer/ Archaeologist, Mississippi Band of Choctaw Indians, kcarleton@choctaw.org.

Sincerely,

Joan M. Exnicios
Chief, Environmental Planning Branch

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

MARCH 7, 2014

REPLY TO ATTENTION OF

Regional Planning and
Environment Division, South

Leonard M. Harjo, Principal Chief
Seminole Nation of Oklahoma
P.O. Box 1498
Wewoka, OK 74884

Dear Principal Chief Harjo:

The United States Army Corps of Engineers, New Orleans District (CEMVN), is continuing consultation to develop Programmatic Agreements (PAs) for two studies, the Southwest Coastal Louisiana (SWC LA) study and the West Shore Lake Pontchartrain (WSLP) study, in accordance with 36 CFR § 800.14(b) of the regulations implementing Section 106 of the National Historic Preservation Act. We invite you to participate in the consultation for the development of these two separate PAs.

The CEMVN has determined that implementation of the selected TSP for each study has the potential to cause effects on historic properties and proposes to develop two PAs to establish Section 106 consultation procedures tailored to the accelerated schedules required by the USACE SMART Feasibility Study Process. The undertakings have been summarized in previous Section 106 consultation correspondence and are detailed in the draft Integrated Feasibility Report and Programmatic Environmental Impact Statement for the SWC LA study, available electronically for review at http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx and the draft Integrated Feasibility Report and Environmental Impact Statement for the WSLP study, available electronically for review at http://www.mvn.usace.army.mil/About/Projects/WestShoreLakePontchartrain.

A teleconference has been scheduled for March 10, 2014, and the agenda and call-in information will be provided by email. We request that you inform us of your desire to participate as a consulting party in these PAs. Given the accelerated schedules, CEMVN requests that consultation for the development of the PAs utilize a combination of email and teleconferences.

As always, should you have any questions or concerns about the proposed action, you may contact Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; rebecca.hill@usace.army.mil. An electronic copy of this letter and all future correspondence pertaining to the development of the PAs will be provided electronically to Ms. Natalie Harjo, Tribal Historic Preservation Officer, Seminole Nation of Oklahoma, harjo.n@sno-nsn.gov.

Sincerely,

Joan M. Exnicios
Chief, Environmental Planning Branch

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

MARCH 7, 2014

REPLY TO
ATTENTION OF

Regional Planning and
Environment Division, South

James Billie, Chairman
Seminole Tribe of Florida
6300 Stirling Road
Hollywood, FL 33024

Dear Chairman Billie:

The United States Army Corps of Engineers, New Orleans District (CEMVN), is continuing consultation to develop Programmatic Agreements (PAs) for two studies, the Southwest Coastal Louisiana (SWC LA) study and the West Shore Lake Pontchartrain (WSLP) study, in accordance with 36 CFR § 800.14(b) of the regulations implementing Section 106 of the National Historic Preservation Act. We invite you to participate in the consultation for the development of these two separate PAs.

The CEMVN has determined that implementation of the selected TSP for each study has the potential to cause effects on historic properties and proposes to develop two PAs to establish Section 106 consultation procedures tailored to the accelerated schedules required by the USACE SMART Feasibility Study Process. The undertakings have been summarized in previous Section 106 consultation correspondence and are detailed in the draft Integrated Feasibility Report and Programmatic Environmental Impact Statement for the SWC LA study, available electronically for review at http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx and the draft Integrated Feasibility Report and Environmental Impact Statement for the WSLP study, available electronically for review at http://www.mvn.usace.army.mil/About/Projects/WestShoreLakePontchartrain.

A teleconference has been scheduled for March 10, 2014, and the agenda and call-in information will be provided by email. We request that you inform us of your desire to participate as a consulting party in these PAs. Given the accelerated schedules, CEMVN requests that consultation for the development of the PAs utilize a combination of email and teleconferences.

As always, should you have any questions or concerns about the proposed action, you may contact Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; rebecca.hill@usace.army.mil. An electronic copy of this letter and all future correspondence pertaining to the development of the PAs will be provided electronically to Mr. Paul N. Backhouse, Tribal Historic Preservation Officer, Seminole Tribe of Florida, paulbackhouse@semtribe.com; Ms. Anne Mullins, Deputy Tribal Historic Preservation Officer, annemullins@semtribe.com; Mr. Bradley Mueller, Compliance Review Supervisor, bradleymueller@semtribe.com; and Ms. Alison Swing, Compliance Review Data Analyst, alisonswing@semtribe.com.

Sincerely,

Joan M. Exnicios

Joan M. Exnicios
Chief, Environmental Planning Branch

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

MARCH 7, 2014

REPLY TO
ATTENTION OF

Regional Planning and
Environment Division, South

Earl J. Barbry, Sr., Chairman
Tunica-Biloxi Tribe of Louisiana
P.O. Box 1589
Marksville, LA 71351

Dear Chairman Barbry:

The United States Army Corps of Engineers, New Orleans District (CEMVN), is continuing consultation to develop Programmatic Agreements (PAs) for two studies, the Southwest Coastal Louisiana (SWC LA) study and the West Shore Lake Pontchartrain (WSLP) study, in accordance with 36 CFR § 800.14(b) of the regulations implementing Section 106 of the National Historic Preservation Act. We invite you to participate in the consultation for the development of these two separate PAs.

The CEMVN has determined that implementation of the selected TSP for each study has the potential to cause effects on historic properties and proposes to develop two PAs to establish Section 106 consultation procedures tailored to the accelerated schedules required by the USACE SMART Feasibility Study Process. The undertakings have been summarized in previous Section 106 consultation correspondence and are detailed in the draft Integrated Feasibility Report and Programmatic Environmental Impact Statement for the SWC LA study, available electronically for review at http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx and the draft Integrated Feasibility Report and Environmental Impact Statement for the WSLP study, available electronically for review at http://www.mvn.usace.army.mil/About/Projects/WestShoreLakePontchartrain.

A teleconference has been scheduled for March 10, 2014, and the agenda and call-in information will be provided by email. We request that you inform us of your desire to participate as a consulting party in these PAs. Given the accelerated schedules, CEMVN requests that consultation for the development of the PAs utilize a combination of email and teleconferences.

As always, should you have any questions or concerns about the proposed action, you may contact Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; rebecca.hill@usace.army.mil. An electronic copy of this letter and all future correspondence pertaining to the development of the PAs will be provided electronically to Mr. Earl Barbry, Jr., Cultural Director, Tunica-Biloxi Tribe of Louisiana, earlii@tunica.org.

Sincerely,

Joan M. Exnicios
Chief, Environmental Planning Branch

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

February 27, 2014

REPLY TO
ATTENTION OF:

Regional Planning and
Environment Division, South
Environmental Planning Branch

Reid Nelson, Director
Office of Federal Agency Programs
Advisory Council on Historic Preservation
Old Post Office
1100 Pennsylvania Ave., NW, Suite 809
Washington, D.C. 20004

Dear Mr. Nelson:

The United States Army Corps of Engineers, New Orleans District (CEMVN), is continuing consultation to develop a Programmatic Agreement (PA) for the Southwest Coastal Louisiana (SWC LA) study in accordance with 36 CFR § 800.14(b) of the regulations implementing Section 106 of the National Historic Preservation Act. We invite the Advisory Council on Historic Preservation to participate in this consultation.

The CEMVN has determined that implementation of the selected TSP has the potential to cause effects on historic properties and proposes to develop a PA to establish Section 106 consultation procedures tailored to the accelerated schedule required by the USACE SMART Feasibility Study Process. Section 106 consultation was initiated with the Louisiana State Historic Preservation Office and federally-recognized Tribes on November 27, 2013, and the undertaking is detailed in the draft Integrated Feasibility Report and Programmatic Environmental Impact Statement for the SWC LA study, available electronically for review at http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx.

The CEMVN has completed a review of existing information on historic properties within the study area, and a copy of the draft Cultural Resources Assessment and Research Design is being provided electronically for review. A teleconference has been scheduled for March 6, 2014, and the agenda and call-in information will be provided by email.

Should you have any questions or concerns, you may contact Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; Rebecca.Hill@usace.army.mil. An electronic copy of this letter, a copy of the letter to SHPO dated November 27, 2013, and the draft Cultural Resources Assessment and Research Design will be submitted to Tom McCulloch, tmcculloch@achp.gov.

Sincerely,

Sandra Stiles
for Joan M. Exnicios
Chief, Environmental Planning Branch

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

February 27, 2014

REPLY TO
ATTENTION OF:

Regional Planning and
Environment Division, South
Environmental Planning Branch

Ms. Pam Breaux
State Historic Preservation Officer
Department of Culture, Recreation, & Tourism
P.O. Box 44247
Baton Rouge, LA 70804

Dear Ms. Breaux:

The United States Army Corps of Engineers, New Orleans District (CEMVN), is continuing consultation to develop a Programmatic Agreement (PA) for the Southwest Coastal Louisiana (SWC LA) study in accordance with 36 CFR § 800.14(b) of the regulations implementing Section 106 of the National Historic Preservation Act. We invite the State Historic Preservation Office to participate in this consultation.

The CEMVN has determined that implementation of the selected TSP has the potential to cause effects on historic properties and proposes to develop a PA to establish Section 106 consultation procedures tailored to the accelerated schedule required by the USACE SMART Feasibility Study Process. The undertaking is summarized in our letter dated November 27, 2013, and is detailed in the draft Integrated Feasibility Report and Programmatic Environmental Impact Statement for the SWC LA study, available electronically for review at http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx.

The CEMVN has completed a review of existing information on historic properties within the study area, and a copy of the draft Cultural Resources Assessment and Research Design is being provided electronically for review and comment. A teleconference has been scheduled for March 6, 2014, and the agenda and call-in information will be provided by email.

Should you have any questions or concerns, you may contact Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; Rebecca.Hill@usace.army.mil. An electronic copy of this letter and the draft Cultural Resources Assessment and Research Design will be submitted to Section106@crt.la.gov.

Sincerely,

Joan M. Exnicios
Chief, Environmental Planning Branch

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

February 27, 2014

REPLY TO
ATTENTION OF:

Regional Planning and
Environment Division, South
Environmental Planning Branch

Mr. Jerome Zeringue, Chairman
Coastal Protection and Restoration
Authority Board of Louisiana
P.O. Box 94004
Office of Governor-Coastal, 4th Floor
Baton Rouge, LA 70804

Dear Mr. Zeringue:

The United States Army Corps of Engineers, New Orleans District (CEMVN), is continuing consultation to develop a Programmatic Agreement (PA) for the Southwest Coastal Louisiana (SWC LA) study in accordance with 36 CFR § 800.14(b) of the regulations implementing Section 106 of the National Historic Preservation Act. We invite the Coastal Protection and Restoration Authority Board of Louisiana to participate in this consultation.

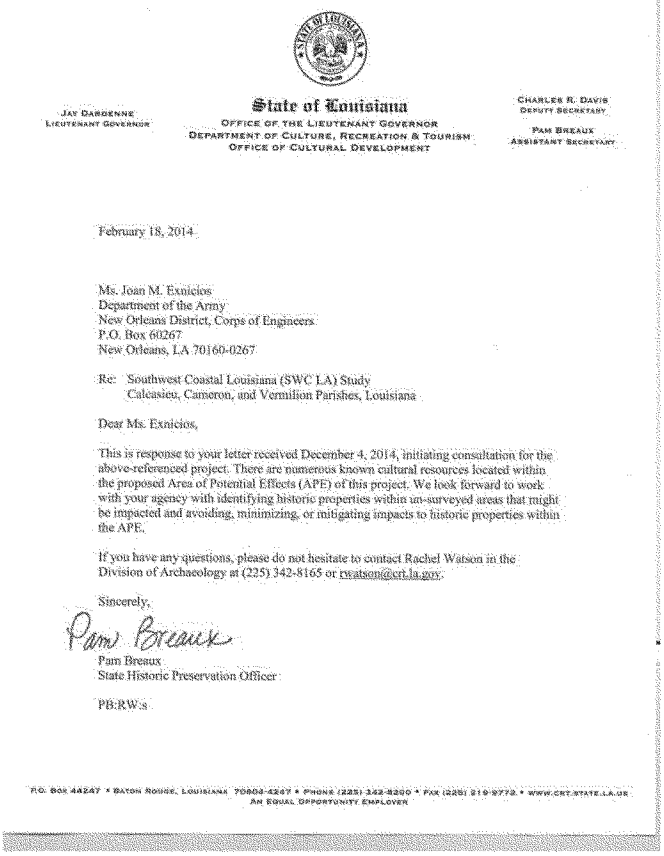
The CEMVN has determined that implementation of the selected TSP has the potential to cause effects on historic properties and proposes to develop a PA to establish Section 106 consultation procedures tailored to the accelerated schedule required by the USACE SMART Feasibility Study Process. The proposed undertaking is detailed in the draft Integrated Feasibility Report and Programmatic Environmental Impact Statement for the SWC LA study, available electronically for review at http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx.

The CEMVN has completed a review of existing information on historic properties within the study area, and a copy of the draft Cultural Resources Assessment and Research Design is being provided electronically for review. A teleconference has been scheduled for March 6, 2014, and the agenda and call-in information will be provided by email.

Should you have any questions or concerns, you may contact Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; Rebecca.Hill@usace.army.mil. An electronic copy of this letter and the draft Cultural Resources Assessment and Research Design will be submitted to Ms. Elizabeth Jarrell, elizabeth.jarrell@la.gov and Ms. Elizabeth Davoli, elizabeth.davoli@la.gov.

Sincerely,

Sandra Stills
for Joan M. Exnicios
Chief, Environmental Planning Branch



JAY DARDENNE
LIEUTENANT GOVERNOR

State of Louisiana
OFFICE OF THE LIEUTENANT GOVERNOR
DEPARTMENT OF CULTURE, RECREATION & TOURISM
OFFICE OF CULTURAL DEVELOPMENT

CHARLES R. DAVIS
DEPUTY SECRETARY

PAM BREAUX
ASSISTANT SECRETARY

February 18, 2014

Ms. Joan M. Exnicios
Department of the Army
New Orleans District, Corps of Engineers
P.O. Box 60267
New Orleans, LA 70160-0267

Re: Southwest Coastal Louisiana (SWC LA) Study
Calcasieu, Cameron, and Vermilion Parishes, Louisiana

Dear Ms. Exnicios,

This is response to your letter received December 4, 2014, initiating consultation for the above-referenced project. There are numerous known cultural resources located within the proposed Area of Potential Effects (APE) of this project. We look forward to work with your agency with identifying historic properties within un-surveyed areas that might be impacted and avoiding, minimizing, or mitigating impacts to historic properties within the APE.

If you have any questions, please do not hesitate to contact Rachel Watson in the Division of Archaeology at (225) 342-8165 or rwatson@crt.la.gov.

Sincerely,

Pam Breaux

Pam Breaux
State Historic Preservation Officer

PB:RW:s

P.O. BOX 44247 • BATON ROUGE, LOUISIANA 70804-4247 • PHONE (225) 342-8200 • FAX (225) 219-9772 • WWW.CRT.STATE.LA.US
AN EQUAL OPPORTUNITY EMPLOYER

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO ATTENTION OF

November 27, 2013

Regional Planning and
Environment Division, South

Ms. Pam Breaux
State Historic Preservation Officer
Department of Culture, Recreation and Tourism
Office of Cultural Development
P.O. Box 44247
Baton Rouge, Louisiana 70804

Dear Ms. Breaux:

The United States Army Corps of Engineers (USACE) and the Coastal Protection and Restoration Authority Board of Louisiana (CPRAB) are investigating the feasibility of implementing hurricane and storm damage risk reduction measures as well as ecosystem restoration measures within southwest coastal Louisiana.

The New Orleans District (CEMVN) is preparing a Southwest Coastal Louisiana (SWC LA) Integrated Feasibility Report and Environmental Impact Statement (Integrated Report), which will describe all aspects of the SWC LA study, from its inception through the evolution of the various alternatives, the discussion of potential impacts to applicable natural, socioeconomic and cultural resources, to the decision to recommend a preferred alternative.

The purpose of this letter is to initiate consultation for the SWC LA study, in partial fulfillment of responsibilities under the National Environmental Policy Act and Section 106 of the National Historic Preservation Act. The CEMVN offers you the opportunity to review and comment on the potential of the proposed action to significantly affect historic properties.

Study Authority and History of Investigation

The hurricane and storm damage risk reduction purpose of the SWC LA study was authorized on December 7, 2005, by the Committee on Transportation and Infrastructure, U.S. House of Representatives, Resolution Docket 2747, and the ecosystem restoration purpose was recommended for approval in the 2005 USACE Chief's Report for the Louisiana Coastal Area (LCA) Ecosystem Restoration Program that was authorized in the Water Resources Development Act of 2007. The Feasibility Cost Share Agreement was signed with the CPRAB on January 14, 2009. In 2013 the CEMVN was directed to transition the project to SMART planning.

-2-

This is the second CEMVN study within the USACE SMART Planning framework, which organizes the planning process for feasibility studies around key decision points (please refer to enclosed diagram). Following preparation of the Integrated Report, a public comment period will be conducted along with technical, peer and policy reviews. Additional feasibility work remains to be completed on engineering, cost estimating, environmental, economic, real estate and construction elements of the plan. Results of the reviews and additional feasibility work will be incorporated into the final report, which will be made available for review before the Chief of Engineers makes a final recommendation on the project.

Study Area

The study area is located in southwestern Louisiana, covering an area of approximately 4,700 square miles (please refer to enclosed map of the study area). The area occupies a portion of the Pleistocene Prairie Terrace (or Prairie Complex) on the northern edge of Cameron and Vermilion parishes, as well as most of Calcasieu Parish, and most of the Marginal Plain (or Chenier Plain) on the coast in Cameron and the southern portions of Calcasieu and Vermilion parishes. The study area includes residential, commercial, industrial and undeveloped land.

Proposed Action

Proposed measures of the National Economic Development plan include residential structure elevation, flood proofing, and the acquisition of qualifying structures. The National Ecosystem Restoration (NER) purpose of SWC LA project is to significantly restore environmental conditions for the Chenier Plain ecosystem. Proposed NER measures include nine marsh restoration measures that would restore approximately 8,579 acres and nourish approximately 4,026 acres, resulting in approximately 8,714 net acres; two hydrologic and salinity control measures to restore approximately 6,092 net acres; five shoreline protection measures spanning approximately 266,884 linear feet to protect approximately 5,509 net acres; the preservation of the historic Sabine oyster reef; and a chenier reforestation program to include the planting of trees on approximately 1,413 acres (please refer to the two enclosed maps of the draft NER TSP). The alternatives will be further developed in the Integrated Report.

Section 106 Consultation

The USACE has determined that the proposed action is an undertaking as defined in 36 CFR § 800.16(y) that has the potential to cause effects on historic properties. This letter initiates formal Section 106 consultation pursuant to 36 CFR § 800.3(c). CEMVN is currently reviewing existing information on historic properties within the study area. Following the preparation of the Integrated Report, CEMVN will schedule a teleconference with consulting parties to discuss the area of potential effects (APE), the existing information on historic properties within the APE, as well as data concerning possible historic properties not yet identified, and the level of effort for the identification and evaluation of historic properties.

-3-

Your response to this letter, including any information your office may wish to provide at this time concerning the proposed undertaking and its potential to significantly affect historic properties is greatly appreciated. Please also notify us of any other interested party who may wish to participate in this consultation.

As always, should you have any questions or concerns about the proposed action or the SMART Planning Framework, you may contact Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; Rebecca.Hill@usace.army.mil. An electronic copy of this letter with enclosures will be provided to Section106@crt.la.gov.

Sincerely,

Sandra Stiles for
Joan M. Exnicios
Chief, Environmental Planning Branch

Enclosures

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO ATTENTION OF

November 27, 2013

Regional Planning and
Environment Division, South

Carlos Bullock, Chairman
Alabama-Coushatta Tribe of Texas
571 State Park Rd 56
Livingston, TX 77351

Dear Chairman Bullock:

The United States Army Corps of Engineers (USACE) and the Coastal Protection and Restoration Authority Board of Louisiana (CPRAB) are investigating the feasibility of implementing hurricane and storm damage risk reduction measures as well as ecosystem restoration measures within southwest coastal Louisiana.

The New Orleans District (CEMVN) is preparing a Southwest Coastal Louisiana (SWC LA) Integrated Feasibility Report and Environmental Impact Statement (Integrated Report), which will describe all aspects of the SWC LA study, from its inception through the evolution of the various alternatives, the discussion of potential impacts to applicable natural, socioeconomic and cultural resources, to the decision to recommend a preferred alternative.

The purpose of this letter is to initiate consultation for the SWC LA study, in partial fulfillment of responsibilities under Executive Order 13175, the National Environmental Policy Act, and Section 106 of the National Historic Preservation Act. The CEMVN offers you the opportunity to review and comment on the potential of the proposed action to significantly affect protected tribal resources, tribal rights, or Indian lands.

Study Authority and History of Investigation

The hurricane and storm damage risk reduction purpose of the SWC LA study was authorized on December 7, 2005, by the Committee on Transportation and Infrastructure, U.S. House of Representatives, Resolution Docket 2747, and the ecosystem restoration purpose was recommended for approval in the 2005 USACE Chief's Report for the Louisiana Coastal Area (LCA) Ecosystem Restoration Program that was authorized in the Water Resources Development Act of 2007. The Feasibility Cost Share Agreement was signed with the CPRAB on January 14, 2009. In 2013 the CEMVN was directed to transition the project to SMART planning.

-2-

This is the second CEMVN study within the USACE SMART Planning framework, which organizes the planning process for feasibility studies around key decision points (please refer to enclosed diagram). Following preparation of the Integrated Report, a public comment period will be conducted along with technical, peer and policy reviews. Additional feasibility work remains to be completed on engineering, cost estimating, environmental, economic, real estate and construction elements of the plan. Results of the reviews and additional feasibility work will be incorporated into the final report, which will be made available for review before the Chief of Engineers makes a final recommendation on the project.

Study Area

The study area is located in southwestern Louisiana, covering an area of approximately 4,700 square miles (please refer to enclosed map of the study area). The area occupies a portion of the Pleistocene Prairie Terrace (or Prairie Complex) on the northern edge of Cameron and Vermilion parishes, as well as most of Calcasieu Parish, and most of the Marginal Plain (or Chenier Plain) on the coast in Cameron and the southern portions of Calcasieu and Vermilion parishes. The study area includes residential, commercial, industrial and undeveloped land.

Proposed Action

Proposed measures of the National Economic Development plan include residential structure elevation, flood proofing, and the acquisition of qualifying structures. The National Ecosystem Restoration (NER) purpose of SWC LA project is to significantly restore environmental conditions for the Chenier Plain ecosystem. Proposed NER measures include nine marsh restoration measures that would restore approximately 8,579 acres and nourish approximately 4,026 acres, resulting in approximately 8,714 net acres; two hydrologic and salinity control measures to restore approximately 6,092 net acres; five shoreline protection measures spanning approximately 266,884 linear feet to protect approximately 5,509 net acres; the preservation of the historic Sabine oyster reef; and a chenier reforestation program to include the planting of trees on approximately 1,413 acres (please refer to the two enclosed maps of the draft NER TSP). The alternatives will be further developed in the Integrated Report.

Section 106 Consultation

The USACE has determined that the proposed action is an undertaking as defined in 36 CFR § 800.16(y) that has the potential to cause effects on historic properties. This letter initiates formal Section 106 consultation pursuant to 36 CFR § 800.3(c). CEMVN is currently reviewing existing information on historic properties within the study area. Following the preparation of the Integrated Report, CEMVN will schedule a teleconference to discuss the area of potential effects (APE), the existing information on historic properties within the APE, as well as data concerning possible historic properties not yet identified, and the level of effort for the identification and evaluation of historic properties.

-3-

Your response to this letter, including any information your office may wish to provide at this time concerning the proposed undertaking and its potential to significantly affect protected tribal resources, tribal rights, or Indian lands is greatly appreciated. Please also notify us of any other interested party who may wish to participate in this consultation.

As always, should you have any questions or concerns about the proposed action or the SMART Planning Framework, you may contact Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; Rebecca.Hill@usace.army.mil. An electronic copy of this letter with enclosures will be provided to Mr. Bryant J. Celestine, Historic Preservation Officer, Alabama Coushatta Tribe of Texas, celestine.bryant@actribe.org.

Sincerely,

for Sandra Stiles
Joan M. Exnicios
Chief, Environmental Planning Branch

Enclosures

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO ATTENTION OF

November 27, 2013

Regional Planning and
Environment Division, South

Brenda Shemayme Edwards, Chairwoman
Caddo Nation of Oklahoma
P.O. Box 487
Binger, OK 73009

Dear Chairwoman Edwards:

The United States Army Corps of Engineers (USACE) and the Coastal Protection and Restoration Authority Board of Louisiana (CPRAB) are investigating the feasibility of implementing hurricane and storm damage risk reduction measures as well as ecosystem restoration measures within southwest coastal Louisiana.

The New Orleans District (CEMVN) is preparing a Southwest Coastal Louisiana (SWC LA) Integrated Feasibility Report and Environmental Impact Statement (Integrated Report), which will describe all aspects of the SWC LA study, from its inception through the evolution of the various alternatives, the discussion of potential impacts to applicable natural, socioeconomic and cultural resources, to the decision to recommend a preferred alternative.

The purpose of this letter is to initiate consultation for the SWC LA study, in partial fulfillment of responsibilities under Executive Order 13175, the National Environmental Policy Act, and Section 106 of the National Historic Preservation Act. The CEMVN offers you the opportunity to review and comment on the potential of the proposed action to significantly affect protected tribal resources, tribal rights, or Indian lands.

Study Authority and History of Investigation

The hurricane and storm damage risk reduction purpose of the SWC LA study was authorized on December 7, 2005, by the Committee on Transportation and Infrastructure, U.S. House of Representatives, Resolution Docket 2747, and the ecosystem restoration purpose was recommended for approval in the 2005 USACE Chief's Report for the Louisiana Coastal Area (LCA) Ecosystem Restoration Program that was authorized in the Water Resources Development Act of 2007. The Feasibility Cost Share Agreement was signed with the CPRAB on January 14, 2009. In 2013 the CEMVN was directed to transition the project to SMART planning.

-2-

This is the second CEMVN study within the USACE SMART Planning framework, which organizes the planning process for feasibility studies around key decision points (please refer to enclosed diagram). Following preparation of the Integrated Report, a public comment period will be conducted along with technical, peer and policy reviews. Additional feasibility work remains to be completed on engineering, cost estimating, environmental, economic, real estate and construction elements of the plan. Results of the reviews and additional feasibility work will be incorporated into the final report, which will be made available for review before the Chief of Engineers makes a final recommendation on the project.

Study Area

The study area is located in southwestern Louisiana, covering an area of approximately 4,700 square miles (please refer to enclosed map of the study area). The area occupies a portion of the Pleistocene Prairie Terrace (or Prairie Complex) on the northern edge of Cameron and Vermilion parishes, as well as most of Calcasieu Parish, and most of the Marginal Plain (or Chenier Plain) on the coast in Cameron and the southern portions of Calcasieu and Vermilion parishes. The study area includes residential, commercial, industrial and undeveloped land.

Proposed Action

Proposed measures of the National Economic Development plan include residential structure elevation, flood proofing, and the acquisition of qualifying structures. The National Ecosystem Restoration (NER) purpose of SWC LA project is to significantly restore environmental conditions for the Chenier Plain ecosystem. Proposed NER measures include nine marsh restoration measures that would restore approximately 8,579 acres and nourish approximately 4,026 acres, resulting in approximately 8,714 net acres; two hydrologic and salinity control measures to restore approximately 6,092 net acres; five shoreline protection measures spanning approximately 266,884 linear feet to protect approximately 5,509 net acres; the preservation of the historic Sabine oyster reef; and a chenier reforestation program to include the planting of trees on approximately 1,413 acres (please refer to the two enclosed maps of the draft NER TSP). The alternatives will be further developed in the Integrated Report.

Section 106 Consultation

The USACE has determined that the proposed action is an undertaking as defined in 36 CFR § 800.16(y) that has the potential to cause effects on historic properties. This letter initiates formal Section 106 consultation pursuant to 36 CFR § 800.3(c). CEMVN is currently reviewing existing information on historic properties within the study area. Following the preparation of the Integrated Report, CEMVN will schedule a teleconference to discuss the area of potential effects (APE), the existing information on historic properties within the APE, as well as data concerning possible historic properties not yet identified, and the level of effort for the identification and evaluation of historic properties.

-3-

Your response to this letter, including any information your office may wish to provide at this time concerning the proposed undertaking and its potential to significantly affect protected tribal resources, tribal rights, or Indian lands is greatly appreciated. Please also notify us of any other interested party who may wish to participate in this consultation.

As always, should you have any questions or concerns about the proposed action or the SMART Planning Framework, you may contact Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; Rebecca.Hill@usace.army.mil. An electronic copy of this letter with enclosures will be provided to Mr. Robert Cast, Tribal Historic Preservation Officer, Caddo Nation of Oklahoma, rcast@caddonation.org.

Sincerely,

Rebecca Hill

for Joan M. Exnicios
Chief, Environmental Planning Branch

Enclosures

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO ATTENTION OF

November 27, 2013

Regional Planning and
Environment Division, South

John Paul Darden, Chairman
Chitimacha Tribe of Louisiana
P.O. Box 661
Charenton, LA 70523

Dear Chairman Darden:

The United States Army Corps of Engineers (USACE) and the Coastal Protection and Restoration Authority Board of Louisiana (CPRAB) are investigating the feasibility of implementing hurricane and storm damage risk reduction measures as well as ecosystem restoration measures within southwest coastal Louisiana.

The New Orleans District (CEMVN) is preparing a Southwest Coastal Louisiana (SWC LA) Integrated Feasibility Report and Environmental Impact Statement (Integrated Report), which will describe all aspects of the SWC LA study, from its inception through the evolution of the various alternatives, the discussion of potential impacts to applicable natural, socioeconomic and cultural resources, to the decision to recommend a preferred alternative.

The purpose of this letter is to initiate consultation for the SWC LA study, in partial fulfillment of responsibilities under Executive Order 13175, the National Environmental Policy Act, and Section 106 of the National Historic Preservation Act. The CEMVN offers you the opportunity to review and comment on the potential of the proposed action to significantly affect protected tribal resources, tribal rights, or Indian lands.

Study Authority and History of Investigation

The hurricane and storm damage risk reduction purpose of the SWC LA study was authorized on December 7, 2005, by the Committee on Transportation and Infrastructure, U.S. House of Representatives, Resolution Docket 2747, and the ecosystem restoration purpose was recommended for approval in the 2005 USACE Chief's Report for the Louisiana Coastal Area (LCA) Ecosystem Restoration Program that was authorized in the Water Resources Development Act of 2007. The Feasibility Cost Share Agreement was signed with the CPRAB on January 14, 2009. In 2013 the CEMVN was directed to transition the project to SMART planning.



This is the second CEMVN study within the USACE SMART Planning framework, which organizes the planning process for feasibility studies around key decision points (please refer to enclosed diagram). Following preparation of the Integrated Report, a public comment period will be conducted along with technical, peer and policy reviews. Additional feasibility work remains to be completed on engineering, cost estimating, environmental, economic, real estate and construction elements of the plan. Results of the reviews and additional feasibility work will be incorporated into the final report, which will be made available for review before the Chief of Engineers makes a final recommendation on the project.

Study Area

The study area is located in southwestern Louisiana, covering an area of approximately 4,700 square miles (please refer to enclosed map of the study area). The area occupies a portion of the Pleistocene Prairie Terrace (or Prairie Complex) on the northern edge of Cameron and Vermilion parishes, as well as most of Calcasieu Parish, and most of the Marginal Plain (or Chenier Plain) on the coast in Cameron and the southern portions of Calcasieu and Vermilion parishes. The study area includes residential, commercial, industrial and undeveloped land.

Proposed Action

Proposed measures of the National Economic Development plan include residential structure elevation, flood proofing, and the acquisition of qualifying structures. The National Ecosystem Restoration (NER) purpose of SWC LA project is to significantly restore environmental conditions for the Chenier Plain ecosystem. Proposed NER measures include nine marsh restoration measures that would restore approximately 8,579 acres and nourish approximately 4,026 acres, resulting in approximately 8,714 net acres; two hydrologic and salinity control measures to restore approximately 6,092 net acres; five shoreline protection measures spanning approximately 266,884 linear feet to protect approximately 5,509 net acres; the preservation of the historic Sabine oyster reef; and a chenier reforestation program to include the planting of trees on approximately 1,413 acres (please refer to the two enclosed maps of the draft NER TSP). The alternatives will be further developed in the Integrated Report.

Section 106 Consultation

The USACE has determined that the proposed action is an undertaking as defined in 36 CFR § 800.16(y) that has the potential to cause effects on historic properties. This letter initiates formal Section 106 consultation pursuant to 36 CFR § 800.3(c). CEMVN is currently reviewing existing information on historic properties within the study area. Following the preparation of the Integrated Report, CEMVN will schedule a teleconference to discuss the area of potential effects (APE), the existing information on historic properties within the APE, as well as data concerning possible historic properties not yet identified, and the level of effort for the identification and evaluation of historic properties.

-3-

Your response to this letter, including any information your office may wish to provide at this time concerning the proposed undertaking and its potential to significantly affect protected tribal resources, tribal rights, or Indian lands is greatly appreciated. Please also notify us of any other interested party who may wish to participate in this consultation.

As always, should you have any questions or concerns about the proposed action or the SMART Planning Framework, you may contact Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; Rebecca.Hill@usace.army.mil. An electronic copy of this letter with enclosures will be provided to Mrs. Kimberly Walden, M. Ed., Cultural Director/Tribal Historic Preservation Officer, Chitimacha Tribe of Louisiana, kswalden@chitimacha.gov.

Sincerely,

for Sandra Stiles
Joan M. Exnicios
Chief, Environmental Planning Branch

Enclosures

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO ATTENTION OF

November 27, 2013

Regional Planning and
Environment Division, South

Gregory E. Pyle, Chief
Choctaw Nation of Oklahoma
P.O. Box 1210
Durant, OK 74702-1210

Dear Chief Pyle:

The United States Army Corps of Engineers (USACE) and the Coastal Protection and Restoration Authority Board of Louisiana (CPRAB) are investigating the feasibility of implementing hurricane and storm damage risk reduction measures as well as ecosystem restoration measures within southwest coastal Louisiana.

The New Orleans District (CEMVN) is preparing a Southwest Coastal Louisiana (SWC LA) Integrated Feasibility Report and Environmental Impact Statement (Integrated Report), which will describe all aspects of the SWC LA study, from its inception through the evolution of the various alternatives, the discussion of potential impacts to applicable natural, socioeconomic and cultural resources, to the decision to recommend a preferred alternative.

The purpose of this letter is to initiate consultation for the SWC LA study, in partial fulfillment of responsibilities under Executive Order 13175, the National Environmental Policy Act, and Section 106 of the National Historic Preservation Act. The CEMVN offers you the opportunity to review and comment on the potential of the proposed action to significantly affect protected tribal resources, tribal rights, or Indian lands.

Study Authority and History of Investigation

The hurricane and storm damage risk reduction purpose of the SWC LA study was authorized on December 7, 2005, by the Committee on Transportation and Infrastructure, U.S. House of Representatives, Resolution Docket 2747, and the ecosystem restoration purpose was recommended for approval in the 2005 USACE Chief's Report for the Louisiana Coastal Area (LCA) Ecosystem Restoration Program that was authorized in the Water Resources Development Act of 2007. The Feasibility Cost Share Agreement was signed with the CPRAB on January 14, 2009. In 2013 the CEMVN was directed to transition the project to SMART planning.

-2-

This is the second CEMVN study within the USACE SMART Planning framework, which organizes the planning process for feasibility studies around key decision points (please refer to enclosed diagram). Following preparation of the Integrated Report, a public comment period will be conducted along with technical, peer and policy reviews. Additional feasibility work remains to be completed on engineering, cost estimating, environmental, economic, real estate and construction elements of the plan. Results of the reviews and additional feasibility work will be incorporated into the final report, which will be made available for review before the Chief of Engineers makes a final recommendation on the project.

Study Area

The study area is located in southwestern Louisiana, covering an area of approximately 4,700 square miles (please refer to enclosed map of the study area). The area occupies a portion of the Pleistocene Prairie Terrace (or Prairie Complex) on the northern edge of Cameron and Vermilion parishes, as well as most of Calcasieu Parish, and most of the Marginal Plain (or Chenier Plain) on the coast in Cameron and the southern portions of Calcasieu and Vermilion parishes. The study area includes residential, commercial, industrial and undeveloped land.

Proposed Action

Proposed measures of the National Economic Development plan include residential structure elevation, flood proofing, and the acquisition of qualifying structures. The National Ecosystem Restoration (NER) purpose of SWC LA project is to significantly restore environmental conditions for the Chenier Plain ecosystem. Proposed NER measures include nine marsh restoration measures that would restore approximately 8,579 acres and nourish approximately 4,026 acres, resulting in approximately 8,714 net acres; two hydrologic and salinity control measures to restore approximately 6,092 net acres; five shoreline protection measures spanning approximately 266,884 linear feet to protect approximately 5,509 net acres; the preservation of the historic Sabine oyster reef; and a chenier reforestation program to include the planting of trees on approximately 1,413 acres (please refer to the two enclosed maps of the draft NER TSP). The alternatives will be further developed in the Integrated Report.

Section 106 Consultation

The USACE has determined that the proposed action is an undertaking as defined in 36 CFR § 800.16(y) that has the potential to cause effects on historic properties. This letter initiates formal Section 106 consultation pursuant to 36 CFR § 800.3(c). CEMVN is currently reviewing existing information on historic properties within the study area. Following the preparation of the Integrated Report, CEMVN will schedule a teleconference to discuss the area of potential effects (APE), the existing information on historic properties within the APE, as well as data concerning possible historic properties not yet identified, and the level of effort for the identification and evaluation of historic properties.

-3-

Your response to this letter, including any information your office may wish to provide at this time concerning the proposed undertaking and its potential to significantly affect protected tribal resources, tribal rights, or Indian lands is greatly appreciated. Please also notify us of any other interested party who may wish to participate in this consultation.

As always, should you have any questions or concerns about the proposed action or the SMART Planning Framework, you may contact Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; Rebecca.Hill@usace.army.mil. An electronic copy of this letter with enclosures will be provided to Mr. Ian Thompson, Director/Tribal Historic Preservation Officer, Choctaw Nation of Oklahoma, ithompson@choctawnation.com.

Sincerely,

for Joan M. Exnicios
Chief, Environmental Planning Branch

Enclosures

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO ATTENTION OF

November 27, 2013

Regional Planning and
Environment Division, South

Kevin Sickey, Chief
Coushatta Tribe of Louisiana
P.O. Box 818
Elton, LA 70532

Dear Chief Sickey:

The United States Army Corps of Engineers (USACE) and the Coastal Protection and Restoration Authority Board of Louisiana (CPRAB) are investigating the feasibility of implementing hurricane and storm damage risk reduction measures as well as ecosystem restoration measures within southwest coastal Louisiana.

The New Orleans District (CEMVN) is preparing a Southwest Coastal Louisiana (SWC LA) Integrated Feasibility Report and Environmental Impact Statement (Integrated Report), which will describe all aspects of the SWC LA study, from its inception through the evolution of the various alternatives, the discussion of potential impacts to applicable natural, socioeconomic and cultural resources, to the decision to recommend a preferred alternative.

The purpose of this letter is to initiate consultation for the SWC LA study, in partial fulfillment of responsibilities under Executive Order 13175, the National Environmental Policy Act, and Section 106 of the National Historic Preservation Act. The CEMVN offers you the opportunity to review and comment on the potential of the proposed action to significantly affect protected tribal resources, tribal rights, or Indian lands.

Study Authority and History of Investigation

The hurricane and storm damage risk reduction purpose of the SWC LA study was authorized on December 7, 2005, by the Committee on Transportation and Infrastructure, U.S. House of Representatives, Resolution Docket 2747, and the ecosystem restoration purpose was recommended for approval in the 2005 USACE Chief's Report for the Louisiana Coastal Area (LCA) Ecosystem Restoration Program that was authorized in the Water Resources Development Act of 2007. The Feasibility Cost Share Agreement was signed with the CPRAB on January 14, 2009. In 2013 the CEMVN was directed to transition the project to SMART planning.

-2-

This is the second CEMVN study within the USACE SMART Planning framework, which organizes the planning process for feasibility studies around key decision points (please refer to enclosed diagram). Following preparation of the Integrated Report, a public comment period will be conducted along with technical, peer and policy reviews. Additional feasibility work remains to be completed on engineering, cost estimating, environmental, economic, real estate and construction elements of the plan. Results of the reviews and additional feasibility work will be incorporated into the final report, which will be made available for review before the Chief of Engineers makes a final recommendation on the project.

Study Area

The study area is located in southwestern Louisiana, covering an area of approximately 4,700 square miles (please refer to enclosed map of the study area). The area occupies a portion of the Pleistocene Prairie Terrace (or Prairie Complex) on the northern edge of Cameron and Vermilion parishes, as well as most of Calcasieu Parish, and most of the Marginal Plain (or Chenier Plain) on the coast in Cameron and the southern portions of Calcasieu and Vermilion parishes. The study area includes residential, commercial, industrial and undeveloped land.

Proposed Action

Proposed measures of the National Economic Development plan include residential structure elevation, flood proofing, and the acquisition of qualifying structures. The National Ecosystem Restoration (NER) purpose of SWC LA project is to significantly restore environmental conditions for the Chenier Plain ecosystem. Proposed NER measures include nine marsh restoration measures that would restore approximately 8,579 acres and nourish approximately 4,026 acres, resulting in approximately 8,714 net acres; two hydrologic and salinity control measures to restore approximately 6,092 net acres; five shoreline protection measures spanning approximately 266,884 linear feet to protect approximately 5,509 net acres; the preservation of the historic Sabine oyster reef; and a chenier reforestation program to include the planting of trees on approximately 1,413 acres (please refer to the two enclosed maps of the draft NER TSP). The alternatives will be further developed in the Integrated Report.

Section 106 Consultation

The USACE has determined that the proposed action is an undertaking as defined in 36 CFR § 800.16(y) that has the potential to cause effects on historic properties. This letter initiates formal Section 106 consultation pursuant to 36 CFR § 800.3(c). CEMVN is currently reviewing existing information on historic properties within the study area. Following the preparation of the Integrated Report, CEMVN will schedule a teleconference to discuss the area of potential effects (APE), the existing information on historic properties within the APE, as well as data concerning possible historic properties not yet identified, and the level of effort for the identification and evaluation of historic properties.

-3-

Your response to this letter, including any information your office may wish to provide at this time concerning the proposed undertaking and its potential to significantly affect protected tribal resources, tribal rights, or Indian lands is greatly appreciated. Please also notify us of any other interested party who may wish to participate in this consultation.

As always, should you have any questions or concerns about the proposed action or the SMART Planning Framework, you may contact Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; Rebecca.Hill@usace.army.mil. An electronic copy of this letter with enclosures will be provided to Dr. Linda Langley, Tribal Historic Preservation Officer, Coushatta Tribe of Louisiana, llangley@mcneese.edu, and Mr. Michael Tarpley, Deputy Tribal Historic Preservation Officer, Coushatta Tribe of Louisiana, kokua.aina57@gmail.com.

Sincerely,

Sandra Stiles for
Joan M. Exnicios
Chief, Environmental Planning Branch

Enclosures

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO ATTENTION OF

November 27, 2013

Regional Planning and
Environment Division, South

B. Cheryl Smith, Principal Chief
Jena Band of Choctaw Indians
P.O. Box 14
Jena, LA 71342

Dear Principal Chief Smith:

The United States Army Corps of Engineers (USACE) and the Coastal Protection and Restoration Authority Board of Louisiana (CPRAB) are investigating the feasibility of implementing hurricane and storm damage risk reduction measures as well as ecosystem restoration measures within southwest coastal Louisiana.

The New Orleans District (CEMVN) is preparing a Southwest Coastal Louisiana (SWC LA) Integrated Feasibility Report and Environmental Impact Statement (Integrated Report), which will describe all aspects of the SWC LA study, from its inception through the evolution of the various alternatives, the discussion of potential impacts to applicable natural, socioeconomic and cultural resources, to the decision to recommend a preferred alternative.

The purpose of this letter is to initiate consultation for the SWC LA study, in partial fulfillment of responsibilities under Executive Order 13175, the National Environmental Policy Act, and Section 106 of the National Historic Preservation Act. The CEMVN offers you the opportunity to review and comment on the potential of the proposed action to significantly affect protected tribal resources, tribal rights, or Indian lands.

Study Authority and History of Investigation

The hurricane and storm damage risk reduction purpose of the SWC LA study was authorized on December 7, 2005, by the Committee on Transportation and Infrastructure, U.S. House of Representatives, Resolution Docket 2747, and the ecosystem restoration purpose was recommended for approval in the 2005 USACE Chief's Report for the Louisiana Coastal Area (LCA) Ecosystem Restoration Program that was authorized in the Water Resources Development Act of 2007. The Feasibility Cost Share Agreement was signed with the CPRAB on January 14, 2009. In 2013 the CEMVN was directed to transition the project to SMART planning.

-2-

This is the second CEMVN study within the USACE SMART Planning framework, which organizes the planning process for feasibility studies around key decision points (please refer to enclosed diagram). Following preparation of the Integrated Report, a public comment period will be conducted along with technical, peer and policy reviews. Additional feasibility work remains to be completed on engineering, cost estimating, environmental, economic, real estate and construction elements of the plan. Results of the reviews and additional feasibility work will be incorporated into the final report, which will be made available for review before the Chief of Engineers makes a final recommendation on the project.

Study Area

The study area is located in southwestern Louisiana, covering an area of approximately 4,700 square miles (please refer to enclosed map of the study area). The area occupies a portion of the Pleistocene Prairie Terrace (or Prairie Complex) on the northern edge of Cameron and Vermilion parishes, as well as most of Calcasieu Parish, and most of the Marginal Plain (or Chenier Plain) on the coast in Cameron and the southern portions of Calcasieu and Vermilion parishes. The study area includes residential, commercial, industrial and undeveloped land.

Proposed Action

Proposed measures of the National Economic Development plan include residential structure elevation, flood proofing, and the acquisition of qualifying structures. The National Ecosystem Restoration (NER) purpose of SWC LA project is to significantly restore environmental conditions for the Chenier Plain ecosystem. Proposed NER measures include nine marsh restoration measures that would restore approximately 8,579 acres and nourish approximately 4,026 acres, resulting in approximately 8,714 net acres; two hydrologic and salinity control measures to restore approximately 6,092 net acres; five shoreline protection measures spanning approximately 266,884 linear feet to protect approximately 5,509 net acres; the preservation of the historic Sabine oyster reef; and a chenier reforestation program to include the planting of trees on approximately 1,413 acres (please refer to the two enclosed maps of the draft NER TSP). The alternatives will be further developed in the Integrated Report.

Section 106 Consultation

The USACE has determined that the proposed action is an undertaking as defined in 36 CFR § 800.16(y) that has the potential to cause effects on historic properties. This letter initiates formal Section 106 consultation pursuant to 36 CFR § 800.3(c). CEMVN is currently reviewing existing information on historic properties within the study area. Following the preparation of the Integrated Report, CEMVN will schedule a teleconference to discuss the area of potential effects (APE), the existing information on historic properties within the APE, as well as data concerning possible historic properties not yet identified, and the level of effort for the identification and evaluation of historic properties.

-3-

Your response to this letter, including any information your office may wish to provide at this time concerning the proposed undertaking and its potential to significantly affect protected tribal resources, tribal rights, or Indian lands is greatly appreciated. Please also notify us of any other interested party who may wish to participate in this consultation.

As always, should you have any questions or concerns about the proposed action or the SMART Planning Framework, you may contact Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; Rebecca.Hill@usace.army.mil. An electronic copy of this letter with enclosures will be provided to Ms. Dana Masters, Tribal Historic Preservation Officer, Jena Band of Choctaw Indians, jbc.thpo106@aol.com, and Ms. Lillie McCormick, Environmental Director, Jena Band of Choctaw Indians, lmmccormickjbc@centurytel.net.

Sincerely,

for Joan M. Exnicios
Chief, Environmental Planning Branch

Enclosures

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO ATTENTION OF

November 27, 2013

Regional Planning and
Environment Division, South

Phyliss J. Anderson, Chief
Mississippi Band of Choctaw Indians
P.O. Box 6257
Choctaw, MS 39350

Dear Chief Anderson:

The United States Army Corps of Engineers (USACE) and the Coastal Protection and Restoration Authority Board of Louisiana (CPRAB) are investigating the feasibility of implementing hurricane and storm damage risk reduction measures as well as ecosystem restoration measures within southwest coastal Louisiana.

The New Orleans District (CEMVN) is preparing a Southwest Coastal Louisiana (SWC LA) Integrated Feasibility Report and Environmental Impact Statement (Integrated Report), which will describe all aspects of the SWC LA study, from its inception through the evolution of the various alternatives, the discussion of potential impacts to applicable natural, socioeconomic and cultural resources, to the decision to recommend a preferred alternative.

The purpose of this letter is to initiate consultation for the SWC LA study, in partial fulfillment of responsibilities under Executive Order 13175, the National Environmental Policy Act, and Section 106 of the National Historic Preservation Act. The CEMVN offers you the opportunity to review and comment on the potential of the proposed action to significantly affect protected tribal resources, tribal rights, or Indian lands.

Study Authority and History of Investigation

The hurricane and storm damage risk reduction purpose of the SWC LA study was authorized on December 7, 2005, by the Committee on Transportation and Infrastructure, U.S. House of Representatives, Resolution Docket 2747, and the ecosystem restoration purpose was recommended for approval in the 2005 USACE Chief's Report for the Louisiana Coastal Area (LCA) Ecosystem Restoration Program that was authorized in the Water Resources Development Act of 2007. The Feasibility Cost Share Agreement was signed with the CPRAB on January 14, 2009. In 2013 the CEMVN was directed to transition the project to SMART planning.

-2-

This is the second CEMVN study within the USACE SMART Planning framework, which organizes the planning process for feasibility studies around key decision points (please refer to enclosed diagram). Following preparation of the Integrated Report, a public comment period will be conducted along with technical, peer and policy reviews. Additional feasibility work remains to be completed on engineering, cost estimating, environmental, economic, real estate and construction elements of the plan. Results of the reviews and additional feasibility work will be incorporated into the final report, which will be made available for review before the Chief of Engineers makes a final recommendation on the project.

Study Area

The study area is located in southwestern Louisiana, covering an area of approximately 4,700 square miles (please refer to enclosed map of the study area). The area occupies a portion of the Pleistocene Prairie Terrace (or Prairie Complex) on the northern edge of Cameron and Vermilion parishes, as well as most of Calcasieu Parish, and most of the Marginal Plain (or Chenier Plain) on the coast in Cameron and the southern portions of Calcasieu and Vermilion parishes. The study area includes residential, commercial, industrial and undeveloped land.

Proposed Action

Proposed measures of the National Economic Development plan include residential structure elevation, flood proofing, and the acquisition of qualifying structures. The National Ecosystem Restoration (NER) purpose of SWC LA project is to significantly restore environmental conditions for the Chenier Plain ecosystem. Proposed NER measures include nine marsh restoration measures that would restore approximately 8,579 acres and nourish approximately 4,026 acres, resulting in approximately 8,714 net acres; two hydrologic and salinity control measures to restore approximately 6,092 net acres; five shoreline protection measures spanning approximately 266,884 linear feet to protect approximately 5,509 net acres; the preservation of the historic Sabine oyster reef; and a chenier reforestation program to include the planting of trees on approximately 1,413 acres (please refer to the two enclosed maps of the draft NER TSP). The alternatives will be further developed in the Integrated Report.

Section 106 Consultation

The USACE has determined that the proposed action is an undertaking as defined in 36 CFR § 800.16(y) that has the potential to cause effects on historic properties. This letter initiates formal Section 106 consultation pursuant to 36 CFR § 800.3(c). CEMVN is currently reviewing existing information on historic properties within the study area. Following the preparation of the Integrated Report, CEMVN will schedule a teleconference to discuss the area of potential effects (APE), the existing information on historic properties within the APE, as well as data concerning possible historic properties not yet identified, and the level of effort for the identification and evaluation of historic properties.

-3-

Your response to this letter, including any information your office may wish to provide at this time concerning the proposed undertaking and its potential to significantly affect protected tribal resources, tribal rights, or Indian lands is greatly appreciated. Please also notify us of any other interested party who may wish to participate in this consultation.

As always, should you have any questions or concerns about the proposed action or the SMART Planning Framework, you may contact Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; Rebecca.Hill@usace.army.mil. An electronic copy of this letter with enclosures will be provided to Mr. Kenneth H. Carleton, Tribal Historic Preservation Officer/ Archaeologist, Mississippi Band of Choctaw Indians, kcarleton@choctaw.org.

Sincerely,

Joan M. Exnicios
Chief, Environmental Planning Branch

Enclosures

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO ATTENTION OF

November 27, 2013

Regional Planning and
Environment Division, South

John Berrey, Chairman
Quapaw Tribe of Oklahoma
P.O. Box 765
Quapaw, OK 74363

Dear Chairman Berrey:

The United States Army Corps of Engineers (USACE) and the Coastal Protection and Restoration Authority Board of Louisiana (CPRAB) are investigating the feasibility of implementing hurricane and storm damage risk reduction measures as well as ecosystem restoration measures within southwest coastal Louisiana.

The New Orleans District (CEMVN) is preparing a Southwest Coastal Louisiana (SWC LA) Integrated Feasibility Report and Environmental Impact Statement (Integrated Report), which will describe all aspects of the SWC LA study, from its inception through the evolution of the various alternatives, the discussion of potential impacts to applicable natural, socioeconomic and cultural resources, to the decision to recommend a preferred alternative.

The purpose of this letter is to initiate consultation for the SWC LA study, in partial fulfillment of responsibilities under Executive Order 13175, the National Environmental Policy Act, and Section 106 of the National Historic Preservation Act. The CEMVN offers you the opportunity to review and comment on the potential of the proposed action to significantly affect protected tribal resources, tribal rights, or Indian lands.

Study Authority and History of Investigation

The hurricane and storm damage risk reduction purpose of the SWC LA study was authorized on December 7, 2005, by the Committee on Transportation and Infrastructure, U.S. House of Representatives, Resolution Docket 2747, and the ecosystem restoration purpose was recommended for approval in the 2005 USACE Chief's Report for the Louisiana Coastal Area (LCA) Ecosystem Restoration Program that was authorized in the Water Resources Development Act of 2007. The Feasibility Cost Share Agreement was signed with the CPRAB on January 14, 2009. In 2013 the CEMVN was directed to transition the project to SMART planning.

-2-

This is the second CEMVN study within the USACE SMART Planning framework, which organizes the planning process for feasibility studies around key decision points (please refer to enclosed diagram). Following preparation of the Integrated Report, a public comment period will be conducted along with technical, peer and policy reviews. Additional feasibility work remains to be completed on engineering, cost estimating, environmental, economic, real estate and construction elements of the plan. Results of the reviews and additional feasibility work will be incorporated into the final report, which will be made available for review before the Chief of Engineers makes a final recommendation on the project.

Study Area

The study area is located in southwestern Louisiana, covering an area of approximately 4,700 square miles (please refer to enclosed map of the study area). The area occupies a portion of the Pleistocene Prairie Terrace (or Prairie Complex) on the northern edge of Cameron and Vermilion parishes, as well as most of Calcasieu Parish, and most of the Marginal Plain (or Chenier Plain) on the coast in Cameron and the southern portions of Calcasieu and Vermilion parishes. The study area includes residential, commercial, industrial and undeveloped land.

Proposed Action

Proposed measures of the National Economic Development plan include residential structure elevation, flood proofing, and the acquisition of qualifying structures. The National Ecosystem Restoration (NER) purpose of SWC LA project is to significantly restore environmental conditions for the Chenier Plain ecosystem. Proposed NER measures include nine marsh restoration measures that would restore approximately 8,579 acres and nourish approximately 4,026 acres, resulting in approximately 8,714 net acres; two hydrologic and salinity control measures to restore approximately 6,092 net acres; five shoreline protection measures spanning approximately 266,884 linear feet to protect approximately 5,509 net acres; the preservation of the historic Sabine oyster reef; and a chenier reforestation program to include the planting of trees on approximately 1,413 acres (please refer to the two enclosed maps of the draft NER TSP). The alternatives will be further developed in the Integrated Report.

Section 106 Consultation

The USACE has determined that the proposed action is an undertaking as defined in 36 CFR § 800.16(y) that has the potential to cause effects on historic properties. This letter initiates formal Section 106 consultation pursuant to 36 CFR § 800.3(c). CEMVN is currently reviewing existing information on historic properties within the study area. Following the preparation of the Integrated Report, CEMVN will schedule a teleconference to discuss the area of potential effects (APE), the existing information on historic properties within the APE, as well as data concerning possible historic properties not yet identified, and the level of effort for the identification and evaluation of historic properties.

-3-

Your response to this letter, including any information your office may wish to provide at this time concerning the proposed undertaking and its potential to significantly affect protected tribal resources, tribal rights, or Indian lands is greatly appreciated. Please also notify us of any other interested party who may wish to participate in this consultation.

As always, should you have any questions or concerns about the proposed action or the SMART Planning Framework, you may contact Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; Rebecca.Hill@usace.army.mil. An electronic copy of this letter with enclosures will be provided to Mr. Everett Bandy, Tribal Historic Preservation Officer, Quapaw Tribe of Oklahoma, ebandy@quapawtribe.com.

Sincerely,

Sandra Stiles for
Joan M. Exnicios
Chief, Environmental Planning Branch

Enclosures



REPLY TO ATTENTION OF

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

November 27, 2013

Regional Planning and
Environment Division, South

Leonard M. Harjo, Principal Chief
Seminole Nation of Oklahoma
P.O. Box 1498
Wewoka, OK 74884

Dear Principal Chief Harjo:

The United States Army Corps of Engineers (USACE) and the Coastal Protection and Restoration Authority Board of Louisiana (CPRAB) are investigating the feasibility of implementing hurricane and storm damage risk reduction measures as well as ecosystem restoration measures within southwest coastal Louisiana.

The New Orleans District (CEMVN) is preparing a Southwest Coastal Louisiana (SWC LA) Integrated Feasibility Report and Environmental Impact Statement (Integrated Report), which will describe all aspects of the SWC LA study, from its inception through the evolution of the various alternatives, the discussion of potential impacts to applicable natural, socioeconomic and cultural resources, to the decision to recommend a preferred alternative.

The purpose of this letter is to initiate consultation for the SWC LA study, in partial fulfillment of responsibilities under Executive Order 13175, the National Environmental Policy Act, and Section 106 of the National Historic Preservation Act. The CEMVN offers you the opportunity to review and comment on the potential of the proposed action to significantly affect protected tribal resources, tribal rights, or Indian lands.

Study Authority and History of Investigation

The hurricane and storm damage risk reduction purpose of the SWC LA study was authorized on December 7, 2005, by the Committee on Transportation and Infrastructure, U.S. House of Representatives, Resolution Docket 2747, and the ecosystem restoration purpose was recommended for approval in the 2005 USACE Chief's Report for the Louisiana Coastal Area (LCA) Ecosystem Restoration Program that was authorized in the Water Resources Development Act of 2007. The Feasibility Cost Share Agreement was signed with the CPRAB on January 14, 2009. In 2013 the CEMVN was directed to transition the project to SMART planning.

-2-

This is the second CEMVN study within the USACE SMART Planning framework, which organizes the planning process for feasibility studies around key decision points (please refer to enclosed diagram). Following preparation of the Integrated Report, a public comment period will be conducted along with technical, peer and policy reviews. Additional feasibility work remains to be completed on engineering, cost estimating, environmental, economic, real estate and construction elements of the plan. Results of the reviews and additional feasibility work will be incorporated into the final report, which will be made available for review before the Chief of Engineers makes a final recommendation on the project.

Study Area

The study area is located in southwestern Louisiana, covering an area of approximately 4,700 square miles (please refer to enclosed map of the study area). The area occupies a portion of the Pleistocene Prairie Terrace (or Prairie Complex) on the northern edge of Cameron and Vermilion parishes, as well as most of Calcasieu Parish, and most of the Marginal Plain (or Chenier Plain) on the coast in Cameron and the southern portions of Calcasieu and Vermilion parishes. The study area includes residential, commercial, industrial and undeveloped land.

Proposed Action

Proposed measures of the National Economic Development plan include residential structure elevation, flood proofing, and the acquisition of qualifying structures. The National Ecosystem Restoration (NER) purpose of SWC LA project is to significantly restore environmental conditions for the Chenier Plain ecosystem. Proposed NER measures include nine marsh restoration measures that would restore approximately 8,579 acres and nourish approximately 4,026 acres, resulting in approximately 8,714 net acres; two hydrologic and salinity control measures to restore approximately 6,092 net acres; five shoreline protection measures spanning approximately 266,884 linear feet to protect approximately 5,509 net acres; the preservation of the historic Sabine oyster reef; and a chenier reforestation program to include the planting of trees on approximately 1,413 acres (please refer to the two enclosed maps of the draft NER TSP). The alternatives will be further developed in the Integrated Report.

Section 106 Consultation

The USACE has determined that the proposed action is an undertaking as defined in 36 CFR § 800.16(y) that has the potential to cause effects on historic properties. This letter initiates formal Section 106 consultation pursuant to 36 CFR § 800.3(c). CEMVN is currently reviewing existing information on historic properties within the study area. Following the preparation of the Integrated Report, CEMVN will schedule a teleconference to discuss the area of potential effects (APE), the existing information on historic properties within the APE, as well as data concerning possible historic properties not yet identified, and the level of effort for the identification and evaluation of historic properties.

-3-

Your response to this letter, including any information your office may wish to provide at this time concerning the proposed undertaking and its potential to significantly affect protected tribal resources, tribal rights, or Indian lands is greatly appreciated. Please also notify us of any other interested party who may wish to participate in this consultation.

As always, should you have any questions or concerns about the proposed action or the SMART Planning Framework, you may contact Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; Rebecca.Hill@usace.army.mil. An electronic copy of this letter with enclosures will be provided to Ms. Natalie Harjo, Tribal Historic Preservation Officer, Seminole Nation of Oklahoma, harjo.n@sno-nsn.gov.

Sincerely,

Rebecca Hill

for Joan M. Exnicios
Chief, Environmental Planning Branch

Enclosures

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO ATTENTION OF

November 27, 2013

Regional Planning and
Environment Division, South

James Billie, Chairman
Seminole Tribe of Florida
6300 Stirling Road
Hollywood, FL 33024

Dear Chairman Billie:

The United States Army Corps of Engineers (USACE) and the Coastal Protection and Restoration Authority Board of Louisiana (CPRAB) are investigating the feasibility of implementing hurricane and storm damage risk reduction measures as well as ecosystem restoration measures within southwest coastal Louisiana.

The New Orleans District (CEMVN) is preparing a Southwest Coastal Louisiana (SWC LA) Integrated Feasibility Report and Environmental Impact Statement (Integrated Report), which will describe all aspects of the SWC LA study, from its inception through the evolution of the various alternatives, the discussion of potential impacts to applicable natural, socioeconomic and cultural resources, to the decision to recommend a preferred alternative.

The purpose of this letter is to initiate consultation for the SWC LA study, in partial fulfillment of responsibilities under Executive Order 13175, the National Environmental Policy Act, and Section 106 of the National Historic Preservation Act. The CEMVN offers you the opportunity to review and comment on the potential of the proposed action to significantly affect protected tribal resources, tribal rights, or Indian lands.

Study Authority and History of Investigation

The hurricane and storm damage risk reduction purpose of the SWC LA study was authorized on December 7, 2005, by the Committee on Transportation and Infrastructure, U.S. House of Representatives, Resolution Docket 2747, and the ecosystem restoration purpose was recommended for approval in the 2005 USACE Chief's Report for the Louisiana Coastal Area (LCA) Ecosystem Restoration Program that was authorized in the Water Resources Development Act of 2007. The Feasibility Cost Share Agreement was signed with the CPRAB on January 14, 2009. In 2013 the CEMVN was directed to transition the project to SMART planning.

-2-

This is the second CEMVN study within the USACE SMART Planning framework, which organizes the planning process for feasibility studies around key decision points (please refer to enclosed diagram). Following preparation of the Integrated Report, a public comment period will be conducted along with technical, peer and policy reviews. Additional feasibility work remains to be completed on engineering, cost estimating, environmental, economic, real estate and construction elements of the plan. Results of the reviews and additional feasibility work will be incorporated into the final report, which will be made available for review before the Chief of Engineers makes a final recommendation on the project.

Study Area

The study area is located in southwestern Louisiana, covering an area of approximately 4,700 square miles (please refer to enclosed map of the study area). The area occupies a portion of the Pleistocene Prairie Terrace (or Prairie Complex) on the northern edge of Cameron and Vermilion parishes, as well as most of Calcasieu Parish, and most of the Marginal Plain (or Chenier Plain) on the coast in Cameron and the southern portions of Calcasieu and Vermilion parishes. The study area includes residential, commercial, industrial and undeveloped land.

Proposed Action

Proposed measures of the National Economic Development plan include residential structure elevation, flood proofing, and the acquisition of qualifying structures. The National Ecosystem Restoration (NER) purpose of SWC LA project is to significantly restore environmental conditions for the Chenier Plain ecosystem. Proposed NER measures include nine marsh restoration measures that would restore approximately 8,579 acres and nourish approximately 4,026 acres, resulting in approximately 8,714 net acres; two hydrologic and salinity control measures to restore approximately 6,092 net acres; five shoreline protection measures spanning approximately 266,884 linear feet to protect approximately 5,509 net acres; the preservation of the historic Sabine oyster reef; and a chenier reforestation program to include the planting of trees on approximately 1,413 acres (please refer to the two enclosed maps of the draft NER TSP). The alternatives will be further developed in the Integrated Report.

Section 106 Consultation

The USACE has determined that the proposed action is an undertaking as defined in 36 CFR § 800.16(y) that has the potential to cause effects on historic properties. This letter initiates formal Section 106 consultation pursuant to 36 CFR § 800.3(c). CEMVN is currently reviewing existing information on historic properties within the study area. Following the preparation of the Integrated Report, CEMVN will schedule a teleconference to discuss the area of potential effects (APE), the existing information on historic properties within the APE, as well as data concerning possible historic properties not yet identified, and the level of effort for the identification and evaluation of historic properties.

-3-

Your response to this letter, including any information your office may wish to provide at this time concerning the proposed undertaking and its potential to significantly affect protected tribal resources, tribal rights, or Indian lands is greatly appreciated. Please also notify us of any other interested party who may wish to participate in this consultation.

As always, should you have any questions or concerns about the proposed action or the SMART Planning Framework, you may contact Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; Rebecca.Hill@usace.army.mil. An electronic copy of this letter with enclosures will be provided to Mr. Paul N. Backhouse, Tribal Historic Preservation Officer, Seminole Tribe of Florida, paulbackhouse@semtribe.com; Ms. Anne Mullins, Deputy Tribal Historic Preservation Officer, annemullins@semtribe.com; Mr. Bradley Mueller, Compliance Review Supervisor, bradleymueller@semtribe.com; Mr. Elliott York, Compliance Review and Data Analyst, elliottyork@semtribe.com; and Ms. Alison Swing, Compliance Review Data Analyst, alisonswing@semtribe.com.

Sincerely,

Joan M. Exnicios
Chief, Environmental Planning Branch

Enclosures

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO ATTENTION OF

November 27, 2013

Regional Planning and
Environment Division, South

Earl J. Barbry, Sr., Chairman
Tunica-Biloxi Tribe of Louisiana
P.O. Box 1589
Marksville, LA 71351

Dear Chairman Barbry:

The United States Army Corps of Engineers (USACE) and the Coastal Protection and Restoration Authority Board of Louisiana (CPRAB) are investigating the feasibility of implementing hurricane and storm damage risk reduction measures as well as ecosystem restoration measures within southwest coastal Louisiana.

The New Orleans District (CEMVN) is preparing a Southwest Coastal Louisiana (SWC LA) Integrated Feasibility Report and Environmental Impact Statement (Integrated Report), which will describe all aspects of the SWC LA study, from its inception through the evolution of the various alternatives, the discussion of potential impacts to applicable natural, socioeconomic and cultural resources, to the decision to recommend a preferred alternative.

The purpose of this letter is to initiate consultation for the SWC LA study, in partial fulfillment of responsibilities under Executive Order 13175, the National Environmental Policy Act, and Section 106 of the National Historic Preservation Act. The CEMVN offers you the opportunity to review and comment on the potential of the proposed action to significantly affect protected tribal resources, tribal rights, or Indian lands.

Study Authority and History of Investigation

The hurricane and storm damage risk reduction purpose of the SWC LA study was authorized on December 7, 2005, by the Committee on Transportation and Infrastructure, U.S. House of Representatives, Resolution Docket 2747, and the ecosystem restoration purpose was recommended for approval in the 2005 USACE Chief's Report for the Louisiana Coastal Area (LCA) Ecosystem Restoration Program that was authorized in the Water Resources Development Act of 2007. The Feasibility Cost Share Agreement was signed with the CPRAB on January 14, 2009. In 2013 the CEMVN was directed to transition the project to SMART planning.

-2-

This is the second CEMVN study within the USACE SMART Planning framework, which organizes the planning process for feasibility studies around key decision points (please refer to enclosed diagram). Following preparation of the Integrated Report, a public comment period will be conducted along with technical, peer and policy reviews. Additional feasibility work remains to be completed on engineering, cost estimating, environmental, economic, real estate and construction elements of the plan. Results of the reviews and additional feasibility work will be incorporated into the final report, which will be made available for review before the Chief of Engineers makes a final recommendation on the project.

Study Area

The study area is located in southwestern Louisiana, covering an area of approximately 4,700 square miles (please refer to enclosed map of the study area). The area occupies a portion of the Pleistocene Prairie Terrace (or Prairie Complex) on the northern edge of Cameron and Vermilion parishes, as well as most of Calcasieu Parish, and most of the Marginal Plain (or Chenier Plain) on the coast in Cameron and the southern portions of Calcasieu and Vermilion parishes. The study area includes residential, commercial, industrial and undeveloped land.

Proposed Action

Proposed measures of the National Economic Development plan include residential structure elevation, flood proofing, and the acquisition of qualifying structures. The National Ecosystem Restoration (NER) purpose of SWC LA project is to significantly restore environmental conditions for the Chenier Plain ecosystem. Proposed NER measures include nine marsh restoration measures that would restore approximately 8,579 acres and nourish approximately 4,026 acres, resulting in approximately 8,714 net acres; two hydrologic and salinity control measures to restore approximately 6,092 net acres; five shoreline protection measures spanning approximately 266,884 linear feet to protect approximately 5,509 net acres; the preservation of the historic Sabine oyster reef; and a chenier reforestation program to include the planting of trees on approximately 1,413 acres (please refer to the two enclosed maps of the draft NER TSP). The alternatives will be further developed in the Integrated Report.

Section 106 Consultation

The USACE has determined that the proposed action is an undertaking as defined in 36 CFR § 800.16(y) that has the potential to cause effects on historic properties. This letter initiates formal Section 106 consultation pursuant to 36 CFR § 800.3(c). CEMVN is currently reviewing existing information on historic properties within the study area. Following the preparation of the Integrated Report, CEMVN will schedule a teleconference to discuss the area of potential effects (APE), the existing information on historic properties within the APE, as well as data concerning possible historic properties not yet identified, and the level of effort for the identification and evaluation of historic properties.

-3-

Your response to this letter, including any information your office may wish to provide at this time concerning the proposed undertaking and its potential to significantly affect protected tribal resources, tribal rights, or Indian lands is greatly appreciated. Please also notify us of any other interested party who may wish to participate in this consultation.

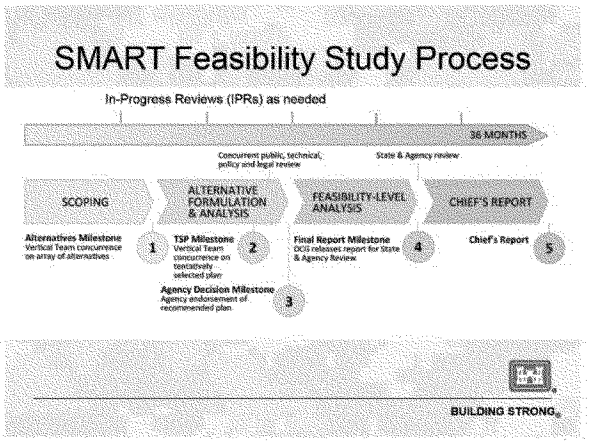
As always, should you have any questions or concerns about the proposed action or the SMART Planning Framework, you may contact Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; Rebecca.Hill@usace.army.mil. An electronic copy of this letter with enclosures will be provided to Mr. Earl Barbry, Jr., Cultural Director, Tunica-Biloxi Tribe of Louisiana, earlii@tunica.org.

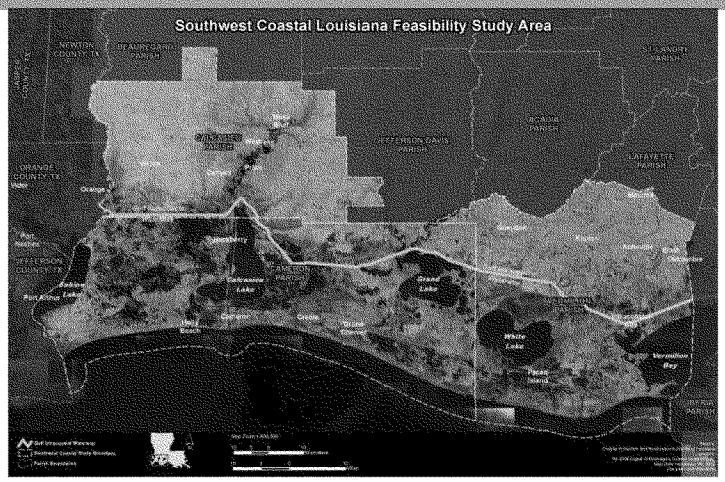
Sincerely,

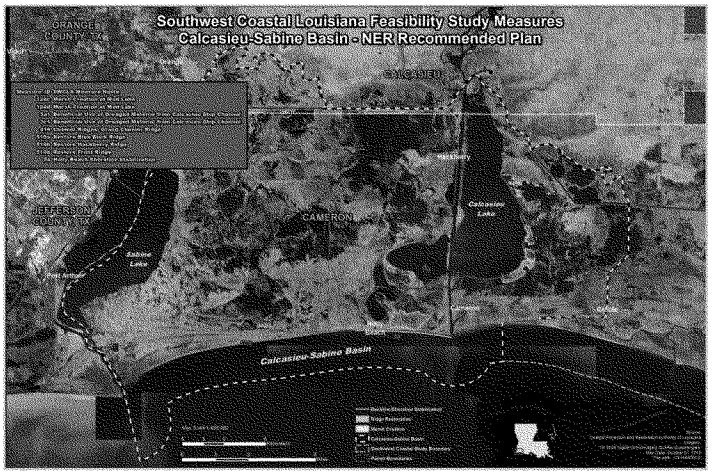
Sandra Stiles

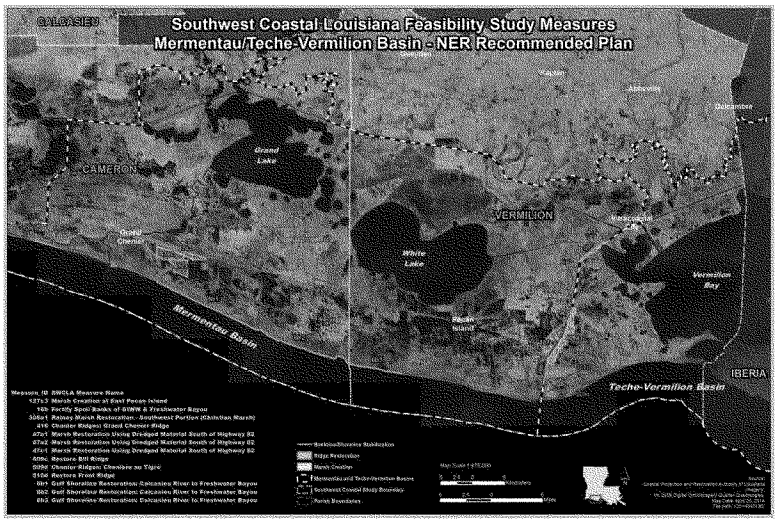
for Joan M. Exnicios
Chief, Environmental Planning Branch

Enclosures


SMART Feasibility Study Process
In-Progress Reviews (IPRs) as needed
36 MONTHS
Concurrent public, technical, policy and legal review
State & Agency review
SCOPING
ALTERNATIVE FORMULATION & ANALYSIS
FEASIBILITY-LEVEL ANALYSIS
CHIEF'S REPORT
Alternatives Milestone
Vertical Team concurrence on array of alternatives
1
TSP Milestone
Vertical Team concurrence on tentatively selected plan
2
Agency Decision Milestone
Agency endorsement of recommended plan
3
Final Report Milestone
DCIS releases report for State & Agency Review
4
Chief's Report
5
BUILDING STRONG®


Southwest Coastal Louisiana Feasibility Study Area


Southwest Coastal Louisiana Feasibility Study Measures
Calcasieu-Sabine Basin - NER Recommended Plan
Calcasieu-Sabine Basin


Southwest Coastal Louisiana Feasibility Study Measures
Mermentau/Teche-Vermilion Basin - NER Recommended Plan
CALCASIEU
CAMERON
VERMILION
IBERIA
Grand Lake
White Lake
Marsh Island
Vermilion Bay
Mermentau Basin
Teche-Vermilion Basin

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO
ATTENTION OF

DECEMBER 11, 2013

Regional Planning and
Environment Division, South

Carlos Bullock, Chairman
Alabama-Coushatta Tribe of Texas
571 State Park Rd 56
Livingston, TX 77351

Dear Chairman Bullock:

The United States Army Corps of Engineers (USACE), New Orleans District (CEMVN), has prepared a draft Integrated Feasibility Report and Programmatic Environmental Impact Statement (Draft Integrated Report) for the Southwest Coastal Louisiana (SWC LA) Study. A copy of the Draft Integrated Report is enclosed and is available electronically for review at http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx; hard copies are available upon request.

In partial fulfillment of responsibilities under Executive Order 13175, the National Environmental Policy Act (NEPA), and Section 106 of the National Historic Preservation Act, the CEMVN offers you the opportunity to review and comment on the potential of the proposed action described in the Draft Integrated Report to significantly affect protected tribal resources, tribal rights, or Indian lands. Consultation for the proposed action was initiated in a letter dated November 27, 2013.

The Draft Integrated Report proposes potential solutions that would provide nonstructural hurricane and storm damage risk reduction measures as well as ecosystem restoration features in the 4,700 square mile study area located in Calcasieu, Cameron and Vermillion parishes in southwest Louisiana.

Proposed measures of the National Economic Development plan include residential structure elevation, flood proofing and the acquisition of qualifying structures. The proposed measures of the National Ecosystem Restoration (NER) plan would significantly restore environmental conditions for the Chenier Plain ecosystem. The proposed NER measures include nine marsh restoration measures that would restore approximately 8,579 acres and nourish approximately 4,026 acres, resulting in approximately 8,714 net acres; two hydrologic and salinity control measures to restore approximately 6,092 net acres; five shoreline protection measures spanning approximately 266,884 linear feet to protect approximately 5,509 net acres; the preservation of the historic Sabine oyster reef; and a chenier invasive species control and reforestation program to include the planting of trees on approximately 1,413 acres.



Section 106 Consultation

Formal Section 106 consultation pursuant to 36 CFR § 800.3(c) has been initiated with the Louisiana State Historic Preservation Officer (SHPO) and eleven federally recognized Tribes with an interest in USACE undertakings within the boundaries of CEMVN, and the CEMVN will continue consultation with the SHPO and federally recognized Tribes. With selection of the TSP as presented in the Draft Integrated Report, the CEMVN will now proceed with the identification and evaluation of historic properties, the results of which will be coordinated with the SHPO and federally recognized Tribes in a continuation of Section 106 consultation.

CEMVN is nearing completion of its review of existing information on historic properties within the study area and will be scheduling a teleconference via a forthcoming email to Mr. Celestine to discuss the area of potential effects (APE), the existing information on historic properties within the APE, as well as data concerning possible historic properties not yet identified, and the level of effort for the identification and evaluation of historic properties.

Please review the Integrated Draft Report and provide comments. The official closing date for receipt of comments will be January 26, 2014. Please send comments and/or any questions or concerns about the SWC LA study or the SMART Planning framework to Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; rebecca.hill@usace.army.mil. Comments and/or questions may also be submitted via the contact information available on the website http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx. An electronic copy of this letter will be provided to Mr. Bryant J. Celestine, Historic Preservation Officer, Alabama Coushatta Tribe of Texas, celestine.bryant@actribe.org.

Sincerely,

Joan M. Exnicios
Chief, Environmental Planning Branch

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO ATTENTION OF

DECEMBER 11, 2013

Regional Planning and
Environment Division, South

Brenda Shemayme Edwards, Chairwoman
Caddo Nation of Oklahoma
P.O. Box 487
Binger, OK 73009

Dear Chairwoman Edwards:

The United States Army Corps of Engineers (USACE), New Orleans District (CEMVN), has prepared a draft Integrated Feasibility Report and Programmatic Environmental Impact Statement (Draft Integrated Report) for the Southwest Coastal Louisiana (SWC LA) Study. A copy of the Draft Integrated Report is enclosed and is available electronically for review at http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx; hard copies are available upon request.

In partial fulfillment of responsibilities under Executive Order 13175, the National Environmental Policy Act (NEPA), and Section 106 of the National Historic Preservation Act, the CEMVN offers you the opportunity to review and comment on the potential of the proposed action described in the Draft Integrated Report to significantly affect protected tribal resources, tribal rights, or Indian lands. Consultation for the proposed action was initiated in a letter dated November 27, 2013.

The Draft Integrated Report proposes potential solutions that would provide nonstructural hurricane and storm damage risk reduction measures as well as ecosystem restoration features in the 4,700 square mile study area located in Calcasieu, Cameron and Vermillion parishes in southwest Louisiana.

Proposed measures of the National Economic Development plan include residential structure elevation, flood proofing and the acquisition of qualifying structures. The proposed measures of the National Ecosystem Restoration (NER) plan would significantly restore environmental conditions for the Chenier Plain ecosystem. The proposed NER measures include nine marsh restoration measures that would restore approximately 8,579 acres and nourish approximately 4,026 acres, resulting in approximately 8,714 net acres; two hydrologic and salinity control measures to restore approximately 6,092 net acres; five shoreline protection measures spanning approximately 266,884 linear feet to protect approximately 5,509 net acres; the preservation of the historic Sabine oyster reef; and a chenier invasive species control and reforestation program to include the planting of trees on approximately 1,413 acres.

-2-

Section 106 Consultation

Formal Section 106 consultation pursuant to 36 CFR § 800.3(c) has been initiated with the Louisiana State Historic Preservation Officer (SHPO) and eleven federally recognized Tribes with an interest in USACE undertakings within the boundaries of CEMVN, and the CEMVN will continue consultation with the SHPO and federally recognized Tribes. With selection of the TSP as presented in the Draft Integrated Report, the CEMVN will now proceed with the identification and evaluation of historic properties, the results of which will be coordinated with the SHPO and federally recognized Tribes in a continuation of Section 106 consultation.

CEMVN is nearing completion of its review of existing information on historic properties within the study area and will be scheduling a teleconference via a forthcoming email to Mr. Cast to discuss the area of potential effects (APE), the existing information on historic properties within the APE, as well as data concerning possible historic properties not yet identified, and the level of effort for the identification and evaluation of historic properties.

Please review the Integrated Draft Report and provide comments. The official closing date for receipt of comments will be January 26, 2014. Please send comments and/or any questions or concerns about the SWC LA study or the SMART Planning framework to Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; rebecca.hill@usace.army.mil. Comments and/or questions may also be submitted via the contact information available on the website http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx. An electronic copy of this letter will be provided to Mr. Robert Cast, Tribal Historic Preservation Officer, Caddo Nation of Oklahoma, rcast@caddonation.org.

Sincerely,

Joan M. Exnicios
Chief, Environmental Planning Branch

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO ATTENTION OF

DECEMBER 11, 2013

Regional Planning and
Environment Division, South

John Paul Darden, Chairman
Chitimacha Tribe of Louisiana
P.O. Box 661
Charenton, LA 70523

Dear Chairman Darden:

The United States Army Corps of Engineers (USACE), New Orleans District (CEMVN), has prepared a draft Integrated Feasibility Report and Programmatic Environmental Impact Statement (Draft Integrated Report) for the Southwest Coastal Louisiana (SWC LA) Study. A copy of the Draft Integrated Report is enclosed and is available electronically for review at http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx; hard copies are available upon request.

In partial fulfillment of responsibilities under Executive Order 13175, the National Environmental Policy Act (NEPA), and Section 106 of the National Historic Preservation Act, the CEMVN offers you the opportunity to review and comment on the potential of the proposed action described in the Draft Integrated Report to significantly affect protected tribal resources, tribal rights, or Indian lands. Consultation for the proposed action was initiated in a letter dated November 27, 2013.

The Draft Integrated Report proposes potential solutions that would provide nonstructural hurricane and storm damage risk reduction measures as well as ecosystem restoration features in the 4,700 square mile study area located in Calcasieu, Cameron and Vermillion parishes in southwest Louisiana.

Proposed measures of the National Economic Development plan include residential structure elevation, flood proofing and the acquisition of qualifying structures. The proposed measures of the National Ecosystem Restoration (NER) plan would significantly restore environmental conditions for the Chenier Plain ecosystem. The proposed NER measures include nine marsh restoration measures that would restore approximately 8,579 acres and nourish approximately 4,026 acres, resulting in approximately 8,714 net acres; two hydrologic and salinity control measures to restore approximately 6,092 net acres; five shoreline protection measures spanning approximately 266,884 linear feet to protect approximately 5,509 net acres; the preservation of the historic Sabine oyster reef; and a chenier invasive species control and reforestation program to include the planting of trees on approximately 1,413 acres.

-2-

Section 106 Consultation

Formal Section 106 consultation pursuant to 36 CFR § 800.3(c) has been initiated with the Louisiana State Historic Preservation Officer (SHPO) and eleven federally recognized Tribes with an interest in USACE undertakings within the boundaries of CEMVN, and the CEMVN will continue consultation with the SHPO and federally recognized Tribes. With selection of the TSP as presented in the Draft Integrated Report, the CEMVN will now proceed with the identification and evaluation of historic properties, the results of which will be coordinated with the SHPO and federally recognized Tribes in a continuation of Section 106 consultation.

CEMVN is nearing completion of its review of existing information on historic properties within the study area and will be scheduling a teleconference via a forthcoming email to Mrs. Walden to discuss the area of potential effects (APE), the existing information on historic properties within the APE, as well as data concerning possible historic properties not yet identified, and the level of effort for the identification and evaluation of historic properties.

Please review the Integrated Draft Report and provide comments. The official closing date for receipt of comments will be January 26, 2014. Please send comments and/or any questions or concerns about the SWC LA study or the SMART Planning framework to Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; rebecca.hill@usace.army.mil. Comments and/or questions may also be submitted via the contact information available on the website http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx. An electronic copy of this letter will be provided to Mrs. Kimberly Walden, M. Ed., Cultural Director/Tribal Historic Preservation Officer, Chitimacha Tribe of Louisiana, kswalden@chitimacha.gov.

Sincerely,

Joan M. Exnicios

Joan M. Exnicios
Chief, Environmental Planning Branch

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO ATTENTION OF

DECEMBER 11, 2013

Regional Planning and
Environment Division, South

Gregory E. Pyle, Chief
Choctaw Nation of Oklahoma
P.O. Box 1210
Durant, OK 74702-1210

Dear Chief Pyle:

The United States Army Corps of Engineers (USACE), New Orleans District (CEMVN), has prepared a draft Integrated Feasibility Report and Programmatic Environmental Impact Statement (Draft Integrated Report) for the Southwest Coastal Louisiana (SWC LA) Study. A copy of the Draft Integrated Report is enclosed and is available electronically for review at http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx; hard copies are available upon request.

In partial fulfillment of responsibilities under Executive Order 13175, the National Environmental Policy Act (NEPA), and Section 106 of the National Historic Preservation Act, the CEMVN offers you the opportunity to review and comment on the potential of the proposed action described in the Draft Integrated Report to significantly affect protected tribal resources, tribal rights, or Indian lands. Consultation for the proposed action was initiated in a letter dated November 27, 2013.

The Draft Integrated Report proposes potential solutions that would provide nonstructural hurricane and storm damage risk reduction measures as well as ecosystem restoration features in the 4,700 square mile study area located in Calcasieu, Cameron and Vermillion parishes in southwest Louisiana.

Proposed measures of the National Economic Development plan include residential structure elevation, flood proofing and the acquisition of qualifying structures. The proposed measures of the National Ecosystem Restoration (NER) plan would significantly restore environmental conditions for the Chenier Plain ecosystem. The proposed NER measures include nine marsh restoration measures that would restore approximately 8,579 acres and nourish approximately 4,026 acres, resulting in approximately 8,714 net acres; two hydrologic and salinity control measures to restore approximately 6,092 net acres; five shoreline protection measures spanning approximately 266,884 linear feet to protect approximately 5,509 net acres; the preservation of the historic Sabine oyster reef; and a chenier invasive species control and reforestation program to include the planting of trees on approximately 1,413 acres.

-2-

Section 106 Consultation

Formal Section 106 consultation pursuant to 36 CFR § 800.3(c) has been initiated with the Louisiana State Historic Preservation Officer (SHPO) and eleven federally recognized Tribes with an interest in USACE undertakings within the boundaries of CEMVN, and the CEMVN will continue consultation with the SHPO and federally recognized Tribes. With selection of the TSP as presented in the Draft Integrated Report, the CEMVN will now proceed with the identification and evaluation of historic properties, the results of which will be coordinated with the SHPO and federally recognized Tribes in a continuation of Section 106 consultation.

CEMVN is nearing completion of its review of existing information on historic properties within the study area and will be scheduling a teleconference via a forthcoming email to Dr. Thompson and Ms. Jacobs to discuss the area of potential effects (APE), the existing information on historic properties within the APE, as well as data concerning possible historic properties not yet identified, and the level of effort for the identification and evaluation of historic properties.

Please review the Integrated Draft Report and provide comments. The official closing date for receipt of comments will be January 26, 2014. Please send comments and/or any questions or concerns about the SWC LA study or the SMART Planning framework to Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; rebecca.hill@usace.army.mil. Comments and/or questions may also be submitted via the contact information available on the website http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx. An electronic copy of this letter will be provided to Dr. Ian Thompson, Director/Tribal Historic Preservation Officer, Choctaw Nation of Oklahoma, ithompson@choctawnation.com and Ms. Johnnie Jacobs, NHPA Section 106 Coordinator, jjacobs@choctawnation.com.

Sincerely,

Joan M. Exnicios

Joan M. Exnicios
Chief, Environmental Planning Branch

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO ATTENTION OF

DECEMBER 11, 2013

Regional Planning and
Environment Division, South

Kevin Sickey, Chief
Coushatta Tribe of Louisiana
P.O. Box 818
Elton, LA 70532

Dear Chief Sickey:

The United States Army Corps of Engineers (USACE), New Orleans District (CEMVN), has prepared a draft Integrated Feasibility Report and Programmatic Environmental Impact Statement (Draft Integrated Report) for the Southwest Coastal Louisiana (SWC LA) Study. A copy of the Draft Integrated Report is enclosed and is available electronically for review at http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx; hard copies are available upon request.

In partial fulfillment of responsibilities under Executive Order 13175, the National Environmental Policy Act (NEPA), and Section 106 of the National Historic Preservation Act, the CEMVN offers you the opportunity to review and comment on the potential of the proposed action described in the Draft Integrated Report to significantly affect protected tribal resources, tribal rights, or Indian lands. Consultation for the proposed action was initiated in a letter dated November 27, 2013.

The Draft Integrated Report proposes potential solutions that would provide nonstructural hurricane and storm damage risk reduction measures as well as ecosystem restoration features in the 4,700 square mile study area located in Calcasieu, Cameron and Vermillion parishes in southwest Louisiana.

Proposed measures of the National Economic Development plan include residential structure elevation, flood proofing and the acquisition of qualifying structures. The proposed measures of the National Ecosystem Restoration (NER) plan would significantly restore environmental conditions for the Chenier Plain ecosystem. The proposed NER measures include nine marsh restoration measures that would restore approximately 8,579 acres and nourish approximately 4,026 acres, resulting in approximately 8,714 net acres; two hydrologic and salinity control measures to restore approximately 6,092 net acres; five shoreline protection measures spanning approximately 266,884 linear feet to protect approximately 5,509 net acres; the preservation of the historic Sabine oyster reef; and a chenier invasive species control and reforestation program to include the planting of trees on approximately 1,413 acres.

-2-

Section 106 Consultation

Formal Section 106 consultation pursuant to 36 CFR § 800.3(c) has been initiated with the Louisiana State Historic Preservation Officer (SHPO) and eleven federally recognized Tribes with an interest in USACE undertakings within the boundaries of CEMVN, and the CEMVN will continue consultation with the SHPO and federally recognized Tribes. With selection of the TSP as presented in the Draft Integrated Report, the CEMVN will now proceed with the identification and evaluation of historic properties, the results of which will be coordinated with the SHPO and federally recognized Tribes in a continuation of Section 106 consultation.

CEMVN is nearing completion of its review of existing information on historic properties within the study area and will be scheduling a teleconference via a forthcoming email to Dr. Langley and Mr. Tarpley to discuss the area of potential effects (APE), the existing information on historic properties within the APE, as well as data concerning possible historic properties not yet identified, and the level of effort for the identification and evaluation of historic properties.

Please review the Integrated Draft Report and provide comments. The official closing date for receipt of comments will be January 26, 2014. Please send comments and/or any questions or concerns about the SWC LA study or the SMART Planning framework to Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; rebecca.hill@usace.army.mil. Comments and/or questions may also be submitted via the contact information available on the website http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx. An electronic copy of this letter will be provided to Dr. Linda Langley, Tribal Historic Preservation Officer, Coushatta Tribe of Louisiana, llangley@mcneese.edu, and Mr. Michael Tarpley, Deputy Tribal Historic Preservation Officer, Coushatta Tribe of Louisiana, kokua.aina57@gmail.com.

Sincerely,

Joan M. Exnicios

Joan M. Exnicios
Chief, Environmental Planning Branch

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO ATTENTION OF

DECEMBER 11, 2013

Regional Planning and
Environment Division, South

B. Cheryl Smith, Principal Chief
Jena Band of Choctaw Indians
P.O. Box 14
Jena, LA 71342

Dear Principal Chief Smith:

The United States Army Corps of Engineers (USACE), New Orleans District (CEMVN), has prepared a draft Integrated Feasibility Report and Programmatic Environmental Impact Statement (Draft Integrated Report) for the Southwest Coastal Louisiana (SWC LA) Study. A copy of the Draft Integrated Report is enclosed and is available electronically for review at http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx; hard copies are available upon request.

In partial fulfillment of responsibilities under Executive Order 13175, the National Environmental Policy Act (NEPA), and Section 106 of the National Historic Preservation Act, the CEMVN offers you the opportunity to review and comment on the potential of the proposed action described in the Draft Integrated Report to significantly affect protected tribal resources, tribal rights, or Indian lands. Consultation for the proposed action was initiated in a letter dated November 27, 2013.

The Draft Integrated Report proposes potential solutions that would provide nonstructural hurricane and storm damage risk reduction measures as well as ecosystem restoration features in the 4,700 square mile study area located in Calcasieu, Cameron and Vermillion parishes in southwest Louisiana.

Proposed measures of the National Economic Development plan include residential structure elevation, flood proofing and the acquisition of qualifying structures. The proposed measures of the National Ecosystem Restoration (NER) plan would significantly restore environmental conditions for the Chenier Plain ecosystem. The proposed NER measures include nine marsh restoration measures that would restore approximately 8,579 acres and nourish approximately 4,026 acres, resulting in approximately 8,714 net acres; two hydrologic and salinity control measures to restore approximately 6,092 net acres; five shoreline protection measures spanning approximately 266,884 linear feet to protect approximately 5,509 net acres; the preservation of the historic Sabine oyster reef; and a chenier invasive species control and reforestation program to include the planting of trees on approximately 1,413 acres.

-2-

Section 106 Consultation

Formal Section 106 consultation pursuant to 36 CFR § 800.3(c) has been initiated with the Louisiana State Historic Preservation Officer (SHPO) and eleven federally recognized Tribes with an interest in USACE undertakings within the boundaries of CEMVN, and the CEMVN will continue consultation with the SHPO and federally recognized Tribes. With selection of the TSP as presented in the Draft Integrated Report, the CEMVN will now proceed with the identification and evaluation of historic properties, the results of which will be coordinated with the SHPO and federally recognized Tribes in a continuation of Section 106 consultation.

CEMVN is nearing completion of its review of existing information on historic properties within the study area and will be scheduling a teleconference via a forthcoming email to Ms. Masters and Ms. McCormick to discuss the area of potential effects (APE), the existing information on historic properties within the APE, as well as data concerning possible historic properties not yet identified, and the level of effort for the identification and evaluation of historic properties.

Please review the Integrated Draft Report and provide comments. The official closing date for receipt of comments will be January 26, 2014. Please send comments and/or any questions or concerns about the SWC LA study or the SMART Planning framework to Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; rebecca.hill@usace.army.mil. Comments and/or questions may also be submitted via the contact information available on the website http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx. An electronic copy of this letter will be provided to Ms. Dana Masters, Tribal Historic Preservation Officer, Jena Band of Choctaw Indians, jbc.thpo106@aol.com, and Ms. Lillie McCormick, Environmental Director, Jena Band of Choctaw Indians, lmmccormickjbc@centurytel.net.

Sincerely,

Joan M. Exnicios
Chief, Environmental Planning Branch

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO ATTENTION OF

DECEMBER 11, 2013

Regional Planning and
Environment Division, South

Phyliss J. Anderson, Chief
Mississippi Band of Choctaw Indians
P.O. Box 6257
Choctaw, MS 39350

Dear Chief Anderson:

The United States Army Corps of Engineers (USACE), New Orleans District (CEMVN), has prepared a draft Integrated Feasibility Report and Programmatic Environmental Impact Statement (Draft Integrated Report) for the Southwest Coastal Louisiana (SWC LA) Study. A copy of the Draft Integrated Report is enclosed and is available electronically for review at http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx; hard copies are available upon request.

In partial fulfillment of responsibilities under Executive Order 13175, the National Environmental Policy Act (NEPA), and Section 106 of the National Historic Preservation Act, the CEMVN offers you the opportunity to review and comment on the potential of the proposed action described in the Draft Integrated Report to significantly affect protected tribal resources, tribal rights, or Indian lands. Consultation for the proposed action was initiated in a letter dated November 27, 2013.

The Draft Integrated Report proposes potential solutions that would provide nonstructural hurricane and storm damage risk reduction measures as well as ecosystem restoration features in the 4,700 square mile study area located in Calcasieu, Cameron and Vermillion parishes in southwest Louisiana.

Proposed measures of the National Economic Development plan include residential structure elevation, flood proofing and the acquisition of qualifying structures. The proposed measures of the National Ecosystem Restoration (NER) plan would significantly restore environmental conditions for the Chenier Plain ecosystem. The proposed NER measures include nine marsh restoration measures that would restore approximately 8,579 acres and nourish approximately 4,026 acres, resulting in approximately 8,714 net acres; two hydrologic and salinity control measures to restore approximately 6,092 net acres; five shoreline protection measures spanning approximately 266,884 linear feet to protect approximately 5,509 net acres; the preservation of the historic Sabine oyster reef; and a chenier invasive species control and reforestation program to include the planting of trees on approximately 1,413 acres.

-2-

Section 106 Consultation

Formal Section 106 consultation pursuant to 36 CFR § 800.3(c) has been initiated with the Louisiana State Historic Preservation Officer (SHPO) and eleven federally recognized Tribes with an interest in USACE undertakings within the boundaries of CEMVN, and the CEMVN will continue consultation with the SHPO and federally recognized Tribes. With selection of the TSP as presented in the Draft Integrated Report, the CEMVN will now proceed with the identification and evaluation of historic properties, the results of which will be coordinated with the SHPO and federally recognized Tribes in a continuation of Section 106 consultation.

CEMVN is nearing completion of its review of existing information on historic properties within the study area and will be scheduling a teleconference via a forthcoming email to Mr. Carleton to discuss the area of potential effects (APE), the existing information on historic properties within the APE, as well as data concerning possible historic properties not yet identified, and the level of effort for the identification and evaluation of historic properties.

Please review the Integrated Draft Report and provide comments. The official closing date for receipt of comments will be January 26, 2014. Please send comments and/or any questions or concerns about the SWC LA study or the SMART Planning framework to Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; rebecca.hill@usace.army.mil. Comments and/or questions may also be submitted via the contact information available on the website http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastaLaspx. An electronic copy of this letter will be provided to Mr. Kenneth H. Carleton, Tribal Historic Preservation Officer/ Archaeologist, Mississippi Band of Choctaw Indians, kcarleton@choctaw.org.

Sincerely,

Joan M Exnicios

Joan M. Exnicios
Chief, Environmental Planning Branch

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO ATTENTION OF

DECEMBER 11, 2013

Regional Planning and
Environment Division, South

John Berrey, Chairman
Quapaw Tribe of Oklahoma
P.O. Box 765
Quapaw, OK 74363

Dear Chairman Berrey:

The United States Army Corps of Engineers (USACE), New Orleans District (CEMVN), has prepared a draft Integrated Feasibility Report and Programmatic Environmental Impact Statement (Draft Integrated Report) for the Southwest Coastal Louisiana (SWC LA) Study. A copy of the Draft Integrated Report is enclosed and is available electronically for review at http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx; hard copies are available upon request.

In partial fulfillment of responsibilities under Executive Order 13175, the National Environmental Policy Act (NEPA), and Section 106 of the National Historic Preservation Act, the CEMVN offers you the opportunity to review and comment on the potential of the proposed action described in the Draft Integrated Report to significantly affect protected tribal resources, tribal rights, or Indian lands. Consultation for the proposed action was initiated in a letter dated November 27, 2013.

The Draft Integrated Report proposes potential solutions that would provide nonstructural hurricane and storm damage risk reduction measures as well as ecosystem restoration features in the 4,700 square mile study area located in Calcasieu, Cameron and Vermillion parishes in southwest Louisiana.

Proposed measures of the National Economic Development plan include residential structure elevation, flood proofing and the acquisition of qualifying structures. The proposed measures of the National Ecosystem Restoration (NER) plan would significantly restore environmental conditions for the Chenier Plain ecosystem. The proposed NER measures include nine marsh restoration measures that would restore approximately 8,579 acres and nourish approximately 4,026 acres, resulting in approximately 8,714 net acres; two hydrologic and salinity control measures to restore approximately 6,092 net acres; five shoreline protection measures spanning approximately 266,884 linear feet to protect approximately 5,509 net acres; the preservation of the historic Sabine oyster reef; and a chenier invasive species control and reforestation program to include the planting of trees on approximately 1,413 acres.

-2-

Section 106 Consultation

Formal Section 106 consultation pursuant to 36 CFR § 800.3(c) has been initiated with the Louisiana State Historic Preservation Officer (SHPO) and eleven federally recognized Tribes with an interest in USACE undertakings within the boundaries of CEMVN, and the CEMVN will continue consultation with the SHPO and federally recognized Tribes. With selection of the TSP as presented in the Draft Integrated Report, the CEMVN will now proceed with the identification and evaluation of historic properties, the results of which will be coordinated with the SHPO and federally recognized Tribes in a continuation of Section 106 consultation.

CEMVN is nearing completion of its review of existing information on historic properties within the study area and will be scheduling a teleconference via a forthcoming email to Mr. Bandy to discuss the area of potential effects (APE), the existing information on historic properties within the APE, as well as data concerning possible historic properties not yet identified, and the level of effort for the identification and evaluation of historic properties.

Please review the Integrated Draft Report and provide comments. The official closing date for receipt of comments will be January 26, 2014. Please send comments and/or any questions or concerns about the SWC LA study or the SMART Planning framework to Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; rebecca.hill@usace.army.mil. Comments and/or questions may also be submitted via the contact information available on the website http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx. An electronic copy of this letter will be provided to Mr. Everett Bandy, Tribal Historic Preservation Officer, Quapaw Tribe of Oklahoma, ebandy@quapawtribe.com.

Sincerely,

Joan M. Exnicios

Joan M. Exnicios
Chief, Environmental Planning Branch

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO ATTENTION OF

DECEMBER 11, 2013

Regional Planning and
Environment Division, South

Leonard M. Harjo, Principal Chief
Seminole Nation of Oklahoma
P.O. Box 1498
Wewoka, OK 74884

Dear Principal Chief Harjo:

The United States Army Corps of Engineers (USACE), New Orleans District (CEMVN), has prepared a draft Integrated Feasibility Report and Programmatic Environmental Impact Statement (Draft Integrated Report) for the Southwest Coastal Louisiana (SWC LA) Study. A copy of the Draft Integrated Report is enclosed and is available electronically for review at http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx; hard copies are available upon request.

In partial fulfillment of responsibilities under Executive Order 13175, the National Environmental Policy Act (NEPA), and Section 106 of the National Historic Preservation Act, the CEMVN offers you the opportunity to review and comment on the potential of the proposed action described in the Draft Integrated Report to significantly affect protected tribal resources, tribal rights, or Indian lands. Consultation for the proposed action was initiated in a letter dated November 27, 2013.

The Draft Integrated Report proposes potential solutions that would provide nonstructural hurricane and storm damage risk reduction measures as well as ecosystem restoration features in the 4,700 square mile study area located in Calcasieu, Cameron and Vermillion parishes in southwest Louisiana.

Proposed measures of the National Economic Development plan include residential structure elevation, flood proofing and the acquisition of qualifying structures. The proposed measures of the National Ecosystem Restoration (NER) plan would significantly restore environmental conditions for the Chenier Plain ecosystem. The proposed NER measures include nine marsh restoration measures that would restore approximately 8,579 acres and nourish approximately 4,026 acres, resulting in approximately 8,714 net acres; two hydrologic and salinity control measures to restore approximately 6,092 net acres; five shoreline protection measures spanning approximately 266,884 linear feet to protect approximately 5,509 net acres; the preservation of the historic Sabine oyster reef; and a chenier invasive species control and reforestation program to include the planting of trees on approximately 1,413 acres.

-2-

Section 106 Consultation

Formal Section 106 consultation pursuant to 36 CFR § 800.3(c) has been initiated with the Louisiana State Historic Preservation Officer (SHPO) and eleven federally recognized Tribes with an interest in USACE undertakings within the boundaries of CEMVN, and the CEMVN will continue consultation with the SHPO and federally recognized Tribes. With selection of the TSP as presented in the Draft Integrated Report, the CEMVN will now proceed with the identification and evaluation of historic properties, the results of which will be coordinated with the SHPO and federally recognized Tribes in a continuation of Section 106 consultation.

CEMVN is nearing completion of its review of existing information on historic properties within the study area and will be scheduling a teleconference via a forthcoming email to Ms. Harjo to discuss the area of potential effects (APE), the existing information on historic properties within the APE, as well as data concerning possible historic properties not yet identified, and the level of effort for the identification and evaluation of historic properties.

Please review the Integrated Draft Report and provide comments. The official closing date for receipt of comments will be January 26, 2014. Please send comments and/or any questions or concerns about the SWC LA study or the SMART Planning framework to Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; rebecca.hill@usace.army.mil. Comments and/or questions may also be submitted via the contact information available on the website http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx. An electronic copy of this letter will be provided to Ms. Natalie Harjo, Tribal Historic Preservation Officer, Seminole Nation of Oklahoma, harjo.n@sno-nsn.gov, Ms. Rachel Dinwiddie, Environmental Protection Program Manager, dinwiddie.r@sno-nsn.gov, and Mr. Mickey Douglas, Environmental Protection Office, douglas.m@sno-nsn.gov.

Sincerely,

Joan M Exnicios

Joan M. Exnicios
Chief, Environmental Planning Branch

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO ATTENTION OF

DECEMBER 11, 2013

Regional Planning and
Environment Division, South

James Billie, Chairman
Seminole Tribe of Florida
6300 Stirling Road
Hollywood, FL 33024

Dear Chairman Billie:

The United States Army Corps of Engineers (USACE), New Orleans District (CEMVN), has prepared a draft Integrated Feasibility Report and Programmatic Environmental Impact Statement (Draft Integrated Report) for the Southwest Coastal Louisiana (SWC LA) Study. A copy of the Draft Integrated Report is enclosed and is available electronically for review at http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx; hard copies are available upon request.

In partial fulfillment of responsibilities under Executive Order 13175, the National Environmental Policy Act (NEPA), and Section 106 of the National Historic Preservation Act, the CEMVN offers you the opportunity to review and comment on the potential of the proposed action described in the Draft Integrated Report to significantly affect protected tribal resources, tribal rights, or Indian lands. Consultation for the proposed action was initiated in a letter dated November 27, 2013.

The Draft Integrated Report proposes potential solutions that would provide nonstructural hurricane and storm damage risk reduction measures as well as ecosystem restoration features in the 4,700 square mile study area located in Calcasieu, Cameron and Vermillion parishes in southwest Louisiana.

Proposed measures of the National Economic Development plan include residential structure elevation, flood proofing and the acquisition of qualifying structures. The proposed measures of the National Ecosystem Restoration (NER) plan would significantly restore environmental conditions for the Chenier Plain ecosystem. The proposed NER measures include nine marsh restoration measures that would restore approximately 8,579 acres and nourish approximately 4,026 acres, resulting in approximately 8,714 net acres; two hydrologic and salinity control measures to restore approximately 6,092 net acres; five shoreline protection measures spanning approximately 266,884 linear feet to protect approximately 5,509 net acres; the preservation of the historic Sabine oyster reef; and a chenier invasive species control and reforestation program to include the planting of trees on approximately 1,413 acres.

-2-

Section 106 Consultation

Formal Section 106 consultation pursuant to 36 CFR § 800.3(c) has been initiated with the Louisiana State Historic Preservation Officer (SHPO) and eleven federally recognized Tribes with an interest in USACE undertakings within the boundaries of CEMVN, and the CEMVN will continue consultation with the SHPO and federally recognized Tribes. With selection of the TSP as presented in the Draft Integrated Report, the CEMVN will now proceed with the identification and evaluation of historic properties, the results of which will be coordinated with the SHPO and federally recognized Tribes in a continuation of Section 106 consultation.

CEMVN is nearing completion of its review of existing information on historic properties within the study area and will be scheduling a teleconference via a forthcoming email to Mr. Backhouse to discuss the area of potential effects (APE), the existing information on historic properties within the APE, as well as data concerning possible historic properties not yet identified, and the level of effort for the identification and evaluation of historic properties.

Please review the Integrated Draft Report and provide comments. The official closing date for receipt of comments will be January 26, 2014. Please send comments and/or any questions or concerns about the SWC LA study or the SMART Planning framework to Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; rebecca.hill@usace.army.mil. Comments and/or questions may also be submitted via the contact information available on the website http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx. An electronic copy of this letter will be provided to Mr. Paul N. Backhouse, Tribal Historic Preservation Officer, Seminole Tribe of Florida, paulbackhouse@semtribe.com; Ms. Anne Mullins, Deputy Tribal Historic Preservation Officer, annemullins@semtribe.com; Mr. Bradley Mueller, Compliance Review Supervisor, bradleymueller@semtribe.com; and Ms. Alison Swing, Compliance Review Data Analyst, alisonswing@semtribe.com.

Sincerely,

Joan M. Exnicios

Joan M. Exnicios
Chief, Environmental Planning Branch

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO ATTENTION OF

DECEMBER 11, 2013

Regional Planning and
Environment Division, South

Earl J. Barbry, Sr., Chairman
Tunica-Biloxi Tribe of Louisiana
P.O. Box 1589
Marksville, LA 71351

Dear Chairman Barbry:

The United States Army Corps of Engineers (USACE), New Orleans District (CEMVN), has prepared a draft Integrated Feasibility Report and Programmatic Environmental Impact Statement (Draft Integrated Report) for the Southwest Coastal Louisiana (SWC LA) Study. A copy of the Draft Integrated Report is enclosed and is available electronically for review at http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx; hard copies are available upon request.

In partial fulfillment of responsibilities under Executive Order 13175, the National Environmental Policy Act (NEPA), and Section 106 of the National Historic Preservation Act, the CEMVN offers you the opportunity to review and comment on the potential of the proposed action described in the Draft Integrated Report to significantly affect protected tribal resources, tribal rights, or Indian lands. Consultation for the proposed action was initiated in a letter dated November 27, 2013.

The Draft Integrated Report proposes potential solutions that would provide nonstructural hurricane and storm damage risk reduction measures as well as ecosystem restoration features in the 4,700 square mile study area located in Calcasieu, Cameron and Vermillion parishes in southwest Louisiana.

Proposed measures of the National Economic Development plan include residential structure elevation, flood proofing and the acquisition of qualifying structures. The proposed measures of the National Ecosystem Restoration (NER) plan would significantly restore environmental conditions for the Chenier Plain ecosystem. The proposed NER measures include nine marsh restoration measures that would restore approximately 8,579 acres and nourish approximately 4,026 acres, resulting in approximately 8,714 net acres; two hydrologic and salinity control measures to restore approximately 6,092 net acres; five shoreline protection measures spanning approximately 266,884 linear feet to protect approximately 5,509 net acres; the preservation of the historic Sabine oyster reef; and a chenier invasive species control and reforestation program to include the planting of trees on approximately 1,413 acres.

-2-

Section 106 Consultation

Formal Section 106 consultation pursuant to 36 CFR § 800.3(c) has been initiated with the Louisiana State Historic Preservation Officer (SHPO) and eleven federally recognized Tribes with an interest in USACE undertakings within the boundaries of CEMVN, and the CEMVN will continue consultation with the SHPO and federally recognized Tribes. With selection of the TSP as presented in the Draft Integrated Report, the CEMVN will now proceed with the identification and evaluation of historic properties, the results of which will be coordinated with the SHPO and federally recognized Tribes in a continuation of Section 106 consultation.

CEMVN is nearing completion of its review of existing information on historic properties within the study area and will be scheduling a teleconference via a forthcoming email to Mr. Barbry to discuss the area of potential effects (APE), the existing information on historic properties within the APE, as well as data concerning possible historic properties not yet identified, and the level of effort for the identification and evaluation of historic properties.

Please review the Integrated Draft Report and provide comments. The official closing date for receipt of comments will be January 26, 2014. Please send comments and/or any questions or concerns about the SWC LA study or the SMART Planning framework to Ms. Rebecca Hill; Archeologist/Tribal Liaison; U.S. Army Corps of Engineers, New Orleans District; (504) 862-1474; rebecca.hill@usace.army.mil. Comments and/or questions may also be submitted via the contact information available on the website http://www.mvn.usace.army.mil/About/Projects/SouthwestCoastal.aspx. An electronic copy of this letter will be provided to Mr. Earl Barbry, Jr., Cultural Director, Tunica-Biloxi Tribe of Louisiana, earlii@tunica.org.

Sincerely,

Joan M. Exnicios
Chief, Environmental Planning Branch

SOUTHWEST COASTAL LOUISIANA
INTEGRATED FINAL FEASIBILITY REPORT
AND
ENVIRONMENTAL IMPACT STATEMENT

APPENDIX A

Annex G

U.S. Fish and Wildlife Service Final Coordination Act Report

Southwest Coastal Louisiana Feasibility Study

FINAL
FISH AND WILDLIFE COORDINATION ACT REPORT

PROVIDED TO
NEW ORLEANS DISTRICT
U.S. ARMY CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

PREPARED BY

RONALD PAILLE
SENIOR FISH AND WILDLIFE BIOLOGIST

U.S. FISH AND WILDLIFE SERVICE
ECOLOGICAL SERVICES
LAFAYETTE, LOUISIANA

FEBRUARY 2016

EXECUTIVE SUMMARY

The U.S. Army Corps of Engineers (Corps) was requested to conduct the Southwest Coastal Louisiana Feasibility Study (SWLA Study) via Resolution Docket 2747 adopted on December 7, 2005, by the U.S. House of Representatives Committee on Transportation and Infrastructure. That Docket specifically requested the Secretary of the Army, in accordance with section 10 of the River and Harbors Act, to "survey the coast of Louisiana in Cameron, Calcasieu, and Vermilion Parishes with particular reference to the advisability of providing hurricane protection and storm damage reduction and related purposes to include the feasibility of constructing an armored 12-foot levee along the Gulf Intracoastal Waterway."

Measures to provide storm damage reduction and ecosystem restoration were evaluated within the study area. Those measures included construction of levees designed to provide hurricane storm surge protection and non-structural measures such as structure flood proofing, relocations, and buyouts. Measures to protect and restore coastal wetlands and unique natural ecosystem features (such as cheniers) were evaluated, including the construction of shoreline protection measures along navigation canals, interior lakes and bays, and the Gulf of Mexico, plus measures to re-create marshes in shallow open water areas.

The initial list of proposed project measures was derived from existing large-scale coastal protection and ecosystem restoration plans (e.g., the Louisiana Coastal Protection and Restoration Plan [LACPR], the Louisiana Coastal Area Ecosystem Restoration Study Report [LCA], and the Louisiana's Comprehensive Master Plan for a Sustainable Coast [State Master Plan 2012]). Public comments were received during the project scoping process, and recommendations were provided by local representatives and natural resource agencies during the initial planning phase of the project. The initial list of potential project measures was reduced to a more focused and achievable final list of measures based on criteria that were approved by an interagency project delivery team.

The final list of measures was assembled into 6 possible protection levee alternatives and 6 ecosystem restoration alternatives, all of which were evaluated for cost effectiveness. Of the flood protection features, only the non-structural protection measures in select locations were cost effective and included in the Recommended Plan (RP). Restoration Alternative 4 (Entry Salinity Control Alternative) was initially chosen as the most cost effective of the comprehensive plans and was included in the RP. However, subsequent consideration resulted in modifying alternative 4 to eliminate the Cameron-Creole Spillway structure, the Sabine Pass and Calcasieu Ship Channel salinity control structures (measures 47a, 48 and 7, respectively), and to add the shoreline protection measures on the Gulf shore at Rockefeller Refuge (measures 6b1, 6b2, and 6b3).

In addition to providing hurricane storm surge protection in developed portions of the project area, implementation of the RP would restore, enhance, and protect substantial areas of coastal marsh and forested chenier habitat. However, implementation of some restoration measures could result in some minor adverse impacts. The recommendations provided below address ways to avoid such unintended impacts and to improve fish and wildlife habitat quality in

restoration areas. Therefore, the Service supports implementation of the RP provided the following recommendations are included as part of the plan.

1. To the greatest degree practical, borrow pits for construction of marsh creation measures should be located to avoid and minimize direct and indirect impacts to vegetated wetlands. Borrow pit construction should also avoid the following:
    a. avoid inducing wave refraction/diffraction erosion of existing shorelines
    b. avoid inducing slope failure of existing shorelines
    c. avoid submerged aquatic vegetation
    d. avoid increased saltwater intrusion
    e. avoid excessive disturbance to area water bottoms
    f. avoid inducing hypoxia

2. Marsh creation measures should avoid, to the degree practical, areas of dense submerged aquatic vegetation.

3. The Corps should monitor ecosystem restoration features to document the degree of success achieved. We recommend the Service and other interested natural resource agencies be included in developing those monitoring criteria and in the review of subsequent monitoring information and reports.

4. The Corps should obtain a right-of-way from the Service prior to conducting any work on Sabine or Cameron Prairie National Wildlife Refuges, in conformance with Section 29.21-1, Title 50, Right-of-Way Regulations. Issuance of a right-of-way will be contingent on a determination that the proposed work will be compatible with the purposes for which the Refuge was established.

5. All planning, design, or other construction-related activities (e.g., surveys, geotechnical borings, etc.) conducted on National Wildlife Refuges (NWRs) will require the Corps to obtain a Special Use Permit from the Refuge Manager of the Southwest Louisiana Refuge Complex. We recommend that the Corps request issuance of a Special Use Permit well in advance of conducting any work on the refuge. Please contact the Refuge Manager (337/598-2216 or SWLRComplex@fws.gov) for further information on compatibility of proposed ecosystem restoration measures, and for assistance in obtaining a Special Use Permit. Close coordination by both the Corps and its contractor must be maintained with the Refuge Manager to ensure that construction and maintenance activities are carried out in accordance with provisions of any Special Use Permit issued by the NWR.

6. The Corps should contact the Louisiana Department of Wildlife and Fisheries prior to conducting any work on Rockefeller Refuge (337-491-2593).

7. We recommend the Corps continue to coordinate with the Service throughout planning and construction to ensure that the proposed project does not impact waterbird nesting colonies, threatened or endangered species, or species that may be listed in the future.

8. We recommend the Corps coordinate with the Service and other interested natural resource agencies when developing detailed plans regarding restoration measures, especially during the Preliminary Engineering and Design Phase (PED) and construction phase, for measures where specific recommendations have been provided below.

9. To the greatest degree possible, sediment pumping should be conducted during non-growing season periods to reduce possible salinity impacts on adjoining vegetation.

Service recommendations regarding specific ecosystem restoration measures are provided below:

10. Marsh creation measures south of Grand Chenier (47a1, 47a2, and 47c1)
    a. Combined, these measures would convert over 2,000 acres of existing shallow open water to solid marsh. We recommend that some of those open water areas not be filled to maintain aquatic habitat (i.e., ponds) used by fisheries, waterfowl, and other wildlife.
    b. To avoid saltwater entrapment impacts, the engineers are encouraged to design channels to provide drainage/water exchange, and avoid ponding of Gulf water effluent within or adjacent to the fill areas. Similarly, we recommend any ponds or enclosed non-fill areas have drainage channels (existing or man-made) to carry away Gulf water effluent and avoid concentration of salts.
    c. To pump into eastern and western extremes of the designated fill area, the pipeline route should depart from that designated route only within the proposed fill area, and should be routed through unvegetated open water areas, to avoid impacting existing marshes.

11. Marsh creation along Freshwater Bayou Canal (measures 127c3 and 306a1)
    a. To avoid saltwater effluent impacts, we recommend the effluent be drained toward Freshwater Bayou Canal and not into the interior marshes. After construction, once saltwater drainage from the fill areas has been completed, those drainage routes should be plugged and drainage of the fill areas should be redirected into interior marshes.
    b. If a containment dike is constructed adjacent to the Freshwater Bayou Canal, the Service recommends that it not be degraded after construction so that it can help to maintain the desired hydrologic isolation of the interior marshes from the canal.

12. Marsh creation near Mud Lake (measure 124c)
    a. This measure would convert over 1,900 acres of existing shallow open water to solid marsh. We recommend that some of those open water areas not be filled to maintain aquatic habitat (i.e., ponds) used by fisheries and waterfowl.
    b. To avoid saltwater entrapment impacts, the engineers are encouraged to design channels to provide drainage/water exchange, and avoid ponding of Gulf water effluent within or adjacent to the fill areas. Similarly, we recommend any ponds or enclosed non-fill areas have drainage channels (existing or man-made) to carry away Gulf water effluent and avoid concentration of salts.



c. The proposed containment dikes along the western and southeastern fill area boundaries may block existing drainage routes for marshes adjacent to the fill area. To avoid potential saltwater entrapment impacts and impaired drainage impacts, we recommend weir boxes along those sections of dike be eliminated unless the presence of unimpeded drainage routes can be documented.

13. Marsh creation near West Cove (measure 124d)
    a. To prevent ponding impacts and saltwater entrapment impacts to marshes south of the fill area, we recommend the containment dike designs avoid closing both canals that provide drainage for the fill area and adjacent marshes.
    b. If funding is provided to the Service to construct this or other measures located on National Wildlife Refuges, that funding should include funding necessary to cover the necessary administration, engineering, and design work.

This final report is submitted in fulfillment of the requirements of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), and constitutes the final report of the Secretary of the Interior as required by Section 2(b) of that Act. This report has incorporated comments made by the National Marine Fisheries Service (see Appendix A) on our draft Coordination Act Report dated February 26, 2015. No comments on our February 2015 draft Coordination Act Report were received from the Louisiana Department of Wildlife and Fisheries.

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES v

INTRODUCTION 1

DESCRIPTION OF STUDY AREA 2

FISH AND WILDLIFE RESOURCE CONDITIONS 4
- Existing Fish and Wildlife Habitats 4
  - Forested Habitat 5
  - Scrub-Shrub Habitat 6
  - Fresh Marsh 6
  - Intermediate Marsh 8
  - Brackish Marsh 8
  - Saline Marsh 9
  - Open Water 9
  - Submerged Aquatic Vegetation Habitat 9
  - Developed Lands 9
- Existing Fishery Resources 10
  - Essential Fish Habitat 10
- Existing Wildlife Resources 11
  - Species of Management Concern 12
  - Threatened and Endangered Species 12
  - Wildlife Management Areas and Parks 13
- Future Fish and Wildlife Resources 14

DESCRIPTION OF ALTERNATIVES AND RECOMMENDED PLAN 16

FISH AND WILDLIFE CONCERNS IN THE PROJECT AREA 19

EVALUATION METHODOLOGY 23

POTENTIAL SIGNIFICANT IMPACTS 23

FISH AND WILDLIFE CONSERVATION MEASURES 27

SERVICE POSITION AND RECOMMENDATIONS 28

LITERATURE CITED 34

LIST OF FIGURES

Figure 1 Coastal marshes within the Calcasieu-Sabine and Mermentau Basins 2
Figure 2 Marsh types (2007) within the Calcasieu-Sabine Basin 7
Figure 3 Marsh types (2007) within the Mermentau Basin 7
Figure 4 Average annual regional mash acreage change from 1985 to 2010 (percent/year) 14
Figure 5 Map of non-structural protection reaches included in the Recommended Plan 17
Figure 6 Recommended Plan measures in the Calcasieu-Sabine Basin 20
Figure 7 Recommended Plan measures in the Mermentau Basin 21

LIST OF TABLES

Table 1 EFH requirements for Managed Fisheries Species in Ecoregion 4 11
Table 2 Average annual marsh acreage lost (1985 to 2010) 15
Table 3 Protection and restoration planning objectives 17
Table 4 Ecosystem restoration alternatives evaluated 18
Table 5 Restoration measures comprising the Recommended Plan, by basin 22
Table 6 Predicted benefits of ecosystem restoration alternatives 26
Table 7 Estimated costs and benefits of Recommended Plan measures 25
Table 8 Summary of Recommended Plan acreage benefits by habitat type 26
Table 9 U. S. Fish and Wildlife Service Resource Categories 27

INTRODUCTION

The Southwest Coastal Louisiana Feasibility Study (SWLA Study) was authorized by Resolution Docket 2747 adopted on December 7, 2005, by the U.S. House of Representatives Committee on Transportation and Infrastructure. That Docket specifically requested the Secretary of the Army, in accordance with section 10 of the River and Harbors Act, to "survey the coast of Louisiana in Cameron, Calcasieu, and Vermilion Parishes with particular reference to the advisability of providing hurricane protection and storm damage reduction and related purposes to include the feasibility of constructing an armored 12-foot levee along the Gulf Intracoastal Waterway." Investigation of area ecosystem restoration measures was authorized via the Water Resources Development Act of 2007 (Title VII, Louisiana Coastal Area program, Chenier Plain Freshwater and Sediment Management and Allocation Reassessment Study).

The study area is located within Louisiana's Chenier Plain which is characterized by lakes, bayous, wetlands, cheniers, and coastal beaches. The Mermentau Basin and the Calcasieu/Sabine Basin are the two major hydrologic basins within the Chenier Plain. There are numerous communities within the study area including Abbeville, Cameron, Delcambre, Erath, Gueydan, Hackberry, Kaplan, Lake Arthur, Lake Charles, and Sulphur. Although the approved Southwest Coastal Louisiana Feasibility Study authorization is restricted to Calcasieu, Cameron, and Vermilion Parishes, several project alternatives occurring beyond those parishes were considered because of their anticipated effects on the project area.

Numerous project measures and groups of measures were evaluated. Surge protection alternatives included alternative levee alignments (including the armored 12-foot levee described above), as well as non-structural alternatives. Ecosystem restoration alternatives included various combinations of salinity control/reduction measures, strategic marsh creation measures, strategically located shoreline protection measures, and restoration/reforestation of cheniers.

This report provides an analysis of the impacts of the Recommended Plan (RC) on fish and wildlife resources. The RC is a combination of non-structural storm surge protection measures, and an array of different types of ecosystem restoration features. The proposed non-structural measures may include earthen berms (3 – 7 feet high) around individual structures. Where structures are located adjacent to wetlands, sheet pile structures will be constructed in lieu of earthen berms to avoid possible wetland impacts associated with berm construction.

The Fish and Wildlife Service (Service) has reviewed available information regarding construction of the proposed ecosystem restoration measures. Our comments, provided herein, are intended to assist the U.S. Army Corps of Engineers (Corps) in avoiding adverse impacts to adjoining marshes that could occur due to construction of the proposed restoration measures.

This final report is submitted in fulfillment of the requirements of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), and constitutes the final report of the Secretary of the Interior as required by Section 2(b) of that Act. This report has incorporated comments made by the National Marine Fisheries Service (see Appendix A) on our draft Coordination Act Report dated February 26, 2015. No comments on our February 2015

draft Coordination Act Report were received from the Louisiana Department of Wildlife and Fisheries.

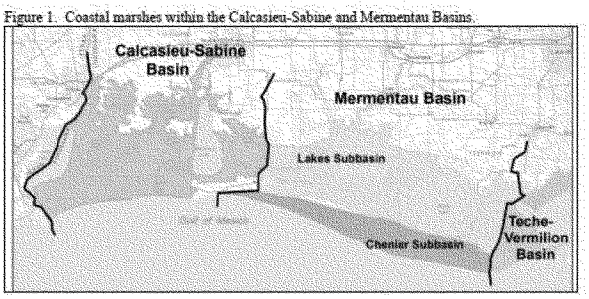
DESCRIPTION OF STUDY AREA

The study area, which encompasses Calcasieu, Cameron, and Vermilion Parishes, is typically termed the Chenier Plain of Louisiana. The Chenier Plain encompasses the southwestern Louisiana coastal zone from Freshwater Bayou west of Vermilion Bay to Sabine Lake on the Texas-Louisiana border. Cheniers are relict beach ridges that generally parallel the Gulf shoreline, and derive their name from the Cajun word "chene" meaning oak, because oaks are the dominant tree species on the crests of the higher chenier ridges (Penland et al. 1989). Because chenier elevations are higher than the surrounding marshes, they often serve as hydrologic barriers, with varying levels of effectiveness, between saline marshes to the south and freshwater marshes to the north (U.S. Army Corps of Engineers 2008). The two hydrologic basins encompassed by the study area are the Mermentau and the Calcasieu-Sabine Basins (Figure 1).

Mermentau Basin

The Mermentau River Basin is located between Freshwater Bayou Canal to the east and that segment of Louisiana Highway 27 east of Calcasieu Lake. The Basin encompasses an area of about 4.2 million acres and contains productive agricultural lands and a variety of natural environments (U.S. Army Corps of Engineers 1999). Coastal wetlands within the Mermentau Basin are divided into two sub-basins, the Lakes and Chenier Sub-basins (Figure 1), both of

Figure 1. Coastal marshes within the Calcasieu-Sabine and Mermentau Basins.



which occur within the feasibility study boundary. North of the Lakes Sub-basin are uplands beyond the study boundary that cover an area of 3,683 square miles of predominantly agricultural land (Gammill et al. 2002). The principal agricultural products in this region are rice and

2

crawfish, which both require ample supplies of fresh water typically provided via the Corps' management of the Mermentau Basin Project (U.S. Army Corps of Engineers 1999).

The Lakes Sub-basin is located roughly between the Gulf Intracoastal Waterway (GIWW) and Louisiana Highway 82, and historically functioned as a low-salinity brackish estuary (Corps 2008). Construction of navigation channels, locks, and water control structures has altered the historical north-south river and tidal-driven hydrology and shifted it to an east-west system that drains through the GIWW. The Corps' locks and water control structures that are located along the perimeter of the Lakes Sub-basin regulate both salinity and water level so that the Lakes Sub-basin now functions more as a freshwater reservoir and less as the low-salinity estuary that existed prior to these alterations (Gammill et al. 2002). The demand for a reliable fresh water supply for agricultural use was the primary reason for the development of the Mermentau Basin Project (U.S. Army Corps of Engineers 1999).

The Mermentau Basin Project involves the operation and management of five navigation locks and control structures: (1) the Calcasieu Lock located on the Gulf Intracoastal Waterway (GIWW) near the intersection of Louisiana Highway 384, (2) the Leland Bowman Lock situated on the GIWW near Intracoastal City, (3) the Freshwater Bayou Lock located on the Freshwater Bayou Canal approximately one mile north of the Gulf of Mexico, (4) the Catfish Point Control Structure located on the southwest side of the basin where the Mermentau River exits Grand Lake, and (5) the Schooner Bayou Control Structure located on the east side of the basin in the old Intracoastal Waterway between Freshwater Bayou and White Lake. The target water level inside the basin is 2.0 feet above mean low Gulf and the five Corps structures are operated in concert to maintain this level and preclude saltwater intrusion (U.S. Army Corps of Engineers 1999).

The Chenier Sub-basin is located south of the Lakes Sub-basin, between Louisiana Highway 82 and the Gulf of Mexico. Approximately one-third of this sub-basin is comprised of the State-owned and operated Rockefeller Wildlife Refuge. The Chenier Sub-basin is characterized by tidally influenced salt marshes, though hydrology throughout much of the area is managed through impoundments that range in size from hundreds to thousands of acres. The purpose of that management is to control salinity in order to reduce wetland losses and/or sustain recreational and agricultural endeavors (U.S. Army Corps of Engineers 2008).

Calcasieu-Sabine Basin

The Calcasieu-Sabine Basin extends from Sabine Lake and River eastward to the Louisiana Highway 27 segment east of Calcasieu Lake. The Calcasieu-Sabine Basin consists of two semi-distinct sub-basins, the Calcasieu River Basin and the Sabine River Basin. When the GIWW was built in the 1920s, it breached the Gum Cove Ridge which had historically formed a partial north-to-south oriented hydrologic barrier between the Calcasieu and Sabine Lake systems. That breach, in combination with several smaller canals, now facilitates water exchange between the sub-basins, and has exacerbated saltwater intrusion problems in the marshes adjacent to the GIWW. The typical water-movement scenario is that south winds push salt water into Calcasieu Lake, westward through the GIWW, and across the Gum Cove Ridge breach. This water is eventually swept down the Sabine River and into Sabine Lake. Currently, salt water that is

pushed into Calcasieu Lake remains there because there is little back flow from the Lake. Without the Gum Cove Ridge breach, the current semi-circular flow patterns would not exist, and lake levels would rise more modestly, thus reducing the volume of seawater entering Calcasieu Lake (Lopez et al. 2008).

The widening and deepening (to -40 feet deep by 400 feet wide) of the Calcasieu River and Pass Ship navigation channel (referred to as the Calcasieu Ship Channel [CSC]), as well as the removal of the channel mouth bar, has increased saltwater and tidal intrusion into the Calcasieu-Sabine Basin, resulting in marsh loss, tidal export of organic marsh substrate, and an overall shift to more saline habitats in the region. In 1968, the Corps completed construction of the Calcasieu River Saltwater Barrier on the Calcasieu River north of the City of Lake Charles. This barrier minimizes the flow of salt water into the upper reaches of the Calcasieu River to protect agricultural water supplies (Gammill et al. 2002). The Corps-maintained Calcasieu Lock, located east of the CSC on the GIWW near its intersection with Louisiana Highway 384, is operated to prevent saltwater intrusion into the Mermentau Basin as part of the Corps' Mermentau Basin Project.

The Sabine River has a drainage area of approximately 9,325 square miles and is the dominant influence across most of the Calcasieu-Sabine Basin in moderating salinity and tidal fluctuations. Sabine Pass was first dredged for navigation in 1880, and has been progressively deepened to its present depth of -40 feet. The Sabine-Neches Canal (later to become the Sabine-Neches Waterway) was constructed in the early 1900s. That channel not only facilitates saltwater intrusion into the area, it also funnels freshwater inflows more directly to the gulf, largely bypassing the adjacent marshes in Louisiana and Texas. A feasibility analysis has been conducted to deepen and widen the Sabine-Neches Ship Channel, but construction has yet to be initiated due to lack of funding. Saltwater intrusion in the Neches River has, in the past, necessitated the release of large quantities of water from the Sam Rayburn Reservoir to prevent saltwater contamination of industrial, agricultural, and municipal freshwater supply for Beaumont, Texas. To remedy those problems, a permanent saltwater barrier in the Neches River at Beaumont was constructed in 2003.

FISH AND WILDLIFE RESOURCE CONDITIONS

Existing Fish and Wildlife Habitats

The Chenier Plain consists of open water ponds and lakes, cheniers, gulf shorelines, and freshwater, intermediate, brackish, and saline marsh (Giron and Perez 2009). Marshes within Louisiana's Chenier Plain began forming about 3,000-4,000 years ago during periods when the Mississippi River occupied a more westerly course (Gosselink et al.1979). Expansive mud flats were created by large quantities of Mississippi River sediment that periodically accreted along the Gulf shoreline. When the river would shift to a more easterly location, erosion would rework the gulf shoreline to form beach ridges parallel to shore (Gammill et al. 2002). These ridges, consisting mainly of sand and shell, were typically higher in elevation than surrounding marshes and were colonized by live oaks. Early explorers called the ridges "cheniere," a French word meaning "place of oaks" (Kniffen and Hilliard 1988). Over time, a series of Gulf of Mexico

shoreline transgressions and regressions caused by periodic shifting of the Mississippi channel from east to west resulted in the shore-parallel ridge and swale topography that dominates Louisiana's Chenier Plain today (Gammill et al. 2002). Despite substantial hydrologic alterations, wetlands of the Chenier Plain continue to support nationally significant fish and wildlife resources. They provide important habitat for various species of plants, fish and wildlife, and they serve as ground water recharge areas, provide storage areas for storm and flood waters, serve as natural water filtration areas, provide protection from wave action, erosion, and storm damage, and provide various consumptive and non-consumptive recreational opportunities. Predominant habitats and their associated fish and wildlife values are described below.

Forested Habitat

The four major forest types within the study area include swamp, bottomland hardwood, pine-oak forests, and upland chenier forest. Swamps are generally dominated with baldcypress, water tupelo, swamp red maple, and various understory plant species. Coastal swamp forests typically occupy the area between fresh marshes and areas of higher elevation, including the transition zones between bottomland hardwood forests on riverine interdistributary ridges and lower elevation marshes. Healthy cypress swamps occur in fresh water areas experiencing minimal daily tidal action and where the salinity range does not normally exceed 2 parts per thousand (ppt). Salinities of 3 ppt or higher may cause significant stress and mortality of baldcypress. However, short-term exposure to such salinities may be tolerated if it does not penetrate into and persist in the soil (U.S. Army Corps of Engineers 2009).

Bottomland hardwood forests occur primarily along the floodplains and distributary ridges of the various bayous and rivers within northern portions of the study area. Common tree species include sugarberry, water oak, live oak, nuttall oak, overcup oak, bitter pecan, black willow, American elm, swamp red maple, box elder, green ash, and baldcypress (U.S. Army Corps of Engineers 2009).

The suppression of fire within area pine flatwoods has resulted in the conversion of those forests to pine-oak forests. These pine-oak forests are generally found on poorly drained flats and depressional areas north of the GIWW and predominantly around the cities of Sulphur and Lake Charles. Common tree species include loblolly pine, slash pine, longleaf pine, water oak, laurel oak, sweet bay, sweetgum, rough-leaf dogwood, and wax myrtle. These former pine flatwood communities may also contain a very diverse herbaceous community that can include many state rare species (U.S. Army Corps of Engineers 2009).

A unique feature of the Chenier Plain is the chenier ridge habitat that formed on abandoned beach ridges. These ancient beaches, composed primarily of sand and shell fragments, were stranded behind prograding shorelines built during periods of sedimentation fed by the Mississippi River. Common tree species on cheniers include live oak, sugarberry, swamp red maple, sweetgum, and water oak. Red mulberry, toothache-tree, and sweet acacia also occur on these ridges (U.S. Army Corps of Engineers 2009). Cheniers are important storm surge buffers, often serving as hydrologic barriers that limit saltwater intrusion into interior marshes (U.S. Army Corps of Engineers 2008). Wooded habitats on the cheniers are critically important

5

stopover habitat for neotropical songbirds migrating across the Gulf (Moore and Simons 1992, Moore 1999).

Scrub-Shrub Habitat

Scrub-shrub habitat within the study area often occupies a zone where marshes transition into slightly higher elevation habitats. Scrub shrub habitats are found along bayou ridges and on dredged material embankments, and areas typically bordered by marsh, swamp, or bottomland hardwoods. In saline areas, scrub-shrub communities are dominated by black mangrove on flooded saltmarsh edges, or by marsh elder and eastern baccharis on low ridges, bayou banks, and spoil banks and other disturbed areas. Brackish scrub-shrub wetlands are also dominated by eastern baccharis and marsh elder, although wax myrtle is common on low ridges, bayousides, and spoilbanks as well. Typical scrub-shrub vegetation in intermediate and fresh areas includes elderberry, wax myrtle, buttonbush, rattlebox, swamp red maple, Chinese tallow tree, marsh elder, and eastern baccharis. Dwarf palmetto and prickly pear cactus are common in the understory of Chenier/maritime forest. Yaupon, dwarf palmetto, swamp privet and Virginia willow also occur in thickets and the understory of swamps and bottomland hardwood forests (U.S. Army Corps of Engineers 2009). Those habitats often support a variety of wildlife, depending on local conditions; they provide nesting and feeding sites for wading birds, songbirds and other birds, and wildlife escape cover.

Fresh Marsh

Freshwater marshes are quite heterogeneous, with local species composition governed by frequency and duration of flooding, micro-topography, substrate, current flow and salinity. This marsh type is typically dominated by maidencane, duck potato, spikerushes, pennywort, elephant-ear and alligatorweed. Other common plants are California bulrush, giant cutgrass, beggarticks and cattail. Fresh marshes are often very diverse with different species of grasses and broad-leaved annuals waxing and waning throughout the growing season. Chabreck (1972) documented 93 plant species occurring in the fresh marshes of coastal Louisiana. In some areas, fresh marshes consist of nearly pure stands of maidencane. Aquatic plants commonly found in fresh marsh waters are duckweed, coontail, Eurasian watermilfoil, southern naiad, water hyacinth, pondweeds, white waterlily, elodea, hydrilla, water celery, water shield, fanwort, American lotus, and several invasive species of *Salvinia*. Fresh marsh salinity rarely exceeds 2 ppt, with a year-round range of approximately 0.5-1.0 parts per thousand (ppt).

Canal-induced saltwater intrusion has drastically reduced the extent of fresh marsh that historically existed within the Calcasieu-Sabine Basin (Figure 2). However, fresh marsh remains the dominant marsh type within the upper Lakes Sub-basin of the Mermentau Basin (Figure 3).

Freshwater marshes support extremely high densities of migratory waterfowl and other wildlife. However, because of saltwater intrusion, freshwater marshes have undergone the highest rate of reduction in acreage of any of the marsh type in Louisiana over the past few decades.

Figure 2. Marsh types (2007) within the Calcasieu-Sabine Basin.

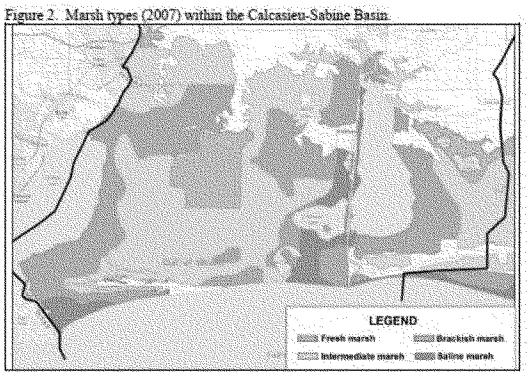
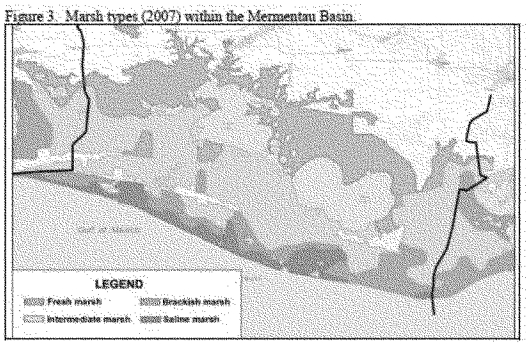


Figure 3. Marsh types (2007) within the Mermentau Basin.



7

Intermediate Marsh

Intermediate marsh may occur when annual salinity averages 3 to 4 ppt; but often intermediate marsh salinities may be fresh for much of the year with higher salinity conditions occurring during the late summer and early fall. Chabreck's (1972) identification of 54 species of plants in intermediate marsh indicates that plant species richness is relatively high. The intermediate marsh can be difficult to identify, as it sometimes may not appear as a transitional zone between brackish and fresh marshes. Saltmeadow cordgrass or duck potato is usually the dominant or co-dominant species. These are commonly accompanied by three-cornered grass, common reed, seashore paspalum, coastal waterhyssop, California bulrush, Walter's millet, sawgrass, deer pea, spikerushes, and flatsedges. Aquatic plant species found in intermediate marsh waters include widgeon grass, Eurasian watermilfoil, water celery, and southern naiad. Intermediate marshes are considered extremely important for many wildlife species, such as alligators and wading birds, and serve as important nursery areas for juvenile marine organisms. Although still a common natural community type in Louisiana, intermediate marsh appears to be declining in aerial extent, which has been attributed to a shift toward brackish marsh due to increased salinity levels. Expanding on previous studies by Penfound and Hathaway (1938) and Chabreck (1970), Visser et al. (2000), classified intermediate marsh in the Chenier Plain as a combination of sawgrass, saltmeadow cordgrass, and California bulrush.

Intermediate marsh occurs within the more interior portions of the Calcasieu-Sabine Basin where exposure to saltwater intrusion is lessened by distance from saltwater sources. Intermediate marsh may have an irregular tidal regime, with salinity ranging from 3 to 10 ppt. This marsh type is very important to many species of avian wildlife and supports large numbers of wintering waterfowl. It is also critical nursery habitat to juvenile marine organisms. Gradual changes in salinity conditions can cause this habitat to shift towards brackish marsh.

Brackish Marsh

Inland from salt marsh, and subject to moderate tidal influence, are brackish marshes. This marsh type is dominated by saltmeadow cordgrass. Brackish marshes are often interspersed with numerous small ponds and water channels and have experienced substantial marsh breakup and degradation in recent years. Salinity levels often range between 0.5 to 5.0 ppt and average salinity is in the range of 8 ppt, however, much higher salinities may occur periodically. In the brackish marsh, saltmeadow cordgrass is the dominant herbaceous species. Saltgrass, three-cornered grass, smooth cordgrass, black needlerush, and leafy three-square are often co-dominant or common in this zone. It should be noted that some of these species also occur in saline marsh, but the order of dominance differs. Chabreck (1972) identified forty species of plants in brackish marsh. Aquatic plants that commonly occur in brackish marsh waters include widgeon grass, Eurasian watermilfoil, water celery, and horned pondweed. Visser et al. (2000) classified brackish marsh in the Chenier Plain as a combination of saltmeadow cordgrass, three-cornered grass, and leafy three square.

Brackish marshes occur predominantly along the borders of Calcasieu and Sabine Lakes. Brackish marshes are extremely important as nurseries for fish and shellfish. Wading birds, muskrats and shorebirds are also common in such areas.

8

Saline Marsh

Salt marshes usually receive regular tidal inundation and occur in the most saline zones along the Gulf of Mexico shoreline and adjacent to the Calcasieu Ship Channel. Smooth cordgrass is the dominant plant in this marsh type, and often forms near-monotypic stands. Herbaceous vegetation of the saline marsh is typically dominated by smooth cordgrass intermixed with saltgrass, saltmeadow cordgrass, black needlerush, and saltwort. Chabreck (1972) identified 12 species of emergent vegetation typically associated with this marsh type. Within the described marsh zones, many ponds and lakes support submerged and/or floating-leafed aquatic vegetation (SAV). Aquatic vegetation is rare in saline waters along the Louisiana coast (Chabreck, 1972). However, widgeon grass may occur in open water areas of saline marshes bordering on the brackish marsh zone and in saline areas where tidal flow has been decreased by structures or other changes in hydrology. Average salinity is approximately 16 ppt. Relative to other marsh types, salt marsh typically supports fewer terrestrial vertebrates although some species like seaside sparrows and clapper rails are common (U.S. Army Corps of Engineers 2009). Salinity levels may range from 5.0 to 18 ppt, however, salinities may occasionally be lower or higher.

Saline marsh habitat exists in the project area closest to the Gulf of Mexico beach rim and along the Lower Lake (i.e., river miles (RMs) 5 to 12) and Calcasieu Pass (i.e., RMs 0 to 5) portions of the Calcasieu Ship Channel. Saline marshes are regularly flooded by high tides and have less plant diversity than the other marsh types.

Open Water

Small ponds and shallow open water areas associated with each of the above marsh plant communities are scattered throughout the project area. Some of the larger well known open water areas include Lake Charles, Prien Lake, Moss Lake, and Calcasieu Lake along the ship channel. Black Lake, Browns Lake, and Mud Lake are open water areas occurring west of the ship channel. Willow Lake and Sweet Lake occur east of the ship channel.

Submerged Aquatic Vegetation Habitat

Some protected shallow open water habitats within the project area support submerged aquatic vegetation (SAV). Prior to Hurricane Rita concentrations of SAVs densities up to 80 percent coverage occurred within Cameron Prairie National Wildlife Refuge (NWR) and those concentrations are expected to return (personal communication with NWR personnel 2007). Project area SAV habitats may include areas of widgeon grass, duckweeds, coontail, bladderworts, watermilfoil, hydrilla, mermaidweeds, and pondweeds. As these aquatic plants die, their decomposition by bacteria and fungi contribute to the food web by providing detritus for many aquatic invertebrates. SAVs are very important to wildlife and are utilized by many duck species.

Developed Lands

Developed areas are located on the higher elevations of the Pleistocene terrace along the GIWW and around the Lake Charles area and are typically well drained. Within the coastal marshes, most development is located on cheniers. They include agricultural lands and commercial and residential developments. Levees are also included in this category. Levees are frequently mowed, and, as such, provide poor wildlife habitat. Some levees are vegetated with an

9

assortment of scrub/shrub species including marsh elder, eastern baccharis, Chinese tallow tree, common reed, and goldenrod. These higher-elevation areas may provide low-to-moderate-value habitat for terrestrial wildlife, including some migratory bird species.

Existing Fishery Resources

The project-area wetlands and associated shallow waters provide nursery and feeding habitat for recreationally and commercially important estuarine-dependent fishes and shellfishes (e.g., red drum, black drum, Atlantic croaker, spot, sand seatrout, spotted seatrout, southern flounder, Gulf menhaden, striped mullet, blue crab, white shrimp and brown shrimp). Commercial shrimp harvests have been positively correlated with the area of tidal emergent wetlands (Turner 1977 and 1982). Future commercial harvests of shrimp and other fishes and shellfishes would likely be adversely impacted by continued losses in estuarine marsh habitat (Turner 1982). Portions of the project area also provide habitat for freshwater fishes that can tolerate low-salinity conditions, including largemouth bass, bluegill, warmouth, gars, freshwater drum, blue catfish and channel catfish.

Salt and brackish marshes serve as nursery areas for myriads of juvenile shrimp, crabs, redfish, seatrout, Gulf menhaden, etc., and greatly enhance the production of marine organisms. Vegetation production rates in estuarine marshes are extremely high, providing an abundance of detritus to support the estuarine food web.

Much of the existing project area-wetlands are subject to permitted structural management that varies from semi-impounded to completely impounded marsh. The majority of the water control structures within the semi-impounded management areas are supposed to be operated to allow ingress and egress of estuarine fishery organisms, especially brown shrimp and white shrimp, except during drawdowns, periods of high salinity, or waterfowl seasons. Unmanaged coastal wetlands are of particular importance due to their relative scarcity within the Calcasieu-Sabine Basin.

Essential Fish Habitat

Estuarine wetlands and associated shallow waters within the project area have been identified as Essential Fish Habitat (EFH) for postlarval, juvenile and sub-adult stages of brown shrimp, white shrimp, and red drum. EFH in the nearshore, marine-portion of the project area and in the lower portions of the estuary has also been designated as EFH for an array of other species (Table 1). EFH requirements vary depending upon species and life stage. Categories of EFH in the project area include estuarine emergent wetlands, estuarine water column, submerged aquatic vegetation, and estuarine water bottoms. Detailed information on Federally managed fisheries and their EFH is provided in the 2005 generic amendment of the Fishery Management Plans for the Gulf of Mexico, prepared by the Gulf of Mexico Fishery Management Council (GMFMC). That generic amendment was prepared in accordance with the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), (P.L. 104-297). Estuarine-dependent species listed in Table 1 may also serve as prey for other species managed under the MSFCMA by the GMFMC (e.g., red

10

drum, mackerels, snappers, and groupers) and highly migratory species (e.g., billfishes and sharks) managed by the NOAA-Fisheries.

Table 1. EFH requirements for Managed Fisheries Species in Ecoregion 4.

EFH Requirements for Species Managed by the Gulf of Mexico Fishery Management Council: Ecoregion 4: Mississippi River Delta (South Pass) to Freeport, TX.			
Species	Life Stage	System[1]	EFH
Brown shrimp	juvenile	E	<18m; SAV, sand/shell/soft bottom, emergent marsh, oyster reef
White shrimp	larvae/postlarvae	M/E	<82m; pelagic, soft bottom, emergent marsh
	juvenile	E	<20m; soft bottom, emergent marsh
Red drum	larvae/postlarvae	E	all estuaries planktonic, SAV, sand/shell/soft bottom, emergent marsh
	juvenile	M/E	GOM, <3m Vermilion Bay & E, all estuaries SAV, sand/shell/soft/hard bottom, emergent marsh
	adults	M/E	GOM 1-46 m Vermilion Bay & E, SAV, sand/shell/soft/hard bottom, emergent marsh
Lane snapper	hetero	E/M	4-130 m, reefs, SAV
	juvenile	E/M	<20, SAV, mangrove, reefs, sand/shell/soft bottom
	adults	E/M	4-130 m, shoal banks
King mackerel	juvenile	M	<5m; pelagic
Vermilion snapper	juvenile	M	1-25 m; hard bottom
Gray snapper	adult	E/M	0-90 m, emergent marsh, soft bottom, hard bottom, sand shell, shoal banks
Cobia	adult, juvenile	M	1-300 m, pelagic
Gray/reef/sandbar/dusky/ blacktip shark	adult, juvenile	M	1-300 m, pelagic, drift algae
Atlantic sharpnose shark	neonate/juvenile/adult	M	All nearshore and offshore waters Freeport, TX, to mouth of the Mississippi River
Scalloped hammerhead	neonate	M	All nearshore waters to 30 fathoms; Galveston Bay, Vermilion Bay to West Bay, TX
Bull shark	neonate	M	Estuaries and nearshore waters Freeport to mouth of Sabine River; nearshore waters off west Cameron Parish

[1]E=Estuarine, M=marine

Existing Wildlife Resources

The project area supports an array of productive coastal habitats, dominated by intermediate and brackish marshes and associated shallow estuarine waters. The project-area wetlands and adjacent shallow waters, as well as the chenier ridges, support numerous federal-trust wildlife resources, including migratory birds, threatened and endangered species, and various federal and private land holdings that are held or managed to benefit those species.

The chenier and coastal forest habitats associated with the project area provide nesting habitat for songbirds (e.g., the mockingbird, yellow-billed cuckoo, brown thrasher and northern parula), as

11

well as stopover areas for trans-Gulf migrating songbirds. Other avian species found in project area's forested habitats include the American woodcock, common yellow-shafted flicker, belted kingfisher, and several species of raptors (e.g., red-tailed hawk and red-shouldered hawk). Wading bird colonies containing species such as anhinga, great egret, and great blue heron typically occur in wooded wetland and scrub-shrub habitat.

Mammals associated with the project area forested habitats include game species such as eastern cottontail, swamp rabbit, white-tailed deer, and gray and fox squirrels; commercially important furbearers such as river otter, muskrat, and nutria; and other mammal species such as striped skunk, coyote, nine-banded armadillo, and Virginia opossum. Smaller mammals such as the cotton rat, marsh rice rat, and white-footed mouse serve as forage for both mammalian and avian carnivores.

Reptiles which utilize study-area forested habitats include the ground skink, five-lined skink, green anole, and western ribbon snake, and numerous other species. Some of the amphibians expected to be found in study-area forested habitats including small-mouthed salamander, green treefrog, bullfrog, and southern leopard frog.

Wildlife expected to utilize the study-area estuarine marshes include wading birds (e.g., herons, egrets, ibises, and roseate spoonbills), rails, migratory waterfowl (e.g., green-winged teal, blue-winged teal, mottled duck, gadwall, American widgeon, and lesser scaup), raptors, and songbirds. Brackish marshes having abundant submerged aquatic vegetation often support large numbers of puddle ducks. Shorebirds utilizing estuarine marshes include killdeer, American avocet, black-necked stilt, American oystercatcher, common snipe, and various other species. Seabirds include white pelican, brown pelican, black skimmer, herring gull, laughing gull, and several species of terns. Other nongame birds such as boat-tailed grackle, red-winged blackbird, seaside sparrow, olivaceous cormorant, belted kingfisher, and sedge wren also utilize estuarine marshes.

Estuarine marsh wildlife also includes swamp rabbit, nutria, muskrat, mink, river otter, raccoon, white-tailed deer, and coyote. Reptiles are limited primarily to the American alligator in intermediate and brackish marshes, and the diamond-backed terrapin and gulf salt marsh snake in brackish and saline marshes. Juvenile sea turtles may seasonally utilize bays and saline marsh ponds in the lower Calcasieu Estuary.

Species of Management Concern

Species of fish, wildlife, and plants labeled as "S1" and S2" by the Louisiana Department of Wildlife and Fisheries are rare species that are vulnerable to extirpation in Louisiana. These species, along with those identified as priority species by the Gulf Coast Joint Venture are species of management concern. Continued population declines could result in these species becoming candidates for listing under the Endangered Species Act.

Species of concern which use project area Gulf beaches include snowy plover, Wilson's plover, long-billed curlew, Hudsonian godwit, gull-billed tern, reddish egret, black skimmer, and peregrine falcon. An "S2" plant found on beaches in Cameron Parish is the wedge leaf prairie

12

clover. Species of concern that would use project area intermediate, brackish and saline marsh habitat and adjacent open waters include the Louisiana-eyed silk moth, glossy ibis, seaside sparrow, black rail, mottled duck, peregrine falcon, and the diamondback terrapin.

Threatened and Endangered Species

Federally listed threatened or endangered species that occur within the study area include the piping plover (*Charadrius melodus*), the red knot (*Calidris canutus rufa*), the whooping crane (*Grus americana*), and the West Indian manatee (*Trichechus manatus*). Also, threatened and endangered species of sea turtles are known to occur in the southern portion of Calcasieu Lake and/or in nearshore Gulfwaters including the green sea turtle, the hawksbill sea turtle, the Kemp's Ridley sea turtle, and the leatherback sea turtle. The Sprague's pipet (*Anthus spragueii*) is a candidate species for federal listing as a threatened or endangered species

By letter dated March 20, 2015, the Service concurred with the Corps' determination that the project "may affect but will not likely adversely affect" the piping plover or it's critical habitat, red knot, West Indian Manatee, Gulf sturgeon, loggerhead and Kemps Ridley sea turtles, and would have "no effect" on the red-cockaded woodpecker, green, leatherback, and hawksbill sea turtles or loggerhead critical habitat.

By letter dated August 25, 20015, the Service concurred with the Corps' determination that the revised National Economic Development portion of the project would have no effect of the red-cockaded woodpecker.

No further ESA consultation with the Service will be necessary for the proposed action, unless there are significant changes in the scope or location of the proposed project or the project has not been initiated one year from the date of the above-referenced letters. If the proposed project has not been initiated within one year, follow-up consultation (via telephone call or e-mail) should be accomplished with the Service prior to making expenditures because our threatened and endangered species information is updated periodically. If the scope or location of the proposed project is changed significantly, consultation should occur as soon as such changes are made.

Wildlife Management Areas and Parks

Sabine National Wildlife Refuge (NWR) is comprised of 124,511 acres of coastal marsh west of the Calcasieu Lake, and its primary management objective is to preserve a large area of coastal wetlands for wintering and migrating waterfowl from both the Mississippi and Central Flyways. This refuge is also a major nursery area for many estuarine-dependent marine species as well as being the home for alligators and other reptiles, mammals, and numerous wading, water and marsh birds. Cameron Prairie NWR is located east of Calcasieu Lake. Two units (i.e., the Gibbstown and East Cove units) compose this refuge and provide fresh marsh and brackish to saline marsh habitats to support alligators, cottonmouth snakes, white-tailed deer, rabbits, roseate spoonbills, and more than 200 other birds, as well as shrimp, crabs, and many species of fish. Lacassine NWR is located in the Mermentau Basin, northwest of Grand Lake, and is very heavily used by wintering waterfowl. Should proposed project activities directly or indirectly affect those NWRs, please contact the Refuge Complex Leader of the Southwest Louisiana National

13

Wildlife Refuges (337-598-2216), to obtain a Compatible-Use Determination, and to ascertain the need for a Special Use Permit that may be required should work be conducted on that NWR. The Rockefeller Wildlife Refuge, owned and operated by the Louisiana Department of Wildlife and Fisheries is located south of Grand Chenier in the Mermentau Basin. This 76,000-acre refuge consists of numerous tidal marsh management units operated to provide habitat for wintering migratory waterfowl. Project activities on Rockefeller Refuge should be coordinated with the Refuge manager (337-491-2593).

Future Fish and Wildlife Resources

Loss of coastal marshes is the primary problem affecting study area fish and wildlife resources. Satellite land acreage data (1985-2010) from the U.S. Geological Survey (USGS) was plotted and linear regressions were used to calculate average annual loss rates in percent of 1985 acres per year. Regression derived acreages were aggregated to generate regional loss rates (Figure 4).

Throughout the study area, an average of 930 acres has been lost per year from 1985 to 2010 (Table 2). Hurricane Rita (2005) and Hurricane Ike (2008) caused substantial marsh losses and have likely driven marsh loss rates higher than the rates that existed prior to those storms.

Figure 4. Average annual regional marsh acreage change from 1985 to 2010 (percent/year).

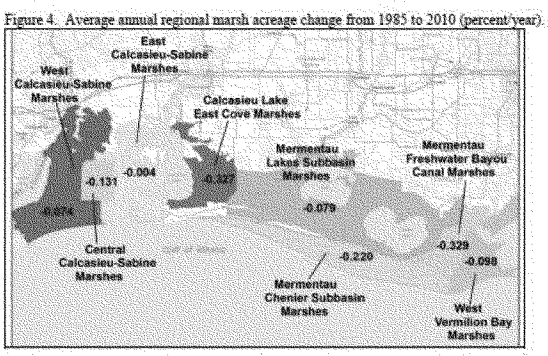


Table 2. Average annual marsh acres lost (1985 to 2010).

Calcaiseu-Sabine Basin				Mermentau Basin	
West Cal-Sab Marshes	Central Cal-Sab Marshes	East Cal-Sab Marshes	East Calcasieu Lake Marshes	Merm. Lakes Subbasin Marshes	Merm. Chenier Subbasin Marshes
-119	-39	-5	-197	-231	-338
			-361		-569

Marsh loss within the West Calcasieu-Sabine marshes is the result of recent rapid losses in the Cameron Meadows Oil and Gas Field north of Johnsons Bayou. Observations suggest that the marsh in this area has drowned and was likely caused by mineral extraction related subsidence of the vegetated marsh surface. Except for this area, the region was experiencing minimal marsh loss prior to Hurricanes Rita and Ike. Central and East Calcasieu-Sabine regions were relatively stable until impacted by Hurricanes Rita and Ike. Recent marsh creation and dredged material disposal efforts have partially offset hurricane related losses in that east region. Marshes east of Calcasieu Lake and throughout the Mermentau Basin were also adversely impacted by these recent hurricanes.

A major cause of marsh loss in the Calcasieu-Sabine Basin has been saltwater intrusion caused by the construction and enlargement of the Calcasieu River and Pass navigation channel, the GIWW, and the Sabine Neches Waterway (LCWCRTF 1998). Those deep-draft channels increased salinity levels, water levels, and duration of high tides (Suhayda et al. 1989) throughout the estuary. The increased salinity stressed fresh and intermediate marsh vegetation, contributing to plant death and ultimately conversion of those marshes to shallow open water. Those hydrology changes resulted in the rapid conversion of interior low-salinity marshes to open water and brackish marshes. Once those losses had occurred, loss rates decreased as the most vulnerable areas had become open water. However, saltwater intrusion continues to impact sensitive low-salinity marsh areas during drought-induced high salinity periods.

Prior to Hurricanes Rita and Ike, the Lakes Sub-basin marshes and other study area marshes were relatively stable. However, significant study area marsh loss occurred prior to 1985
Other Mermentau Basin problems include shoreline erosion along the Gulf of Mexico, which is greatest in the vicinity of Rockefeller Refuge where 30 to 40 feet per year is lost to the Gulf (van Beek and Meyer-Arendt 1982 and Williams et al. 1992).

Shoreline erosion is also a problem along the shores of large lakes such as Calcasieu Lake, Sabine Lake, Grand Lake, and White Lake. Ship wakes and wind waves are the predominant mechanism of erosion causing the Calcasieu Ship Channel to widen at an average of 7.5 feet per year in this reach (Fischenich 2004).

15

Using tide gage data from the Sabine Pass tide gage and U.S. Army Corps of Engineers methods, a subsidence rate of 3.9 mm/year has been calculated and is assumed to be the rate affecting the entire study area. The combination of subsidence and sea level rise is called submergence or relative sea level rise. Submergence causes marshes to become inundated with higher water levels, stressing most non-fresh marsh plants and leading to plant death and conversion of marshes to open water. Other major causes of study-area marsh loss include altered hydrology, storm events, and developments including the direct and indirect impacts of dredge and fill activities (LCWCRTF 1998).

Wetland losses result in increasing acreage of open water. Continued wetland losses are expected to cause significant declines in coastal fish and shellfish production and in the study area's carrying capacity for migratory waterfowl, wading birds, other migratory birds, alligators, furbearers, and game mammals such as white-tailed deer and swamp rabbit. Wetland losses will also reduce storm surge protection of developed lands, and will likely contribute to water quality degradation associated with excessive nutrient inputs.

Aside from marsh loss, saltwater intrusion has converted fresh marsh habitats to more brackish communities. Marshes not hydrologically managed will continue to provide habitat for more salt tolerant species. Because of continued saltwater intrusion, habitat quantity and quality for freshwater fishes, waterfowl, alligators, and more freshwater-tolerant estuarine species (i.e., Gulf menhaden, white shrimp) will continue to decrease throughout most of this area. Habitat quantity will increase for species such as brown shrimp, spotted seatrout, and black drum, which prefer brackish and saline conditions (LCWCRTF 1999). However, continued degradation of those brackish and saline marshes may reduce production of those fish and shellfish.

DESCRIPTION OF ALTERNATIVES AND RECOMMENDED PLAN

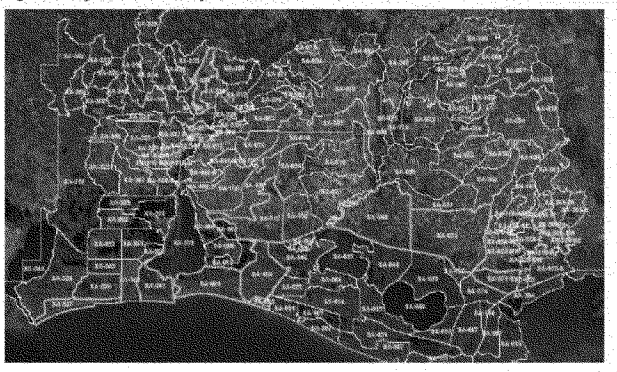
Project goals are to provide hurricane protection and ecosystem restoration that improves ecosystem sustainability. Specific planning objectives were identified to solve the problems by taking advantage of opportunities (Table 3). Levee alternatives were developed and evaluated to provide storm surge protection for the communities of Lake Charles/Sulphur and Abbeville/Erath/Delcambre. Each of those alignments was evaluated at levee heights to protect against 0.5 percent, 1.0 percent, and 2.0 percent annual chance of occurrence storms. In addition to those traditional levee alternatives, non-structural alternatives consisting of buyouts and elevating flood prone structures have also been evaluated throughout the study area.

None of the protection levee alternatives were cost efficient. However, non-structural protection measures did provide a cost-efficient alternative within some regions of the project area and hence, non-structural measures for those regions were selected for inclusion in the TSP (Figure 5). Those non-structural measures will include the construction of 3-7 foot high earthen berms around specific structures. Where construction of those berms could result in impacts to adjacent wetlands, sheetpile structures will be constructed in lieu of earthen berms.

Table 3. Protection and restoration planning objectives.

Objective No.	Objective Description
1	Reduce the risk of damages and losses from hurricane and storm surge flooding in southwest Louisiana
2	Manage tidal flows in southwest coastal Louisiana to improve drainage and prevent salinity from exceeding 2 ppt for fresh marsh and 6 ppt for intermediate marsh
3	Increase wetland productivity in southwest coastal Louisiana in fresh and intermediate marshes to maintain function by reducing the time water levels exceed marsh surfaces.
4	Reduce shoreline erosion and stabilize canal banks in southwest coastal Louisiana areas to protect adjacent wetlands.
5	Restore landscapes, including marsh, shoreline, and cheniers in southwest coastal Louisiana, to maintain their function as wildlife habitat and improve their ability to serve as protective barriers

Figure 5. Map of non-structural protection reaches included in the Recommended Plan.



Ecosystem restoration measures were classified into either hydrology/salinity control measures, marsh creation measures, shoreline protection measures, chenier restoration/reforestation, or oyster reef restoration measures (to improve wetland hydrology). The hydrology/salinity control measures included water control structures and/or navigation locks at Sabine Pass and Calcasieu Pass to reduce saltwater intrusion into the estuary, or control structures to reduce marsh flooding and saltwater intrusion from Calcasieu Lake into interior marshes. Marsh creation/restoration measures and shoreline protection measures were strategically located to protect areas where erosion and marsh loss could result in the establishment of new channels connecting the Gulf of Mexico with interior marshes. Candidate measures were screened based on cost effectiveness, and only the most cost effective measures were retained.

The retained measures were then combined to create an array of restoration alternatives (Table 4). Alternative 1, the Large Integrated Restoration across Basins plan, incorporates all hydrology/salinity control measures, except the Gum Cove Ridge control structure, plus the full array of marsh creation and shoreline protection features, plus all chenier restoration features. Alternative 2, the Moderate Integrated Restoration plan, is similar to Alternative 1 except that it has a reduced number of marsh creation and shoreline protection features. Alternative 3, the Moderate Integrated Restoration Plan with Gum Cove, is identical to Alternative 2 except that it includes the Gum Cove Ridge water control structure. Alternative 4, the Entry Salinity Control plan, includes the water control structures that regulate exchange with the Gulf (this includes the Catfish Point structure), plus a lesser number of marsh creation and shoreline protection features compared to Alternatives 2 and 3.

Table 4. Ecosystem restoration alternatives evaluated.

Alternative Number	Alternative Description
1	Large Integrated Restoration Across Basins
2	Moderate Integrated Restoration
3	Moderate Integrated Restoration w/ Gum Cove
4	Entry Salinity Control Focus
5	Interior Perimeter Control Focus
6	Marsh & Shoreline Focus

Chenier restoration is included in this and all alternatives. Alternative 5 is similar to Alternative 4 except that Alternative 5, the Interior Perimeter Control plan, includes hydrology/salinity control measures that are limited to the interior perimeter control structures (including the Catfish Point structure and the Gum Cove Ridge structure). Chenier restoration is included in

Alternative 5. Alternative 6, the Marsh and Shoreline plan, includes the same interior perimeter hydrology/salinity control measures, minus the Gum Cove control structure, and it includes all marsh creation measures, most of the shoreline protection measures, and all chenier restoration measures.

Restoration Alternative 4 (Entry Salinity Control Alternative), minus the Calcasieu Ship Channel salinity control structure, was initially chosen as the most cost effective of the comprehensive plans. However, subsequent consideration resulted in modifying alternative 4 to eliminate the Sabine Pass salinity control structure (measure 48) and the freshwater retention structure on Little Pecan Bayou (measure 13). Shoreline protection measures on the Gulf shore at Rockefeller Refuge (measures 6b1, 6b2, and 6b3) were also added to this plan. Although the Calcasieu Ship Channel salinity control structure might provide significant environmental benefits, it could not be adequately evaluated under this study because of its complexity. It is recommended that consideration of the Calcasieu Ship Channel salinity control structure be pursued via a separate and independent feasibility analysis. The Cameron-Creole Watershed Spillway is poorly defined and benefits for this feature are also uncertain. It too is being recommended for additional study. RP measures in the Calcasieu-Sabine and the Mermentau Basins are illustrated in Figures 6 and 7, respectively, and listed in Table 5.

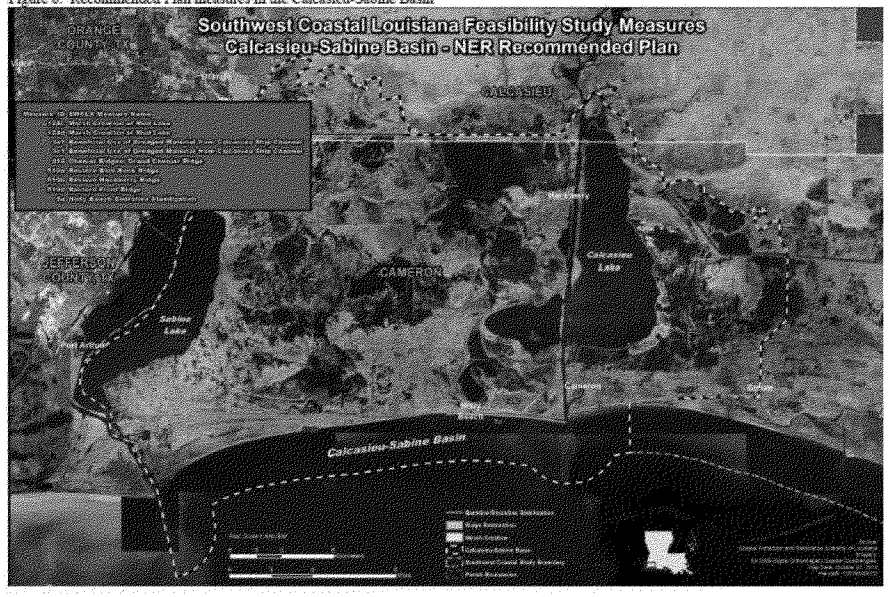
FISH AND WILDLIFE CONCERNS IN THE PROJECT AREA

Major fish and wildlife resource concerns in the study area include ecosystem-wide hydrologic alterations associated with construction of major navigation channels within the study area and the resulting loss of coastal marsh and the conversion of fresher marshes to more saline habitats. Marsh loss due to shoreline erosion along the Gulf of Mexico is also a problem. The Service is also concerned with water-quality degradation from agricultural and urban run-off, and industrial discharges, into upper Calcasieu Basin waterbodies. Forested areas that once provided habitat for neotropical migrants have suffered extensive losses and continue to be lost to development and sea level rise and subsidence.

The coastal marshes of the Calcasieu-Sabine Basin have been identified by the North American Waterfowl Management Plan (NAWMP), Gulf Coast Joint Venture, as a key waterfowl wintering area. The Gulf Coast is the terminus of the Central and Mississippi Flyways and is therefore one of the most important waterfowl areas in North America, providing both wintering and migration habitat for significant numbers of the continental duck and goose populations that use both flyways. Aside from being a key waterfowl wintering area, the Chenier Plain provides important year round habitat for over 90 % of the continental population of mottled ducks and serves as a key breeding area for whistling ducks. The goal of the NAWMP, Chenier Plain Initiative is to provide wintering and migration habitat for significant numbers of dabbling ducks, diving ducks, and geese (especially lesser snow and greater white-fronted), as well as year-round habitat for mottled ducks. Because wintering waterfowl prefer fresh and intermediate marshes, and because navigation projects have contributed to substantial reductions in those preferred waterfowl habitats, measures to reduce salinity levels would have a positive impact of waterfowl habitat quantity, quality, and usage.

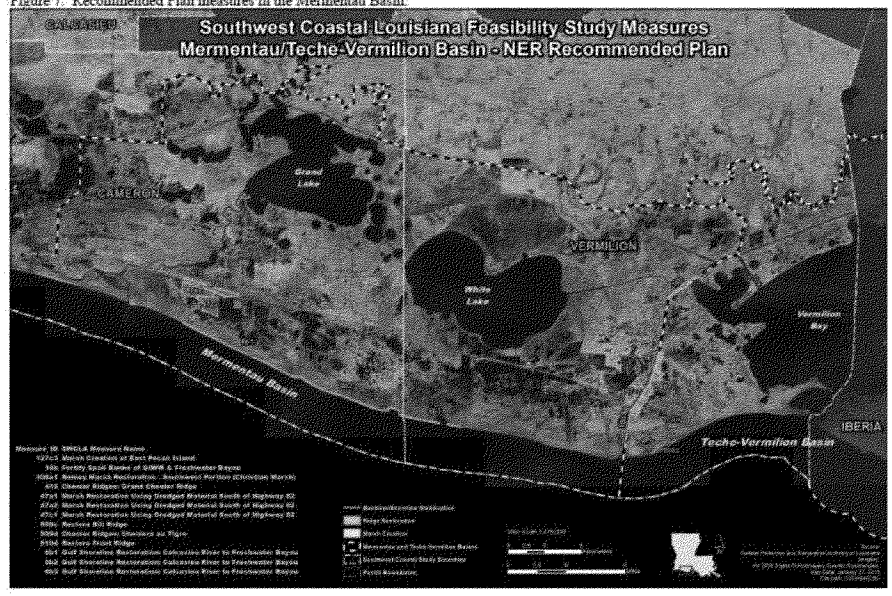
19

Figure 6. Recommended Plan measures in the Calcasieu-Sabine Basin



JA 37-899 10/04/2019 607

Figure 7. Recommended Plan measures in the Mermentau Basin



JA 37-899 10/04/2019 608

Table 5. Restoration measures comprising the Recommended Plan, by basin.

Basin	Measure Type	Measure Number	Measure Description
CS	Marsh Creation	124c	Marsh creation at Mud Lake
CS	Marsh Creation	124d	Marsh creation at Mud Lake
CS	Marsh Creation	3a1	Beneficial use of dredged material from ship channel
CS	Marsh Creation	3c1	Beneficial use of dredged material from ship channel
CS	Shoreline Prot.	5a	Holly Beach shoreline protection
CS	Chenier Rest.	416	Chenier restoration: Grand Chenier
CS	Chenier Rest.	510a	Chenier restoration: Blue Buck Ridge
CS	Chenier Rest.	510b	Chenier restoration: Hackberry Ridge
CS	Chenier Rest.	510d	Chenier restoration: Front Ridge
Merm	Marsh Creation	127c3	Marsh creation at east Pecan Island
Merm	Marsh Creation	306a1	Marsh creation at Rainey marsh (SW portion)
Merm	Marsh Creation	47a1	Marsh creation using dredged material south of Hwy 82
Merm	Marsh Creation	47a2	Marsh creation using dredged material south of Hwy 82
Merm	Marsh Creation	47c1	Marsh creation using dredged material south of Hwy 82
Merm	Shoreline Prot.	16b	Fortify spoil banks of GIWW and Freshwater Bayou
Merm	Shoreline Prot.	6b1	Gulf shore protection: Calc River to Freshwater Bayou
Merm	Shoreline Prot.	6b2	Gulf shore protection: Calc River to Freshwater Bayou
Merm	Shoreline Prot.	6b3	Gulf shore protection: Calc River to Freshwater Bayou
Merm	Chenier Rest.	416	Chenier restoration: Grand Chenier ridge
Merm	Chenier Rest.	509c	Chenier restoration: Bill Ridge
Merm	Chenier Rest.	509d	Chenier restoration: Cheniere au Tigre
Merm	Chenier Rest.	510d	Chenier restoration: Front Ridge

Concerns exist that a future break of the eroding Gulf of Mexico shoreline into deteriorating interior marshes would create a new tidal pass, and would result in harmful salinity increases within interior marshes. Depending upon the location of such shoreline breaches, the resulting impacts could have ecosystem scale impacts. To avoid such impacts, shoreline protection and marsh creation/restoration measures have been proposed in strategic locations where such scenarios appear more likely.

Serious water quality problems exist in the upper Calcasieu estuary where industrial discharges have resulted in the contamination of upper basin marshes and waterbottoms with dioxins, polychlorinated biphenyls and heavy metals. Should non-structural protection measures occur in those environments, those contaminants might be resuspended thereby allowing tidal action and rainfall runoff to then distribute the contaminants to other portions of the system.

Study area chenier ridges were historically forested. Residential and agricultural development has resulted in the clearing of most of the formerly forested areas. Mining of sand has also

resulted in additional impacts to the chenier forests and to the chenier landforms. In addition to impeding storm surges, forested cheniers provide important stopover habitat for trans-Gulf neotropical migratory songbirds, many of which have experienced population declines in recent decades.

EVALUATION METHODOLOGY

Hundreds of flood prone structures within the study area were identified. Five or six of those structures were located adjacent to wetlands. Rather than construct earthen berms around those buildings, flood protection will be provided by constructing sheetpile structures around those buildings. As a result, no impacts to wetlands and associated fish and wildlife habitats would occur as a result of providing non-structural flood protection.

To evaluate the initial array of ecosystem restoration alternatives, several methodologies were used. Wetland acreage benefits associated with the proposed hydrology/salinity control structures were determined using the Wetland Morphology, Eco-Hydrology, and Vegetation models developed for evaluating the 2012 State Master Plan to provide a scientifically sound and defensible way to estimate the comprehensive benefits of those measures (Meselhe et al. 2013, Couvillion et al. 2013, and Visser et al. 2013). In general, the H&S measures carried forward in the study were those that had larger-scale benefits. Recognizing the complexity of those measures and the need for more robust assessments, the Calcasieu Ship Channel salinity control measure and the Cameron-Creole Spillway measure are not part of the Recommended Plan, but instead are recommended for further study to better assess their benefits/impacts.

For measures having a smaller area of impact, and for measures not expected to affect hydrologic processes, a contractor utilized the Wetland Value Assessment (WVA) methodology to determine benefits for ecosystem restoration measures (benefits in Average Annual Habitat Units [AAHUs]). In addition to AAHUs, the WVA methodology also allows for the calculation of net wetland acreage benefits at the end of the project's 50-year life (future with project acreage minus future without project acreage). Net acres for marsh creation/restoration measures were determined using typical spreadsheet methods and standard assumptions (created marshes lost at 50 percent of the background rate). Shoreline protection net acreage was also determined using spreadsheet methods and the assumption that Gulf shoreline protection features reduced background loss rate 50 percent while interior protection features reduced loss rates 100 percent.

POTENTIAL SIGNIFICANT IMPACTS

Construction of non-structural protection berms and/or sheetpile protection structures is not expected to result in impacts to wetlands, nor would they provide any benefits to wetlands or associated fish and wildlife resources.

Wetland benefits in AAHUs and net wetland acres (future with project acres minus future without project acres at the end of the 50-year project life) for each wetland restoration

alternative are summarized in Table 6. Those net acreage values have been used as the benefit metric to compute the cost per benefit values (i.e., cost per year 50 net acreage) used to develop the Recommended Plan. After modifications to the plan as discussed above, the estimated net marsh acreage and AAHU benefits of the Recommended Plan measures are provided in Table 7.

Implementation of the Recommended Plan would result in a net marsh gain at the end of the 50-year project life of 14,035 acres (12,781 acres of brackish marsh and 1,254 acres of saline marsh).

Table 6. Predicted benefits of ecosystem restoration alternatives.

Alternative	Alternative Description	Acres Created	Acres Nourished	Total Acres	Net Acres	AAHU's
1	Large Integrated Restoration Across Basins				31,960	17,888
	Marsh Creation	20,149	5,522	25,671	17,807	8,726
	Shoreline Protection				6,614	1,939
	Hydro & Salinity Control				6,126	6,685
	Chenier Reforestation			1,413	1,413	538
2	Moderate Integrated Restoration				28,077	14,905
	Marsh Creation	16,059	3,306	19,365	13,820	6,916
	Shoreline Protection				4,847	1,559
	Hydro & Salinity Control				7,997	5,892
	Chenier Reforestation			1,413	1,413	538
3	Moderate Integrated Restoration w/ Gum Cove				21,849	14,223
	Marsh Creation	16,059	3,306	19,365	13,820	6,916
	Shoreline Protection				4,847	1,559
	Hydro & Salinity Control				1,769	5,210
	Chenier Reforestation			1,413	1,413	538
4	Entry Salinity Control Focus				20,377	9,785
	Marsh Creation	8,579	4,026	12,605	8,714	4,194
	Shoreline Protection				1,314	268
	Hydro & Salinity Control				9,136	4,785
	Chenier Reforestation			1,413	1,413	538
5	Interior Perimeter Control Focus				12,129	5,238
	Marsh Creation	8,579	4,026	12,605	8,714	4,194
	Shoreline Protection				1,314	268
	Hydro & Salinity Control				688	239
	Chenier Reforestation			1,413	1,413	538
6	Marsh & Shoreline Focus				24,449	14,937
	Marsh Creation	20,149	5,522	25,671	17,807	8,726
	Shoreline Protection				4,895	1,559
	Hydro & Salinity Control				334	4,114
	Chenier Reforestation			1,413	1,413	538

25

Table 7. Estimated benefits and costs of Recommended Plan measures.

Measure Number	Marsh Restoration Measure Name	Basin	Net Benefits (acres)	Benefits (AAHU)	Initial Construction Costs
3a1	Beneficial Use of Dredged Material from Calcasieu Ship Channel	Calcasieu	454	191	66,593,748
3c1	Beneficial Use of Dredged Material from Calcasieu Ship Channel	Calcasieu	1,324	607	168,194,346
47a1	Marsh Restoration Using Dredged Material South of Highway 82	Mermentau	895	272	105,234,982
47a2	Marsh Restoration Using Dredged Material South of Highway 82	Mermentau	1,218	381	97,348,440
47c1	Marsh Restoration Using Dredged Material South of Highway 82	Mermentau	1,135	353	95,372,834
124c	Marsh Creation at Mud Lake	Calcasieu	1,228	500	112,219,520
124d	Marsh Creation at Mud Lake	Calcasieu	168	4	28,882,160
127c3	Marsh Restoration at Pecan Island	Mermentau	735	241	61,662,041
306a1	Rainey Marsh Restoration Southwest Portion (Christian Marsh)	Mermentau	743	151	75,885,692
	Totals:		*7,900*	*2,700*	*811,593,763*
Measure Number	**Shoreline Protection Measure Name**	**Basin**	**Net Benefits (acres)**	**Benefits (AAHU)**	**Initial Construction Costs**
5a	Holly Beach Shoreline Stabilization – Breakwaters	Calcasieu	26	56	144,044,021
6b1	Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou	Mermentau	2,140	625	198,480,921
6b2	Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou	Mermentau	1,583	466	145,876,561
6b3	Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou	Mermentau	1,098	312	115,270,890
16b	Fortify Spoil Banks of the GIWW and Freshwater Bayou	Mermentau	1,288	279	36,018,600
	Totals:		*6,135*	*1,738*	*638,690,993*
Measure Number	**Chenier Reforestation**	**Basin**	**Net Benefits (acres)**	**Benefits (AAHU)**	**Initial Construction Costs**
CR	Chenier Reforestation	Calcasieu	1,132	442	196,778
CR	Chenier Reforestation	Mermentau	282	96	49,523
	Totals:		*1413*	*338*	*246,301*

26

Table 8. Summary of Recommended Plan acreage benefits by habitat type.

Summary of Calcasieu Basin Marsh Creation Benefits							
Measure Number	Basin	Location	Marsh Type	Acres Created	Acres Nourished	Total Acres	Net Benefits (acres)
3a1	Calcasieu	GIWW	Brackish	599	-	599	454
3c1	Calcasieu	SE Calcasieu Lake	Brackish	1,347	734	2,081	1,324
124c	Calcasieu	Mud Lake	Saline	1,077	708	1,837	1,228
124d	Calcasieu	West Cove	Brackish	159	448	607	168
	Saline Marsh Total			1,077	708	1,837	1,228
	Brackish Marsh Total			2,105	1,182	3,287	1,946
	Calcasieu Basin Total			3,182	1,890	5,124	3,174
Summary of Mermentau Basin Marsh Creation Benefits							
Measure Number	Basin	Location	Marsh Type	Acres Created	Acres Nourished	Total Acres	Net Benefits (acres)
47a1	Mermentau	Grand Chenier	Brackish	933	88	1,021	895
47a2	Mermentau	Grand Chenier	Brackish	1,297	126	1,423	1,218
47c1	Mermentau	Grand Chenier	Brackish	1,304	4	1,308	1,135
127c3	Mermentau	Freshwater Bayou	Brackish	832	62	894	735
306a1	Mermentau	Freshwater Bayou	Brackish	627	1,269	1,896	743
	Brackish Marsh Total			4,993	1,549	6,542	4,726
	Calcasieu & Mermentau Brackish Marsh Creation Total			7,098	2,731	9,829	6,672
	Calcasieu & Mermentau Saline Marsh Creation Total			1,077	708	1,837	1,228
	Calcasieu & Mermentau All Marsh Creation Total			8,175	3,439	11,666	7,900

Summary of Shoreline Marsh Protection Benefits				
Measure Number	Basin	Location	Marsh Type	Net Benefits (acres)
5a	Calcasieu	Holly Beach	Saline	26
6b1	Mermentau	Rockefeller Refuge	Brackish	2,140
6b2	Mermentau	Rockefeller Refuge	Brackish	1,583
6b3	Mermentau	Rockefeller Refuge	Brackish	1,098
16b	Mermentau	Freshwater Bayou	Brackish	1,288
	Gulf of Mexico - Brackish Marsh Total			4,821
	Gulf of Mexico - Saline Marsh Total			26
	Freshwater Bayou - Brackish Marsh Total			1,288
	Total Shoreline Protection Total			6,135

Summary of Chenier Reforestation Benefits		
Measure Number	Basin	Net Benefits (acres)
	Calcasieu	1,132
	Mermentau	282
	Chenier Reforestation Total	1,414

TOTAL Marsh Net Benefits	
Brackish (acres)	Saline (acres)
12,781	1,254
Total	14,035

The Recommended Plan would not only restore productive fish and wildlife habitat, but because of their strategic locations, those measures may also provide unquantified indirect protection benefits to adjacent marshes and shallow open water habitats. Additionally, the chenier reforestation measures would restore 1,414 acres of forested chenier habitat. These reforestation measures would substantially increase the acreage of critically important stop-over habitat for trans-Gulf migrating neotropical songbirds, many of which have experienced recent population declines. The proposed marsh creation, shoreline protection and chenier reforestation measures,

would also serve to dampen storm surges and protect communities located north of the coastal marshes.

FISH AND WILDLIFE CONSERVATION MEASURES

The President's Council on Environmental Quality defined the term mitigation in the National Environmental Policy Act regulations to include:

a) avoiding the impacts altogether by not taking a certain action or parts of an action;
b) minimizing impacts by limiting the degree or magnitude of the action and its implementation;
c) rectifying the impacts by repairing, rehabilitating, or restoring the affected environment;
d) reducing or eliminating the impacts over time by preservation and maintenance operations during the life of the action; and,
e) compensation for the impacts by replacing or providing substitute resources or environments.

The Service's mitigation policy (Federal Register, Volume 46, Number 15, pages 7656-7663, January 23, 1991) provides guidance to help ensure that the level of mitigation recommended by the Service is consistent with the value and scarcity of the fish and wildlife resources involved. In keeping with that policy, the Service usually recommends that losses of high-value habitats which are becoming scarce be avoided or minimized to the greatest extent possible. Unavoidable losses of such habitats should be fully compensated by replacement of the same kind of habitat value; this is called in-kind mitigation. The mitigation planning goals and associated Service recommendations should be based on the four categories, as shown in Table 9.

Table 9. U. S. Fish and Wildlife Service Resource Categories.

FWS Resource Categories
Resource Category 1 - Habitat to be impacted is of high value for evaluation species and is unique and irreplaceable on a national basis or in the ecoregion section. The mitigation goal for this Resource Category is that there should be no loss of existing habitat value.
Resource Category 2 - Habitat to be impacted is of high value for evaluation species and is relatively scarce or becoming scarce on a national basis or in the ecoregion section. The mitigation goal for habitat placed in this category is that there should be no net loss of in-kind habitat value.
Resource Category 3 - Habitat to be impacted is of high to medium value for evaluation species and is relatively abundant on a national basis. FWS's mitigation goal here is that there be no net loss of habitat value while minimizing loss of in-kind habitat value.
Resource Category 4 - Habitat to be impacted is of medium to low value for evaluation species. The mitigation goal is to minimize loss of habitat value.

28

Bottomland hardwood forests, bald cypress swamps, and coastal marshes are considered by the Service to be aquatic resources of national importance due to their increasing scarcity and high habitat value for fish and wildlife within Federal trusteeship (i.e., migratory waterfowl, wading birds, other migratory birds, threatened and endangered species, and interjurisdictional fisheries). Therefore, the Service recommends that unavoidable losses of those habitats should be compensated via in-kind replacement.

Based on current project plans, there would be no net adverse impacts to the above-mentioned aquatic resources of national importance and hence, no need to mitigate for adverse impacts. The proposed ecosystem restoration measures would instead, increase the quantity of those valuable habitats.

SERVICE POSITION AND RECOMMENDATIONS

Although the proposed ecosystem restoration measures will provide a substantial benefit to wetlands and associated fish and wildlife resources, future design details of certain measures could nevertheless have some unintended adverse impacts to adjoining wetlands and/or fish and wildlife resources. The recommendations provided below address ways to avoid such unintended impacts and to improve fish and wildlife habitat quality in and adjacent to those restoration areas. Therefore, the Service supports implementation of the Recommended Plan provided the following recommendations are included as part of the plan.

Because submerged aquatic vegetation provides food for migratory waterfowl, and provides high quality nursery habitat for estuarine dependent fisheries (Castellanos and Rozas 2001, and Kanouse et al. 2006), the open water areas targeted for marsh creation measures should avoid areas of dense submerged aquatic vegetation to the greatest degree possible.

Marsh Creation south of Grand Chenier (measures 47a1, 47a2, and 47c1):
These proposed marsh creation measures would convert over 2,000 acres of existing shallow open water to solid marsh. Because those open water areas provide habitat for waterfowl and estuarine fisheries, we recommend that some of those open water areas not be filled to maintain aquatic habitat (i.e., ponds) used by fisheries and waterfowl.

Because the slurried fill material will come from the Gulf of Mexico, the salinity of the effluent may be very high. If that water is trapped within adjoining marshes or within the fill areas, evapotranspiration during summer and/or droughts could cause damage to adjoining marsh vegetation and/or reduce vegetative colonization of fill areas. To avoid such impacts, we recommend the engineers ensure that adequate channels exist to provide drainage/water exchange, and avoid ponding of Gulf water effluent within or adjacent to the fill areas. Similarly, any ponds or enclosed non-fill areas should have drainage channels (existing or man-made) to carry away Gulf water effluent and avoid concentration of salts.

To the greatest degree possible, sediment pumping should be conducted during non-growing season periods to reduce possible salinity impacts on adjoining vegetation. If this would require

29

mobilization and demobilization of the sediment pipeline at the beach crossing during months when piping plover are present, the Service does not believe that this would be a problem given limited extent of that activity, and the other proposed measures to reduce or avoid impacts to plovers.

The proposed pipeline route utilizes an existing north-south canal for much of its length. To pump into eastern and western extremes of the designated fill area, the pipeline route should depart from that designated route only within the proposed fill area, and should be routed through open water areas, to avoid impacting existing marshes.

Marsh Creation along Freshwater Bayou Canal (measures 127c3 and 306a1):
The proposed fill areas are strategically located adjacent to Freshwater Bayou Canal to isolate the canal from interior marshes, to preclude canal related hydrology impacts from impacting interior marshes and waters. Currently, the plans would have the fill areas drain into interior marshes away from Freshwater Bayou Canal. Because the slurried sediment will be obtained from the near shore Gulf of Mexico, the adjacent intermediate marshes and open water areas might be harmed by the saltwater effluent draining from the fill areas. To minimize that impact, the Service recommends that the effluent be drained into Freshwater Bayou Canal and not the interior marshes. After construction, dewatering, and saltwater drainage from the fill areas has been completed, those drainage routes should be plugged and drainage of the fill areas should be redirected into interior marshes.

If a containment dike is constructed adjacent to the Freshwater Bayou Canal, the Service would recommend that it not be degraded after construction so that it can help to maintain the desired hydrologic isolation of the canal from the interior marshes.

Marsh Creation near Mud Lake (measures 124c and 124d):
Measure 124c would convert over 1,900 acres of existing shallow open water to solid marsh. Because those open water areas provide habitat for waterfowl and estuarine fisheries, we recommend that some of those open water areas should not be filled to maintain aquatic habitat (i.e., ponds) used by fisheries, waterfowl, and other wildlife.

Because the slurried fill material will come from the Gulf of Mexico, the salinity of the effluent may be very high. If that water is trapped within adjoining marshes or within the fill areas, evapotranspiration during summer and/or droughts could cause damage to adjoining marsh vegetation and/or reduce vegetative colonization of fill areas. To avoid such impacts, we recommend the engineers ensure that adequate channels exist to provide drainage/water exchange, and avoid ponding of Gulf water effluent within or adjacent to the fill areas. Similarly, any ponds or enclosed non-fill areas should have drainage channels (existing or man-made) to carry away Gulf water effluent and avoid concentration of salts.

The proposed containment dikes along the western and southeastern fill area boundaries may block existing drainage routes for marshes adjacent to the fill area. Should construction of containment dikes create unintentional impoundments, evapotranspiration may increase the salinity of effluent water discharged into those drainage-impaired marshes during the summer

and/or droughts. To avoid potential saltwater impacts and impaired drainage impacts, we recommend weir boxes along those sections of dike be eliminated unless the presence of unimpeded drainage routes can be documented.

Measure 124d would create approximately 149 acres of marsh along the southern edge of West Cove. Because of oil field board roads located south of the proposed fill area, the fill area and marshes south of the fill area must drain northward via several small canals, into West Cove. To prevent ponding impacts to marshes south of the fill area, we recommend the designs for the containment dikes should avoid closing both of those canals.

Portions of measure 124d are located on Sabine National Wildlife Refuge, and portions of measure 3c1 (marsh creation along the eastern rim of Calcasieu Lake) are located on Cameron Prairie National Wildlife Refuge. Internal policy precludes the Corps from constructing projects on federal lands. Rather than deleting these measures from the Recommended Plan and potentially losing the critical landscape functions these marshes provide, the Corps is recommending that funding for the construction of these restoration projects be given to the Service. For the Service to construct those measures, the funding should include costs for the necessary surveys, engineering and design, and inspection costs, in addition to direct construction costs.

Cameron-Creole Spillway (measure74a):
The stated design of this structure differs substantially from that found in the 2012 Louisiana Comprehensive Master Plan for a Sustainable Coast (Master Plan). The Service would prefer a design that would allow for greater operational flexibility than the proposed spillway which would have an invert elevation of +2.0 ft NAVD1988. Although the Service supports the Master Plan concept for this measure, details regarding design and operation of this measure are not yet sufficient to authorize this measure under this study. According to staff working to determine benefits (Ken Duffy email correspondence Feb. 2015), the modeling methods used to assess this measure were not sufficient to capture anticipated flood reduction benefits. Consequently, the Service recommends that an independent feasibility assessment of this feature be conducted and that the design should include lower invert elevations and provide greater operational flexibility than that described under this study. Such a design may also provide more benefits if it could be used to discharge excess water when stages are less than +2.0 feet NAVD1988.

The proposed ecosystem restoration measures will create and protect areas of strategically important marshes. However, implementation of some restoration measures could result in some minor adverse impacts. To avoid and/or reduce those project-related adverse impacts to fish and wildlife resources, and to enhance the desired ecosystem benefits, the Service provides the following general recommendations:

1. To the greatest degree practical, borrow pits for construction of marsh creation measures should be located to avoid and minimize direct and indirect impacts to vegetated wetlands. Borrow pit construction should also avoid the following:
    a. avoid inducing wave refraction/diffraction erosion of existing shorelines
    b. avoid inducing slope failure of existing shorelines

31

c. avoid submerged aquatic vegetation
d. avoid increased saltwater intrusion
e. avoid excessive disturbance to area water bottoms
f. avoid inducing hypoxia

2. Marsh creation measures should avoid, to the degree practical, areas of dense submerged aquatic vegetation.

3. The Corps should monitor ecosystem restoration features to document the degree of success achieved. We recommend the Service and other interested natural resource agencies be included in developing those monitoring criteria and in the review of subsequent monitoring information and reports.

4. The Corps should obtain a right-of-way from the Service prior to conducting any work on Sabine or Cameron Prairie National Wildlife Refuges, in conformance with Section 29.21-1, Title 50, Right-of-Way Regulations. Issuance of a right-of-way will be contingent on a determination that the proposed work will be compatible with the purposes for which the Refuge was established.

5. All planning, design, or other construction-related activities (e.g., surveys, geotechnical borings, etc.) conducted on National Wildlife Refuges (NWRs) will require the Corps to obtain a Special Use Permit from the Refuge Manager of the Southwest Louisiana Refuge Complex. We recommend that the Corps request issuance of a Special Use Permit well in advance of conducting any work on the refuge. Please contact the Refuge Manager (337/598-2216 or SWLRComplex@fws.gov) for further information on compatibility of proposed ecosystem restoration measures, and for assistance in obtaining a Special Use Permit. Close coordination by both the Corps and its contractor must be maintained with the Refuge Manager to ensure that construction and maintenance activities are carried out in accordance with provisions of any Special Use Permit issued by the NWR.

6. The Corps should contact the Louisiana Department of Wildlife and Fisheries prior to conducting any work on Rockefeller Refuge (337-491-2593).

7. We recommend the Corps continue to coordinate with the Service throughout planning and construction to ensure that the proposed project does not impact waterbird nesting colonies, threatened or endangered species, or species that may be listed in the future.

8. We recommend the Corps coordinate with the Service and other interested natural resource agencies when developing detailed plans regarding restoration measures, especially during the Preliminary Engineering and Design Phase (PED) and construction phase, for measures where specific recommendations have been provided below.

9. To the greatest degree possible, sediment pumping should be conducted during non-growing season periods to reduce possible salinity impacts on adjoining vegetation.

32

Service recommendations regarding specific ecosystem restoration measures are provided below:

10. Marsh creation measures south of Grand Chenier (47a1, 47a2, and 47c1)
    a. Combined, these measures would convert over 2,000 acres of existing shallow open water to solid marsh. We recommend that some of those open water areas not be filled to maintain aquatic habitat (i.e., ponds) used by fisheries, waterfowl, and other wildlife.
    b. To avoid saltwater entrapment impacts, the engineers are encouraged to design channels to provide drainage/water exchange, and avoid ponding of Gulf water effluent within or adjacent to the fill areas. Similarly, we recommend any ponds or enclosed non-fill areas have drainage channels (existing or man-made) to carry away Gulf water effluent and avoid concentration of salts.
    c. To pump into eastern and western extremes of the designated fill area, the pipeline route should depart from that designated route only within the proposed fill area, and should be routed through unvegetated open water areas, to avoid impacting existing marshes.

11. Marsh creation along Freshwater Bayou Canal (measures 127c3 and 306a1)
    a. To avoid saltwater effluent impacts, we recommend the effluent be drained toward Freshwater Bayou Canal and not into the interior marshes. After construction, once saltwater drainage from the fill areas has been completed, those drainage routes should be plugged and drainage of the fill areas should be redirected into interior marshes.
    b. If a containment dike is constructed adjacent to the Freshwater Bayou Canal, the Service recommends that it not be degraded after construction so that it can help to maintain the desired hydrologic isolation of the interior marshes from the canal.

12. Marsh creation near Mud Lake (measure 124c)
    a. This measure would convert over 1,900 acres of existing shallow open water to solid marsh. We recommend that some of those open water areas not be filled to maintain aquatic habitat (i.e., ponds) used by fisheries and waterfowl.
    b. To avoid saltwater entrapment impacts, the engineers are encouraged to design channels to provide drainage/water exchange, and avoid ponding of Gulf water effluent within or adjacent to the fill areas. Similarly, we recommend any ponds or enclosed non-fill areas have drainage channels (existing or man-made) to carry away Gulf water effluent and avoid concentration of salts.
    c. The proposed containment dikes along the western and southeastern fill area boundaries may block existing drainage routes for marshes adjacent to the fill area. To avoid potential saltwater entrapment impacts and impaired drainage impacts, we recommend weir boxes along those sections of dike be eliminated unless the presence of unimpeded drainage routes can be documented.

13. Marsh creation near West Cove (measure 124d)

a. To prevent ponding impacts and saltwater entrapment impacts to marshes south of the fill area, we recommend the containment dike designs avoid closing both canals that provide drainage for the fill area and adjacent marshes.
b. If funding is provided to the Service to construct this or other measures located on National Wildlife Refuges, that funding should include funding necessary to cover the necessary administration, engineering, and design work.

This final report is submitted in fulfillment of the requirements of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), and constitutes the final report of the Secretary of the Interior as required by Section 2(b) of that Act. This report has incorporated comments made by the National Marine Fisheries Service (see Appendix A) on our draft Coordination Act Report dated February 26, 2015. No comments on our February 2015 draft Coordination Act Report were received from the Louisiana Department of Wildlife and Fisheries.

34

LITERATURE CITED

Castellanos, D.L. and L.P. Rozas. 2001. Nekton use of submerged aquatic vegetation, marsh, and shallow unvegetated bottom in the Atchafalaya River Delta, a Louisiana tidal freshwater ecosystem. Estuaries. Vol. 24, No. 2, p. 184-197.

Chabreck, R.H. 1970. Marsh zones and vegetative types in the Louisiana coastal region. Ph.D. Dissertation, Louisiana State University, Baton Rouge, Louisiana.

Chabreck, R.H. 1972. Vegetation, water, and soil characteristics of the Louisiana coastal region. La. State Univ., Baton Rouge. Agric. Expt. Stn. Bull. No. 664. 72 pp.

Couvillion, B. R., Steyer, G. D., Hongqing, W., Beck, H. J., & Rybczyk, J. M. 2013. Forecasting the Effects of Coastal Protection and Restoration Projects on Wetland Morphology in Coastal Louisiana under Multiple Environmental Uncertainty Scenarios. Journal Of Coastal Research, 29-50. doi:10.2112/SI_67_3

Fischenich, J. C. 2004. Draft. Calcasieu River and Ship Channel Erosion and Sediment Impact Assessment (Phase 1). U.S. Army Corps of Engineers, ERDC Environmental Laboratory.

Gammill, S, K. Balkum, K. Duffy, E. Meselhe, J. Porthouse, E. Ramsey, and R. Walters. 2002. Hydrologic Investigation of the Louisiana Chenier Plain. Prepared for the Louisiana Coastal Wetlands Conservation and Restoration Task Force. Louisiana Department of Natural Resources, Coastal Restoration Division, Baton Rouge, LA. 135 pp.

Giron, C. and B. Perez. 2009. Existing Conditions Report for the Southwest Coastal Louisiana Feasibility Study. Prepared by CH2MHill for the Louisiana Office of Coastal Protection and Restoration, the U.S. Army Corps of Engineers, and the Southwest Coastal Louisiana Project Delivery Team. 33pp.

Gosselink, J. G., C. L. Cordes, and J. W. Parsons. 1979. An ecological characterization of the chenier plain coastal ecosystem of Louisiana and Texas, vol. I. FWS/OBS-78/9. 301 pp.

Kanouse, S., M.K. LaPeyre, and J.A. Nyman. 2006. Nekton use of Ruppia maritime and non-

vegetated bottom habitat types within brackish marsh ponds. Mar. Ecol. Prog. Ser. Vol. 327:61-69.

Kniffen, F. B., and S. B. Hilliard. 1988. Louisiana — its land and people. Louisiana State University Press, Baton Rouge. 213 pp.

Lopez, J., N. Snider, C. Dufrechou, M. Hester, P. Keddy, P. Kemp, B. Kohl, S. Kulkarni, A. McCorquodale, M. O'Connell, J. Suhayda, B. Rogers, and D. Bollinger. 2008. Comprehensive Recommendations Supporting the Use of the Multiple Lines of Defense Strategy to Sustain Coastal Louisiana (Version I). Published by the Multiple Lines of Defense Assessment Team with funding from the McKnight Foundation. 408pp.

Louisiana Coastal Wetlands Conservation and Restoration Task Force. 1998. Coast 2050: Toward a Sustainable Coastal Louisiana. Louisiana Department of Natural Resources. Baton Rouge, Louisiana. 161pp.

Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority. 1999. Coast 2050: Toward a Sustainable Coastal Louisiana, The Appendices. Appendix F— Region 4 Supplemental Information. Louisiana Department of Natural Resources. Baton Rouge, La.

Meselhe, E., McCorquodale, J., Shelden, J., Dortch, M., Stokka Brown, T., Elkan, P., Rodrigue, M., Schindler, J., & Zhanxian, W. 2013. Ecohydrology Component of Louisiana's 2012 Coastal Master Plan: Mass-Balance Compartment Model. Journal Of Coastal Research, 16-28. doi:10.2112/SI_67_2.1

Moore, F. 1999. Neotropical migrants and the Gulf of Mexico: the cheniers of Louisiana and stopover ecology. Pp. 51-62 In Gathering of Angels, Migrating Birds and their Ecology (K.P. Able, Editor). Oxford University Press, New York. 489 pp.

Moore, F., and T.R. Simons. 1992. Habitat suitability and stopover ecology of neotropical landbird migrants. Pp. 345-355 In Ecology and Conservation of Neotropical Migrant Landbirds. Edited by J.M. Hagan and D. Johnston. Smithsonian Institution Press.

Penfound, W.T. and E.S. Hathaway. 1938. Plant communities in the marshland of southeastern Louisiana. Ecological Monographs. 8:1-56.

Penland, S. and J.R. Suter. 1989. The geomorphology of the Mississippi River Chenier Plain. In: P.G.E.F. Augustinus (Editor), Cheniers and Chenier Plains. Mar. Geol. 90: 231-258.

Suhayda, J., M. Young, and X. Ren, 1989. Simulation study of natural and man-made changes in estuarine systems. International Association of Science and Technology for Development. ACTA Press, ISBN 0-99896. 133-1, 7 pages.

Turner, R.E. 1977. Intertidal vegetation and commercial yields of penaeid shrimp.

Trans. Am. Fish. Soc. 106:411-416.

Turner, R.E. 1982. Wetland losses and coastal fisheries: an enigmatic and economically significant dependency. *In* Boesch, D.F.(ed.). Proceedings of the conference on coastal erosion and wetland modification in Louisiana: causes, consequences, and options. U.S. Fish and Wildlife Service, Biological Services Program, Washington, D.C. FWS/OBS-82/59. 256 pp.

U.S. Army Corps of Engineers. 1999. The Mermentau Basin Project. New Orleans District Report. 11pp.

U.S. Army Corps of Engineers. 2008. Southwest Coastal Louisiana Feasibility Study. Project Management Plan. 36pp.

U.S. Army Corps of Engineers. 2009. Louisiana coastal protection and restoration final technical report: Appendix, coastal restoration plan and structural environmental impacts. 347pp.

Van Beek, J.L. and K.J. Meyer-Arendt. 1982. Louisiana's eroding coastline: recommendations for protection. Coastal Environments, Inc., Baton Rouge, LA.

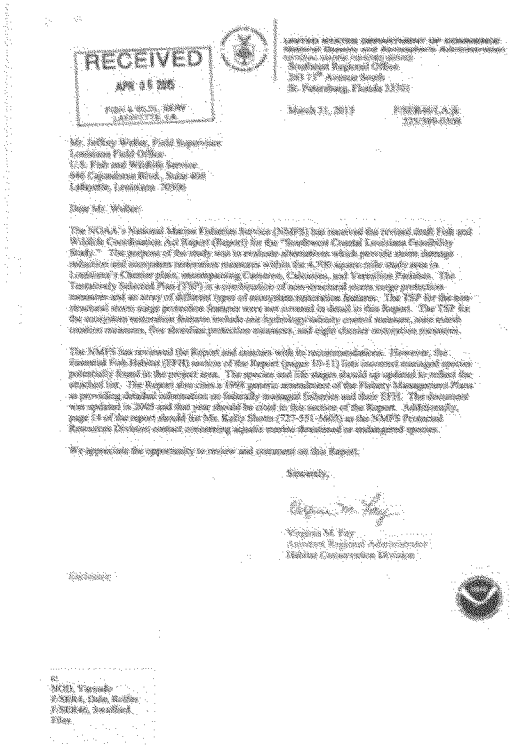
Visser, J.M, C.E. Sasser, R.H. Chabreck, and R.G. Linscombe. 2000. Marsh vegetation types of the Chenier Plain, Louisiana, USA. Estuaries. 23: 318-327.

Visser, J. M., Duke-Sylvester, S. M., Carter, J., & Broussard III, W. P. 2013. A Computer Model to Forecast Wetland Vegetation Changes Resulting from Restoration and Protection in Coastal Louisiana. Journal Of Coastal Research, 51-59. doi:10.2112/SI_67_4

Williams, S.J., S. Penland, A.H. Sallenger, Jr., editors. 1992. Atlas of shoreline changes in Louisiana from 1853 to 1989. Prepared by the U.S. Geological Survey and the Louisiana Geological Survey.

APPENDIX A

National Marine Fisheries Service
comments on the
Feb 2016 Revised Draft Coordination Act Report



RECEIVED
APR 15 2015

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701

March 31, 2015 F/SER46:LA/jk
727/551-5608

Mr. Jeffrey Weller, Field Supervisor
Louisiana Field Office
U.S. Fish and Wildlife Service
646 Cajundome Blvd., Suite 400
Lafayette, Louisiana 70506

Dear Mr. Weller:

The NOAA's National Marine Fisheries Service (NMFS) has received the revised draft Fish and Wildlife Coordination Act Report (Report) for the "Southwest Coastal Louisiana Feasibility Study." The purpose of the study was to evaluate alternatives which provide storm damage reduction and ecosystem restoration measures within the 4,795 square mile study area in Louisiana's Chenier plain, encompassing Cameron, Calcasieu, and Vermilion Parishes. The Tentatively Selected Plan (TSP) is a combination of non-structural storm surge protection measures and an array of different types of ecosystem restoration features. The TSP for the non-structural storm surge protection features were not covered in detail in this Report. The TSP for the ecosystem restoration features include one hydrologic/salinity control measure, nine marsh creation measures, five shoreline protection measures, and eight channel restoration measures.

The NMFS has reviewed the Report and concurs with its recommendations. However, the Essential Fish Habitat (EFH) section of the Report (pages 10-11) lists incorrect managed species potentially found in the project area. The species and life stages should be updated to reflect the attached list. The Report also cites a 1998 generic amendment of the Fishery Management Plans as providing detailed information on federally managed fisheries and their EFH. The document was updated in 2005 and that year should be cited in this section of the Report. Additionally, page 14 of the report should list Ms. Kelly Burns (727-551-5605) as the NMFS Protected Resources Division contact concerning aquatic marine threatened or endangered species.

We appreciate the opportunity to review and comment on this Report.

Sincerely,

Virginia M. Fay
Assistant Regional Administrator
Habitat Conservation Division

Enclosure

cc:
NOD, Vicksburg
F/SER4, Dale, Rollin
F/SER46, Swafford
File

A-2

EFH Requirements for Species Managed by the Gulf of Mexico Fishery Management Council: Ecoregion 4, Mississippi River Delta (South Pass) to Freeport, TX.

Species	Life Stage	System[1]	EFH
Brown shrimp	juvenile	E	<50 m, SAV, unvegetated bottom, emergent marsh, oyster reef
White shrimp	larvae/postlarvae	M,E	<22 m, pelagic, soft bottom, emergent marsh
	juvenile	E	<36 m, soft bottom, emergent marsh
Redfishes	larvae/postlarvae	E	all seagrass, plankton, SAV, unvegetated bottom, emergent marsh
	juvenile	M,E	<20 m, <1 m Secchi depth, SAV, unvegetated bottom, emergent marsh
	adults	M,E	<20 m, <1 m Secchi depth, SAV, unvegetated bottom, emergent marsh
Lane snapper	larvae	E,M	<1-31 m, mud, SAV
	juvenile	E,M	<20 m, SAV, mangrove, reefs, unvegetated, bottom
	adults	E,M	<120 m, coral reefs
King mackerel	juvenile	M	<50 m, pelagic
Spanish mackerel	juvenile	M	<20 m, near bottom
Gray snapper	adult	E,M	<30 m, emergent marsh, soft bottom, hard bottom, reef fish, coral reefs
Tilefish	adult/juvenile	M	<500 m, pelagic
Gray triggerfish	adult/juvenile	M	<300 m, pelagic, reefs, algae
Atlantic sharpnose shark	neonate/juvenile/adult	M	All members, all waters within Sections 7a, 7b and 7c of the M Statistical Area
Bonnethead shark	neonate	M	All members waters in M bounded by Alabama Bay, Canadian Bay in West Bay, Tx.
Bull shark	neonate	M	Estuarine and nearshore waters, Freshwater to coastal waters, Gulf waterbodies within 100 m of Common Ground

[1] E=estuarine, M=marine

A-3

United States Department of the Interior

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506

December 3, 2013

Colonel Richard L. Hansen
District Commander
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Colonel Hansen:

Please reference the ongoing Southwest Coastal Louisiana Feasibility Study currently being finalized by the New Orleans District Corps of Engineers (Corps). The Fish and Wildlife Service (FWS) provided you with a draft Coordination Act Report (CAR) dated November 2013. After we submitted our draft CAR, the Tentatively Selected Plan (TSP) was modified to remove all storm surge protection levees from the array of measures designed to provide storm surge protection for study area communities. Consequently, the Service is providing this Supplemental CAR to address this change and update our recommendations. This supplemental report is submitted in partial fulfillment of the requirements of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). Neither this Supplemental Report, nor our November 2013 draft CAR constitutes the final report of the Secretary of the Interior as required by Section 2(b) of that Act. This Supplemental CAR has been provided to the Louisiana Department of Wildlife and Fisheries and the National Marine Fisheries Service. Their comments on these reports will be incorporated into our final report.

On November 26, 2013, my staff was informed that the Corps had decided to remove all structural protection levee features from the TSP. This is the third change to the TSP that has occurred since the Service began preparing our draft CAR. Not only have these changes required additional time on the part of our staff, but these changes reveal that the Corps' new planning method has resulted in the identification of a TSP before all the necessary information was available. Moreover, the Service is concerned that in the haste to proceed rapidly through the planning process, this new project planning method may result in the rejection of some alternatives and the selection of others without sufficient information, including details on proposed measures which are needed to understand and quantify the environmental benefits and impacts. Therefore, we request that our concerns about this new method be presented to the appropriate policy makers for their consideration.

In our November 2013 draft CAR, the Service identified a number of planning deficiencies with

the proposed storm surge protection levees and the inability to properly assess their associated impacts to fish and wildlife. Now that the TSP has been modified to eliminate those proposed levees, the Service hereby updates the recommendations contained in our November 2013 draft CAR to revoke all those recommendations (i.e. recommendations 1 through 5) that reference the proposed storm surge protection levees. All the remaining recommendations and comments remain valid and should be addressed by the Corps to fulfil the requirements of the Fish and Wildlife Coordination Act.

Thank you for the opportunity to update our comments. The above findings and recommendations do not constitute the final report of the Secretary of the Interior as required by Section 2(b) of the Fish and Wildlife Coordination Act. Please contact Mr. Ronny Paille of this office (337/291-3117) if you require additional information.

Sincerely,

Jeffrey D. Weller
Supervisor
Louisiana Ecological Services Office

cc: EPA, Dallas, TX
NMFS, Baton Rouge, LA
Southwest Louisiana National Wildlife Refuges Complex, Bell City, LA
LA Dept. of Wildlife and Fisheries, Baton Rouge, LA
LA Dept. of Natural Resources (CMD), Baton Rouge, LA
LA Office of Coastal Protection and Restoration, Baton Rouge, LA

2

United States Department of the Interior

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506
November 5, 2013

Colonel Richard L. Hansen
District Commander
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Colonel Hansen:

Attached is the Draft Fish and Wildlife Coordination Act Report on the tentatively selected plan for the Southwest Coastal Louisiana Feasibility Study, Louisiana. That study is evaluating alternatives for providing hurricane protection and storm damage reduction and related purposes in Cameron, Calcasieu, and Vermilion Parishes.

This draft report is transmitted under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), and is being coordinated with the Louisiana Department of Wildlife and Fisheries and the National Marine Fisheries Service. Comments by those agencies will be incorporated to our final report.

Should your staff have any questions regarding the enclosed draft report, please have them contact Ronny Paille of this office at 337/291-3117.

Sincerely,

Jeffrey D. Weller
Supervisor
Louisiana Ecological Field Office

Attachment
cc: SW Louisiana Refuges, Bell City, LA
NMFS, Baton Rouge, LA
EPA, Dallas, TX
LA Dept. of Wildlife and Fisheries, Baton Rouge, LA
OCPR, Baton Rouge, LA

Southwest Coastal Louisiana Feasibility Study

DRAFT
FISH AND WILDLIFE COORDINATION ACT REPORT

PROVIDED TO
NEW ORLEANS DISTRICT
U.S. ARMY CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

PREPARED BY

RONALD PAILLE
SENIOR FISH AND WILDLIFE BIOLOGIST

U.S. FISH AND WILDLIFE SERVICE
ECOLOGICAL SERVICES
LAFAYETTE, LOUISIANA

NOVEMBER 2013

EXECUTIVE SUMMARY

The Corps of Engineers (Corps) was requested to conduct the Southwest Coastal Louisiana Feasibility Study (SWLA Study) via Resolution Docket 2747 adopted on December 7, 2005, by the U.S. House of Representatives Committee on Transportation and Infrastructure. That Docket specifically requested the Secretary of the Army, in accordance with section 110 of the River and Harbors Act, to "survey the coast of Louisiana in Cameron, Calcasieu, and Vermilion Parishes with particular reference to the advisability of providing hurricane protection and storm damage reduction and related purposes to include the feasibility of constructing an armored 12-foot levee along the Gulf Intracoastal Waterway."

Numerous measures to provide storm damage reduction and ecosystem restoration measures were evaluated within the study area. Those measures included construction of levees designed to provide hurricane storm surge protection (including the armored 12-foot levee described above), protection and restoration of coastal wetlands and unique natural ecosystem features (such as cheniers), construction of shoreline protection projects (for navigation canals, interior lakes and bays, and the Gulf of Mexico), and implementation of non-structural protection measures such as structure relocations and buyouts.

The initial list of proposed project measures was derived from existing large-scale coastal protection and ecosystem restoration plans (e.g., the Louisiana Coastal Protection and Restoration Plan [LACPR], the Louisiana Coastal Area Ecosystem Restoration Study Report [LCA], and the Louisiana's Comprehensive Master Plan for a Sustainable Coast [State Master Plan 2012]), public comments received during the project scoping process, and recommendations provided by local representatives and natural resource agencies during the initial planning phase of the project. The initial list of potential project measures was reduced to a more focused and achievable final list of measures based on criteria that were approved by an interagency project delivery team.

The final list of measures was assembled into 6 possible protection levee alternatives and 6 ecosystem restoration alternatives, all of which were evaluated for cost effectiveness. The Lake Charles Eastbank levee, together with non-structural protection measures in select locations, was chosen as the protection measures for inclusion in the Tentatively Selected Plan (TSP). Restoration Alternative 4 (Entry Salinity Control Alternative) was initially chosen as the most cost effective of the comprehensive plans and was included in the TSP. However, subsequent consideration resulted in modifying alternative 4 to eliminate the Sabine Pass and Calcasieu Ship Channel salinity control structures (measures 48 and 7, respectively), and to add the shoreline protection measures on the Gulf shore at Rockefeller Refuge (measures 6B1, 6B2, and 6B3).

In addition to providing hurricane storm surge protection in developed portions of the project area, implementation of the TSP would restore, enhance, and protect substantial areas of coastal marsh and forested chenier habitat. Because many design details regarding the proposed surge protection levees are yet to be developed, additional planning work must be conducted before impacts can be fully determined. Similarly, the proposed ecosystem restoration measures need additional planning work and interagency coordination to finalize estimated benefits and impacts

with any degree of certainty. To complete needed planning of project features, to reduce and avoid project-related adverse impacts to fish and wildlife resources, and to enhance the desired ecosystem benefits, the Fish and Wildlife Service provides the following recommendations:

1. The Corps should conduct further planning of the proposed protection levee to reduce and avoid impacts to wetlands and forest habitats. Additional levee planning work should also include the development of measures to avoid interrupted drainage impacts in a manner that reduces or avoids impacts to wetlands and forested habitats. The additional planning work should be coordinated with the Service and other interested natural resource agencies. Any pump stations needed for drainage of the protected area should be designed to discharge into wetlands to reduce adverse effects of discharging runoff directly into open water bodies.

2. The Corps should also determine where levee borrow material will be obtained.

3. To the greatest degree practical, borrow pits for construction of proposed levee and marsh creation measures should be located to avoid and minimize direct and indirect impacts to vegetated wetlands. Efforts should be made to further reduce those direct impacts by hauling in fill material, using sheetpile for the levee crest, deep soil mixing, or other alternatives. Borrow pit construction should also avoid the following:
   a. avoid inducing wave refraction/diffraction erosion of existing shorelines
   b. avoid inducing slope failure of existing shorelines
   c. avoid submerged aquatic vegetation
   d. avoid increased saltwater intrusion
   e. avoid excessive disturbance to area water bottoms
   f. avoid inducing hypoxia

4. Once levee planning has been completed, the Corps should revise estimates of direct and indirect impacts to wetlands and forested habitats, including impacts associated with acquisition of borrow material. That work should be conducted in cooperation with the Service and other interested natural resource agencies.

5. The Corps should conduct a Hazardous, Toxic and Radioactive Waste (HTRW) assessment of tidally influenced levee construction locations and subaqueous marsh creation borrow sites. If those HTRW assessments indicate that contamination exceeds National Oceanic and Atmospheric Administration screening levels, then alternative locations should be considered, or, explanation of the containment methods that would allow levee construction should be provided to the Service and other interested natural resource agencies.

6. For ecosystem restoration measures not being used to mitigate construction impacts, the Service recommends that the Corps conduct monitoring of those features to

ii

document the degree of success achieved. The Service and other interested natural resource agencies should be involved in developing those monitoring criteria and in the review of subsequent monitoring information and reports. For mitigation features, the Service also recommends that all interested natural resource agencies be involved in the planning of project features, monitoring plans, development of success criteria, and adaptive management plans. In addition, all mitigation plans should address the 12 mitigation requirements in Appendix A.

7. The Corps should obtain a right-of-way from the Service prior to conducting any work on Sabine or Cameron Prairie National Wildlife Refuges, in conformance with Section 29.21-1, Title 50, Right-of-Way Regulations. Issuance of a right-of-way will be contingent on a determination that the proposed work will be compatible with the purposes for which the Refuge was established.

8. All construction or maintenance activities (e.g., surveys, land clearing, etc.) on National Wildlife Refuges (NWRs) will require the Corps to obtain a Special Use Permit from the Refuge Manager of the Southwest Louisiana Refuge Complex; furthermore, all activities on NWRs must be coordinated with the Refuge Manager. Therefore, we recommend that the Corps request issuance of a Special Use Permit well in advance of conducting any work on the refuge. Please contact the Refuge Manager (337/598-2216 or SWLRComplex@fws.gov) for further information on compatibility of proposed ecosystem restoration measures, and for assistance in obtaining a Special Use Permit. Close coordination by both the Corps and its contractor must be maintained with the Refuge Manager to ensure that construction and maintenance activities are carried out in accordance with provisions of any Special Use Permit issued by the NWR.

9. The Corps should contact the Louisiana Department of Wildlife and Fisheries prior to conducting any work on Rockefeller Refuge (337-491-2593).

10. The Corps should continue to coordinate with the Service throughout planning and construction to ensure that the proposed project does not impact waterbird nesting colonies, and threatened or endangered species that may be listed in the future.

Given that the design and evaluation of most project features has been at a programmatic level, the Service cannot fulfill its Fish and Wildlife Coordination Act (FWCA)(48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) responsibilities at this time. Therefore, this draft report is presented in partial fulfillment of that act and does not constitute the final report of the Secretary of Interior as required by Section 2(b) of the FWCA. To complete those assessments, we will require additional funding during the project's pre-construction engineering and design phase. Estimates of those funding needs should be coordinated in advance with the Service, and should be based on the extent of remaining work and the nature and complexity of issues associated with the remaining planning/design issues.

iii

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES v

INTRODUCTION 1

DESCRIPTION OF STUDY AREA 2

FISH AND WILDLIFE RESOURCE CONDITIONS 4
Existing Fish and Wildlife Habitats 4
Forested Habitat 5
Scrub-Shrub Habitat 6
Fresh Marsh 6
Intermediate Marsh 8
Brackish Marsh 8
Saline Marsh 9
Open Water 9
Submerged Aquatic Vegetation Habitat 9
Developed Lands 10
Existing Fishery Resources 10
Essential Fish Habitat 10
Existing Wildlife Resources 11
Threatened and Endangered Species 12
Wildlife Refuges 15
Future Fish and Wildlife Resources 15

DESCRIPTION OF ALTERNATIVES AND RECOMMENDED PLAN 17

FISH AND WILDLIFE CONCERNS IN THE PROJECT AREA 22

EVALUATION METHODOLOGY 26

POTENTIAL SIGNIFICANT IMPACTS 26

FISH AND WILDLIFE CONSERVATION MEASURES 30

SERVICE POSITION AND RECOMMENDATIONS 31

LITERATURE CITED 35

Appendix A 38

LIST OF FIGURES

Figure 1 Coastal marshes within the coastal Calcasieu-Sabine and Mermentau Basins 3
Figure 2 Marsh types (2007) within the Calcasieu-Sabine Basin 7
Figure 3 Marsh types (2007) within the Mermentau Basin 15
Figure 4 Average annual regional mash acreage change from 1985 to 2010 (percent per year) 16
Figure 5 Lake Charles/Sulphur area alternative levee alignments 19
Figure 6 Abbeville/Erath/Delcambre area alternative levee alignments 19
Figure 7 Combined Abbeville/Erath/Delcambre area alternative levee alignments 20
Figure 8 Map of non-structural protection reaches included in the TSP 20
Figure 9 TSP measures in the Calcasieu-Sabine Basin 24
Figure 10 TSP measures in the Mermentau Basin 25
Figure 11 Marshes that might be impounded near Gray Plantation Drive 28

LIST OF TABLES

Table 1 Average annual marsh acreage lost (1985 to 2010) 16
Table 2 Protection and restoration planning objectives 18
Table 3 Ecosystem restoration alternatives evaluated 21
Table 4 Restoration measures comprising the TSP 22
Table 5 Preliminary direct construction impacts to wetlands and forested habitats 27
Table 6 Predicted benefits of ecosystem restoration alternatives 29
Table 7 Estimated benefits of the TSP 29
Table 8 U. S. Fish and Wildlife Service Resource Categories 30

INTRODUCTION

The Southwest Coastal Louisiana Feasibility Study (SWLA Study) was authorized by Resolution Docket 2747 adopted on December 7, 2005, by the U.S. House of Representatives Committee on Transportation and Infrastructure. That Docket specifically requested the Secretary of the Army, in accordance with section 110 of the River and Harbors Act, to "survey the coast of Louisiana in Cameron, Calcasieu, and Vermilion Parishes with particular reference to the advisability of providing hurricane protection and storm damage reduction and related purposes to include the feasibility of constructing an armored 12-foot levee along the Gulf Intracoastal Waterway." Investigation of area ecosystem restoration measures was authorized via the Water Resources Development Act of 2007 (Title VII, Louisiana Coastal Area program, Chenier Plain Freshwater and Sediment Management and Allocation Reassessment Study).

The study area is located within Louisiana's Chenier Plain which is characterized by lakes, bayous, wetlands, cheniers, and coastal beaches. The Mermentau Basin and the Calcasieu/Sabine Basin are the two major hydrologic basins within the Chenier Plain. There are numerous communities within the study area including Abbeville, Cameron, Delcambre, Erath, Gueydan, Hackberry, Kaplan, Lake Arthur, Lake Charles, and Sulphur. Although the approved Southwest Coastal Louisiana Feasibility Study authorization is restricted to Calcasieu, Cameron, and Vermilion Parishes, several project alternatives occurring beyond those parishes were considered because of their anticipated effects on the project area.

Numerous project measures and groups of measures were evaluated. Surge protection alternatives included alternative levee alignments (including the armored 12-foot levee described above), as well as non-structural alternatives. Ecosystem restoration alternatives included various combinations of salinity control/reduction measures, strategic marsh creation measures, strategically located shoreline protection measures, and restoration/reforestation of cheniers.

This report provides a preliminary analysis of the impacts of the Tentatively Selected Plan (TSP) on fish and wildlife resources. The TSP is a combination of structural and non-structural storm surge protection measures, and an array of different types of ecosystem restoration features. The Service conducted a cursory assessment of direct impacts associated with construction of proposed levee alternatives. Because details regarding drainage of the protected area have not yet been developed, this impact assessment is considered preliminary and likely to change. The analysis of ecosystem restoration benefits was conducted by a contracted consulting firm. Because planning details for many of those measures have not yet been developed, and because specifics of those measures have not been made available to the Service and interested natural resource agencies, the Service considers the benefit and impact assessments as preliminary. Since information needed to fully assess project benefits and impacts is not yet available, this draft report is submitted in partial fulfillment of the requirements of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), and does not constitute the final report of the Secretary of the Interior as required by Section 2(b) of that Act. This draft report has been provided to the Louisiana Department of Wildlife and Fisheries and the National Marine Fisheries Service. Their comments on this report will be incorporated into our final

report.

DESCRIPTION OF STUDY AREA

The study area, which encompasses Calcasieu, Cameron, and Vermilion Parishes, is typically termed the Chenier Plain of Louisiana. The Chenier Plain encompasses the southwestern Louisiana coastal zone from Freshwater Bayou west of Vermilion Bay to Sabine Lake near the Texas-Louisiana border. Cheniers are relict beach ridges that generally parallel the Gulf shoreline, and derive their name from the Cajun word "chene" meaning oak, because oaks are the dominant tree species on the crests of the higher chenier ridges (Penland et al. 1989). Because chenier elevations are higher than the surrounding marshes, they often serve as hydrologic barriers, with varying levels of effectiveness, between saline marshes to the south and freshwater marshes to the north (Corps 2008). The two hydrologic basins encompassed by the study area are the Mermentau and the Calcasieu-Sabine Basins (Figure 1).

Mermentau Basin

The Mermentau River Basin is located between Freshwater Bayou Canal to the east and that segment of Louisiana Highway 27 east of Calcasieu Lake. The Basin encompasses an area of about 4.2 million acres and contains productive agricultural lands and a variety of natural environments (Corps 1999). The Mermentau Basin is divided into two sub-basins, the Lakes and Chenier Subbasins (Figure 1), both of which occur within the feasibility study boundary. North of the Lakes Sub-basin lies uplands beyond the study boundary and covers an area of 3,683 mi^2 of predominantly agricultural land (Gammill et al. 2002). The principal agricultural products in this region are rice and crawfish, which both require ample supplies of fresh water typically provided via the Corps' management of the Mermentau Basin Project (Corps 1999).

The Lakes Sub-basin is located roughly between the Gulf Intracoastal Waterway (GIWW) and Louisiana Highway 82, and historically functioned as a low-salinity brackish estuary (Corps 2008). Construction of navigation channels, locks, and water control structures has altered the historical north-south river and tidal-driven hydrology and shifted it to an east-west system that drains through the GIWW. The Corps' locks and water control structures that are located along the perimeter of the Lakes Sub-basin regulate both salinity and water level so that the Lakes Sub-basin now functions more as a freshwater reservoir and less as the low-salinity estuary that it was prior to these alterations (Gammill et al. 2002). The demand for a reliable fresh water supply for agricultural use was the primary reason for the development of the Mermentau Basin Project (Corps 1999).

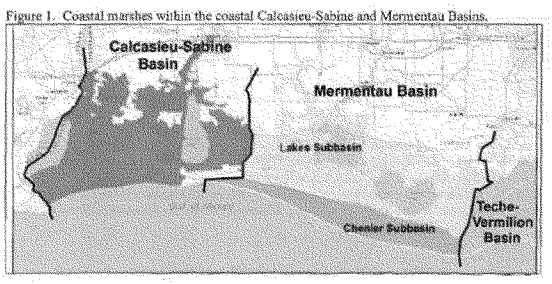
The Mermentau Basin Project involves the operation and management of five navigation locks and control structures: (1) the Calcasieu Lock located on the Gulf Intracoastal Waterway (GIWW) near the intersection of Louisiana Highway 384, (2) the Leland Bowman Lock situated on the GIWW near Intracoastal City, (3) the Freshwater Bayou Lock located on the Freshwater Bayou Canal approximately one mile north of the Gulf of Mexico, (4) the Catfish Point Control Structure located on the southwest side of the basin where the Mermentau River exits Grand Lake, and (5) the Schooner Bayou Control Structure located on the east side of the basin in the

2

old Intracoastal Waterway between Freshwater Bayou and White Lake. The target water level inside the basin is 2.0 feet above mean low Gulf and the five Corps structures are operated in concert to maintain this level and preclude saltwater intrusion (Corps 1999).

The Chenier Sub-basin is located south of the Lakes Sub-basin, between Louisiana Highway 82 and the Gulf of Mexico. Approximately one-third of this sub-basin is comprised of the State-owned and operated Rockefeller Wildlife Refuge. The Chenier Sub-basin is characterized by tidally influenced salt marshes, though hydrology throughout much of the area is managed through impoundments that range in size from hundreds to thousands of acres. The purpose of that management is to control salinity in order to reduce wetland losses and/or sustain recreational and agricultural endeavors (Corps 2008).

Figure 1. Coastal marshes within the coastal Calcasieu-Sabine and Mermentau Basins.



Calcasieu-Sabine Basin

The Calcasieu-Sabine Basin extends from Sabine Lake and River eastward to the Louisiana Highway 27 segment east of Calcasieu Lake. The Calcasieu-Sabine Basin consists of two semi-distinct sub-basins, the Calcasieu River Basin and the Sabine River Basin. When the GIWW was built in the 1920s, it breached the Gum Cove Ridge which had historically formed a partial north-to-south oriented hydrologic barrier between the Calcasieu and Sabine Lake systems. That breach, in combination with several smaller canals, now facilitates water exchange between the sub-basins, and has exacerbated saltwater intrusion problems in the marshes adjacent to the GIWW. The typical water-movement scenario is that south winds push salt water into Calcasieu Lake, westward through the GIWW, and across the Gum Cove Ridge breach. This water is eventually swept down the Sabine River and into Sabine Lake. Currently, salt water that is pushed into Calcasieu Lake remains there because there is little back flow from the Lake. Without the Gum Cove Ridge breach, the current semi-circular flow patterns would not exist, and lake levels would rise more modestly, thus reducing the volume of seawater entering Calcasieu Lake (Lopez et al. 2008).

3

The widening and deepening (to -40 feet deep by 400 feet wide) of the Calcasieu River and Pass Ship navigation channel (referred to as the Calcasieu Ship Channel [CSC]), as well as the removal of the channel mouth bar, has increased saltwater and tidal intrusion into the Calcasieu-Sabine Basin, resulting in marsh loss, tidal export of organic marsh substrate, and an overall shift to more saline habitats in the region. In 1968, the Corps completed construction of the Calcasieu River Saltwater Barrier on the Calcasieu River north of the City of Lake Charles. This barrier minimizes the flow of salt water into the upper reaches of the Calcasieu River to protect agricultural water supplies (Gammill et al. 2002). The Corps-maintained Calcasieu Lock, located east of the CSC on the GIWW near its intersection with Louisiana Highway 384, is operated to prevent saltwater intrusion into the Mermentau Basin as part of the Corps' Mermentau Basin Project.

The Sabine River has a drainage area of approximately 9,325 square miles and is the dominant influence across most of the Calcasieu-Sabine Basin in moderating salinity and tidal fluctuations. Sabine Pass was first dredged for navigation in 1880, and has been progressively deepened to its present depth of -40 feet. The Sabine-Neches Canal (later to become the Sabine-Neches Waterway) was constructed in the early 1900s. That channel not only facilitates saltwater intrusion into the area, it also funnels freshwater inflows more directly to the gulf, largely bypassing the adjacent marshes in Louisiana and Texas. A feasibility analysis has been conducted to deepen and widen the Sabine-Neches Ship Channel, but construction has yet to be initiated due to lack of funding. Saltwater intrusion in the Neches River has, in the past, necessitated the release of large quantities of water from the Sam Rayburn Reservoir to prevent saltwater contamination of industrial, agricultural, and municipal freshwater supply for Beaumont, Texas. To remedy those problems, a permanent saltwater barrier in the Neches River at Beaumont was constructed in 2003.

FISH AND WILDLIFE RESOURCE CONDITIONS

Existing Fish and Wildlife Habitats

The Chenier Plain consists of open water ponds and lakes, cheniers, gulf shorelines, and freshwater, intermediate, brackish, and saline marsh (Giron and Perez 2009). Marshes within Louisiana's Chenier Plain began forming about 3,000-4,000 years ago during periods when the Mississippi River occupied a more westerly course (Gosselink et al.1979). Expansive mud flats were created by large quantities of Mississippi River sediment that periodically accreted along the Gulf shoreline. When the river would shift to a more easterly location, erosion would rework the gulf shoreline to form beach ridges parallel to shore (Gammill et al. 2002). These ridges, consisting mainly of sand and shell, were typically higher in elevation than surrounding marshes and were colonized by live oaks (*Quercus virginiana*). Early explorers called the ridges "chenière," a French word meaning "place of oaks" (Kniffen and Hilliard 1988). Over time, a series of Gulf of Mexico shoreline transgressions and regressions caused by periodic shifting of the Mississippi channel from east to west resulted in the shore-parallel ridge and swale topography that dominates Louisiana's Chenier Plain today (Gammill et al. 2002). Despite substantial hydrologic alterations, wetlands of the Chenier Plain continue to support nationally

significant fish and wildlife resources. They provide important habitat for various species of plants, fish and wildlife, and they serve as ground water recharge areas, provide storage areas for storm and flood waters, serve as natural water filtration areas, provide protection from wave action, erosion, and storm damage, and provide various consumptive and non-consumptive recreational opportunities. Predominant habitats and their associated fish and wildlife values are described below.

Forested Habitat

The four major forest types within the study area include swamp, bottomland hardwood, pine-oak forests, and upland chenier forest. Swamps are generally dominated with baldcypress (*Taxodium distichum*), water tupelo (*Nyssa aquatica*), swamp red maple (*Acer rubrum* var. *drummondii*), and various understory plant species. Coastal swamp forests typically occupy the area between fresh marshes and areas of higher elevation, including the transition zones between bottomland hardwood forests on riverine interdistributary ridges and lower elevation marshes. Healthy cypress swamps occur in fresh water areas experiencing minimal daily tidal action and where the salinity range does not normally exceed 2 parts per thousand (ppt). Salinities of 3 ppt or higher may cause significant stress and mortality of baldcypress. However, short-term exposure to such salinities may be tolerated if it does not penetrate into and persist in the soil (Corps 2009).

Bottomland hardwood forests occur primarily along the floodplains and distributary ridges of the various bayous and rivers within northern portions of the study area. Common tree species include sugarberry (*Celtis laevigata*), water oak (*Quercus nigra*), live oak, nuttall oak (*Quercus nuttallii*), overcup oak (*Quercus lyrata*), bitter pecan (*Carya aquatica*), black willow (*Salix nigra*), American elm (*Ulmus americana*), swamp red maple, box elder (*Acer negundo*), green ash (*Fraxinus pennsylvanica*), and baldcypress (Corps 2009).

The suppression of fire within area pine flatwoods has resulted in the conversion of forests to pine-oak forests. These pine-oak forests are generally found on poorly drained flats and depressional areas north of the GIWW and predominantly around the cities of Sulphur and Lake Charles. Common tree species include slash pine (*Pinus elliottii*), longleaf pine (*Pinus palustris*), water oak, laurel oak (*Quercus laurifolia*), sweet bay (*Magnolia virginiana*), sweetgum (*Liquidambar styraciflua*), rough-leaf dogwood (*Cornus drummondii*), and wax myrtle (*Myrica cerifera*). These former pine flatwood communities may also contain a very diverse herbaceous community that can include many state rare species (Corps 2009).

A unique feature of the Chenier Plain is the chenier ridge habitat that formed on abandoned beach ridges. These ancient beaches, composed primarily of sand and shell, were stranded behind prograding shorelines built during periods of sedimentation fed by the Mississippi River. Common tree species on cheniers include live oak, sugarberry, swamp red maple, sweetgum, and water oak. Red mulberry (*Morus rubra*), toothache-tree (*Zanthoxylum clava-herculis*), and sweet acacia (*Acacia farnesiana*) also occur on these ridges (Corps 2009). Cheniers are important storm surge buffers, often serving as hydrologic barriers that limit saltwater intrusion into interior marshes (Corps 2008). Wooded habitats on the cheniers are critically important stopover habitat for neotropical songbirds migrating across the Gulf (Moore and Simons 1992, Moore 1999).

5

Scrub-Shrub Habitat

Scrub-shrub habitat within the study area often occupies a zone where marshes transition into slightly higher elevation habitats. Scrub shrub habitats are found along bayou ridges and on dredged material embankments, and areas typically bordered by marsh, swamp, or bottomland hardwoods. In saline areas, scrub-shrub communities are dominated by black mangrove (*Avicennia germinans*) on flooded saltmarsh edges, or by marsh elder (*Iva frutescens*) and Eastern baccharis (*Baccharis halimifolia*) on low ridges, bayou banks, and spoil banks and other disturbed areas. Brackish scrub-shrub wetlands are also dominated by eastern baccharis and marsh elder, although wax myrtle (*Morella cerifera*, formerly *Myrica cerifera*) is common on low ridges, bayousides, and spoilbanks as well. Typical scrub-shrub vegetation in intermediate and fresh areas includes elderberry (*Sambucus canadensis*), wax myrtle, buttonbush (*Cephalanthus occidentalis*), rattlebox (*Sesbania drummondii*), Drummond red maple (*Acer rubrum var. drummondii*), Chinese tallow tree (*Sapium sebiferum*), marsh elder, and eastern baccharis. Dwarf palmetto (*Sabal minor*) and prickly pear cactus (*Opuntia spp.*) are common in the understory of Chenier/maritime forest. Yaupon (*Ilex vomitoria*), dwarf palmetto, swamp privet (*Forestiera acuminata*) and Virginia willow (*Itea virginica*) also occur in thickets and the understory of swamps and bottomland hardwood forests (Corps 2009). Those habitats often support a variety of wildlife, depending on local conditions; they provide nesting and feeding sites for wading birds, songbirds and other birds, and wildlife escape cover.

Fresh Marsh

Freshwater marshes are quite heterogeneous, with local species composition governed by frequency and duration of flooding, micro-topography, substrate, current flow and salinity. This marsh type is typically dominated by maidencane, bulltongue, spikerushes, pennywort (*Hydrocotyle* sp.), elephant-ear (*Colocasia esculenta*) and alligatorweed (*Alternanthera philoxeroides*). Other common plants are bullwhip, giant cutgrass (*Zizaniopsis miliacea*), fourchette (*Bidens laevis*) and cattail (*Typha* sp.). Fresh marshes are often very diverse with different species of grasses and broad-leaved annuals waxing and waning throughout the growing season. Chabreck (1972) documented 93 plant species occurring in the fresh marshes of coastal Louisiana. In some areas, fresh marshes consist of nearly pure stands of maidencane. Aquatic plants commonly found in fresh marsh waters are duckweed (*Lemna minor*), coontail (*Ceratophyllum demersum*), Eurasian watermilfoil, southern naiad, water hyacinth (*Eichornia crassipes*), pondweeds (*Potamogeton* spp.), white waterlily (*Nymphaea odorata*), elodea (*Elodea canadensis*), hydrilla (*Hydrilla verticillata*), water celery, water shield (*Brasenia shreberi*), fanwort (*Cabomba caroliniana*), American lotus (*Nelumbo lutea*), and several invasive species of *Salvinia*. Fresh marsh salinity rarely exceeds 2 ppt, with a year-round range of approximately 0.5-1 ppt.

Canal-induced saltwater intrusion has drastically reduced the extent of fresh marsh that historically existed within the Calcasieu-Sabine Basin (Figure 2). However, fresh marsh remains the dominant marsh type within the upper Lakes Sub-basin of the Mermentau Basin (Figure 3).

6

Figure 2. Marsh types (2007) within the Calcasieu-Sabine Basin.

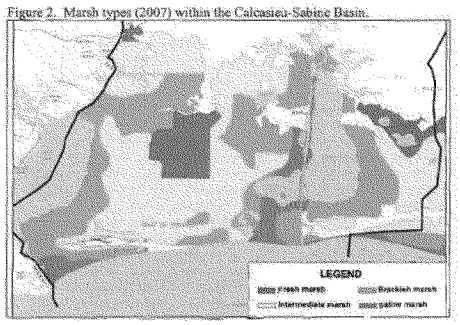
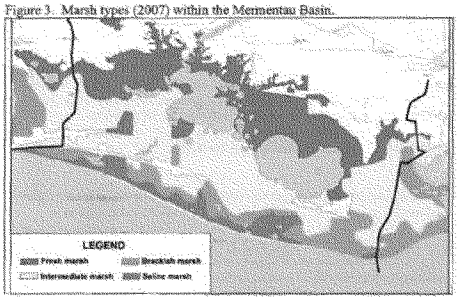


Figure 3. Marsh types (2007) within the Mermentau Basin.



Freshwater marshes support extremely high densities migratory waterfowl and other wildlife. However, because of saltwater intrusion, freshwater marshes have undergone the highest rate of reduction in acreage of any of the marsh type in Louisiana over the past few decades.

7

Intermediate Marsh

Intermediate marsh may occur when annual salinity averages 3 to 4 ppt; but often intermediate marsh salinities may be fresh for much of the year with higher salinity conditions occurring during the late summer and early fall. Chabreck's (1972) identification of 54 species of plants in intermediate marsh indicates that plant species richness is relatively high. The intermediate marsh can be difficult to identify, as it sometimes may appear less as transitional zone between brackish and fresh marshes. Marshhay cordgrass or bulltongue (*Sagittaria lancifolia*) is usually the dominant or co-dominant species. These are commonly accompanied by three-cornered grass, roseau or common reed (*Phragmites australis*), seashore paspalum (*Paspalum vaginatum*), coastal waterhyssop (*Bacopa monnieri*), bullwhip (*Schoenoplectus californicus* formerly *Scirpus californicus*), Walter's millet (*Echinochloa walteri*), sawgrass (*Cladium jamaicense*), deer pea (*Vigna luteola*), rush (*Eleocharis sp.*), dwarf spikerush (*Eleocharis parvula*), and fragrant flatsedge (*Cyperus odoratus*). Aquatic plant species found in intermediate marsh waters include widgeongrass, Eurasian watermilfoil, water celery, and southern naiad (*Najas guadalupensis*). Intermediate marshes are considered extremely important for many wildlife species, such as alligators and wading birds, and serve as important nursery areas for larval marine organisms. Although still a common natural community type in Louisiana, intermediate marsh appears to be declining in aerial extent, which has been attributed to a shift toward brackish marsh due to increased salinity levels. Visser et al. (2000), expanding on previous studies by Penfound and Hathaway (1938) and Chabreck (1970), classified intermediate marsh in the Chenier Plain as a combination of *Cladium jamaicense* (sawgrass), *Spartina patens* (saltmeadow cordgrass), and *Schoenoplectus californicus* (California bulrush).

Intermediate marsh occurs within the more interior portions of the Calcasieu-Sabine Basin where exposure to saltwater intrusion is lessened by distance from saltwater sources. Intermediate marsh may have an irregular tidal regime, with salinity ranging from 3 to 10 ppt. This marsh type is very important to many species of avian wildlife and supports large numbers of wintering waterfowl. It is also critical nursery habitat to larval marine organisms. Gradual changes in salinity conditions can cause this habitat to shift towards brackish marsh.

Brackish Marsh

Inland from salt marsh, and subjected to reduced tidal influence, is brackish marsh. This marsh type is dominated by marsh-hay cordgrass. Brackish marshes are often interspersed with numerous small ponds and water channels and have experienced substantial marsh breakup and degradation in recent years. Salinity levels often range between 0.5 to 5.0 ppt and average salinity is in the range of 8 ppt, however, much higher salinities may occur periodically. In the brackish marsh, marshhay cordgrass is the dominant herbaceous species. Saltgrass, three-cornered grass (*Schoenoplectus americanus*, formerly *Scirpus olneyi*), smooth cordgrass, black needlerush, and leafy three-square (*Schoenoplectus maritimus* formerly *Scirpus maritimus*) are often co-dominant or common in this zone. It should be noted that some of these species also occur in saline marsh, but the order of dominance differs. Chabreck (1972) identified forty species of plants in brackish marsh. Aquatic plants that commonly occur in brackish marsh waters include widgeon grass, Eurasian watermilfoil (*Myriophyllum spicatum*), water celery (*Vallisneria americana*), and horned pondweed (*Zannichellia palustris*). Visser et al. (2000)

8

classified brackish marsh in the Chenier Plain as a combination of *Spartina patens* (saltmeadow cordgrass), *Schoenoplectus americanus* (chairmaker's bulrush), *Schoenoplectus robustus* (sturdy bulrush).

Brackish marshes occur predominantly along the borders of Calcasieu and Sabine Lakes. Brackish marshes are extremely important as nurseries for fish and shellfish. Wading birds, muskrats and shorebirds are also common in such areas.

Saline Marsh

Salt marshes usually receive regular tidal inundation and occur in the most saline zones along the Gulf of Mexico shoreline and adjacent to the Calcasieu Ship Channel. Smooth cordgrass *(Spartina alterniflora)* is the dominant plant in this marsh type, and often forms near-monotypic stands. Herbaceous vegetation of the saline marsh is typically dominated by smooth cordgrass intermixed with saltgrass (*Distichlis spicata*), marshhay cordgrass, black needlerush (*Juncus roemerianus*), and saltwort (*Batis maritima*). Chabreck (1972) identified 12 species of emergent vegetation typically associated with this marsh type. Within the described marsh zones, many ponds and lakes support submerged and/or floating-leafed aquatic vegetation (SAV). Aquatic vegetation is rare in saline waters along the Louisiana coast (Chabreck, 1972). However, widgeon grass (*Ruppia maritima*) may occur in open water areas of saline marshes bordering on the brackish marsh zone and in saline areas where tidal flow has been decreased by structures or other changes in hydrology. Average salinity is approximately 16 ppt. Relative to other marsh types, salt marsh typically supports fewer terrestrial vertebrates although some species like Seaside Sparrows and Clapper Rails are common (Corps 2009). Salinity levels may range from 5.0 to 18 ppt, however, salinities may occasionally be lower or higher.

Saline marsh habitat exists in the project area closest to the Gulf of Mexico beach rim and along the Lower Lake (i.e., river miles (RMs) 5 to 12) and Calcasieu Pass (i.e., RMs 0 to 5) portions of the Calcasieu Ship Channel. Saline marsh is a regularly tidally-flooded habitat having least plant diversity.

Open Water

Small ponds and shallow open water areas associated with each of the above marsh plant communities are scattered throughout the project area. Some of the more defined open water areas include Lake Charles, Prien Lake, Moss Lake, and Calcasieu Lake along the ship channel. Black Lake, Browns Lake, and Mud Lake are open water areas occurring west of the ship channel. Willow Lake and Sweet Lake occur east of the ship channel.

Submerged Aquatic Vegetation Habitat

Some protected shallow open water habitats within the project area support submerged aquatic vegetation (SAV). Prior to Hurricane Rita concentrations of SAVs densities up to 80 percent coverage occurred within Cameron Prairie National Wildlife Refuge (NWR) and those concentrations are expected to return (personal communication with NWR personnel 2007). Project area SAV habitats may include areas of widgeon grass, duckweeds, coontail, bladderworts, watermilfoil, hydrilla, mermaidweeds, and pondweeds. As these aquatic plants die, their decomposition by bacteria and fungi contribute to the food web by providing detritus

9

for many aquatic invertebrates. SAVs are very important to wildlife and are utilized by many duck species.

Developed Lands

Developed areas are located on the higher elevations of the Pleistocene terrace along the GIWW and around the Lake Charles area and are typically well drained. They include agricultural lands and commercial and residential developments. Levees are also included in this category. Levees are frequently mowed, and, as such, provide poor wildlife habitat. Some levees are vegetated with an assortment of scrub/shrub species including marsh elder, eastern baccharis, Chinese tallow tree, common reed, and goldenrod. These higher-elevation areas may provide low-to-moderate-value habitat for terrestrial wildlife, including some migratory bird species.

Existing Fishery Resources

The project-area wetlands and associated shallow waters provide nursery and feeding habitat for recreationally and commercially important estuarine-dependent fishes and shellfishes (e.g., red drum, black drum, Atlantic croaker, spot, sand seatrout, spotted seatrout, southern flounder, Gulf menhaden, striped mullet, blue crab, white shrimp and brown shrimp). Commercial shrimp harvests have been positively correlated with the area of tidal emergent wetlands (Turner 1977 and 1982). Future commercial harvests of shrimp and other fishes and shellfishes would likely be adversely impacted by continued losses in estuarine marsh habitat (Turner 1982). Portions of the project area also provide habitat for freshwater fishes that can tolerate low-salinity conditions, including largemouth bass, bluegill, warmouth, gars, freshwater drum, blue catfish and channel catfish.

Salt and brackish marshes serve as nursery areas for myriads of larval and juvenile shrimp, crabs, redfish, seatrout, Gulf menhaden, etc., and greatly enhance the production of marine organisms. Vegetation production rates in estuarine marshes are extremely high, providing an abundance of detritus to support the estuarine food web.

Much of the existing project area-wetlands are subject to permitted structural management that varies from semi-impounded to completely impounded marsh. The majority of the water control structures within the semi-impounded management areas are supposed to be operated to allow ingress and egress of estuarine fishery organisms, especially brown shrimp and white shrimp, except during drawdowns, periods of high salinity, or waterfowl seasons. Unmanaged coastal wetlands are of particular importance due to their relative scarcity within the Calcasieu-Sabine Basin.

Essential Fish Habitat

Estuarine wetlands and associated shallow waters within the project area have been identified as Essential Fish Habitat (EFH) for both postlarval, juvenile and sub-adult stages of brown shrimp, white shrimp, and red drum, as well as the adult stages of those species in the nearshore and offshore reaches. EFH in the nearshore, marine-portion of the project area and in the lower

10

portions of the estuary has also been designated for the following species and their associated life stages: lane snapper, larvae and juvenile life stages; dog snapper, juvenile life stage; and bonnethead shark, juvenile life stage. EFH requirements vary depending upon species and life stage. Categories of EFH in the project area include estuarine emergent wetlands, estuarine water column, submerged aquatic vegetation, and estuarine water bottoms. Detailed information on Federally managed fisheries and their EFH is provided in the 1998 generic amendment of the Fishery Management Plans for the Gulf of Mexico, prepared by the Gulf of Mexico Fishery Management Council (GMFMC). That generic amendment was prepared in accordance with the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), (P.L. 104-297). Estuarine-dependent species such as those listed above also serve as prey for other species managed under the MSFCMA by the GMFMC (e.g., red drum, mackerels, snappers, and groupers) and highly migratory species (e.g., billfishes and sharks) managed by the NOAA-Fisheries.

Existing Wildlife Resources

The project area supports an array of productive coastal habitats, dominated by intermediate and brackish marshes and associated shallow estuarine waters. The project-area wetlands and adjacent shallow waters, as well as the chenier ridges, support numerous federal-trust wildlife resources, including migratory birds, threatened and endangered species, and various federal and private land holdings that are held or managed to benefit those species.

The chenier and coastal forest habitats associated with the project area provide nesting habitat for songbirds (e.g., the mockingbird, yellow-billed cuckoo, brown thrasher and northern parula), as well as stopover areas for trans-Gulf migrating songbirds. Other avian species found in project area's forested habitats include the American woodcock, common yellow-shafted flicker, belted kingfisher, and several species of raptors (e.g., red-tailed hawk and red-shouldered hawk). Wading bird colonies containing species such as anhinga, great egret, and great blue heron typically occur in wooded wetland and scrub-shrub habitat.

Mammals associated with the project area forested habitats include game species such as eastern cottontail, swamp rabbit, white-tailed deer, and gray and fox squirrels; commercially important furbearers such as river otter, muskrat, and nutria; and other mammal species such as striped skunk, coyote, nine-banded armadillo, and Virginia opossum. Smaller mammals such as the cotton rat, marsh rice rat, and white-footed mouse serve as forage for both mammalian and avian carnivores.

Reptiles which utilize study-area forested habitats include the ground skink, five-lined skink, green anole, and western ribbon snake, and numerous other species. Some of the amphibians expected to be found in study-area forested habitats including small-mouthed salamander, green treefrog, bullfrog, and southern leopard frog.

Wildlife expected to utilize the study-area estuarine marshes include wading birds (e.g., herons, egrets, ibises, and roseate spoonbills), rails, migratory waterfowl (e.g., green-winged teal, blue-

winged teal, mottled duck, gadwall, American widgeon, and lesser scaup), raptors, and songbirds. Brackish marshes having abundant submerged aquatic vegetation often support large numbers of puddle ducks. Shorebirds utilizing estuarine marshes include killdeer, American avocet, black-necked stilt, American oystercatcher, common snipe, and various other species. Seabirds include white pelican, brown pelican, black skimmer, herring gull, laughing gull, and several species of terns. Other nongame birds such as boat-tailed grackle, red-winged blackbird, seaside sparrow, olivaceous cormorant, belted kingfisher, and sedge wren also utilize estuarine marshes.

Estuarine marsh wildlife also includes swamp rabbit, nutria, muskrat, mink, river otter, raccoon, white-tailed deer, and coyote. Reptiles are limited primarily to the American alligator in intermediate and brackish marshes, and the diamond-backed terrapin and gulf salt marsh snake in brackish and saline marshes. Juvenile sea turtles may seasonally utilize bays and saline marsh ponds in the lower Calcasieu Estuary.

Threatened and Endangered Species

Federally listed threatened or endangered species that occur within the study area include the piping plover (*Charadrius melodus*), the whooping crane (*Grus americana*), the West Indian manatee (*Trichechus manatus*), and several species of sea turtles which have also been known to occur in the southern portion of Calcasieu Lake. The red knot (*Calidris canutus rufa*) is proposed for federal listing as a threatened species and the Sprague's pipet (*Anthus spragueii*) is a candidate species for federal listing as a threatened or endangered species.

The piping plover, federally listed as a threatened species, as well as its designated critical habitat, occur along the Louisiana coast. Piping plovers winter in Louisiana, and may be present for 8 to 10 months annually. They arrive from the breeding grounds as early as late July and remain until late March or April. Piping plovers feed extensively on intertidal beaches, mudflats, sand flats, algal flats, and wash-over passes with no or very sparse emergent vegetation; they also require unvegetated or sparsely vegetated areas for roosting. Roosting areas may have debris, detritus, or micro-topographic relief offering refuge to plovers from high winds and cold weather. In most areas, wintering piping plovers are dependent on a mosaic of sites distributed throughout the landscape, because the suitability of a particular site for foraging or roosting is dependant on local weather and tidal conditions. Plovers move among sites as environmental conditions change, and studies have indicated that they generally remain within a 2-mile area. Major threats to this species include the loss and degradation of habitat due to development, disturbance by humans and pets, and predation.

On July 10, 2001, the Service designated critical habitat for wintering piping plovers (Federal Register Volume 66, No. 132). Their designated critical habitat identifies specific areas that are essential to the conservation of the species. The primary constituent elements for piping plover wintering habitat are those habitat components that support foraging, roosting, and sheltering and the physical features necessary for maintaining the natural processes that support those habitat components. Constituent elements are found in geologically dynamic coastal areas that contain intertidal beaches and flats (between annual low tide and annual high tide), and associated dune systems and flats above annual high tide. Important components (or primary constituent

12

elements) of intertidal flats include sand and/or mud flats with no or very sparse emergent vegetation. Adjacent unvegetated or sparsely vegetated sand, mud, or algal flats above high tide are also important, especially for roosting plovers. If implementation of the proposed action has the potential to directly or indirectly affect the piping plover or its critical habitat, further consultation with this office will be necessary.

The red knot (*Calidris canutus rufa*), proposed for federal listing as a threatened species, is a medium-sized shorebird about 9 to 11 inches (23 to 28 centimeters) in length with a proportionately small head, small eyes, short neck, and short legs. The black bill tapers steadily from a relatively thick base to a relatively fine tip; bill length is not much longer than head length. Legs are typically dark gray to black, but sometimes greenish in juveniles or older birds in non-breeding plumage. Non-breeding plumage is dusky gray above and whitish below. The red knot breeds in the central Canadian arctic but is found in Louisiana during spring and fall migrations and the winter months (generally September through March).

During migration and on their wintering grounds, red knots forage along sandy beaches, tidal mudflats, salt marshes, and peat banks. Observations along the Texas coast indicate that red knots forage on beaches, oyster reefs, and exposed bay bottoms, and they roost on high sand flats, reefs, and other sites protected from high tides. In wintering and migration habitats, red knots commonly forage on bivalves, gastropods, and crustaceans. Coquina clams (*Donax variabilis*), a frequent and often important food resource for red knots, are common along many gulf beaches. Major threats to this species along the Gulf of Mexico include the loss and degradation of habitat due to erosion, shoreline stabilization, and development; disturbance by humans and pets; and predation. If implementation of the proposed action has the potential to directly or indirectly affect the red knot or its habitat, further consultation with this office will be necessary.

Beginning in 2010, the Louisiana Department of Wildlife and Fisheries, in cooperation with the U.S. Fish and Wildlife Service and the U.S. Geological Survey, began efforts to establish a nonmigratory flock of whooping cranes (*Grus americana*) into historic southwestern Louisiana habitat on the state-owned White Lake Wetlands Conservation Area in Vermilion Parish, Louisiana. This reintroduced population was designated as a nonessential experimental population (NEP) under section 10(j) of the Endangered Species Act of 1973 (ESA), as amended. A NEP population is a reintroduced population believed not to be essential for the survival of the species, but important for its full recovery and eventual removal from the endangered and threatened list. These populations are treated as "threatened" species except that the ESA's section 7 consultation regulations (requiring consultation with the U.S. Fish and Wildlife Service to reduce adverse impacts from Federal actions) do not apply (except where the species occurs within National Parks or National Wildlife Refuges) and critical habitat cannot be designated. The only natural wild population of the endangered whooping crane remains vulnerable to extirpation through a natural catastrophe or contaminant spill, due primarily to its limited wintering distribution along the Texas gulf coast.

The Sprague's pipit (*Anthus spragueii*), is a candidate species for federal listing as a threatened or endangered species. Candidate species are those taxa for which the Service has on file sufficient information regarding biological vulnerability and threat(s) to support issuance of a

13

proposal to list, but issuance of a proposed rule is currently precluded by higher priority listing actions. Sprague's pipit is a small (4 to 6 inches in length) passerine bird with a plain buffy face, a large eye-ring, and buff and blackish streaking on the crown, nape, and under parts. It winters in Louisiana, arriving from its northern breeding grounds in September and remaining until April. Migration and wintering ecology of this species is poorly known, but Sprague's pipit exhibits a strong preference for open grassland (i.e., native prairie) with native grasses of intermediate height and thickness, and it avoids areas with too much shrub encroachment. Its use of an area is dependent upon habitat conditions. This species is a ground feeder and forages mainly on insects but will occasionally eat seeds.

There is currently no requirement under the Endangered Species Act for consultation regarding project impacts on candidate species. In the interest of conserving the Sprague's pipit, we encourage you to avoid project activities that would adversely affect this species or its habitat. Should it be federally listed as threatened or endangered in the future, however, further consultation on project impacts to this species could then be necessary.

West Indian manatees, federally listed as an endangered species, occasionally enter Lakes Pontchartrain and Maurepas, and associated coastal waters and streams during the summer months (i.e., June through September). Manatees have been regularly reported in the Amite, Blind, Tchefuncte, and Tickfaw Rivers, and in canals within the adjacent coastal marshes of Louisiana. They have also been occasionally observed elsewhere along the Louisiana Gulf coast. The manatee has declined in numbers due to collisions with boats and barges, entrapment in flood control structures, poaching, habitat loss, and pollution. Cold weather and outbreaks of red tide may also adversely affect these animals.

All contract personnel associated with the project should be informed of the potential presence of manatees and the need to avoid collisions with manatees, which are protected under the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973. All construction personnel are responsible for observing water-related activities for the presence of manatee(s). Temporary signs should be posted prior to and during all construction/dredging activities to remind personnel to be observant for manatees during active construction/dredging operations or within vessel movement zones (i.e., work area), and at least one sign should be placed where it is visible to the vessel operator. Siltation barriers, if used, should be made of material in which manatees could not become entangled, and should be properly secured and monitored. If a manatee is sighted within 100 yards of the active work zone, special operating conditions should be implemented, including: no operation of moving equipment within 50 feet of a manatee; all vessels should operate at no wake/idle speeds within 100 yards of the work area; and siltation barriers, if used, should be re-secured and monitored. Once the manatee has left the 100-yard buffer zone around the work area on its own accord, special operating conditions are no longer necessary, but careful observations would be resumed. Any manatee sighting should be immediately reported to the Service's Lafayette, Louisiana Field Office (337/291-3100) and the Louisiana Department of Wildlife and Fisheries, Natural Heritage Program (225/765-2821).)

The National Marine Fisheries Service (NMFS) is responsible for aquatic marine threatened or endangered species. Please contact Eric Hawk (727/570-5312) in St. Petersburg, Florida, for

14

information concerning this and other sea turtle species in their aquatic environment.

Wildlife Management Areas and Parks

Sabine NWR is comprised of 124,511 acres of coastal marsh west of the Calcasieu Lake, and its primary management objective is to preserve a large area of coastal wetlands for wintering and migrating waterfowl from both the Mississippi and Central Flyways. This refuge is also a major nursery area for many estuarine-dependent marine species as well as being the home for alligators and other reptiles, mammals, and numerous wading, water and marsh birds. Cameron Prairie NWR is located east of Calcasieu Lake. Two units (i.e., the Gibbstown and East Cove units) compose this refuge and provide fresh marsh and brackish to saline marsh habitats to support alligators, cottonmouth snakes, white-tailed deer, rabbits, roseate spoonbills, and more than 200 other birds, as well as shrimp, crabs, and many species of fish. Lacassine NWR is located in the Mermentau Basin, northwest of Grand Lake, and is very heavily used by wintering waterfowl. Should proposed project activities directly or indirectly effect those NWRs, please contact Mr. Don Voros, the Southwest Louisiana National Wildlife Refuge Complex Leader (337-598-2216), to obtain a Compatible-Use Determination, and to ascertain the need for a Special Use Permit that may be required should work be conducted on that NWR. The Rockefeller Wildlife Refuge, owned and operated by the Louisiana Department of Wildlife and Fisheries is located south of Grand Chenier in the Mermentau Basin. This 76,000-acre refuge consists of numerous tidal marsh management units operated to provide habitat for wintering migratory waterfowl. Project activities on Rockefeller Refuge should be coordinated with the Refuge manager (337-491-2593).

Future Fish and Wildlife Resources

Loss of coastal marshes is the primary problem affecting study area fish and wildlife resources. Satellite land acreage data (1985-2010) from the U.S. Geological Survey (USGS) was plotted and linear regressions were used to calculate average annual loss rates in percent of 1985 acres per year. Regression derived acreages were aggregated to generate regional loss rates (Figure 4).

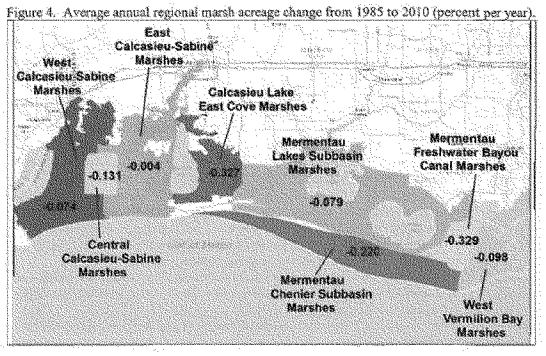
Throughout the study area, an average of 930 acres has been lost per year from 1985 to 2010 (Table 1). Hurricane Rita (2005) and Hurricane Ike (2008) caused substantial marsh losses and have likely driven marsh loss rates higher than the rates that existed prior to those storms.

Table 1. Average annual marsh acres lost (1985 to 2010).

Calcasieu-Sabine Basin				Mermentau Basin	
West Cal-Sab Marshes	Central Cal-Sab Marshes	East Cal-Sab Marshes	East Calcasieu Lake Marshes	Merm. Lakes Subbasin Marshes	Merm. Chenier Subbasin Marshes
-119	-39	-5	-197	-231	-338
			-361		-569

18

Figure 4. Average annual regional marsh acreage change from 1985 to 2010 (percent per year).



Marsh loss within the West Calcasieu-Sabine marshes is the result of recent rapid losses in the Cameron Meadows Oil and Gas Field north of Johnsons Bayou. Observations suggest that the marsh in this area has drowned and no cause is plausible other than mineral extraction related subsidence and associated drowning of marsh vegetation. Without the recent losses in that area, the regional loss rate would actually be positive (no land loss). Central and East Calcasieu-Sabine regions were relatively stable until impacted by Rita and Ike. Recent marsh creation and dredged material disposal efforts have partially offset hurricane related losses in that east region. Marshes east of Calcasieu Lake and throughout the Mermentau Basin were also adversely impacted by these recent hurricanes.

A major cause of marsh loss in the Calcasieu-Sabine Basin has been saltwater intrusion caused by the construction and enlargement of the Calcasieu River and Pass navigation channel, the GIWW, and the Sabine Neches Waterway (LCWCRTF 1998). Those deep-draft channels increased salinity levels throughout the estuary. The increased salinity stressed fresh and intermediate marsh vegetation, contributing to plant death and ultimately conversion of those marshes to shallow open water. Those hydrology changes resulted in the rapid conversion of interior low-salinity marshes to open water and brackish marshes. Once those losses had occurred, loss rates decreased as the most vulnerable areas had become open water. However, saltwater intrusion continues to impact sensitive low-salinity marsh areas during drought-induced high salinity periods.

16

Prior to Hurricanes Rita and Ike, the Lakes Subbasin marshes and other study area marshes were relatively stable. However, significant study area marsh loss occurred prior to 1985 Other Mermentau Basin problems include shoreline erosion along the Gulf of Mexico, which is greatest in the vicinity of Rockefeller Refuge where 30 to 40 feet per year is lost to the Gulf (van Beek and Meyer-Arendt 1982 and Williams et al. 1992).

Shoreline erosion is also a problem along the shores of large lakes such as Calcasieu Lake, Sabine Lake, Grand Lake, and White Lake. Ship wakes and wind waves are the predominant mechanism of erosion causing the Calcasieu Ship Channel to widen at an average of 7.5 feet per year in this reach (Fischenich 2004).

Using tide gage data from the Sabine Pass tide gage and U.S. Army Corps of Engineers methods, a subsidence rate of 3.9 mm/year has been calculated and is assumed to be the rate affecting the entire study area. The combination of subsidence and sea level rise is called submergence or relative sea level rise. Submergence causes marshes to become inundated with higher water levels, stressing most non-fresh marsh plants and leading to plant death and conversion of marshes to open water. Other major causes of study-area marsh loss include altered hydrology, storm events, and developments including the direct and indirect impacts of dredge and fill activities (LCWCRTF 1998).

Wetland losses result in increasing acreage of open water. Continued wetland losses are expected to cause significant declines in coastal fish and shellfish production and in the study area's carrying capacity for migratory waterfowl, wading birds, other migratory birds, alligators, furbearers, and game mammals such as white-tailed deer and swamp rabbit. Wetland losses will also reduce storm surge protection of developed lands, and will likely contribute to water quality degradation associated with excessive nutrient inputs.

Aside from marsh loss, salt water intrusion has converted fresh marsh habitats to more brackish communities. Marshes not hydrologically managed will continue to provide habitat for more salt tolerant species. Because of continued saltwater intrusion, habitat quantity and quality for freshwater fishes, waterfowl, alligators, and more freshwater-tolerant estuarine species (i.e., Gulf menhaden, white shrimp) will continue to decrease throughout most of this area. Habitat quantity will increase for species such as brown shrimp, spotted seatrout, and black drum, which prefer brackish and saline conditions (LCWCRTF 1999). However, continued degradation of those brackish and saline marshes may reduce production of those fish and shellfish.

DESCRIPTION OF ALTERNATIVES AND RECOMMENDED PLAN

Project goals are to provide hurricane protection and ecosystem restoration that improves ecosystem sustainability. Specific planning objectives were identified to solve the problems by taking advantage of opportunities (Table 2).

Table 2. Protection and restoration planning objectives.

Objective No.	Objective Description
1	Reduce the risk of damages and losses from hurricane and storm surge flooding in southwest Louisiana
2	Manage tidal flows in southwest coastal Louisiana to improve drainage and prevent salinity from exceeding 2 ppt for fresh marsh and 6 ppt for intermediate marsh
3	Increase wetland productivity in southwest coastal Louisiana in fresh and intermediate marshes to maintain function by reducing the time water levels exceed marsh surfaces.
4	Reduce shoreline erosion and stabilize canal banks in southwest coastal Louisiana areas to protect adjacent wetlands.
5	Restore landscapes, including marsh, shoreline, and cheniers in southwest coastal Louisiana, to maintain their function as wildlife habitat and improve their ability to serve as protective barriers

Storm surge protection alternatives were developed to protect the communities of Lake Charles/Sulphur and Abbeville/Erath/Delcambre (Figures 5, 6, and 7). Each of those alignments was evaluated at levee heights to protect against 0.5 percent, 1.0 percent, and 2.0 percent annual chance of occurrence storms. In addition to those traditional levee alternatives, non-structural alternatives consisting of buyouts and elevating flood prone structures have also been evaluated throughout the study area.

The only protection levee alignment with a benefit/cost ratio greater than one is the Lake Charles Eastbank alignment. In the Abbeville/Erath/Delcambre area, all of the alternative levee alignments had a benefit/cost ratio less than one. Consequently, the Lake Charles Eastbank alignment has been selected for inclusion in the TSP along with non-structural measures also determined to be most cost effective (Figure 8).

Ecosystem restoration measures were classified into either hydrology/salinity control measures, marsh creation measures, shoreline protection measures, chenier restoration/reforestation, or oyster reef restoration measures (to improve wetland hydrology). The hydrology/salinity control measures consist of water control structures and/or navigation locks at Sabine Pass and Calcasieu Pass to reduce saltwater intrusion into the estuary, or control structures to reduce marsh flooding and saltwater intrusion from Calcasieu Lake into interior marshes. Marsh creation and shoreline protection measures were strategically located to protect areas where erosion and marsh loss could result in the establishment of new channels connecting the Gulf of Mexico with interior marshes. Candidate measures were screened based on cost effectiveness, and only the most cost effective measures were retained.

18

Figure 5. Lake Charles/Sulphur area alternative levee alignments.

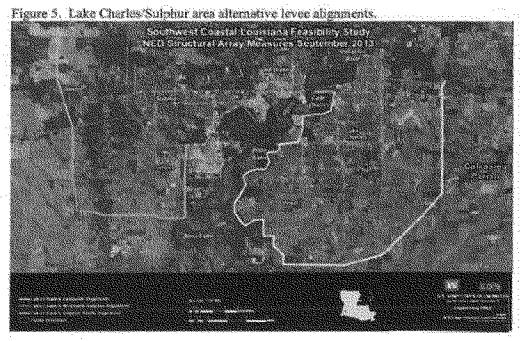
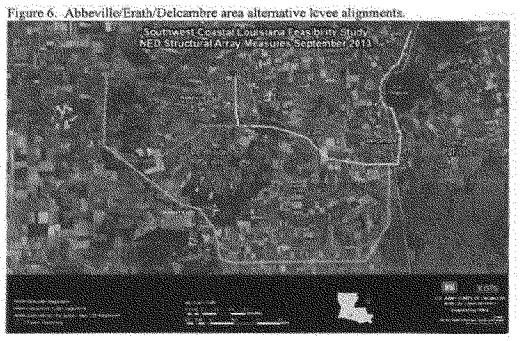


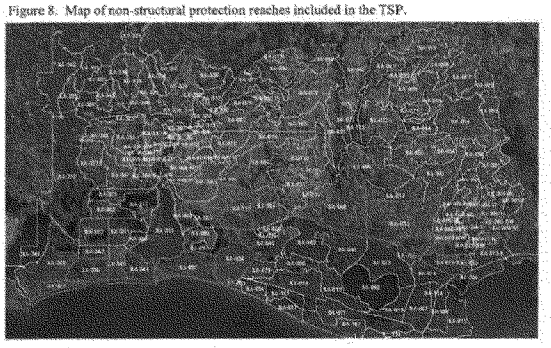
Figure 6. Abbeville/Erath/Delcambre area alternative levee alignments.



19



Figure 8. Map of non-structural protection reaches included in the TSP.



The retained measures were then combined to create an array of restoration alternatives (Table 3). Alternative 1, the Large Integrated Restoration across Basins plan, incorporates all hydrology/salinity control measures, except the Gum Cove Ridge control structure, plus the full array of marsh creation and shoreline protection features, plus all chenier restoration features. Alternative 2, the Moderate Integrated Restoration plan, is similar to Alternative 1 except that it has a reduced number of marsh creation and shoreline protection features. Alternative 3, the Moderate Integrated Restoration Plan with Gum Cove, is identical to Alternative 2 except that it includes the Gum Cove Ridge water control structure. Alternative 4, the Entry Salinity Control plan, includes the water control structures that regulate exchange with the Gulf (this includes the Catfish Point structure), plus a lesser number of marsh creation and shoreline protection features compared to Alternatives 2 and 3. Chenier restoration is included in this and all alternatives. Alternative 5 is similar to Alternative 4 except that Alternative 5, the Interior Perimeter Control plan, includes hydrology/salinity control measures that are limited to the interior perimeter control structures (including the Catfish Point structure and the Gum Cove Ridge structure). Chenier restoration is included in Alternative 5. Alternative 6, the Marsh and Shoreline plan, includes the same interior perimeter hydrology/salinity control measures, minus the Gum Cove control structure, and it includes all marsh creation measures, most of the shoreline protection measures, and all chenier restoration measures.

Table 3. Ecosystem restoration alternatives evaluated.

Alternative Number	Alternative Description
1	Large Integrated Restoration Across Basins
2	Moderate Integrated Restoration
3	Moderate Integrated Restoration w/ Gum Cove
4	Entry Salinity Control Focus
5	Interior Perimeter Control Focus
6	Marsh & Shoreline Focus

Restoration Alternative 4 (Entry Salinity Control Alternative), minus the Calcasieu Pass control structure, was initially chosen as the most cost effective of the comprehensive plans and was included in the TSP. However, subsequent consideration resulted in modifying alternative 4 to eliminate the Sabine Pass salinity control structure (measure 48) and to add the shoreline protection measures on the Gulf shore at Rockefeller Refuge (measures 6B1, 6B2, and 6B3. TSP measures in the Calcasieu-Sabine and the Mermentau Basins are illustrated in Figures 9 and 10, respectively, and listed in Table 4.

21

Table 4. Restoration measures comprising the TSP.

Basin	Measure Type	Measure Number	Measure Description
CS	Oyster Reef	604	Preservation of historic Sabine oyster reefs
CS	Hydrology	74a	Cameron spillway structure at east Calcasieu Lake
CS	Marsh Creation	124c	Marsh creation at Mud Lake
CS	Marsh Creation	124d	Marsh creation at Mud Lake
CS	Marsh Creation	3a1	Beneficial use of dredged material from ship channel
CS	Marsh Creation	3c1	Beneficial use of dredged material from ship channel
CS	Shoreline Prot.	5a	Holly Beach shoreline protection
CS	Chenier Rest.	416	Chenier restoration: Grand Chenier
CS	Chenier Rest.	510a	Chenier restoration: Blue Buck Ridge
CS	Chenier Rest.	510b	Chenier restoration: Hackberry Ridge
CS	Chenier Rest.	510d	Chenier restoration: Front Ridge
Merm	Hydrology	13	Freshwater retention sill on Little Pecan Bayou
Merm	Marsh Creation	127c3	Marsh creation at east Pecan Island
Merm	Marsh Creation	306a1	Marsh creation at Rainey marsh (SW portion)
Merm	Marsh Creation	47a1	Marsh creation using dredged material south of Hwy 82
Merm	Marsh Creation	47a2	Marsh creation using dredged material south of Hwy 82
Merm	Marsh Creation	47c1	Marsh creation using dredged material south of Hwy 82
Merm	Shoreline Prot.	16b	Fortify spoil banks of GIWW and Freshwater Bayou
Merm	Shoreline Prot.	6b1	Gulf shore protection: Calc River to Freshwater Bayou
Merm	Shoreline Prot.	6b2	Gulf shore protection: Calc River to Freshwater Bayou
Merm	Shoreline Prot.	6b3	Gulf shore protection: Calc River to Freshwater Bayou
Merm	Chenier Rest.	416	Chenier restoration: Grand Chenier ridge
Merm	Chenier Rest.	509c	Chenier restoration: Bill Ridge
Merm	Chenier Rest.	509d	Chenier restoration: Cheniere au Tigre
Merm	Chenier Rest.	510d	Chenier restoration: Front Ridge

FISH AND WILDLIFE CONCERNS IN THE PROJECT AREA

Major fish and wildlife resource concerns in the study area include ecosystem-wide hydrologic alterations associated with construction of major navigation channels within the study area and the resulting loss of coastal marsh and the conversion of fresher marshes to more saline habitats. Marsh loss due to shoreline erosion along the Gulf of Mexico is also a problem. The Service is also concerned with water-quality degradation from agricultural and urban run-off, and industrial discharges, into upper Calcasieu Basin waterbodies. Forested areas that once provided habitat for neotropical migrants have suffered extensive losses and continue to be lost to development and sea level rise and subsidence.

The coastal marshes of the Calcasieu-Sabine Basin have been identified by the North American Waterfowl Management Plan (NAWMP), Gulf Coast Joint Venture, as a key waterfowl wintering area. The Gulf Coast is the terminus of the Central and Mississippi Flyways and is

22

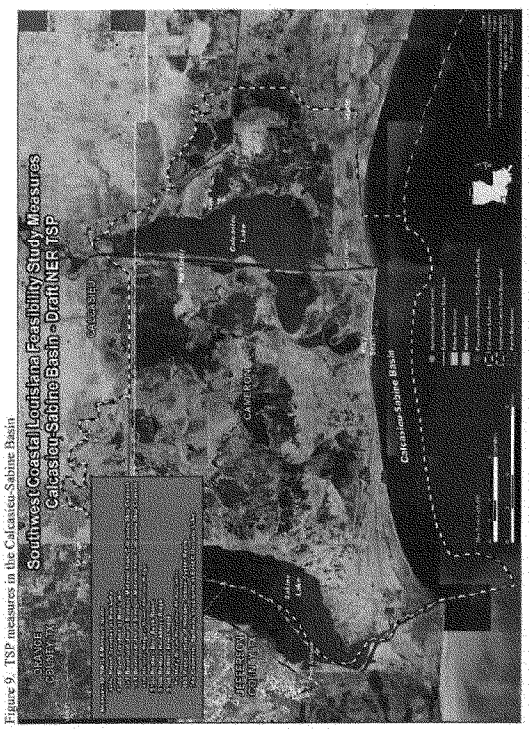
therefore one of the most important waterfowl areas in North America, providing both wintering and migration habitat for significant numbers of the continental duck and goose populations that use both flyways. Aside from being a key waterfowl wintering area, the Chenier Plain provides important year round habitat for over 90 % of the continental population of mottled ducks and serves as a key breeding area for whistling ducks. The goal of the NAWMP, Chenier Plain Initiative is to provide wintering and migration habitat for significant numbers of dabbling ducks, diving ducks, and geese (especially lesser snow and greater white-fronted), as well as year-round habitat for mottled ducks. Because wintering waterfowl prefer fresh and intermediate marshes, and because navigation projects have contributed to substantial reductions in those preferred waterfowl habitats, measures to reduce salinity levels would have a positive impact of waterfowl habitat quantity, quality, and usage.

To counter saltwater intrusion effects resulting from the construction and enlargement of the Calcasieu Ship Channel, and to restore former low-salinity habitats, the U.S. Fish and Wildlife Service installed three water control structures on Sabine National Wildlife Refuge (in 1981) to regulate saltwater intrusion entering marshes west of Calcasieu Lake. Similarly, the U.S. Department of Agriculture's Cameron-Creole Watershed East Cove Unit project (completed in 1989) was constructed to regulate water levels and reduce saltwater intrusion impacts in the fresh and intermediate marsh habitats in the marshes east of Calcasieu Lake. Operation of these water control structures to rectify ecosystem alterations may at times interrupt ingress and egress of estuarine-dependent fish and shellfish, resulting in unintended fisheries impacts. Proposed hydrology restoration measures could also result in additional fisheries impacts. Those impacts could be reduced through water control structure operation plans designed to accommodate fisheries needs to the greatest degree possible, while still achieving salinity control goals.

Concerns exist that a future break of the eroding Gulf of Mexico shoreline into deteriorating interior marshes would create a new tidal pass, and would result in harmful salinity increases within interior marshes. Depending upon the location of such shoreline breaches, the resulting impacts could have ecosystem scale impacts. To avoid such impacts, shoreline protection and marsh creation measures have been proposed in strategic locations where such scenarios appear more likely.

Water quality impacts associated with urban and agriculture runoff are ubiquitous concerns that are difficult to address. However, designing all intercepted drainage pump stations to discharge into wetlands may provide some reduction of those impacts. Borrow canals dredged for levee construction could enhance delivery rates of runoff to wetlands and aggravate such impacts. A more serious concern exists where the proposed levee would be constructed in marshes and waterbottoms contaminated with dioxins, polychlorinated biphenyls and heavy metals. Construction activities might resuspend those contaminants allowing tidal action and rainfall runoff to then distribute the contaminants to other portions of the system.

23


Southwest Coastal Louisiana Feasibility Study Measures
Calcasieu-Sabine Basin - Draft NER TSP
Calcasieu Ship Channel
Calcasieu Lake
Sabine Pass
Sabine Lake
Sabine Ship Channel
Sabine Refuge
Sabine Refuge Marsh Creation
Sabine Refuge Hydrologic Restoration
Sabine Refuge Gulf Shoreline Stabilization
Sabine Refuge Cameron Prairie Ridge Restoration
Sabine Refuge Cameron Prairie Marsh Creation
Sabine Refuge Cameron Prairie Hydrologic Restoration
Sabine Refuge Cameron Prairie Gulf Shoreline Stabilization
Sabine Refuge Cameron Prairie Beneficial Use
Sabine Refuge Beneficial Use
Cameron Parish Gulf Shoreline Stabilization
Cameron Parish Beneficial Use
Calcasieu Ship Channel Beneficial Use
Calcasieu Ship Channel Bank Stabilization
Calcasieu Lake Shoreline Protection
Calcasieu Lake Marsh Creation
Calcasieu Lake Hydrologic Restoration
Calcasieu Lake Beneficial Use
Calcasieu Lake Barrier Island Restoration
Calcasieu Lake Barrier Island Beneficial Use
Calcasieu Lake Barrier Island
Calcasieu Lake
Calcasieu Ship Channel
Calcasieu Lake
Sabine Pass
Sabine Lake
Sabine Ship Channel
Sabine Refuge
Cameron Prairie Ridge Restoration
Cameron Prairie Marsh Creation
Cameron Prairie Hydrologic Restoration
Cameron Prairie Gulf Shoreline Stabilization
Cameron Prairie Beneficial Use

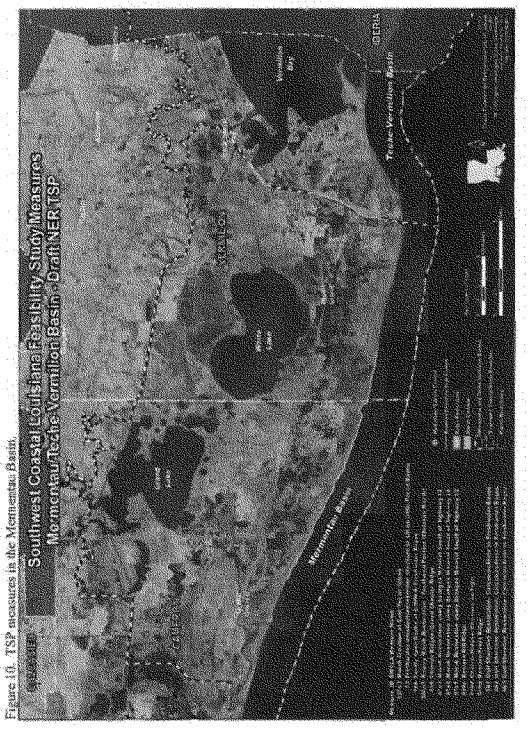


Figure 10. TSP measures in the Morganza Basin.

Study area chenier ridges were historically forested. Residential and agricultural development has resulted in the clearing of most of the formerly forested areas. Mining of sand has also resulted in additional impacts to the chenier forests and to the chenier landforms. In addition to impeding storm surges, forested cheniers provide important stopover habitat for trans-Gulf neotropical migratory songbirds. Proposed measures to restore forested chenier habitats would benefit those migratory species, many of which have experienced population declines in recent decades.

EVALUATION METHODOLOGY

Levee construction impacts were determined by overlaying levee footprint shapefiles on Bing imagery (dated March 2010 to January 2011). After field inspection of impacted areas (September 3, 2013) to confirm habitat types impacted, the acreage of impacted fish and wildlife habitats was digitized and summarized.

The contractor utilized the Wetland Value Assessment (WVA) methodology to determine benefits for environmental restoration measures (benefits in Average Annual Habitat Units [AAHUs]). However, given the preliminary design status of the proposed restoration measures and the compressed study schedule, the Service has instead focused on the contractor's estimated net wetland acreage benefits at the end of the project's 50-year life (future with project acreage minus future without project acreage). Net acres for marsh creation measures were determined using typical spreadsheet methods and standard assumptions (created marshes lost at 50 percent of the background rate). Shoreline protection net acreage was also determined using spreadsheet methods and the assumption that Gulf shoreline protection features reduced background loss rate 50 percent while interior protection features reduced loss rates 100 percent.

Wetland acreage benefits associated with the proposed hydrology/salinity control structures were determined using the Wetland Morphology, Eco-Hydrology, and Vegetation models developed for evaluating the 2012 State Master Plan to provide a scientifically sound and defensible way to estimate the comprehensive benefits of those measures (Meselhe et al. 2013, Couvillion et al. 2013, and Visser et al. 2013). Because those measures were already analyzed using these models as part of the 2012 State Master Plan formulation, those results were used to screen proposed H&S measures. In general, the H&S measures carried forward in the study were those that had larger-scale benefits, i.e., those that helped maintain greater than 500 net acres as determined by the Master Plan models.

POTENTIAL SIGNIFICANT IMPACTS

The resulting preliminary direct construction impacts to marsh and forested areas are provided below for each levee alignment (Table 5). TSP impacts for the Lake Charles Eastbank levee alignment include 23.04 acres of bottomland hardwoods, 6.4 acres of intermediate marsh, 22.16 acres of brackish marsh, and approximately 383.97 acres of non-wetland forest.

26

Table 5. Preliminary direct levee construction impacts to wetlands and forested habitats.

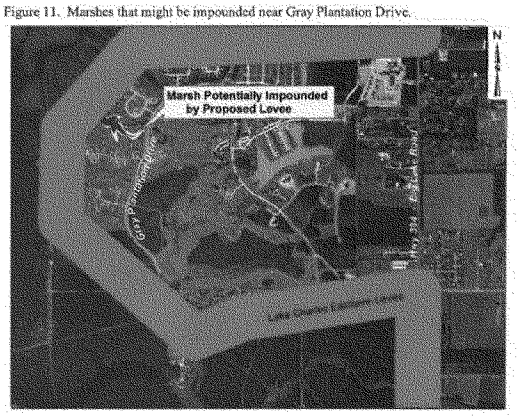
Habitat Type	Lake Charles Sulphur South Alignment (acres)	Lake Charles Westbank Sulphur Alignment (acres)	Lake Charles Eastbank Alignment (acres)	Abbeville to Delcambre Hwy 330 Alignment (acres)	Abbeville Alignment (acres)	Delcambre Erath Alignment (acres)
Pine Plantation	0.00	0.00	39.71	0.00	0.00	0.00
Dry Pine-Oak	161.88	54.92	99.68	0.00	0.00	0.00
Dry Hardwoods	0.00	0.00	0.00	12.78	19.41	7.13
Hydric Pine-Oak	216.76	0.00	284.31	0.00	0.00	0.00
Bottomland Hardwoods	0.00	0.00	23.04	16.63	13.80	4.30
Brackish Marsh	27.79	19.40	22.16	0.00	0.00	0.00
Intermediate Marsh	0.00	0.00	6.40	0.00	0.00	0.00
Swamp	0.00	0.00	0.00	0.00	0.00	45.64
Wetland TOTAL	27.79	19.40	51.60	16.63	13.80	49.83

Construction impacts to non-forested agriculture, residential, industrial, or pasture areas have not been determined. The impacted acreages do not include impacts associated with excavation for borrow material. Some levee reaches may block existing drainage ditches and bayous. As a result, levee construction may cause interrupted drainage impacts to developed property and/or adjacent wetlands. For example, in southwestern Lake Charles, near Graywood Plantation Drive, approximately 2.6 acres of brackish marsh would be impounded if drainage structures are not included to maintain tidal hydrology (Figure 11). Additional marsh impoundment impacts may occur in that area, but those impacts cannot be accurately determined because the planning of levee features has not advanced sufficiently. Tidal marshes, forested wetlands, and other forest habitats might also be impounded if drainage structures are not included to provide drainage and maintain tidal hydrology during non-storm periods. Impoundment impacts might range from destroying these habitats to lesser impacts that would reduce habitat quality. Measures to alleviate such indirect impacts have not been developed, nor have such indirect construction impacts been fully determined.

Although ecosystem restoration measures were evaluated using several different methodologies, net wetland acreage (future with project acres minus future without project acres at the end of the 50-year project life) was computed within each methodology (Table 6). Those net acreage values have been used as the benefit metric to compute the cost per benefit values (i.e., cost per year 50 net acreage) used to select the TSP.

27

Figure 11. Marshes that might be impounded near Gray Plantation Drive.



28

Table 6. Predicted benefits of ecosystem restoration alternatives.

Alternative	Alternative Description	Acres Created	Acres Nourished	Total Acres	Net Acres	AAHU's
1	**Large Integrated Restoration Across Basins**				**31,950**	**17,938**
	Marsh Creation	20,149	5,522	25,671	17,807	8,726
	Shoreline Protection				6,614	1,939
	Hydro & Salinity Control				5,126	6,695
	Chenier Reforestation			1,413	1,413	538
2	**Moderate Integrated Restoration**				**28,077**	**14,905**
	Marsh Creation	16,059	3,306	19,365	13,820	6,916
	Shoreline Protection				4,847	1,559
	Hydro & Salinity Control				7,997	5,892
	Chenier Reforestation			1,413	1,413	538
3	**Moderate Integrated Restoration w/ Gum Cove**				**21,849**	**13,223**
	Marsh Creation	16,059	3,306	19,365	13,820	6,916
	Shoreline Protection				4,847	1,559
	Hydro & Salinity Control				1,769	5,230
	Chenier Reforestation			1,413	1,413	538
4	**Entry Salinity Control Focus**				**20,577**	**9,785**
	Marsh Creation	8,579	4,026	12,605	8,714	4,194
	Shoreline Protection				1,314	268
	Hydro & Salinity Control				9,136	4,785
	Chenier Reforestation			1,413	1,413	538
5	**Interior Perimeter Control Focus**				**12,129**	**5,238**
	Marsh Creation	8,579	4,026	12,605	8,714	4,194
	Shoreline Protection				1,314	268
	Hydro & Salinity Control				688	238
	Chenier Reforestation			1,413	1,413	538
6	**Marsh & Shoreline Focus**				**24,449**	**14,937**
	Marsh Creation	20,149	5,522	25,671	17,807	8,726
	Shoreline Protection				4,895	1,559
	Hydro & Salinity Control				334	4,314
	Chenier Reforestation			1,413	1,413	538

The TSP (see Table 4) is comprised of measures which differ somewhat from those within restoration alternative 4. Estimated acreage benefits of the TSP are provided in Table 7.

Table 7. Estimated benefits of the TSP.

Measure Type	Benefits
Marsh Creation	Net acres = 8714 (create 8579 ac and nourish 4026 acres)
Shoreline Prot.	Net acres = 5509 (266,884 linear feet of protection)
Hydrology	Net acres = 6092 (East Calc. Lake Spillway, Little Pecan Bayou sill)
Chenier Rest.	Reforest 1413 acres

29

FISH AND WILDLIFE CONSERVATION MEASURES

The President's Council on Environmental Quality defined the term mitigation in the National environmental Policy Act regulations to include:

a) avoiding the impacts altogether by not taking a certain action or parts of an action;
b) minimizing impacts by limiting the degree or magnitude of the action and its implementation;
c) rectifying the impacts by repairing, rehabilitating, or restoring the affected environment;
d) reducing or eliminating the impacts over time by preservation and maintenance operations during the life of the action; and,
e) compensation for the impacts by replacing or providing substitute resources or environments.

The Service's mitigation policy (Federal Register, Volume 46, Number 15, pages 7656-7663, January 23, 1991) provides guidance to help ensure that the level of mitigation recommended by the Service is consistent with the value and scarcity of the fish and wildlife resources involved. In keeping with that policy, the Service usually recommends that losses of high-value habitats which are becoming scarce be avoided or minimized to the greatest extent possible. Unavoidable losses of such habitats should be fully compensated by replacement of the same kind of habitat value; this is called in-kind mitigation. The mitigation planning goals and associated Service recommendations should be based on the four categories, as shown in Table 8.

Table 8. U. S. Fish and Wildlife Service Resource Categories.

FWS Resource Categories
Resource Category 1 - Habitat to be impacted is of high value for evaluation species and is unique and irreplaceable on a national basis or in the ecoregion section. The mitigation goal for this Resource Category is that there should be no loss of existing habitat value.
Resource Category 2 - Habitat to be impacted is of high value for evaluation species and is relatively scarce or becoming scarce on a national basis or in the ecoregion section. The mitigation goal for habitat placed in this category is that there should be no net loss of in-kind habitat value.
Resource Category 3 - Habitat to be impacted is of high to medium value for evaluation species and is relatively abundant on a national basis. FWS's mitigation goal here is that there be no net loss of habitat value while minimizing loss of in-kind habitat value.
Resource Category 4 - Habitat to be impacted is of medium to low value for evaluation species. The mitigation goal is to minimize loss of habitat value.

30

Bottomland hardwood forests and coastal marshes are considered by the Service to be aquatic resources of national importance due to their increasing scarcity and high habitat value for fish and wildlife within Federal trusteeship (i.e., migratory waterfowl, wading birds, other migratory birds, threatened and endangered species, and interjurisdictional fisheries). Therefore, the Service recommends that unavoidable losses of those habitats should be compensated via in-kind replacement. Because of schedule constraints, habitat quality assessments could not be conducted and only acreages of impacted habitats are available at this time (see Table 4).

Dry (non-hydric soil) hardwoods, dry (non-hydric soil) pine-oak forest, and hydric soil pine-oak forest habitats impacted by levee construction are considered to be relatively abundant. These are assumed to be Resource Category 3 habitats and impacts to such habitats may be mitigated out of kind, but mitigation should consist of some type of forested habitat. The 1,413 acres of proposed chenier reforestation would likely provide more than adequate compensation for impacted Resource Category 3 forest habitats provided that the chenier reforestation is successful. However, the restored chenier habitats will not likely provide sufficient wetland characteristics to mitigate impacts to hydric soil bottomland hardwoods. Consequently, the Service recommends that impacted bottomland hardwood forests be mitigated through a mitigation bank or through other means.

Construction of the proposed protection levee is anticipated to directly impact 28.56 acres of emergent marsh. Indirect levee impacts to marsh and bottomland hardwoods are likely to occur, but the acreage is not yet known. The 8,579 acres of proposed marsh creation would likely provide more than enough mitigation to compensate for both the direct and indirect marsh impacts. However, the proposed marsh creation measures must also address the need to mitigate the marsh impacts in kind (by habitat type). If the proposed marsh creation measures sufficiently address the in-kind requirements, provide a sufficient quantity of compensation, and if the mitigation is successful, then the proposed marsh creation measures may mitigate the unavoidable impacts associated with levee construction.

SERVICE POSITION AND RECOMMENDATIONS

Because the study schedule has precluded detailed planning and interagency input regarding the proposed levee alignments and ecosystem restoration measures, it is likely that further planning and/or agency and public review may result in modifications to those alignments and proposed restoration measures. The Service recommends that levee alignment modifications be made to further reduce impacts to wetlands and forested habitats, and to avoid or reduce indirect impacts to such habitats through interrupted drainage. To avoid interrupted drainage impacts, additional measures such as runoff collection canals and drainage structures through the levee will be needed to maintain drainage of the protected area. The addition of those drainage measures will likely increase costs and project-related wetland impacts. The Service recommends that the Corps solicit input from the Service and other interested natural resources agencies regarding levee alignment modifications to reduce wetland impacts and to develop features to provide drainage of protected areas. Because borrow locations have not yet been identified, borrow

impacts cannot be determined. Additional environmental review and clearance for the borrow sites should be sought once those sites have been determined.

Discharge of polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), dioxins/furans, heavy metals, and other hazardous compounds into Bayou D'Inde, Bayou Verdine, and the upper Calcasieu River has impacted the upper Calcasieu River estuary adjacent to the proposed TSP protection levee feature. Dredging and site preparation associated with levee construction in those areas may resuspend contaminants and increase their bioavailability to fish and shellfish which provide an important food source for other fish, alligators, wading birds, and other migratory birds and wildlife.

The Service recommends that the project sponsors conduct a Hazardous, Toxic and Radioactive Waste (HTRW) assessment of tidally influenced levee construction locations and subaqueous marsh creation borrow sites. If those HTRW assessments indicate that contamination exceeds NOAA screening levels, then alternative locations should be considered, or, special procedures (e.g., use sediment curtains, etc.) should be implemented to reduce or prevent contaminant re-suspension and dispersal into important downstream fish and wildlife habitats.

For the proposed marsh creation measures, details regarding containment dike location and design, fill elevation, spill box locations, dike degradation protocols, vegetative planting protocols, and other details have not yet been made available to the Service or other interested resource agencies. The Service requests that the Corps work with the Service and interested natural resource agencies to finalize those planning details.

Because submerged aquatic vegetation provides food for migratory waterfowl, and provides high quality nursery habitat for estuarine dependent fisheries (Castellanos and Rozas 2001, and Kanouse et al. 2006), the open water areas targeted for marsh creation measures should avoid areas of dense submerged aquatic vegetation to the greatest degree possible.

Details regarding other ecosystem restoration features such as shoreline protection measures have not yet been provided to the Service. The Service requests that the Corps work with the Service and interested natural resource agencies to finalize those planning details. To understand and concur with the estimated benefits for the installation and operation of the proposed salinity control structures, the assumptions used and an explanation of the modeling methods should be provided to the Service and other interested natural resource agencies.

Ecosystem restoration measures could potentially mitigate all project-related direct and indirect construction impacts. For the restoration measures selected to provide mitigation, the Service recommends that the Corps address the 12 mitigation planning requirements (Appendix A) for each selected mitigation feature.

To determine if mitigation measures have been successful, the Service recommends that the Corps utilize the final mitigation performance protocols developed for the Hurricane Storm Damage Risk Reduction Study. For ecosystem restoration measures not being used to mitigate construction impacts, the Service recommends that the Corps conduct monitoring of those

32

features to document the degree of success achieved. The Service and other interested natural resource agencies should be involved in developing those monitoring criteria and in the review of subsequent monitoring information and reports.

Because many design details regarding the proposed surge protection levees are yet to be developed, additional planning work must be conducted before impacts can be fully determined. Similarly, the proposed ecosystem restoration measures need additional planning work and interagency coordination to finalize estimated benefits and impacts with any degree of certainty. To complete needed planning of project features, to reduce and avoid project-related adverse impacts to fish and wildlife resources, and to enhance the desired ecosystem benefits, the Service provides the following recommendations:

1. The Corps should conduct further planning of the proposed protection levee to reduce and avoid impacts to wetlands and forest habitats. Additional levee planning work should also include the development of measures to avoid interrupted drainage impacts in a manner that reduces or avoids impacts to wetlands and forested habitats. The additional planning work should be coordinated with the Service and other interested natural resource agencies. Any pump stations needed for drainage of the protected area should be designed to discharge into wetlands to reduce adverse effects of discharging runoff directly into open water bodies

2. The Corps should also determine where levee borrow material will be obtained.

3. To the greatest degree practical, borrow pits for construction of proposed levee and marsh creation measures should be located to avoid and minimize direct and indirect impacts to vegetated wetlands. Efforts should be made to further reduce those direct impacts by hauling in fill material, using sheetpile for the levee crest, deep soil mixing, or other alternatives. Borrow pit construction should also avoid the following:
   a. avoid inducing wave refraction/diffraction erosion of existing shorelines
   b. avoid inducing slope failure of existing shorelines
   c. avoid submerged aquatic vegetation
   d. avoid increased saltwater intrusion
   e. avoid excessive disturbance to area water bottoms
   f. avoid inducing hypoxia

4. Once levee planning has been completed, the Corps should revise estimates of direct and indirect impacts to wetlands and forested habitats, including impacts associated with acquisition of borrow material. That work should be conducted in cooperation with the Service and other interested natural resource agencies.

5. The Corps should conduct a Hazardous, Toxic and Radioactive Waste (HTRW) assessment of tidally influenced levee construction locations and subaqueous marsh creation borrow sites. If those HTRW assessments indicate that contamination exceeds NOAA screening levels, then alternative locations should be considered, or, explanation

of the containment methods that would allow levee construction should be provided to the Service and other interested natural resource agencies.

6. For ecosystem restoration measures not being used to mitigate construction impacts, the Service recommends that the Corps conduct monitoring of those features to document the degree of success achieved. The Service and other interested natural resource agencies should be involved in developing those monitoring criteria and in the review of subsequent monitoring information and reports. For mitigation features, the Service also recommends that all interested natural resource agencies be involved in the planning of project features, monitoring plans, development of success criteria, and adaptive management plans. In addition, all mitigation plans should address the 12 mitigation requirements in Appendix A.

7. The Corps should obtain a right-of-way from the Service prior to conducting any work on Sabine or Cameron Prairie National Wildlife Refuges, in conformance with Section 29.21-1, Title 50, Right-of-Way Regulations. Issuance of a right-of-way will be contingent on a determination that the proposed work will be compatible with the purposes for which the Refuge was established.

8. All construction or maintenance activities (e.g., surveys, land clearing, etc.) on National Wildlife Refuges (NWRs) will require the Corps to obtain a Special Use Permit from the Refuge Manager of the Southwest Louisiana Refuge Complex; furthermore, all activities on NWRs must be coordinated with the Refuge Manager. Therefore, we recommend that the Corps request issuance of a Special Use Permit well in advance of conducting any work on the refuge. Please contact the Refuge Manager (337/598-2216 or SWLRComplex@fws.gov) for further information on compatibility of proposed ecosystem restoration measures, and for assistance in obtaining a Special Use Permit. Close coordination by both the Corps and its contractor must be maintained with the Refuge Manager to ensure that construction and maintenance activities are carried out in accordance with provisions of any Special Use Permit issued by the NWR.

9. The Corps should contact the Louisiana Department of Wildlife and Fisheries prior to conducting any work on Rockefeller Refuge (337-491-2593).

10. The Corps should continue to coordinate with the Service throughout planning and construction to ensure that the proposed project does not impact waterbird nesting colonies, and threatened or endangered species that may be listed in the future.

Given that the design and evaluation of most project features has been at a programmatic level, the Service cannot fulfill its Fish and Wildlife Coordination Act (FWCA)(48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) responsibilities at this time. Therefore, this draft report is presented in partial fulfillment of that act and does not constitute the final report of the Secretary of Interior as required by Section 2(b) of the FWCA. To complete those assessments, we will require additional funding during the project's pre-construction engineering and design phase.

34

Estimates of those funding needs should be coordinated in advance with the Service, and should be based on the extent of remaining work and the nature and complexity of issues associated with the remaining planning/design issues.

35

LITERATURE CITED

Castellanos, D.L. and L.P. Rozas. 2001. Nekton use of submerged aquatic vegetation, marsh, and shallow unvegetated bottom in the Atchafalaya River Delta, a Louisiana tidal freshwater ecosystem. Estuaries. Vol. 24, No. 2, p. 184-197.

Chabreck, R.H. 1970. Marsh zones and vegetative types in the Louisiana coastal region. Ph.D. Dissertation, Louisiana State University, Baton Rouge, Louisiana.

Chabreck, R.H. 1972. Vegetation, water, and soil characteristics of the Louisiana coastal region. La. State Univ., Baton Rouge. Agric. Expt. Stn. Bull. No. 664. 72 pp.

Couvillion, B. R., Steyer, G. D., Hongqing, W., Beck, H. J., & Rybczyk, J. M. 2013. Forecasting the Effects of Coastal Protection and Restoration Projects on Wetland Morphology in Coastal Louisiana under Multiple Environmental Uncertainty Scenarios. Journal Of Coastal Research, 29-50. doi:10.2112/SI_67_3

Fischenich, J. C. 2004. Draft. Calcasieu River and Ship Channel Erosion and Sediment Impact Assessment (Phase 1). U.S. Army Corps of Engineers, ERDC Environmental Laboratory.

Gammill, S, K. Balkum, K. Duffy, E. Meselhe, J. Porthouse, E. Ramsey, and R. Walters. 2002. Hydrologic Investigation of the Louisiana Chenier Plain. Prepared for the Louisiana Coastal Wetlands Conservation and Restoration Task Force. Louisiana Department of Natural Resources, Coastal Restoration Division, Baton Rouge, LA. 135 pp.

Giron, C. and B. Perez. 2009. Existing Conditions Report for the Southwest Coastal Louisiana Feasibility Study. Prepared by CH2MHill for the Louisiana Office of Coastal Protection and Restoration, the U.S. Army Corps of Engineers, and the Southwest Coastal Louisiana Project Delivery Team. 33pp.

Gosselink, J. G., C. L. Cordes, and J. W. Parsons. 1979. An ecological characterization of the chenier plain coastal ecosystem of Louisiana and Texas, vol. I. FWS/OBS-78/9. 301 pp.

Kanouse, S., M.K. LaPeyre, and J.A. Nyman. 2006. Nekton use of Ruppia maritime and non-vegetated bottom habitat types within brackish marsh ponds. Mar. Ecol. Prog. Ser. Vol. 327:61-69.

Kniffen, F. B., and S. B. Hilliard. 1988. Louisiana — its land and people. Louisiana State University Press, Baton Rouge. 213 pp.

Lopez, J., N. Snider, C. Dufrechou, M. Hester, P. Keddy, P. Kemp, B. Kohl, S. Kulkarni, A. McCorquodale, M. O'Connell, J. Suhayda, B. Rogers, and D. Bollinger. 2008. Comprehensive Recommendations Supporting the Use of the Multiple Lines of Defense

Strategy to Sustain Coastal Louisiana (Version I). Published by the Multiple Lines of Defense Assessment Team with funding from the McKnight Foundation. 408pp.

Louisiana Coastal Wetlands Conservation and Restoration Task Force. 1998. Coast 2050: Toward a Sustainable Coastal Louisiana. Louisiana Department of Natural Resources. Baton Rouge, Louisiana. 161pp.

Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority. 1999. Coast 2050: Toward a Sustainable Coastal Louisiana, The Appendices. Appendix F— Region 4 Supplemental Information. Louisiana Department of Natural Resources. Baton Rouge, La.

Meselhe, E., McCorquodale, J., Shelden, J., Dortch, M., Stokka Brown, T., Elkan, P., Rodrigue, M., Schindler, J., & Zhanxian, W. 2013. Ecohydrology Component of Louisiana's 2012 Coastal Master Plan: Mass-Balance Compartment Model. Journal Of Coastal Research, 16-28. doi:10.2112/SI_67_2.1

Moore, F. 1999. Neotropical migrants and the Gulf of Mexico: the cheniers of Louisiana and stopover ecology. Pp. 51-62 In Gathering of Angels, Migrating Birds and their Ecology (K.P. Able, Editor). Oxford University Press, New York. 489 pp.

Moore, F., and T.R. Simons. 1992. Habitat suitability and stopover ecology of neotropical landbird migrants. Pp. 345-355 In Ecology and Conservation of Neotropical Migrant Landbirds. Edited by J.M. Hagan and D. Johnston. Smithsonian Institution Press.

Penfound, W.T. and E.S. Hathaway. 1938. Plant communities in the marshland of southeastern Louisiana. Ecological Monographs. 8:1-56.

Penland, S. and J.R. Suter. 1989. The geomorphology of the Mississippi River Chenier Plain. In: P.G.E.F. Augustinus (Editor), Cheniers and Chenier Plains. Mar. Geol. 90: 231-258.

Turner, R.E. 1977. Intertidal vegetation and commercial yields of penaeid shrimp. Trans. Am. Fish. Soc. 106:411-416.

Turner, R.E. 1982. Wetland losses and coastal fisheries: an enigmatic and economically significant dependency. *In* Boesch, D.F.(ed.). Proceedings of the conference on coastal erosion and wetland modification in Louisiana: causes, consequences, and options. U.S. Fish and Wildlife Service, Biological Services Program, Washington, D.C. FWS/OBS-82/59. 256 pp.

U.S. Army Corps of Engineers. 1999. The Mermentau Basin Project. New Orleans District Report. 11pp.

U.S. Army Corps of Engineers. 2008. Southwest Coastal Louisiana Feasibility Study. Project Management Plan. 36pp.

U.S. Army Corps of Engineers. 2009. Louisiana coastal protection and restoration final technical report: Appendix, coastal restoration plan and structural environmental impacts. 347pp.

Van Beek, J.L. and K.J. Meyer-Arendt. 1982. Louisiana's eroding coastline: recommendations for protection. Coastal Environments, Inc., Baton Rouge, LA.

Visser, J.M, C.E. Sasser, R.H. Chabreck, and R.G. Linscombe. 2000. Marsh vegetation types of the Chenier Plain, Louisiana, USA. Estuaries. 23: 318-327.

Visser, J. M., Duke-Sylvester, S. M., Carter, J., & Broussard III, W. P. 2013. A Computer Model to Forecast Wetland Vegetation Changes Resulting from Restoration and Protection in Coastal Louisiana. Journal Of Coastal Research, 51-59. doi:10.2112/SI_67_4

Williams, S.J., S. Penland, A.H. Sallenger, Jr., editors. 1992. Atlas of shoreline changes in Louisiana from 1853 to 1989. Prepared by the U.S. Geological Survey and the Louisiana Geological Survey.

APPENDIX A

TWELVE REQUIRMENTS FOR MITIGATION PLANNING
(from the U.S. Army Corps of Engineers & EPA 2008 Final Mitigation Rule in the FEDERAL REGISTER Vol. 73, No. 70, April 10, 2008)

Twelve Requirements for a Compensatory Mitigation Plan

1. Objectives. A description of the resource type(s) and amount(s) that will be provided, the method of compensation (restoration, establishment, preservation etc.), and how the anticipated functions of the mitigation project will address watershed needs.

2. Site selection. A description of the factors considered during the site selection process. This should include consideration of watershed needs, onsite alternatives where applicable, and practicability of accomplishing ecologically self-sustaining aquatic resource restoration, establishment, enhancement, and/or preservation at the mitigation project site.

3. Site protection instrument. A description of the legal arrangements and instrument including site ownership, that will be used to ensure the long-term protection of the mitigation project site.

4. Baseline information. A description of the ecological characteristics of the proposed mitigation project site, in the case of an application for a DA permit, the impact site. This may include descriptions of historic and existing plant communities, historic and existing hydrology, soil conditions, a map showing the locations of the impact and mitigation site(s) or the geographic coordinates for those site(s), and other characteristics appropriate to the type of resource proposed as compensation. The baseline information should include a delineation of waters of the United States on the proposed mitigation project site. A prospective permittee planning to secure credits from an approved mitigation bank or in-lieu fee program only needs to provide baseline information about the impact site.

5. Determination of credits. A description of the number of credits to be provided including a brief explanation of the rationale for this determination.
   - For permittee-responsible mitigation, this should include an explanation of how the mitigation project will provide the required compensation for unavoidable impacts to aquatic resources resulting from the permitted activity.
   - For permittees intending to secure credits from an approved mitigation bank or in-lieu fee program, it should include the

39

number and resource type of credits to be secured and how these were determined.

6. Mitigation work plan. Detailed written specifications and work descriptions for the mitigation project, including: the geographic boundaries of the project; construction methods, timing, and sequence; source(s) of water; methods for establishing the desired plant community; plans to control invasive plant species; proposed grading plan; soil management; and erosion control measures. For stream mitigation projects, the mitigation work plan may also include other relevant information, such as planform geometry, channel form (e.g., typical channel cross-sections), watershed size, design discharge, and riparian area plantings.

7. Maintenance plan. A description and schedule of maintenance requirements to ensure the continued viability of the resource once initial construction is completed.

8. Performance standards. Ecologically-based standards that will be used to determine whether the mitigation project is achieving its objectives.

9. Monitoring requirements. A description of parameters monitored to determine whether the mitigation project is on track to meet performance standards and if adaptive management is needed. A schedule for monitoring and reporting monitoring results to the DE must be included.

10. Long-term management plan. A description of how the mitigation project will be managed after performance standards have been achieved to ensure the long-term sustainability of the resource, including long-term financing mechanisms and the party responsible for long-term management.

11. Adaptive management plan. A management strategy to address unforeseen changes in site conditions or other components of the mitigation project, including the party or parties responsible for implementing adaptive management measures.

12. Financial assurances. The DE may require additional information as necessary to determine the appropriateness, feasibility, and practicability of the mitigation project.

Other information. The DE may require additional information as necessary to determine the appropriateness, feasibility, and practicability of the mitigation project.

40

SOUTHWEST COASTAL LOUISIANA
REVISED INTEGRATED DRAFT FEASIBILITY REPORT
AND
ENVIRONMENTAL IMPACT STATEMENT

APPENDIX A

Annex H

U.S. Fish and Wildlife Service Scoping / Planning Aid Letter /

Coastal Barrier Resources Act Determination

United States Department of the Interior

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506
October 9, 2009

Colonel Alvin B. Lee
District Engineer
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Colonel Lee:

Please reference your September 29, 2009, letter requesting our participation as a cooperating agency for the Southwest Coastal Louisiana Protection and Restoration Feasibility Study that would be conducted by the U.S. Army Corps of Engineers (Corps). The study, which would involve the preparation of an environmental impact statement (EIS), would investigate the feasibility of providing Federal hurricane protection and storm damage reduction, as well as restoring and protecting fish and wildlife habitat, in portions of Calcasieu, Cameron, and Vermilion Parishes. The study would include the development of alternative plans (which may incorporate both structural and nonstructural components), identification of significant environmental resources, assessment of beneficial and adverse impacts, and formulation of compensatory mitigation measures, if necessary. The U.S. Fish and Wildlife Service (Service) has reviewed the information provided, and offers the following comments in accordance with the National Environmental Policy Act (NEPA) of 1969 (83 Stat. 852; 42 U.S.C. 4321 et seq.), and the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

The Corps and the Service have formally committed to work together to conserve, protect, and restore fish and wildlife resources while ensuring environmental sustainability of our Nation's water resources under the January 22, 2003, Partnership Agreement for Water Resources and Fish and Wildlife. Accordingly, the Service would be pleased to serve as a cooperating agency in developing the EIS for the proposed project in accordance with applicable NEPA/Council on Environmental Quality guidance. Our participation will be specifically limited to: 1) participating in meetings and field trips to obtain baseline information on project-area fish and wildlife resources; 2) evaluating the proposed project's impacts to wetlands and associated fish and wildlife resources, and assisting in the development of measures to avoid, minimize, and/or compensate for those impacts; and 3) providing technical assistance in the development of a Biological Assessment describing the impacts of the proposed activity to federally listed threatened or endangered species and/or their critical habitat.

We appreciate the opportunity to assist the Corps during the planning of the proposed feasibility study. If you require further assistance in this matter, please contact Mr. David Soileau, Jr. (337/291-3109) of this office.

Sincerely,

James F. Boggs
Supervisor
Louisiana Field Office

United States Department of the Interior

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506

March 27, 2009

Colonel Alvin B. Lee
District Engineer
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Colonel Lee:

The U.S. Fish and Wildlife Service (Service) has reviewed the Department of the Army, Corps of Engineers (Corps), Notice of Intent (NOI) to prepare a Draft Environmental Impact Statement (DEIS) for the Southwest Coastal Louisiana Feasibility Study for Calcasieu, Cameron, and Vermilion Parishes, Louisiana. The NOI was published in the Federal Register (Volume 74, No. 38, pg. 8920) on February 27, 2009 (Department of Interior No. ER09/0228). The study was authorized by a resolution adopted by the United States House of Representatives (House) Committee on Transportation and Infrastructure on December 7, 2005. The Fish and Wildlife Service (Service) submits the following comments in accordance with the National Environmental Policy Act of 1969 (83 Stat. 852, as amended; 42 U.S.C. 4321 et seq.), the Migratory Bird Treaty Act (MBTA, 40 Stat. 755, as amended; 16 U.S.C. 703 et seq.), the Bald and Golden Eagle Protection Act (BGEPA) (54 Stat. 250, as amended, 16 U.S.C. 668a-d), the Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.), and the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

The Corps is conducting a study to determine the feasibility of providing Federal hurricane protection and storm damage reduction for portions of Calcasieu, Cameron, and Vermilion Parishes. A specific focus of that study, which is explicitly mentioned in the above-referenced House Committee resolution, will include an evaluation of the feasibility of constructing an armored 12-foot-high levee along the Gulf Intracoastal Waterway. However, numerous other levee alignments and project alternatives are under consideration, including those that would involve a variety of structural, non-structural, and coastal restoration components.

DESCRIPTION OF FISH AND WILDLIFE RESOURCE CONDITIONS

Most of the fish and wildlife habitat within the proposed study area exists as fresh, intermediate, brackish, and saline marshes. There are numerous rivers, bayous, canals, ponds, lakes, and other open water areas within those marshes that would also be affected by the proposed project. The study-area marshes and cheniers provide habitat for a variety of migratory game and non-game birds such as mallard, gadwall, American wigeon, common pintail, black rail, yellow rail, and little blue heron. Those non-game species have exhibited substantial population declines

over the last 30 years, primarily as the result of habitat loss and fragmentation. Numerous reptiles and amphibians inhabit the marshes, bayous, and ponds of the study area including lesser siren, three-toed amphiuma, Gulf Coast toad, eastern narrow-mouthed toad, spring peeper, green treefrog, cricket frog, bullfrog, American alligator, common snapping turtle, alligator snapping turtle, diamondback terrapin, red-eared slider, painted turtle, Mississippi mud turtle, stinkpot, various water snakes, western ribbon snake, speckled kingsnake, and the western cottonmouth. The study area wetlands also help to reduce the impact of storm surges on more inland habitats and infrastructure, and aid in water quality maintenance by reducing excessive dissolved nutrient levels and removing suspended sediments. They provide plant detritus to surrounding estuarine waters, thereby substantially contributing to the detritus-based food web that supports the productivity of commercially and recreationally important fisheries. Brackish and saline marshes support estuarine-dependent (i.e., inter-jurisdictional) fishes and shellfishes (e.g., red drum, Atlantic croaker, Gulf menhaden, blue crab, brown shrimp, and white shrimp). Fresh and intermediate marshes of the study area provide habitat for mammals such as raccoon, mink, and swamp rabbit, and support many commercially and recreationally important fishes such as largemouth bass, black crappie, sunfishes, catfishes, freshwater drum, buffalos, and gars. The numerous cheniers located throughout the proposed project area provide important stopover habitat for as many as 250 species of neotropical migratory songbirds, including a variety of warblers, tanagers, orioles, thrushes, vireos, and grosbeaks.

Most development within the southern portions of the study area is located immediately adjacent to major state highways in the area including Louisiana Highways 82, 27, and 14. The most significant residential, commercial, and industrial developments are within, and immediately surrounding, the cities of Lake Charles and Abbeville. Various types of agriculture, such as sugarcane, rice, crawfish, and livestock production, are also present within the study area.

Threatened and Endangered Species

Federally listed as a threatened species, the piping plover (*Charadrius melodus*), as well as its designated critical habitat, occur along the Louisiana coast. Piping plovers winter in Louisiana, and may be present for 8 to 10 months annually. They arrive from the breeding grounds as early as late July and remain until late March or April. Piping plovers feed extensively on intertidal beaches, mudflats, sand flats, algal flats, and wash-over passes with no or very sparse emergent vegetation; they also require unvegetated or sparsely vegetated areas for roosting. Roosting areas may have debris, detritus, or micro-topographic relief offering refuge to plovers from high winds and cold weather. In most areas, wintering piping plovers are dependent on a mosaic of sites distributed throughout the landscape, because the suitability of a particular site for foraging or roosting is dependant on local weather and tidal conditions. Plovers move among sites as environmental conditions change, and studies have indicated that they generally remain within a 2-mile area. Major threats to this species include the loss and degradation of habitat due to development, disturbance by humans and pets, and predation.

On July 10, 2001, the Service designated critical habitat for wintering piping plovers (Federal Register Volume 66, No. 132). Their designated critical habitat identifies specific areas that are essential to the conservation of the species. The primary constituent elements for piping plover wintering habitat are those habitat components that support foraging, roosting, and sheltering and

the physical features necessary for maintaining the natural processes that support those habitat components. Constituent elements are found in geologically dynamic coastal areas that contain intertidal beaches and flats (between annual low tide and annual high tide), and associated dune systems and flats above annual high tide. Important components (or primary constituent elements) of intertidal flats include sand and/or mud flats with no or very sparse emergent vegetation. Adjacent unvegetated or sparsely vegetated sand, mud, or algal flats above high tide are also important, especially for roosting plovers. Should the proposed project directly or indirectly affect the piping plover or its critical habitat, further consultation with this office will be necessary.

Federally listed as an endangered species, brown pelicans (*Pelecanus occidentalis*) are currently known to nest on Rabbit Island in Calcasieu Lake. Pelicans change nesting sites as habitat changes occur. In spring and summer, nests are built in mangrove trees or other shrubby vegetation, although ground nesting may also occur. Brown pelicans feed along the Louisiana coast in shallow estuarine waters, using sand spits and offshore sand bars as rest and roost areas. Major threats to this species include chemical pollutants, colony site erosion, disease, and human disturbance. Should the proposed project directly or indirectly affect brown pelicans, further consultation with this office will be necessary.

Endangered and threatened sea turtles forage in the nearshore waters, bays and sounds of Louisiana. The National Marine Fisheries Service (NMFS) is responsible for aquatic marine threatened or endangered species. Please contact Eric Hawk (727/824-5312) at the NMFS Regional Office in St. Petersburg, Florida, for information concerning those species in the aquatic environment. When sea turtles leave the aquatic environment and come onshore to nest, however, the Service is responsible for consultation. Accordingly, we recommend that you contact this office if your activities would occur on beach areas during the sea turtle nesting season (depending on the species in question).

Other Federal Trust Species

Forested portions of the study area may provide nesting habitat for the bald eagle (*Haliaeetus leucocephalus*), which was officially removed from the List of Endangered and Threatened Species on August 8, 2007. Bald eagles nest in Louisiana from October through mid-May. Eagles typically nest in mature trees (e.g., bald cypress, sycamore, willow, etc.) near fresh to intermediate marshes or open water. Eagles also winter, and infrequently nest, in mature pine trees near large lakes. Major threats to this species include habitat alteration, human disturbance, and environmental contaminants (i.e., organochlorine pesticides and lead).

Breeding bald eagles occupy "territories" that they will typically defend against intrusion by other eagles, and that they likely return to each year. A territory may include one or more alternate nests that are built and maintained by the eagles, but which may not be used for nesting in a given year. Potential nest trees within a nesting territory may, therefore, provide important alternative bald eagle nest sites. In forested areas, bald eagles often select the tallest trees with limbs strong enough to support a nest. Nest sites typically include at least one perch with a clear view of the water or area where the eagles usually forage. Shoreline trees or snags located near large waterbodies provide the visibility and accessibility needed to locate aquatic prey. Bald

eagles are vulnerable to disturbance during courtship, nest building, egg laying, incubation, and brooding. Disturbance during this critical period may lead to nest abandonment, cracked and chilled eggs, and exposure of small young to the elements. Human activity near a nest late in the nesting cycle may also cause flightless birds to jump from the nest tree, thus reducing their chance of survival.

Although the bald eagle has been removed from the List of Endangered and Threatened Species, it continues to be protected under the MBTA and the BGEPA. The Service developed the National Bald Eagle Management (NBEM) Guidelines to provide landowners, land managers, and others with information and recommendations to minimize potential project impacts to bald eagles, particularly where such impacts may constitute "disturbance," which is prohibited by the BGEPA. A copy of the NBEM Guidelines is available at: http://www.fws.gov/southeast/es/baldeagle/NationalBaldEagleManagementGuidelines.pdf. Those guidelines recommend: (1) maintaining a specified distance between the activity and the nest (buffer area); (2) maintaining natural areas (preferably forested) between the activity and nest trees (landscape buffers); and (3) avoiding certain activities during the breeding season. On-site personnel should be informed of the possible presence of nesting bald eagles within the project boundary, and should identify, avoid, and immediately report any such nests to this office. If a bald eagle nest is discovered within or adjacent to the proposed project area, then an evaluation must be performed to determine whether the project is likely to disturb nesting bald eagles. That evaluation may be conducted on-line at: http://www.fws.gov/southeast/es/baldeagle. Following completion of the evaluation, that website will provide a determination of whether additional consultation is necessary. A copy of that determination should be provided to this office. The Division of Migratory Birds for the Southeast Region of the Service (phone: 404/679-7051, e-mail: SEmigratorybirds@fws.gov) has the lead role in conducting such consultations. Should you need further assistance interpreting the guidelines or performing an on-line project evaluation, please contact this office.

The proposed project would be located in an area where colonial nesting waterbirds may be present. Colonies may be present that are not currently listed in the database maintained by the Louisiana Department of Wildlife and Fisheries (LDWF). That database is updated primarily by monitoring the colony sites that were previously surveyed during the 1980s. Until a new, comprehensive coast-wide survey is conducted to determine the location of newly-established nesting colonies, we recommend that a qualified biologist inspect proposed work sites for the presence of undocumented nesting colonies during the nesting season. To minimize disturbance to colonial nesting birds, the following restrictions on activity should be observed:

1. For colonies containing nesting brown pelicans, all activity occurring within 2,000 feet of a rookery should be restricted to the non-nesting period (i.e., September 15 through March 31). Nesting periods vary considerably among Louisiana's brown pelican colonies, however, so it is possible that this activity window could be altered based upon the dynamics of the individual colony. The LDWF Fur and Refuge Division should be contacted to obtain the most current information about the nesting chronology of individual brown pelican colonies.

2. For colonies containing nesting wading birds (i.e., herons, egrets, night-herons, ibis, and roseate spoonbills), anhingas, and/or cormorants, all activity occurring within 1,000 feet of a rookery should be restricted to the non-nesting period (i.e., September 1 through February 15; exact dates may vary within this window depending on species present).

3. For colonies containing nesting gulls, terns, and/or black skimmers, all activity occurring within 650 feet of a rookery should be restricted to the non-nesting period (i.e., September 16 through April 1; exact dates may vary within this window depending on species present).

In addition, we recommend that on-site contract personnel be informed of the need to identify colonial nesting birds and their nests, and should avoid affecting them during the breeding season.

Publicly and Privately Managed Areas

Publicly owned and/or managed lands within the current study area include three National Wildlife Refuges (Sabine, Cameron Prairie, and Lacassine) managed by the Service, the Rockefeller Wildlife Refuge, State Wildlife Management Area, and Rockefeller Refuge Mitigation Bank managed by LDWF, and the Sam Houston Jones State Park managed by the Office of State Parks.

Lands within the study area that managed by non-governmental organizations include the Little Pecan Island Preserve and the Persimmon Gully Mitigation Bank managed by The Nature Conservancy, and the Paul J. Rainey National Audubon Society Preserve managed by the National Audubon Society.

Privately owned and/or managed lands within the current study area include the Gum Cove, Fresh Marsh, Choupique, and Houston River Mitigation Banks (managed by Stream Properties, Inc.), the Bryan Farms Mitigation Bank (managed by Krauss and Managan Timber Company), the Simon and Delaney Mitigation Bank (managed by Mr. Chris Simon), and No Hope Farms Mitigation Bank (managed by Mr. Carl Nabours). There are also two privately owned Wetlands Reserve Program tracts (administered by the Natural Resources Conservation Service) within the study area (Contract #66-7217-9-3386 and Contract #66-7217-1-3616 in Vermilion Parish) that are encumbered by perpetual conservation easements.

Should proposed project alternatives entail work within or adjacent to, or would potentially alter the hydrology of, any of these managed properties, then the respective owner and manager should be contacted. Also, work proposed to occur on National Wildlife Refuge (NWR) lands would require a compatibility determination as mandated by the National Wildlife Refuge System Administration Act of 1966, as amended. (The amended act is now known as the National Wildlife Refuge System Improvement Act of 1997 [16 U.S.C. 668dd]). The Act states that refuge officials (through delegation of authority from the Secretary of the Interior) shall not initiate or permit a new use of a refuge unless the Secretary has determined that it is a compatible use. A compatible use is defined as any use of a refuge that will not materially interfere with or detract from the fulfillment of the mission of the System or the purposes of that refuge.

5

Federal agencies proposing a project that includes features on a NWR are encouraged to contact the refuge staff early in the planning process. Point of contact for the Service's Southwest Louisiana National Wildlife Refuge Complex is Mr. Don Voros, Project Leader (337) 598-2216. Additional activities (e.g., surveys, soil borings, etc.) that may need to occur on the NWR during the planning process may require a Special Use Permit from the Service; furthermore, all activities on that NWR must be coordinated with the Refuge Manager. Therefore, we recommend that the Corps request issuance of a Special Use Permit well in advance of conducting any work/investigations on a NWR.

Estuarine wetlands and associated shallow waters within the project area have been identified as Essential Fish Habitat (EFH). EFH requirements vary depending upon species and life stage. Categories of EFH in the project area include estuarine emergent wetlands, estuarine water column, submerged aquatic vegetation, and estuarine water bottoms. Detailed information on Federally managed fisheries and their EFH is provided in the 1998 generic amendment of the Fishery Management Plans for the Gulf of Mexico, prepared by the Gulf of Mexico Fishery Management Council (GMFMC). That generic amendment was prepared in accordance with the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA); (P.L. 104-297). Recommendations to minimize and/or avoid impacts to EFH should be developed in coordination with the NMFS.

A portion of the study area lies within units of the Coastal Barrier Resources System. The Coastal Barrier Resources Act (CBRA) restricts Federal expenditures that effectively encourage development of coastal barriers. Coordination with this office should be undertaken to ensure that any proposed project feature is in compliance with the CBRA.

POTENTIAL SIGNIFICANT IMPACTS

Depending on the selected project features, construction of the proposed hurricane protection project has the potential to result in the direct loss of valuable coastal habitats including marsh, swamp, and bottomland hardwood wetlands (including cheniers); those habitats may also sustain losses from secondary impacts related to hydrologic changes in the study area. Developmental pressure on study area wetlands would likely increase should such areas be enclosed by storm-surge protection levees. Reduced water exchange between wetlands enclosed within and those excluded from leveed systems could reduce water quality within the study area by eliminating or reducing the filtering capacity of those wetlands. Wetland habitat losses would reduce populations of resident fish and wildlife, reduce important wintering habitat for waterfowl and other migratory birds, and reduce nursery habitat and detritus input important to the maintenance of estuarine-dependent fish and shellfish production.

PROBLEMS, OPPORTUNITIES, AND PLANNING OBJECTIVES

The most significant fish and wildlife related problem in the study area and throughout coastal Louisiana is the rapid loss of valuable wetland habitat. Since the 1930s, Louisiana has lost over 1,900 square miles of coastal wetlands; and an additional 24 square miles are being lost every

year (Louisiana Department of Natural Resources' *Coastal Restoration Annual Project Reviews: December 2005*). The two major hurricanes of 2005 (Katrina and Rita) have significantly contributed to those coastal wetland losses, and their effects have exceeded all such changes in coastal Louisiana from the last 13 years of hurricanes combined, including Hurricanes Andrew (1992) and Lili (2002) (U.S. Geological Survey's *USGS Reports Latest Land-Water Changes for Southeastern Louisiana, February 2006*). As a result of the high rate of land loss and the national significance of coastal Louisiana wetlands, several programs (e.g., Americas Wetlands, Coast 2050, the Coastal Wetlands Planning, Protection, and Restoration Act, the Louisiana Coastal Area Ecosystem Restoration Study, the Coastal Impact Assistance Program [CIAP], and the Louisiana Comprehensive Hurricane Protection and Restoration Study) are being planned or implemented to restore and protect Louisiana's coastal wetland ecosystems. Many of the goals of those restoration programs and those of the current coastal hurricane protection study are interrelated and necessitate an integrated solution. Projects should be designed in collaboration with one another to ensure that a system-wide solution for coastal flood protection and restoration for the study area is achieved.

Water quality deterioration may be minimized by preserving remaining wetlands via limiting urban expansion and associated pollution discharges into wetlands. To that end, in order to discourage further wetland loss, any proposed hurricane protection levees should be located landward of the wetland/non-wetland interface. Should some wetlands be unavoidably enclosed within the levee, the integrity of present hydrologic regimes should be maintained via installation of water control structures in the levee to ensure adequate water circulation. Preservation of enclosed wetlands could be ensured via the purchase of non-development easements or local flood zoning ordinances. Furthermore, any pumping stations associated with the project should not discharge directly into canals or other open water bodies, but rather into wetland systems that can assimilate those nutrients being discharged.

The need for borrow necessary to complete proposed hurricane protection levees may exceed local availability. Often, the searches for levee-building material have been conducted on a project-by-project basis, and have led to the selection of the least-expensive and easiest sources for borrow material, which are usually located within wetlands adjacent to the proposed levee. Use of such on-site sources that adversely impact wetlands is frequently inconsistent with coastal restoration efforts, and is counterproductive to attaining the goal of increasing non-structural hurricane protection within a sustainable ecosystem.

In order to address the above problems and opportunities, the Service recommends that the following planning objectives and constraints be included in any further planning of hurricane protection features for the study area:

1. Avoid and/or minimize impacts to wetlands and fish and wildlife habitat in the study area.

2. The Service's priority selection process for borrow material outlined in our August 7, 2006, letter to the Corps regarding the Greater New Orleans Hurricane and Storm Damage Risk Reduction Project should be utilized.

3. Coordinate with the LCA Plan near-term restoration planning team, CWPPRA member-agencies, CIAP representatives, and any other pertinent coastal restoration entities to ensure consistency with the objectives of the projects that may have already been constructed, that are proposed for construction, or that have been identified in planning efforts to occur within the subject study area.

4. Avoid impacts to threatened and endangered species and their habitat.

FISH AND WILDLIFE CONSERVATION MEASURES

Implementation of the proposed hurricane protection plan could potentially have significant direct impacts on fish and wildlife resources. Of equal concern is the potential for loss, via future development, of fish and wildlife habitat enclosed by levees constructed as a result of the plan. The Service believes that project plans can be designed to mitigate those negative impacts.

The President's Council on Environmental Quality defined the term "mitigation" in the National Environmental Policy Act regulations to include: (a) avoiding the impact altogether by not taking a certain action or parts of an action; (b) minimizing impacts by limiting the degree or magnitude of the action and its implementation; (c) rectifying the impact by repairing, rehabilitating, or restoring the affected environment; (d) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and (e) compensating for the impact by replacing or providing substitute resources or environments.

If the enclosure of wetlands within the proposed levee is necessary to provide for storm surge protection, mechanisms for protecting enclosed wetlands and for compensating habitat value losses associated with levee construction should be developed. Preservation of enclosed wetlands may be accomplished by installing water control structures in the levee that could be operated to ensure adequate water exchange. Further, protection of enclosed wetlands from future development could be ensured via purchase of non-developmental easements. Compensation for wetland habitat value losses associated with levee construction would likely involve acquisition and/or restoration of in-kind wetland habitats. Detailed mitigation needs will be determined in the feasibility stage.

1. Mitigate impacts to wetlands by:

   a. Incorporating hurricane protection features (e.g., floodwalls, etc.) that would minimize impacts to fish and wildlife habitat;

   b. Requiring that hurricane protection levees are located landward of the wetland/non-wetland interface, and limiting hurricane protection to existing urban developments;

   c. Requiring that borrow material for levee construction be taken from non-forested, non-wetland areas (the Service's priority selection process for borrow material should be utilized);

d. Installing an adequate number of water-control structures in hurricane protection levees that enclose wetlands to maintain normal water exchange and preclude wetland drainage (such structures should be closed only in advance of tropical storms);

e. Acquiring non-development easements on enclosed wetlands to ensure their continued use as floodwater storage areas and to preclude any secondary development;

f. Incorporating water quality improvements by routing urban runoff through enclosed wetlands and discharging any pumped water into floodside wetlands;

g. Ensuring adequate internal drainage exists within the leveed area to prevent levees from compounding existing flooding problems, thus leading to future flood control projects with a resulting loss of wetlands and fish and wildlife resources; and,

h. Implementing measures to compensate for unavoidable losses of wetland habitat values.

2. Avoid impacts to endangered or threatened species and their habitats.

3. Avoid impacts to other Federal trust fish and wildlife resources such as bald eagles and colonial nesting waterbirds.

4. Avoid impacts to public lands, if feasible. If not feasible, coordination with agencies managing the public lands that would be impacted by the proposed project should occur throughout the planning process.

5. Ensure compliance with CBRA where applicable.

FISH AND WILDLIFE COORDINATION ACTIVITIES FOR THE FEASIBILITY STAGE

The following data will be needed to enable the Service to conduct a detailed analysis of project impacts on fish and wildlife resources and to formulate measures to mitigate any losses to those resources.

1. Identification of all alternatives to be considered, including detailed project plans (e.g., a written description and map) for those alternatives.

2. An estimate of current, future-with, and future-without-project development and land loss rates within the project area(s), presented in 10-year intervals, to be impacted by alternatives being considered.

9

3. Identification of habitats, by type and acreage, to be impacted by various alternatives being considered. That data should also be presented in 10-year intervals.

We look forward to assisting the Corps in the documentation of existing conditions, development of alternatives, and assessment of effects of project alternatives on Federal trust resources during the subsequent feasibility study. Should you have any questions regarding our comments, please contact David Soileau, Jr. (337/291-3109) of this office.

Sincerely,

James F. Boggs
Supervisor
Louisiana Field Office

cc: DOI, OEPC, Washington, D.C. (Attn.: Loretta Sutton)
DOI, OEPC, Albuquerque, NM (Attn.: Steven Spencer)
FWS, BAP & HC (ERT), Arlington, VA (Attn.: Stefanie Nash)
FWS, Atlanta, GA (Attn.: Jeff Weller)
COE, CEMVN-PM-RS, Attention: Sandra Stiles, New Orleans, LA
EPA, Dallas, TX
NMFS, Baton Rouge, LA
LDWF, Baton Rouge, LA (Attn.: Kyle Balkum)
LDWF, Natural Heritage Program, Baton Rouge, LA

10

United States Department of the Interior

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506

April 7, 2016

Ms. Joan M. Exnicios
Chief, Environmental Planning Branch
New Orleans District, Corps of Engineers
P.O. Box 60267
New Orleans, Louisiana 70160-0267

Dear Ms. Exnicios:

Thank you for your April 4, 2016, letter regarding the Corps of Engineers' National Ecosystem Restoration (NER) Plan. The NER Plan (CM-4 Small Integrated Restoration) focuses on stabilizing perimeter geomorphology and consists of 49 ecosystem restoration features recommended for construction (9 marsh restoration features; 35 chenier reforestation features and 5 shoreline protection features). The shoreline protection features include the construction of breakwaters at multiple locations of the Gulf of Mexico shoreline from Calcasieu River to Freshwater Bayou, as well as Holly Beach located in Cameron and Vermilion Parishes, Louisiana. Your letter requested the U. S. Fish and Wildlife Service's determination, pursuant to the Coastal Barrier Resource Act (CBRA) of 1982 (96 Stat. 1653, as amended; 16 U.S.C. 3501 et seq.), as to whether those activities would fall within an exemption to the limitation on Federal expenditures. The purposes of the CBRA are "to minimize the loss of human life, wasteful expenditures of Federal revenues, and the damage to fish, wildlife, and other natural resources associated with the coastal barriers along the Atlantic and Gulf Coast…" 16 U.S.C. § 3501(b). Section 3505 of CBRA provides exceptions to the prohibition of Federal expenditures that would have the effect of supporting coastal barrier development. The CBRA generally prohibits the expenditure of Federal funds that would encourage development on coastal barriers.

The proposed restoration features occur within System Units S08, LA-07, LA-08P, S10, LA-10 and S11. Section 3505 (a)(6)(A) provides that such expenditures are exempt for "Projects for the study, management, protection, and enhancement of fish and wildlife resources and habitats, including acquisition of fish and wildlife habitats, and related lands, stabilization projects for fish and wildlife habitats, and recreational projects." Section 206.344 (c) states that there would be Federal financial limitations to carry out "... any project to prevent erosion of, or to otherwise stabilize, an inlet, shoreline, or inshore area, except that such assistance and expenditures may be made available on units designated pursuant to Section 4 on the maps numbered S01 through S08 and LA-07 for purposes other than encouraging development and, in all units in cases where an emergency threatens life, land, and property immediately adjacent to that unit."

The Coastal Barrier Improvement Act of 1990 created a new category of lands known as "Otherwise Protected Areas" (OPAs). These areas pertain to coastal barriers held for conservation or recreation, such as national wildlife refuges, state and county parks, etc. According to our records, part of the project occurs within the state's Rockefeller Wildlife Refuge, which is a designated OPA associated with System Unit LA-08P. The only prohibition within OPAs is Federal Flood Insurance, and therefore, CBRA limitations on federal expenditures do not apply to this project.

Because the project is consistent with the purposes of the CBRA and falls within the exemptions stated above, we have determined that the proposed federal action would be exempt from the limitations of the CBRA, and therefore, eligible for Federal expenditures.

We appreciate the opportunity to provide this determination. If you have any questions regarding our comments, please contact Ms. Amy Trahan (337/291-3126).

Sincerely,

Brad Rieck
Acting Field Supervisor
Louisiana Ecological Services Office

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, NEW ORLEANS DISTRICT
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

April 4, 2016

Regional Planning and Environment
Division South, Environmental Planning Branch

RECEIVED
APR 06 2016
FISH & WLDL. SERV
LAFAYETTE, LA.

Mr. Brad Rieck
Acting Field Supervisor
U.S. Fish and Wildlife Service
646 Cajoundome Blvd. Suite 400
Lafayette, LA 70506

Dear Mr. Rieck:

The US Army Corps of Engineers, New Orleans District (CEMVN) is preparing to go to a Civil Works Review Board (CWRB) for the Southwest Coastal Louisiana Integrated Final Feasibility Report and Environmental Impact Statement (SWC) April 21, 2016. The recommended plan for the SWC study includes a National Economic Development plan (NED) and a National Ecosystem Restoration (NER) plan.

The NER Plan (CM-4 Small Integrated Restoration) focuses on stabilizing perimeter geomorphology and consists of 49 ecosystem restoration features recommended for construction (9 marsh restoration features; 35 chenier reforestation features and 5 shoreline protection features). The shoreline protection features include the construction of breakwaters at multiple locations of the Gulf of Mexico shoreline from Calcasieu River to Freshwater Bayou, as well as Holly Beach. These proposed breakwaters are within units covered under the Coastal Barrier Resources Act (CBRA) which is administered by the U.S. Fish and Wildlife Service.

The CBRA generally prohibits federal expenditures with CBRS units on projects that prevent erosion of or to otherwise stabilize shorelines (See 16 USC 3504). In order to spend Federal funds on proposed breakwaters, they have to fall within an exception to the limitation on Federal expenditures as expressed in 16 USC 3505. CEMVN would like to consult with your office under 16 USC 3503(a) to seek a determination that the proposed breakwaters within the CBRA units fall within an exception to the limitation on Federal expenditures.

-2-

To meet the CWRB review date, we need a letter from your office advising that the proposed breakwater meets an exception under 16 USC 3505(a). If you would like to discuss, have questions or need additional information, please contact Dr. William Klein at (505) 862-2540.

Sincerely,

Joan M. Exnicios
Chief, Environmental Planning Branch

SOUTHWEST COASTAL LOUISIANA
INTEGRATED FINAL FEASIBILITY REPORT
AND
ENVIRONMENTAL IMPACT STATEMENT

APPENDIX A

Annex I

Technical, Institutional, and Public Significance of Relevant Resources

Resource	Institutionally Significant	Technically Significant	Publicly Significant
Soils, Water bottoms, Prime and Unique Farmlands	Council on Environmental Quality (CEQ) memorandum dated August 11, 1980, entitled "Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing the National Environmental Policy Act (NEPA)"; Executive Order 11990 - Protection of Wetlands; Agriculture and Food Act of 1981 (Public Law 97-98) containing the Farmland Protection Policy Act (PL 97-98; 7 U.S.C. 4201 *et seq.*).	Technically significant in determining soils engineering and environmental suitability, based on their physical and chemical properties, for proposed activities. Water bottoms are technically significant because the estuarine bottom sediment characteristics (water bottoms) benthic organismal distribution and is an integral component of the benthic boundary layer.	Significant to the public for determining suitability of construction capabilities, agriculture suitability, and suitability for septic tank type disposal of sanitary waste.
Hydrology	NEPA of 1969; Clean Water Act of 1972; Storm damage Control Act of 1944; Coastal Barrier Resources Act of 1982; Rivers and Harbors Act of 1899; River and Harbor and Storm damage Control Act of 1970; Watershed Protection and Storm damage Prevention Act of 1954; Submerged Lands Act of 1953; Coastal Zone Management Act of 1972; Safe Drinking Water Act of 1974; Estuary Protection Act of 1968; Resource Conservation and Recovery Act of 1976; Comprehensive Environmental Response, Compensation and Liability Act of 1980; Executive Order 11988 Floodplain Management.	Civil Works water resources development projects typically impact (positively or negatively) the interrelationships and interactions between water and its environment.	Publicly significant because the public demands clean water, hazard-free navigation, and protection of estuaries and floodplain management.
Water Quality	Clean Water Act of 1972; Pollution Prevention Act of 1990, the Safe Drinking Water Act of 1974; Water Resources Planning Act of 1965.	Technically significant to restore and maintain the chemical, physical, and biological integrity of the Nation's waters.	Publicly significant because of the desire for clean water and water-related activities such as boating, swimming, fishing, and as a source of potable water.
Coastal Shorelines	Coastal Barrier Resources Act of 1982; Coastal Zone Management Act of 1972; Endangered Species Act of 1973; Estuary Protection Act of 19681 Fish and Wildlife Coordination Act of 1958; Migratory Bird Conservation Act of 1929; Migratory Bird Treaty Act of 1918; Endangered Species Act of 1973; Fish and Wildlife Conservation Act of 1980; Magnuson-Stevens Fishery Conservation and Management Act of 1976.	Technically significant because they are a critical element of the Gulf coastal barrier habitats.	Publicly significant because of the high priority that the public places on their aesthetic, recreational, and commercial value.
Vegetation Resources	Coastal Barrier Resources Act of 1982; Coastal Zone Management Act of 1972; Emergency Wetlands Resources Act of 1986; Estuary Protection Act of 1968; Fish and Wildlife Conservation Act of 1980; Fish and Wildlife Coordination Act of 1958; NEPA of 1969; North American Wetlands Conservation Act of 1989; the Water Resources Development Acts of 1976, 1986, 1990, and 1992; Executive Order 13186 - Migratory Bird Habitat Protection.	Technically significant because they are a critical element of the barrier shoreline habitats. Vegetation resources serve as the basis of productivity, contribute to ecosystem diversity, provide various habitat types for fish and wildlife, and are an indicator of the health of coastal habitats.	Publicly significant because of the high priority that the public places on their aesthetic, recreational, and commercial value.
Wildlife Resources	NEPA of 1969; Coastal Zone Management Act of 1972; Estuary Protection Act of 1968; Fish and Wildlife Coordination Act of 1958; Migratory Bird Conservation Act of 1929; Migratory Bird Treaty Act of 1918; Endangered Species Act of 1973; Fish and Wildlife Conservation Act of 1980; North American Wetlands Conservation Act of 1989; Executive Order 13186 - Migratory Bird Habitat Protection; Marine Mammal Protection Act of 1972.	Technically significant because they are a critical element of the barrier shoreline ecosystem, they are an indicator of the health of various coastal habitats, and many wildlife species are important recreation and commercial resources.	Publicly significant because of the high priority that the public places on their aesthetic, recreational, and commercial value.

JA 37-899 693 10/04/2019

Aquatic Resources	National Environmental Policy Act of 1969; Coastal Zone Management Act of 1972; Estuary Protection Act of 1968.	Technically significant because plankton provide a major, direct food source for animals in the water column and in the sediments; are responsible for at least 40 percent of the photosynthesis occurring on the earth; important for their role in nutrient-cycling; plankton productivity is a major source of primary food-energy for most estuarine systems throughout the world; and phytoplankton production is the major source of autochthonous organic matter in most estuarine ecosystems (Day et al. 1989).	Publicly significant because plankton constitute the lowest trophic food level for many larger organisms important to commercial and recreational fishing. There is also public health concern with noxious plankton blooms (red and brown tides) that produce toxins, and large-scale blooms can lead to hypoxic conditions, which can result in fish kills.
Fisheries	Fish and Wildlife Coordination Act of 1958; Endangered Species Act of 1973; Magnuson-Stevens Fishery Conservation and Management Act of 1976; Coastal Zone Management Act of 1972; Estuary Protection Act of 1968.	Technically significant because they are a critical element of many valuable freshwater and marine habitats, they are an indicator of the health of various freshwater and marine habitats, and many fish species are important commercial resources.	Publicly significant because of the high priority that the public places on their esthetic, recreational, and commercial value. Fisheries resources in the project area include marine and estuarine finfish and shellfish.
Essential Fish Habitat	Magnuson-Stevens Fishery Conservation and Management Act of 1976.	Technically significant because it includes those waters and substrate necessary to Federally-managed fish species for spawning, breeding, feeding or growth to maturity.	Publicly significant because of the high value that the public places on seafood and the recreational and commercial opportunities it provides.
Threatened and Endangered Species	Endangered Species Act of 1973; Marine Mammal Protection Act of 1972; Bald Eagle Protection Act of 1940.	Technically significant because the status of such species provides an indication of the overall health of an ecosystem.	Publicly significant because of the desire of the public to protect them and their habitats.
Cultural and Historic Resources	National Historic Preservation Act of 1966; Abandoned Shipwreck Act of 1987; Archeological Resources Protection Act of 1979; National Environmental Policy Act of 1969.	Technically important because of their association or linkage to past events, to historically important persons, and to design and/or construction values; and for their ability to yield important information about prehistory and history.	Publicly important because preservation groups and private individuals support their protection, restoration, enhancement, or recovery.
Recreational Resources	Federal Water Project Recreation Act of 1965; Land and Water Conservation Fund Act of 1965.	Technically significant because of the high economic value of recreational activities and their contribution to local, state, and national economies.	Publicly significant because of the high value that the public places on fishing, hunting, and boating, as measured by the large number of fishing and hunting licenses sold in Louisiana, and the large per-capita number of recreational boat registrations in Louisiana.
Air Quality	Clean Air Act of 1963, as amended, and the Louisiana Environmental Quality Act of 1983, as amended.	Air quality is technically significant because of the status of regional ambient air quality in relation to the National Ambient Air Quality Standards (NAAQS).	Air quality is publicly significant because of the desire for clean air and public health concerns expressed by many citizens.
Socioeconomic and Human Resources	National Environmental Policy Act of 1969; Estuary Protection Act of 1968; Clean Water Act of 1972; Rivers and Harbors Act of 1899; Watershed Protection and Storm damage Protection Act of 1954. Executive Order 12898 of 1994 – Environmental Justice.	Technically significant because the social and economic welfare of the Nation may be positively or adversely impacted by the proposed action; the social and economic welfare of minority and low-income populations may be positively or disproportionately impacted by proposed actions.	Publicly significant because of the public's concern for health, welfare, and economic and social well-being from water resources projects; also public concerns about the fair and equitable treatment of all people

JA 37-899 694 10/04/2019

SOUTHWEST COASTAL LOUISIANA
INTEGRATED FINAL FEASIBILITY REPORT
AND
ENVIRONMENTAL IMPACT STATEMENT

APPENDIX A

Annex J

Environmental Compliance Laws

Table J-1: Relevant Environmental Federal Statutory Authorities and Executive Orders. (Note: this list is not complete or exhaustive.)	
Abandoned Shipwreck Act of 1987	Marine Mammal Protection Act of 1972
American Indian Religious Freedom Act of 1978	Marine Protected Areas (EO 13158) of 2000
Anadromous Fish conservation Act of 1965	Marine Protection, Research, and Sanctuaries Act of 1972
Antiquities Act of 1906	Migratory Bird Conservation Act of 1929
Archeological Resources Protection Act of 1979	Migratory Bird Treaty Act of 1918
Archeological and Historical Preservation Act of 1974	Migratory Bird Habitat Protection (EO 13186) of 2001
Bald Eagle Protection Act of 1940	National Environmental Policy Act of 1969
Clean Air Act of 1970	National Historic Preservation Act of 1966
Clean Water Act of 1977	Native American Graves Protection and Repatriation Act of 1990
Coastal Barrier Improvement Act of 1990	Neotropical Migratory Bird Conservation Act of 2000
Coastal Barrier Resources Act of 1982	Noise Control Act of 1972
Coastal Wetlands Planning, Protection, and Restoration Act of 1990	Nonindigenous Aquatic Nuisance Prevention and Control Act of 1996
Coastal Zone Management Act of 1972	North American Wetlands Conservation Act of 1989
Comprehensive Environmental Response, Compensation, and Liability Act of 1980	Oil Pollution Act of 1990
Consultation and Coordination with Indian Tribal Governments (EO 13175) of 2000	Outer Continental Shelf Lands Act of 1953
Emergency Planning and Community Right-to-Know Act of 1986	Pollution Prevention Act of 1990
Emergency Wetlands Restoration Act of 1986	Prime and Unique Farmlands, 1980 CEQ Memorandum
Endangered Species Act of 1973	Protection and Enhancement of the Cultural Environment (EO 11593) of 1971
Environmental Quality Improvement Act of 1970	Protection and Enhancement of Environmental Quality (EO 11991) of 1977
Estuaries and Clean Water Act of 2000	Protection of Children from Environmental Health Risks and Safety Issues (EO 13045) of 1997
Estuary Protection Act of 1968	Protection of Cultural Property (EO 12555) of 1986
Estuary Restoration Act of 2000	Protection of Wetlands (EO 11990) of 1977
Exotic Organisms (EO 11987) of 1977	Reclamation Projects Authorization and Adjustments Act of 1992
Farmland Protection Policy Act of 1981	Recreational Fisheries (EO 12962) of 1995
Federal Actions to Address Environmental Justice in Minority Populations & Low-Income Populations (EO 12898) of 1994	Resource Conservation and Recovery Act of 1976
Federal Emergency Management (EO 12148) of 1979	Responsibilities of Federal Agencies to Protect Migratory Birds (EO 13186) of 2001
Federal Facilities Compliance Act of 1992	Rivers and Harbors Acts of 1899 and 1956
Federal Land Policy and Management Act of 1976	River and Harbor and Flood Control Act of 1970
Federal Water Pollution Control Act of 1972	Safe Drinking Water Act of 1974
Federal Water Project Recreation Act of 1965	Submerged Land Act of 1953
Fish and Wildlife Conservation Act of 1980	Sustainable Fisheries Act of 1996
Fish and Wildlife Coordination Act of 1934	Toxic Substances Control Act of 1976
Flood Control Act of 1944	Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970
Floodplain Management (EO 11988) of 1977	Water Resources Development Acts of 1976, 1986, 1990, 1992, and 2007
Food Security Act of 1985	Water Resources Planning Act of 1965
Greening of the Government Through Efficient Energy Management (EO 13148) of 2000	Watershed Protection & Flood Prevention Act of 1954
Historic Sites Act of 1935	Water Pollution Control Act Amendments of 1972
Historical and Archeological Data-Preservation Act of 1974	Wild and Scenic River Act of 1968
Indian Sacred Sites (EO 13007) of 1996	Wilderness Act of 1964
Invasive Species (EO 13112) of 1999	
Land & Water Conservation Fund Act of 1965	
Magnuson-Stevens Fishery Conservation and Management Act of 1976	

(Note: this list is not complete or exhaustive.)	
Air Control Act	Louisiana Threatened and Endangered Species and Rare & Unique Habitats
Archeological Treasury Act of 1974	Protection of Cypress Trees
Louisiana Coastal Resources Program	Water Control Act
Louisiana Scenic Rivers Act of 1988	

ENVIRONMENTAL LAWS AND COMPLIANCE (*NEPA REQUIRED)

Federal projects must comply with Federal and state environmental laws, regulations, policies, rules and guidance. The team has coordinated and will continue to coordinate with Federal and state resource agencies during planning of the proposed action. Status of compliance with the various laws is presented below.

Bald and Golden Eagle Protection Act of 1940 (Bald Eagles)

The Bald and Golden Eagle Protection Act protects two eagle species. Bald eagles occur or occasionally occur in the proposed project area. Based on review of existing data and preliminary field surveys, the CEMVN finds that implementation of the Recommended Plan (RP) would have no effect on bald eagles.

Clean Air Act of 1970

The Clean Air Act (CAA) sets goals and standards for the quality and purity of air. It requires the Environmental Protection Agency to set National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. The project area is in Calcasieu, Cameron, and Vermilion Parishes, which are currently in attainment of NAAQS. The Louisiana Department of Environmental Quality is not required by the CAA and Louisiana Administrative Code, Title 33 to grant a general conformity determination.

Clean Water Act of 1977 – Section 401

The Clean Water Act (CWA) sets and maintains goals and standards for water quality and purity. Section 401 requires a Water Quality Certification from the Louisiana Department of Environmental Quality that a proposed project does not violate established effluent limitations and water quality standards. Section 401 Water Quality Certification signed July 6, 2015.

Clean Water Act of 1972 – Section 404(b)(1) (Wetlands)

The USACE administers regulations under Section 404(b)(1) of the CWA, which establishes a program to regulate the discharge of dredged and fill material into waters of the U.S., including wetlands. Potential project-induced impacts subject to these regulations has been evaluated. Section 404(b)(1) signed February 18, 2016.

Coastal Zone Management Act of 1972 (Coastal Zone Development)

The Coastal Zone Management Act provides for the management, beneficial use, protection and development of the nation's coastal resources by encouraging and assisting the states to exercise effectively their responsibilities in the coastal zone through the development and implementation of management programs to achieve wise use of the land and water resources of the coastal zone, giving full consideration to ecological, cultural, historic, and esthetic values as well as the needs for compatible economic development. A Consistency Determination for the National Economic Development (NED) and the National Ecosystem Restoration (NER) Plans, dated April 29, 2014, was provided to the Louisiana Department of Natural Resources (LDNR), Office of Coastal Management for concurrence. By letter dated June 30, 2014, the LDNR, Office of Coastal Management provided programmatic concurrence that the project, at that stage of development (i.e., at a programmatic level), was consistent with the Louisiana Coastal Resources Program, but future phases of the project which may have coastal impacts would need to be reviewed as they were developed.

A revised Consistency Determination for fully constructible NED and NER Recommended Plans was provided to the LDNR, Office of Coastal Management on January 5, 2016. By letter dated February 12, 2016, the LDNR, Office of Coastal Management provided concurrence that the Southwest Coastal Louisiana project (application number C20160002) is consistent with the Louisiana Coastal Resources Program.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980
An appropriate level of assessment for the presence of Hazardous, Toxic and Radioactive Waste (HTRW) is required for feasibility studies per Engineering Regulation 1165-2-132 HTRW Guidance for Civil Works Projects. HTRW includes any material listed as a "Hazardous Substance" under the CERCLA. Other regulated contaminants include those substances that are not included under CERCLA but pose a potential health or safety hazard, and are regulated. Examples include, but are not limited to, many industrial wastes, naturally occurring radioactive materials (NORM), many products and wastes associated with the oil and gas industry, herbicides, and pesticides. Petrochemical and other plants are located along the Calcasieu River Ship Channel and the Lake Charles, Westlake, and Sulphur industrial corridors. These facilities have the potential for chemical and other HTRW-type discharges. Several waterways in the project area are known to be contaminated with CERCLA-regulated constituents. Some of these waterways are located within and nearby the NED and NER project areas

Consistent with the CERCLA, current USACE practice is to prepare a Phase I Environmental Site Assessment (ESA) following ASTM Standard E 1527-05. For the NER RP, an ASTM Phase I Environmental Site Assessment (ESA) has been completed. For the NED RP, an ASTM Phase I ESA and asbestos investigation will be conducted prior to construction of any nonstructural risk reduction measures and ecosystem restoration measures to confirm the absence of HTRW and damaged or friable asbestos or asbestos-containing materials, and, if warranted, additional HTRW investigations and a Phase II ESA will be conducted at the property. If the presence of HTRW, asbestos, or asbestos-containing materials in a damaged or friable form is confirmed on the property, the property owner shall be obligated, at his sole cost and expense, to conduct all necessary response and remedial activities in full compliance with applicable local, state, and federal laws and regulations and provide proof of same before the property can be deemed to have met the eligibility requirements.

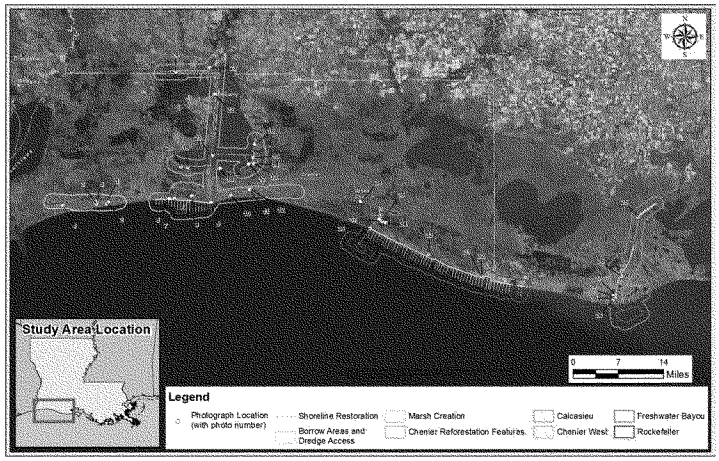


Figure 1. Restoration areas and points of interest photographed during the 3 February 2015 and 5 February 2015 aerial surveys.

An aerial survey of the Phase I buffer zones for each NER restoration area (Chenier West, Calcasieu, Rockefeller, and Freshwater Bayou) on 3 February 2015 and 5 February 2015 and documented mainly residential areas, marsh areas, oil and gas facilities, marinas, one dump site, and several unidentifiable drums/containers within the Phase I buffer zones for each restoration area (see Figure 1). Further investigation (i.e., pedestrian survey) is needed to determine if there are *recognized environmental conditions* associated with some of the aforementioned locations and items viewed during the aerial survey (see Table 1).

Table 1. Points of interest photographed during the aerial survey; these points will be investigated during the forthcoming pedestrian survey.

Site Number	Latitude	Longitude	Notes
4	29.75408	-93.72572	drum
7	29.77029	-93.43835	drum
10	29.7776	-93.29251	silo
11	29.789231	-93.244207	recycle center/dump
20	29.84121	-93.42261	drum
21	29.867346	-93.341841	drum
31	29.59649	-92.64969	metal box w/ legs and hatch ~4'x4'x5'
32	29.59576	-92.64734	another box
33	29.64556	-92.78358	tank

After a review of the Environmental Database Review (EDR) report generated for each of the four restoration areas, there appear to be no *recognized environmental conditions* within the restoration areas. The EDR report included a search of available ("reasonably ascertainable") government records within the four restoration areas for the databases listed below:

FEDERAL RECORDS

NPL	National Priority List
Proposed NPL	Proposed National Priority List Sites
Delisted NPL	National Priority List Deletions
NPL LIENS	Federal Superfund Liens
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
LIENS 2	CERCLA Lien Information
CORRACTS	Corrective Action Report
RCRA-TSDF	Resource Conservation and Recovery Act - Treatment, Storage and Disposal
US ENG CONTROLS	Engineering Controls Sites List
US INST CONTROL	Sites with Institutional Controls
HMIRS	Hazardous Materials Information Reporting System
DOT OPS	Incident and Accident Data
US CDL	Clandestine Drug Labs
US BROWNFIELDS	Listing of Brownfields Sites
DOD	Department of Defense Sites
FUDS	Formerly Used Defense Sites
LUCIS	Land Use Control Information System
CONSENT	Superfund (CERCLA) Consent Decrees
ROD	Records of Decision

UMTRA	Uranium Mill Tailings Sites
ODI	Open Dump Inventory
DEBRIS REGION 9	Torres Martinez Reservation Illegal Dump Site Locations
US MINES	Mines Master Index File
TSCA	Toxic Substances Control Act
FTTS	FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
HIST FTTS	FIFRA/TSCA Tracking System Administrative Case Listing
SSTS	Section 7 Tracking Systems
PADS	PCB Activity Database System
MLTS	Material Licensing Tracking System
RADINFO	Radiation Information Database
RAATS	RCRA Administrative Action Tracking System
LEAD SMELTERS	Lead Smelter Sites
FEMA UST	Underground Storage Tank Listing
COAL ASH DOE	Steam-Electric Plant Operation Data
2020 COR ACTION	2020 Corrective Action Program List
PRP	Potentially Responsible Parties
EPA WATCH LIST	EPA Watch List
US FIN ASSUR	Financial Assurance Information
FEDERAL FACILITY	Federal Facility Site Information listing
SCRD DRYCLEANERS	State Coalition for Remediation of Drycleaners Listing
COAL ASH EPA	Coal Combustion Residues Surface Impoundments List
PCB TRANSFORMER	PCB Transformer Registration Database
US HIST CDL	National Clandestine Laboratory Register
CERC-NFRAP	CERCLIS No Further Remediation Planned
RCRA-LQG	RCRA Large Quantity Generators
RCRA-SQG	RCRA Small Quantity Generators
RCRA-CESQG	RCRA Conditionally Exempt Small Quantity Generators
RCRA NonGen / NLR	RCRA Non-Generators Do Not Presently Generate Hazardous Waste
ERNS	Emergency Response Notification System
TRIS	Toxic Chemical Release Inventory System
ICIS	Integrated Compliance Information System
FINDS	Facility Index System
RMP	Risk Management Program
US AIRS	US Aerometric Information Retrieval System

STATE AND LOCAL RECORDS

LA AUL	Conveyance Notice Listing
LA HIST DEBRIS	LDEQ Approved Debris Sites
LA SWRCY	Recycling Directory
LA HIST LUST	Underground Storage Tank Case History Incidents
LA LIENS	Environmental Liens
LA DEL SHWS	Deleted Potential & Confirmed Sites
LA VCP	Voluntary Remediation Program Sites
LA DRYCLEANERS	Drycleaner Facility Listing
LA BROWNFIELDS	Brownfields Inventory
LA CDL	Clandestine Drug Lab
LA COAL ASH	Coal Ash Disposal Sites
LA SHWS	Potential and Confirmed Sites List
LA SWF/LF	Solid Waste Facilities/Landfill Sites
LA DEBRIS	LDEQ Approved Debris Sites

LA UIC	Underground Injection Well Locations
LA LUST	Leaking Underground Storage Tank Incident Reports
LA UST	Underground Storage Tank
NY MANIFEST	Manifest
LA SPILLS	Spills and/or Releases
TX Ind. Haz Waste	Industrial and Hazardous Waste Database
LA NPDES	Louisiana Pollutant Discharge Elimination System
LA AIRS	Facilities with Air Permits Issued by the Air Permits Division
LA REM	Facilities Listed by the Underground Storage Tank and Remediation Division
LA ASBESTOS	Asbestos Demolition and Renovation Notification

TRIBAL RECORDS

INDIAN RESERV	Indian Reservations
INDIAN ODI	Report on the Status of Open Dumps on Indian Lands
INDIAN LUST	Leaking Underground Storage Tanks on Indian Land
INDIAN UST	Underground Storage Tanks on Indian Land
INDIAN VCP	Voluntary Cleanup Priority Listing

Interviews and information requests have been initiated with entities within each of the four restoration areas. No *recognized environmental conditions* have been reported within the restoration areas based upon information obtained thus far. Sources contacted for interviews and information requests are listed below:

United States Geological Survey
Louisiana Department of Natural Resources
Louisiana Oil Spill Coordinator's Office
U.S. Coast Guard
National Marine Fisheries Service
Cameron Parish Building Permits Office
Vermilion Parish Building Permits Office
Cameron Parish Fire District #10 (Johnson Bayou/Holly Beach) Fire Department
Vermilion Parish Fire Department
Cameron Parish Office of Emergency Preparedness
Vermilion Parish Office of Emergency Preparedness
Cameron Parish Police Jury
Vermilion Parish Police Jury
Cameron Parish Holly Beach Sewer Board District No. 10
Cameron Parish Sheriff's Office
Cameron Parish Tax Assessor's Office
Vermilion Parish Tax Assessor's Office
Louisiana Department of Environmental Quality

Endangered Species Act of 1973 (Threatened & Endangered Species)

The Endangered Species Act (ESA) is designed to protect and recover threatened and endangered (T&E) species of fish, wildlife and plants. The CEMVN is coordinating with the USFWS and the National Marine Fisheries Service (NMFS) to ensure for the protection of those T&E species under their respective jurisdictions. The USFWS identified in their September 20, 2013 email eleven listed T&E species, the Red-cockaded woodpecker, Piping plover, Red knot, Whooping crane, Gulf sturgeon, West Indian manatee, Green sea turtle, Hawksbill sea turtle, Kemp's Ridley sea turtle, Leatherback sea turtle and loggerhead sea turtle that are known to occur or occasionally occur in the project area. In addition, designated Piping plover critical habitat and Loggerhead critical habitat also occur within the project area. No plants were identified as being threatened or endangered in the project area. Based on review of existing data and preliminary field surveys, the MVN has determined that the proposed action *"may affect but will not likely adversely affect"* the piping plover or it's critical

habitat, red knot, West Indian manatee, Gulf sturgeon, loggerhead and Kemps Ridley sea turtles; would have no effect on the green, leatherback, and hawksbill sea turtles or loggerhead critical habitat and would not adversely impact other species of concern that could potentially be found in the project area. As part of the 2015 Revised Draft EIS, a Biological Assessment (BA) for NER Recommended Plan was submitted to USFWS on March 11, 2015; the USFWS concurred by letter on March 20, 2015. A BA was submitted to USFWS for the NED Recommended Plan on July 17, 2015; the USFWS concurred by letter on August 25, 2015. A BA for the NER RP was submitted to the NMFS on March 12, 2015 and NMFS provided their letter of concurrence dated January 26, 2016.

Louisiana State Threatened and Endangered Species and Rare and Unique Habitat
The Louisiana Department of Wildlife and Fisheries Louisiana Natural Heritage Program lists T&E species, rare, unique, and imperiled habitats in the State of Louisiana. Based on review of the LNHP online database, the following rare or unique habitats, animals and plants are found in the project area: Brackish marsh, coastal dune grassland, coastal live oak-hackberry forest, coastal prairie, freshwater marsh, red wolf, crested caracara, snowy plover, piping plover, Wilson's plover, common ground-dove, sandhill crane, diamondback terrapin, brown pelican, roseate spoonbill, glossy ibis, paddlefish, eastern spotted skunk, ornate box turtle, manatee, Gregg's amaranth, A milk-vetch, golden canna, dune sandbur, sand dune spurge, wedge-leaf prairie-clover, wedge-leaf whitlow-grass, slim spike-rush, punctuate cupgrass, narrow-leaved puccoon, grapefruit primrose willow, saltflat-grass, blue water lily, roundleaf scarf-pea, Correll's false dragon-head, wand blackroot, Mexican hat, small's beaksedge, southern beaksedge, sand rose-gentian, brookweed, Elliott sida, Florida bully, powdery thalia, woolly honeysweet, sea oats (LDWF 2013). The CEMVN finds the NER RP would have long term beneficial impacts on these rare and unique habitats and Louisiana T&E species.

Colonial Nesting Water Birds
The USFWS indicated in their January 9, 2009 coordination letter that the project area is known to support colonial nesting water birds (e.g., herons, egrets, ibis, night-herons and roseate spoonbills). Based on review of existing data and preliminary field surveys, the CEMVN finds that implementation of the RP would have no effect on colonial nesting water birds with implementation of Best Management Practices (BMPs) and USFWS recommendations.

Farmland Protection Policy Act of 1981 (Farmland)
The Farmland Protection Policy Act (FPPA) is intended to minimize the impact of Federal programs on the unnecessary and irreversible conversion of farmland to nonagricultural uses. Projects are subject to requirements if they may irreversibly convert farmland to nonagricultural use and are completed by a Federal agency or with assistance from a Federal agency. There are approximately 3,200 acres of soils that are classified as prime farmlands in the Lake Charles East levee alignment area (NED). The Lake Charles area is a heavily developed urban area and few areas are currently being used for agriculture or pastureland. Approximately 514 acres of soils classified as prime farmlands are present on chenier ridges that could be removed from current or future agricultural use as a result of proposed reforestation activities. In compliance with the Farmland Protection Policy Act (FPPA), the USACE consulted with the Department of Agriculture – Natural Resources Conservation Service (NRCS) to determine the precise acreages that would be impacted. By letter dated December 13, 2013 the NRCS concurs that impacts to prime and unique farmlands from the RP would not "irreversibly" impact prime farmland and is therefore exempt from the rules and regulations of Section 1539-1549 of Farmland Protection Policy Act.

Fish and Wildlife Coordination Act of 1934 (Fish & Wildlife)
The Fish and Wildlife Coordination Act (FWCA) provides authority for the USFWS involvement in evaluating impacts to fish and wildlife from proposed water resource development projects. It requires that fish and wildlife resources receive equal consideration to other project features. It requires Federal agencies that construct, license or permit water resource development projects to first consult with the USFWS, NMFS and state resource agencies regarding the impacts on fish and wildlife resources and measures to mitigate these impacts. Section 2(b) requires the USFWS to produce a Coordination Act Report (FWCAR) that details existing fish and wildlife resources in a project area, potential impacts due to a proposed project and recommendations

for a project. The final FWCAR (February 2016) includes the USFWS final positions and recommendations and are contained in Appendix A Annex G. The draft FWCAR is available upon request.

Magnuson-Stevens Fishery Conservation and Management Act of 1976 and the Magnuson-Stevens Act Reauthorization of 2006 (Essential Fish Habitat)

The law and its reauthorization govern marine fisheries management in the U.S. Essential Fish Habitat (EFH) would not intersect the proposed nonstructural NED Plan. The CEMVN has determined that the NER Plan would have significant impacts to EFH by shifting existing shallow open water EFH to marsh EFH and shoreline protection habitat which would protect marsh habitat. Hence, there would be a net positive gain and overall estuarine benefits of higher quality marsh EFH.

Marine Mammal Protection Act of 1972 (Marine Mammals)

The Marine Mammal Protection Act (MMPA) protects whales, dolphins, sea lions, seals, manatees, and other species of marine mammals. The CEMVN finds the RP would have no effect on marine mammals that may occasionally be found in the project area. To avoid "takings" of the West Indian manatee and ensure compliance with the MMPA, the CEMVN commits that 1) all construction personnel will be educated about the MMPA, ESA, and species protected by the MMPA, 2) a search for manatees and dolphins in the project area and mitigation areas would be conducted before construction, and 3) BMPs detailed in Appendix A to avoid or minimize potential entrapment of manatees and dolphins during construction would be implemented.

Migratory Bird Treaty Act of 1918 and Migratory Bird Conservation Act of 1929 (Migratory Birds)

The Migratory Bird Treaty Act (MBTA) and the Migratory Bird Conservation Act (MBCA) protect migratory birds and their habitat. Many important habitats in the project area provide migratory bird shelter, nesting, feeding and roosting habitat. All construction activities shall observe a buffer of 1,000 feet for any colonial-nesting waterbird colonies (e.g., egrets, herons, ibis, pelicans, etc.), 1,300 feet for any shorebird nesting colonies (e.g., terns, gulls, plovers, skimmers, etc.), and 2,000 feet for any brown pelican nesting colonies near the project feature. Based upon a field survey conducted in June 2015 for active colonial-nesting waterbird colonies, one active colonial-nesting waterbird colony was observed within 1,000 feet of the proposed construction limits of marsh creation feature 3a1 within the Calcasieu restoration area. Additionally, a shorebird nesting colony was recorded within 1,300 feet of the proposed construction limits of breakwater feature 6b2 within the Rockefeller restoration area. USFWS and USACE biologists will survey the area before construction to confirm active rookery locations. If colonial-nesting waterbird colonies exist within 1,000 feet, if shorebird colonies exist within 1,300 feet, or if brown pelican nesting colonies exist within 2,000 feet of the proposed action, this could be a project constraint. USFWS guidelines would be followed to avoid adverse impacts to these species

National Historic Preservation Act of 1966 (Cultural and Historic Resources)

Section 106 of the National Historic Preservation Act (NHPA) and the implementing regulations (36 CFR part 800) require Federal agencies to take into account the effects of their undertakings on historic properties, including any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion on, the National Register of Historic Places, and to provide the Advisory Council on Historic Preservation a reasonable opportunity to comment. Federal agencies are required to consult with other parties throughout the Section 106 process, including the State Historic Preservation Officer (SHPO) and Indian Tribes that attach traditional religious and cultural significance to historic properties that may be affected by an undertaking. Taking into account the views of consulting parties and the public, the federal agency will determine how to resolve any adverse effects to historic properties prior to the final decision-making. Section 106 consultation has been initiated, and programmatic agreements for the NED and NER Recommended Plans have been executed and are contained in Appendix A, Annex F.

Tribal Consultation (Tribal Interests)

In partial fulfillment of E.O. 13175 ("Consultation and Coordination With Indian Tribal Governments"), NEPA and Section 106, consultation has been initiated with the following federally recognized Tribes: Alabama-Coushatta Tribe of Texas, Caddo Nation of Oklahoma, Chitimacha Tribe of Louisiana, Choctaw Nation of Oklahoma, Coushatta Tribe of Louisiana, Jena Band of Choctaw Indians, Mississippi Band of

Choctaw Indians, Quapaw Tribe of Oklahoma, Seminole Nation of Oklahoma, Seminole Tribe of Florida and Tunica-Biloxi Tribe of Louisiana. CEMVN has provided Tribes with a summary of the study authority and documentation of completed cultural resource investigations and previously recorded archaeological sites and standing structures within a one-mile buffer of the proposed alternatives, offering Tribes the opportunity to review and comment on the potential of the proposed action to significantly affect protected tribal resources, tribal rights, or Indian lands. Documentation of tribal consultation is included in the Appendix A, Annex F.

Wild and Scenic River Act of 1968 (Rivers)

The Wild and Scenic Rivers Act establishes a National Wild and Scenic Rivers System. The Louisiana Scenic Rivers Act recognizes and implements the 1968 Federal law, to preserve, protect, and enhance the wilderness qualities, scenic beauties, and ecological regimes of rivers and streams. Any construction within 100 feet of a scenic stream requires a scenic streams permit. There are no scenic rivers within the project area.

Executive Order 11514, Protection and Enhancement of Environmental Quality

EO 11514 directs Federal agencies to "initiate measures needed to direct their policies, plans, and programs so as to meet national environmental goals." The RP complies with EO 11514.

Executive Order 11988, Floodplain Management

EO 11988 directs agencies to avoid development in floodplains to the maximum extent feasible. The NED Plan would reduce the risk of storm surge flooding to existing structures within the floodplain. The CEMVN is also providing storm surge information to inform the Floodplain Administrators in Calcasieu, Cameron, and Vermilion Parishes in their floodplain management implementation. The NER Plan would have no significant adverse impacts on the floodplain or its management. Hence, the proposed action complies with EO 11988.

Executive Order 11990, Protection of Wetlands

EO 11990 directs Federal agencies to avoid to the extent possible the long and short term adverse impacts associated with the destruction or modification of wetlands, and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative. Mitigation planning was integrated into the planning by considering, individually and collectively, each of the NEPA mitigation actions of avoiding, minimizing, reducing, and rectifying potential adverse impacts to wetlands to the extent practicable. Implementing the both the NED Plan and the NER Plan would not require any compensatory mitigation. For the NER Plan, unavoidable project-induced impacts to wetlands, such as placement of shoreline protection features and others have been avoided or will be mitigated in-kind by the ecosystem restoration benefits. Hence, the proposed action complies with the EO 11990.

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

EO 12898 requires agencies to make achieving environmental justice (EJ) part of their missions by identifying and addressing disproportionately high and adverse human health or environmental effects of programs, policies and activities on minority populations and low-income populations. Potential EJ issues have been considered throughout planning. As part of the NEPA process, public and scoping meetings were held and attention was given to EJ issues. There are not expected to be any disproportionate EJ impacts from either the NED or NER RPs. However, CEMVN encourages any interested parties to inform the agency of potential EJ concerns.

Executive Order 13112, Invasive Species

EO 13112 directs Federal agencies to prevent the introduction of invasive species; provide for their control; and minimize the economic, ecological, and human health impacts that invasive species cause. The NED and NER RPS are consistent with EO 13112 to the extent practicable and permitted by law and subject to the availability of appropriations, and within Administration budgetary limits. Relevant programs and authorities to prevent the introduction of invasive species would be used during construction. The CEMVN will not authorize, fund, or carry out actions likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless the CEMVN has determined and made public its determination that

the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm would be taken in conjunction with the actions.

Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds

EO 13186 directs Federal agencies to take actions to further implement the MBTA. The NED and NER RPs have been evaluated for potential effects on migratory birds, with emphasis on species of concern. Many important habitats in the project area provide migratory bird shelter, nesting, feeding and roosting habitat. There are not expected to be any adverse effects to migratory birds from the NED and NER Plans.

SOUTHWEST COASTAL LOUISIANA
INTEGRATED FINAL FEASIBILITY REPORT
AND
ENVIRONMENTAL IMPACT STATEMENT

APPENDIX A

Annex K

Threatened and Endangered Species

CONTENT

1. **THREATENED AND ENDANGERED SPECIES** 2
SPRAGUE'S PIPIT 3
RED-COCKADED WOODPECKER 4
PIPING PLOVER 4
RED KNOT 5
WHOOPING CRANE 5
WEST INDIAN MANATEE 6
GULF STURGEON 6
GREEN SEA TURTLE 7
HAWKSBILL SEA TURTLE 7
KEMP'S RIDLEY SEA TURTLE 7
LEATHERBACK SEA TURTLE 8
LOGGERHEAD SEA TURTLE 8
2. **USFWS COORDINATION** 10
3. **NMFS COORDINATION** 36

1. THREATENED AND ENDANGERED SPECIES

Historic and Existing Conditions

Eleven threatened and endangered species and one candidate species are known to occur or occasionally enter the Southwest Coastal Louisiana Project area (See Table 1). The proposed project area also contains Piping plover critical habitat. Personal coordination with USFWS staff concluded that a "programmatic Biological Assessment" is not required, therefore a Biological Assessment (BA) has been prepared and informal consultation with NMFS/USFWS will conclude upon development of subsequent NEPA analysis prior to implementing the Recommended Plans (RPs).

Table 1. Listed and Candidate Species within the Project Area

Species	Acadia Parish	Calcasieu Parish	Cameron Parish	Vermillion Parish
*Sprague's Pipit	Candidate	Candidate	Candidate	Candidate
Red-Cockaded Woodpecker		Endangered		
Piping Plover			Threatened/ Critical habitat	Threatened/ Critical habitat
Red Knot			Threatened	Threatened
**Whooping Crane				Threatened
West Indian Manatee			Endangered	Endangered
Gulf Sturgeon			Threatened	Threatened
Green Sea Turtle			Threatened	Threatened
Hawksbill Sea Turtle			Endangered	Endangered

Kemp's Ridley Sea Turtle			Endangered	Endangered
Leatherback Sea Turtle			Endangered	Endangered
Loggerhead Sea Turtle			Threatened Critical habitat	Threatened Critical habitat

[b] Candidate species are those taxa for which the Service has on file sufficient information regarding biological vulnerability and threat(s) to support issuance of a proposal to list

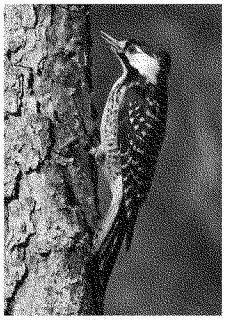
**This is a nonessential population which is considered "threatened". However, the ESA's section 7 consultation regulations do not apply.

Sprague's Pipit Candidate species

The Sprague's pipit, is a candidate species for Federal listing as a threatened or endangered species. Candidate species are those taxa for which the Service has on file sufficient information regarding biological vulnerability and threat(s) to support issuance of a proposal to list, but issuance of a proposed rule is currently precluded by higher priority listing actions. The Sprague's pipit is known to or believed to occur in all parishes within the project area.

Sprague's pipit is a small (4 to 6 inches in length) passerine bird with a plain buffy face, a large eye-ring, and buff and blackish streaking on the crown, nape, and under parts. It winters in Louisiana, arriving from its northern breeding grounds in September and remaining until April. Sprague's pipit exhibits a strong preference for open grassland (i.e., native prairie) with native grasses of intermediate height and thickness, and it avoids areas with too much shrub encroachment. This species is a ground feeder and forages mainly on insects but will occasionally eat seeds (personal coordination USFWS Brigette Firmin).

Red-Cockaded Woodpecker. Endangered species



The red-cockaded woodpecker (RCW) was Federally listed as endangered in 1970. Red-cockaded woodpeckers are known to, or believed to occur within the proposed project area, specifically in Calcasieu Parish. Deforestation for timber harvesting and habitat fragmentation for agricultural purposes has been the driving factor in reducing its habitat. Approximately 1% of their range remains. Mature pines in open upland stands are the preferred habitat of the RCW, however habitat selection varies regionally. Observations in Louisiana suggest significant use of bottomland hardwoods (Jones and Hunt).

The RCW is a small bird with a ladder-back, large white cheek patches and a black cap.

The male possesses a tiny patch of red feathers at the margin of the black cap and white cheeks. They roost and nest in cavities they sculpt primarily in pine trees. They feed on arthropods they gather from under tree bark. RCW can be found in Calcasieu Parish year round.



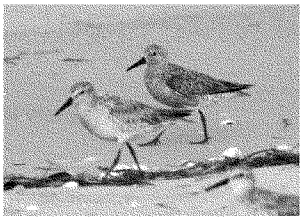
Piping Plover. Threatened species

Hunting in the early 1900s resulted in a drastic reduction of the piping plover population. Ongoing destruction of historical nesting sites further reduced plover populations (USFWS 1988). On December 11, 1985, the USFWS designated the piping plover as endangered in areas of the Great Lakes watershed. The piping plover was designated as threatened, except in those areas where it is listed as endangered. The Piping plover is listed as threatened in Louisiana as well as several other states.

In July of 2001, the USFWS designated specific areas in the United States as critical habitat for wintering piping plovers (Federal Register / Vol. 66, No. 132, 10 July 2001). Piping plover critical habitat is defined by the USFWS as "those elements essential for the primary biological needs of foraging, sheltering, roosting, and the physical features necessary for maintaining the natural processes that support those habitat components. These primary elements are found only in coastal areas with intertidal beaches or flats that are associated with dunes systems." The USFWS designated a total of 1,798 miles (165,211 acres) of shoreline along the Gulf of Mexico and Atlantic coasts as critical wintering habitat. Critical habitat in Louisiana encompasses 24,950 acres along 342.5 miles of shoreline, which is most of the coast of Louisiana. Piping plovers winter in Louisiana but do not nest on Louisiana's coast. They arrive from their northern breeding grounds as early as late July and may be present for 8 to 10 months of the year.

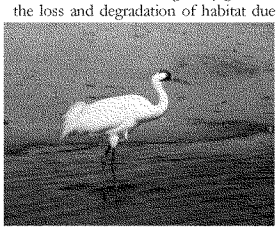
In 2006, an international piping plover breeding and wintering census was conducted. The results of the census showed that the piping plovers were found wintering primarily in Texas (53.8%), Florida (11.7%) and the Bahamas (10.7%). The results of the Census showed only 5.8% found wintering in Louisiana (Elliott-Smith et al 2006). In Louisiana, the 2006 census takers recorded 226 piping plovers, almost half of the 2001 census numbers. The substantial decline in numbers can be attributed to habitat damage incurred by Hurricanes Katrina and Rita. Sites in Terrebonne and Cameron Parishes had some of the largest populations of piping plovers in the state: Raccoon (Last) Island, 39 birds; Whiskey Island, 31 birds; Smith Bayou to West Jetty, 35 birds.

Red Knot: Threatened species



The red knot is a medium-sized shorebird about 9 to 11 inches in length with a proportionately small head, small eyes, short neck, and short legs. The black bill tapers steadily from a relatively thick base to a relatively fine tip; bill length is not much longer than head length. Legs are typically dark gray to black, but sometimes greenish in juveniles or older birds in non-breeding plumage. Non-breeding plumage is dusky gray above and whitish below. The red knot can be found in Louisiana during the winter months (generally October through March).

In the southeastern United States, red knots forage along sandy beaches, tidal mudflats, salt marshes, and peat banks. Observations along the Texas coast indicate that red knots forage on beaches, oyster reefs, and exposed bay bottoms and roost on high sand flats, reefs, and other sites protected from high tides. In wintering and migration habitats, red knots commonly forage on bivalves, gastropods, and crustaceans. Coquina clams, a frequent and often important food resource for red knots, are common along many gulf beaches. Major threats to this species along the Gulf of Mexico include the loss and degradation of habitat due to erosion and shoreline stabilization development, disturbance by humans and pets, and predation (personal coordination USFWS Brigette Firmin).



Whooping Crane: Threatened species (nonessential experimental population (NEP))

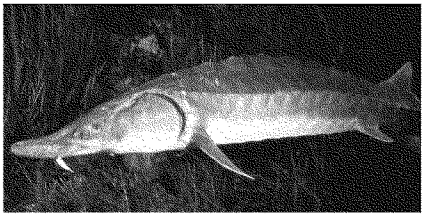
The whooping crane was listed as endangered in 1970 by the U. S. Fish and Wildlife Service. A NEP was introduced into historic southwestern Louisiana habitat on the state-owned White Lake Wetlands Conservation Area in Vermilion Parish, Louisiana. This reintroduced population was designated as NEP under section 10(j) of the Endangered Species Act of 1973 (ESA), as amended. A NEP population is a reintroduced population believed not to be essential for the survival of the species, but important for its full recovery and eventual removal from the endangered and threatened list. These populations are treated as "threatened" species except that the ESA's section 7 consultation regulations do not apply.

The whooping crane is a large white bird with black wing tips, red on forehead and cheeks, bill and legs are dark gray and eyes are yellow. Whooping cranes nest on the ground in marshy areas with bulrushes, cattails and sedges and will sometimes roost in shallow waters. They feed on insects, crabs, clams, crayfish, frogs, rodents, small birds, berries, acorns and other wild fruit (USFWS).

West Indian Manatee: Endangered species



The manatee was listed as an endangered species in 1967 by the USFWS. Manatees inhabit coastal areas from Florida to the Greater Antilles and suitable habitats in Central and South America. The manatees' range is generally restricted to the southeastern United States; individuals occasionally range as far north as Massachusetts and as far west as Texas. On occasion they have been observed in eastern Louisiana waters. Preferred manatee habitat includes abundant submerged aquatic vegetation, such as sea grasses, which are limited to shallow water near shore, because deep water limits the amount of light which can penetrate the water and reach the vegetation (USFWS 2008). They can feed in brackish or salt water, but require a fresh water source, such as estuaries or natural springs, for drinking. The manatee is known to or believed to occur in Cameron and Vermilion Parishes within the project area.



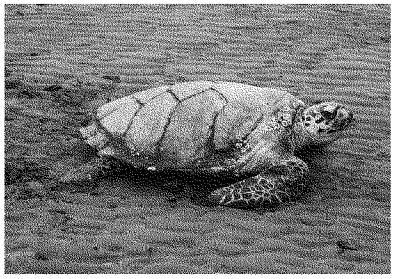
Gulf Sturgeon: Threatened species

On September 30, 1991, the Gulf sturgeon was listed as a threatened species under the Endangered Species Act (ESA) (56 FR 49653). The Gulf sturgeon is known to or believed to occur in Cameron and Vermilion Parishes within the project area. Gulf sturgeons are rather large fish with bony plates and a hard extended snout. They are brackish/marine water bottom feeders that eat primarily macro invertebrates. Gulf sturgeons spawn in fresh water coastal rivers during the warmer months and move to marine waters during the cooler months. Some of the primary causes of the species' decline are habitat loss due to the construction of water control structures, dredging, poor water quality and irrigation (NOAA-6).

Green Sea Turtle: Threatened species



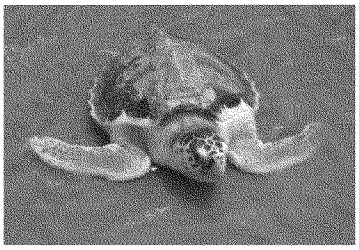
Green sea turtles were listed as Threatened on July 28, 1978. The green sea turtle is known or believed to occur in Cameron and Vermillion Parishes within the project area. Green sea turtles are found worldwide in oceans and gulfs with water temperatures greater than 20° C. During their first year of life they are primarily carnivorous, feeding mainly on invertebrates. As adults they feed almost exclusively on sea grasses growing in shallow water flats (Fritts et al. 1983). Historically, green sea turtles were fished off the Louisiana coast (Rebel 1974, in Fritts et al. 1983), but exploitation and incidental drowning in shrimp trawls led to the decline of this species and its listing as a threatened species. Sightings or strandings are rare in Louisiana, but do occur. Strandings are defined as turtles that wash ashore, dead or alive, or are found floating dead or alive (generally in a weakened condition). NMFS' records show 6 plus strandings in 2011, 9 plus in 2012 and in 2013 4 plus (NOAA-1).



Hawksbill Sea Turtle: Endangered species

Hawksbill sea turtles were listed as endangered in 1970. The Hawksbill sea turtle is known or believed to occur in Cameron and Vermillion Parishes within the project area. Hawksbills regularly occur in the Gulf of Mexico but mainly in Texas They feed on animals associated with coral reefs, sponges, other invertebrates and algae. There is no record of Hawksbill strandings along Louisiana shorelines (NOAA-2).

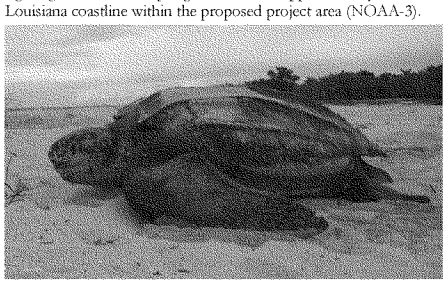
Kemp's Ridley Sea Turtle: Endangered species



The Kemp's ridley sea turtle was listed as endangered on December 2, 1970. Inshore areas of the Gulf of Mexico appear to be important habitat for the Kemp's ridley sea turtle. Kemp's ridley turtles in the Gulf of Mexico tend to be concentrated around major river mouths (Frazier 1980). Ridleys are commonly captured by shrimpers off the Texas coast, as well as in heavily trawled areas off the coasts of Louisiana and Alabama (Carr 1980, Pritchard and Marquez 1973). Kemp's ridley turtles are thought to be the most abundant turtle off the Louisiana coast (Gunter 1981, Viosca 1961) as well as the most endangered of the sea turtles. Occurrence of ridleys in bays and estuaries

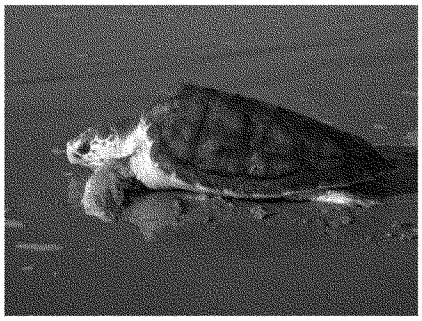
along the Louisiana coast would not be unexpected, since many of their primary food items occur there.

The nesting season for the Kemp's ridley is April through July. The possibility of Kemp's ridley sea turtles nesting in Louisiana has been suggested (Hildebrand 1981, Viosca 1961), but no actual documentation of nesting exists. However, based on information obtained from NMFS, Kemp's ridley sea turtle strandings on the Louisiana coast have been documented and have increased since 2011. In 2013 at least 145 plus Kemp's ridley sea turtles were recorded along the Louisiana coast compared to 104 plus in 2011. The majority of the sightings were in the spring months and approximately half of the 2013 sightings were along the western Louisiana coastline within the proposed project area (NOAA-3).



Leatherback Sea Turtle: Endangered species

The Leatherback sea turtle was listed as endangered in 1970. It is known to or believed to occur in Cameron and Vermillion Parishes within the project area. Leatherbacks feed on soft-bodied prey like jellyfish. Adult leatherbacks have been sighted in the Gulf of Mexico; however, only one stranding has been recorded along the Louisiana shoreline (NOAA-4).



Loggerhead Sea Turtle: Threatened species

The loggerhead was listed as threatened in 1978 by the USFWS. The loggerhead turtle is distributed worldwide in temperate and tropical waters. Nesting is from April through August, with 90 percent of the nesting effort on the gulf coast, occurring on the south-central coast of Florida (Hildebrand 1981). Nesting in Louisiana is limited almost exclusively to the Chandeleur Island. Loggerhead strandings, although few, have been reported along the Louisiana coast. NMFS' records show 19 plus strandings in 2011, 3 plus in 2012 and 6 plus in 2013 (NOAA-5).

The loggerhead's diet includes mollusks, shrimp, crabs, sponges, jellyfish, squid, sea urchins, and basket stars (Caldwell et al. 1955, Hendrickson 1980). Landry (1986) suggested that they may also feed on the by-catch from shrimp trawling. Adult loggerheads feed in waters less than 50 meters in depth, while the primary foraging areas for juveniles appear to be estuaries and bays (Rabalais and Rabalais 1980).

On July 10, 2014 Loggerhead Critical Habitat (*Sargassum* habitat) issued a final rule to designate critical habitat for the Northwest Atlantic Ocean Distinct Population Segment (DPS) of the loggerhead sea turtle (*Caretta caretta*) within the Atlantic Ocean and the Gulf of Mexico pursuant to the Endangered Species Act of 1973, as

amended (ESA). Loggerhead critical habitat exists in the southern (offshore) portion of the SWC project area (see **Figure 4-3** below). This critical habitat expands the entire length of the project (west to east) and the closest points range from approximately 4 miles to 9 miles offshore.

2. USFWS COORDINATION

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO ATTENTION OF

March 11, 2015

Regional Planning and
Environmental Division South
New Orleans Environmental Branch

Jeffrey D. Weller
Supervisor, Louisiana Field Office
US Fish and Wildlife Service
646 Cajundome Blvd. - Suite 400
Lafayette, Louisiana 70506

Dear Mr. Weller:

The U.S. Army Corps of Engineers, New Orleans District (CEMVN) is submitting a request for consultation on the Southwest Coastal Louisiana Project. A Biological Assessment with a determination of *"may affect but will not likely adversely affect"* the piping plover or it's critical habitat, red knot, West Indian manatee, Gulf sturgeon, loggerhead and Kemps Ridley sea turtles; would have *"no effect"* on the Red-cockaded woodpecker, green, leatherback, and hawksbill sea turtles or loggerhead critical habitat and would not adversely impact other species of concern that could potentially be found in the project area has been prepared by the CEMVN and is enclosed for your review and opinion.

Questions and/or concerns should be directed to Ms. Tammy Gilmore; U.S. Army Corps of Engineers; Planning Division; Environmental Planning Branch; CEMVN-PDN-CEP; P.O. Box 60267; New Orleans, Louisiana 70160-0267. Ms. Gilmore may also be contacted by e-mail tammy.h.gilmore@usace.army.mil or phone (504) 862-1002.

Sincerely,

Joan M. Exnicios
Chief, Environmental
Planning Branch

Encls.

Biological Assessment

I. INTRODUCTION

The U.S. Army Corps of Engineers (USACE), New Orleans District (MVN), has prepared this Biological Assessment (BA) to evaluate the potential impacts associated with the proposed hurricane and storm surge damage risk reduction measures and ecosystem restoration features within Calcasieu, Cameron, and Vermilion Parishes in southwest Louisiana referred to as the Southwest Coastal Louisiana Study (the "SWC project").

The low elevation and proximity to the Gulf of Mexico places the unique environment and cultural heritage of southwest Louisiana communities at risk from storm surge flooding and coastal erosion. Land subsidence and rising sea level is expected to increase the potential for coastal flooding, shore erosion, saltwater intrusion, and loss of wetlands and chenier habitats.

II. ACTION AREA

The project area (**Figure 2-1**) is located in southwest Louisiana and includes all of Calcasieu, Cameron, and Vermilion parishes and small portions of Beauregard, Jefferson Davis, and Iberia parishes encompassing approximately 4,700 square miles.

Cameron Parish is located in the southwest corner of Louisiana. The southern boundary of the parish is the Gulf of Mexico. Eighty-two percent of Cameron Parish is coastal marshes. Geographically, it is one of the largest parishes in Louisiana. The parish is chiefly rural and the largest communities are Cameron and Hackberry. Cameron is located along Louisiana Highway 82 (LA-82), while Hackberry is located along LA-27. Other smaller communities include Creole, Johnsons Bayou, and Holly Beach.

Calcasieu Parish is located due north of Cameron Parish. The town of Lake Charles is the parish seat, which is the largest urban area in the project area. Only a small portion of the parish is located in the coastal zone.

Vermilion Parish is located due east of Cameron Parish. The southern boundary of the parish is the Gulf of Mexico. Large expanses of Vermilion Parish are open water (lakes, bays, and streams). Approximately 50 percent of the land is coastal marshes. The parish is chiefly rural and the town of Abbeville is the parish seat as well as the largest urban area in the parish. Other communities include Delcambre, Kaplan, and Gueydan, which are all located along LA-14 in the northern part of the project area. Pecan Island and Forked Island are smaller communities, both located along LA-82 in lower Vermilion Parish. Located along LA-333, Intracoastal City is the nearest access to Vermilion Bay and the Gulf of Mexico in this region and supports the area's oil and shrimp industries.

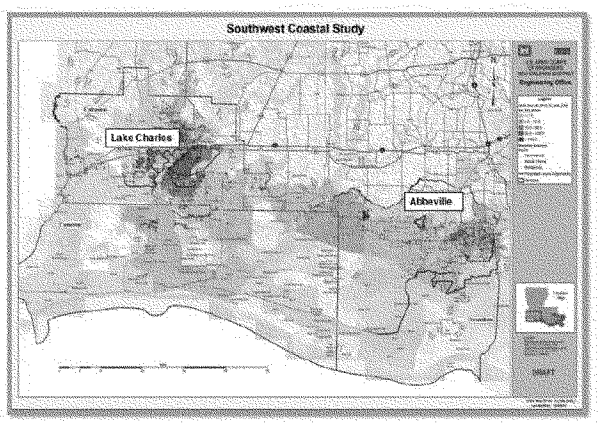


Figure 2-1 SWC Project Area

III. PROJECT DESCRIPTION

The SWC project includes both a National Economic Development (NED) and a National Ecosystem Restoration (NER) component. The NED tentatively selected plan (TSP) is programmatic and nonstructural. The program has been developed to address damages associated with hurricane and coastal storm surge flooding in Calcasieu, Cameron and Vermillion Parishes. The NED TSP is subject to parish-specific codes and regulations, additional NEPA compliance, and participation agreements. Consultation would be reinitiated, as necessary, upon further design of the NED plan and during preparation of additional NEPA compliance. Details of the NED TSP are below and in Figures 3-1:

- Nonstructural measures include:
  - Elevating residential structures*
  - Flood proofing non-residential structures (public and commercial facilities)*
  - Building small berms around warehouses
  - Potentially acquiring structures

  (* Note that some residential structures could be flood-proofed and some commercial structures could be elevated)

- Structures eligible for nonstructural measures have first-floor elevations at or below the 25-year flood zone, based on year 2025 hydrology. Eligible structures would be raised to the 100-year base flood elevation based on year 2075 hydrology.

- The TSP would reduce flood risk for 4,952 residential and non-residential structures (4,219 residential; 396 non-residential; 337 warehouses).

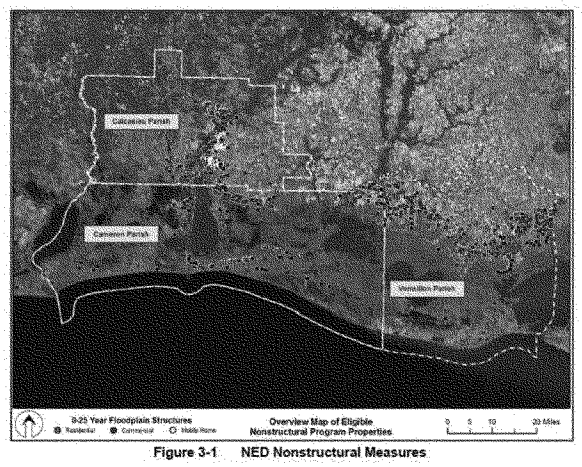


Figure 3-1 NED Nonstructural Measures

The NER TSP is Small Integrated Restoration (Plan CM-4), a comprehensive ecosystem restoration plan that attempts to address land loss problems and ecosystem degradation. The plan is cost effective, and is the least cost comprehensive best buy plan. The plan goal is to minimize land loss, enhance plant productivity by reducing major stressors, and to reinforce and protect critical landscape features. Details of the TSP are listed below and in Figures 3-2 and 3-3:

- A total of 51 ecosystem restoration features
  - 9 marsh restoration features
  - 35 chenier reforestation features
  - 5 shoreline protection features
  - 1 hydrologic / salinity control feature
  - The Calcasieu Ship Channel Salinity Barrier Navigation Study is recommended as an additional long-range study

Details of the construction of the NER plan features are included in the Enclosures section (Annex A).

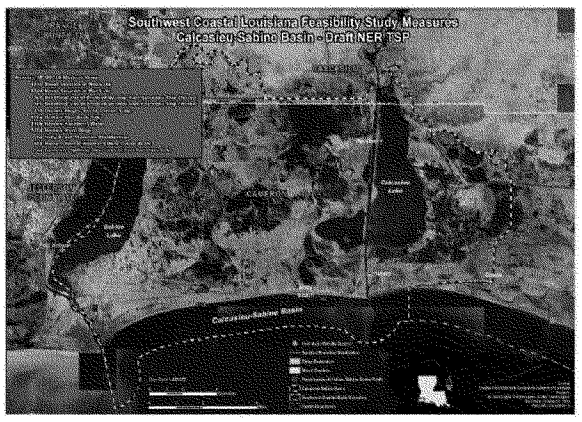


Figure 3-2 NER TSP features (Calcasieu)

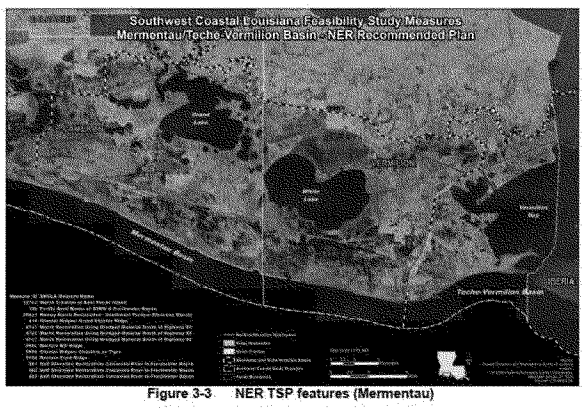


Figure 3-3 NER TSP features (Mermentau)

IV. SPECIES CONSIDERED

Eleven threatened or endangered species and one candidate species are known to or believed to occur within the SWC project area (**Table 4-1**). With the exception of the red-cockaded woodpecker (RCW), all of the species provided in **Table 4-1** below were listed in the November 2013 USFWS Draft Fish and Wildlife Coordination Act Report (USFWS 2013).

Cetaceans

A total of 28 cetaceans have been reported in the Gulf of Mexico waters (Davis et al. 2002). Of these, five Mysticeti (e.g., baleen whales including blue whale (*Balaneoptera musculus*), humpback whale (*Megaptera novaeangliae*), finback whale (*Balaenoptera physalus*), and sei whale (*Balaenoptera borealis*); and Odontoceiti (e.g., toothed whales, including sperm whale (*Physeter macrocephalus*) have been reported in the Gulf of Mexico and all are listed as endangered species. Infrequent, shallow water, historical sightings and strandings in the Gulf of Mexico of these endangered cetaceans suggest that most of these species are rare, accidental, or uncommon in this area (Davis et al. 2002). All whales are principally marine deepwater species and would not likely be impacted by the SWC TSP.

Bald Eagle

The bald eagle (*Haliaeetus leucocephalus*) was removed from the list of Threatened and Endangered species on 8 August 2007. Bald eagles nest in Louisiana from October through mid-May and typically nest in mature trees (such as bald cypress, sycamore, willow, etc.) near fresh to intermediate marshes or open water (USFWS 2013). The bald eagle continues to be protected under the Migratory Bird Treaty Act of 1918 (MBTA) and the Bald and Golden Eagle

Protection Act. Forested portions of the project area may provide habitat for the bald eagle. Most active bald eagle nesting sites have been historically located to the east of the SWC project area (source: http://www.lsuagcenter.com/en/communications/publications/agmag/Archive/2002/Spring/Bald+Eagles+Make+Comeback+in+South+Louisiana.htm). No known nests are located near any project features, however, if an eagle's nest is found, a no-work zone of 660 feet must be implemented and the Corps must be immediately notified.

Brown Pelican and Colonial Nesting Water Birds

The brown pelican (*Pelecanus occidentalis*) was removed from the list of Threatened and Endangered species on 17 December 2009. Their nests continue to be protected under the Migratory Bird Treaty Act (MBTA) of 1918. The brown pelican and a variety of colonial nesting water birds including but not limited to: herons, egrets, ibis, anhinga, double crested cormorants, and roseate spoonbill may nest within the project area. In general, the nesting season for these species runs from February 15 through September 1. The area is also known to support various species of shore birds including but not limited to: Sanderlings, sandpipers, gulls, and terns. These birds and their nests are protected under the MBTA and adverse impacts would be avoided. No known rookeries are located near any project features, however, if any nests are found, a no-work zone of 1,000 feet would be implemented. Additionally, if needed, a bird abatement plan would be developed and implemented, in coordination with USFWS, to deter colonial nesting water birds and shore birds from nesting within project boundaries.

Bottlenose Dolphin

The western north Atlantic bottlenose dolphin (*Tursiops truncatus*) populations found along the mid-Atlantic coast have been designated as depleted under the Marine Mammal Protection Act (MMPA) and, therefore, are stringently managed (NOAA 2015). In addition, the National Marine Fisheries Service (NMFS) has classified five U.S. stocks of bottlenose dolphins as *"strategic"* stocks, they are: Eastern Gulf of Mexico Coastal; Western Gulf of Mexico Coastal; Northern Gulf of Mexico Coastal; Gulf of Mexico Bay, Sound and Estuarine; and Western North Atlantic Coastal (NOAA 2015). Atlantic bottlenose dolphins inhabit temperate and tropical waters, and are found in the United States from Cape Cod to the Gulf of Mexico (IMMS 2015). These marine mammals are protected under the MMPA of 1972 and therefore impacts should be avoided. **Annex B** provides entrapment prevention measures for the Atlantic bottlenose dolphins.

Table 4-1 Threatened and Endangered Species within the SWC Project Area

	Common Name	Scientific Name	Critical Habitat	Agency	Status
Birds	*Sprague's Pipit	*Anthus spragueii*		USFWS	Candidate
	red-cockaded woodpecker	*Picoides borealis*		USFWS	endangered
	piping plover	*Charadrius melodus*	yes	USFWS	threatened
	rufa red knot	*Calidris canutus rufa*		USFWS	threatened
	**whooping crane	*Grus americana*		USFWS	endangered
Fishes	Gulf sturgeon	*Acipenser oxyrinchus desotoi*		NOAA/NMFS	threatened

	Common Name	Scientific Name	Critical Habitat	Agency	Status
Mammals	West Indian manatee	*Trichechus manatus*		USFWS	endangered
Reptiles	green sea turtle	*Chelonia mydas*		NOAA/NMFS	threatened
	Kemp's ridley sea turtle	*Lepidochelys kempii*		NOAA/NMFS	endangered
	leatherback sea turtle	*Dermochelys coriacea*		NOAA/NMFS	endangered
	loggerhead sea turtle	*Caretta caretta*	yes	NOAA/NMFS	threatened
	hawksbill sea turtle	*Eretmochelys imbricata*		NOAA/NMFS	endangered

* Candidate species are those taxa for which the USFWS has on file sufficient information regarding biological vulnerability and threat(s) to support issuance of a proposal to list.

**This is an *"experimental population, nonessential"* designation.

Sources:
http://ecos.fws.gov/ecos/home.action
http://www.nmfs.noaa.gov/pr/species/criticalhabitat.htm

The SWC TSP could potentially impact the piping plover (*Charadrius melodus*), rufa red knot (*Calidris canutus rufa*), West Indian manatee (*Trichechus manatus*), Gulf sturgeon and sea turtles. The project area encompasses critical habitat for the piping plover and for the loggerhead sea turtle (*Caretta caretta*). Only a very small area in the extreme southern off-shore portion of the project area encompasses Sargassum critical habitat for the loggerhead sea turtle. The project area does not encompass critical habitat for any other species mentioned in **Table 4-1** above. Descriptions of the species that could potentially be impacted by the SWC TSP are described below.

Red-cockaded Woodpecker (*Picoides borealis)*
The RCW was listed as endangered in 1970 (35 FR 16047 16048). The RCW is a permanent resident of Louisiana and is dependent on a very specific habitat type. Old stand longleaf pine forests are preferred; however, all of the southern pine species can harbor RCWs. The birds may forage on pines of most sizes but only the oldest fungus infested pines are used as cavity trees. Old pine forests have declined substantially due to the lumber industry, development and agriculture. The red-cockaded woodpecker is known to occur in Calcasieu Parish.

Piping Plover (*Charadrius melodus*)
On December 11, 1985, the USFWS published the final rule (50 CFR 50720) that listed the piping plover as endangered in the Great Lakes watershed (Illinois, Indiana, Michigan, northeastern Minnesota, New York, Ohio, Pennsylvania, Wisconsin, and Ontario, Canada) and as threatened elsewhere within its range. This listing includes piping plovers breeding in Canada, with their status under the Endangered Species Act (ESA) of 1973 determined by whether they breed in the watershed of the Great Lakes (endangered) or elsewhere (threatened). Piping plovers on migratory routes outside of the Great Lakes watershed or on their wintering grounds are considered threatened (USFWS 2001a).

The International Piping Plover Coordination Group facilitates the International Piping Plover Census (IPPC) of breeding and wintering piping plovers throughout their range (Elliott-Smith et al 2006). The IPPC has taken place in 1991, 1996, 2001, 2006, and 2011. (Results from 2011 have not yet been published.) (B. Firmin 2014 personal communication) Survey results for

Louisiana have varied in intensity and number of sites visited over the years due to poor weather conditions, lack of personnel, and logistical constraints for site access (USFWS 2011). Results of those IPPC surveys for Louisiana range from a high of 750 birds in 1991 to a low of 226 birds in 2006; those numbers, however, do not reflect the variations in survey intensity or the number of sites visited (USFWS 2011).

In Louisiana, the 2006 IPPC recorded only 226 piping plovers, the lowest numbers in the State in IPPC history. The substantial decline in numbers of wintering piping plover along the Louisiana coast could be attributed to habitat loss as a result of Hurricanes Katrina and Rita; however, lack of personnel and poor weather conditions also affected survey intensity in the State that year (B. Firmin, USFWS, personal communication 2014). Approximately 40 piping plovers were reported in Cameron Parish in the 2006 Census.

Piping plovers arrive on wintering grounds in July, with some late-nesting birds arriving in September. Migration is poorly understood, but most piping plovers probably migrate non-stop from interior breeding areas to wintering grounds (Haig 1992). The habitats used by wintering birds include beaches, mud flats, sand flats, algal flats, and washover passes (areas where breaks in the sand dunes result in an inlet). Wintering plovers are dependent on a mosaic of habitat patches, and move among these patches depending on local weather and tidal conditions (USFWS 2001a). In late February, piping plovers begin leaving the wintering grounds to migrate back to breeding sites. Northward migration peaks in late March, and by late May most birds have left the wintering grounds (USFWS 2001a).

On July 10, 2001, the USFWS designated 137 areas along the coasts of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana (piping plover critical habitat within the project area is shown in **Figure 4-1**), and Texas as critical habitat for the wintering population of the piping plover. This includes approximately 1,798.3 miles of mapped shoreline and approximately 165,211 acres of mapped area along the gulf and Atlantic coasts and along margins of interior bays, inlets, and lagoons. Approximately 6,548 acres of the aforementioned are located within Cameron and Vermilion Parishes (LA-1 Figure 4-1) (66 FR 36074). All piping plovers are considered threatened species under the Act when on their wintering grounds.

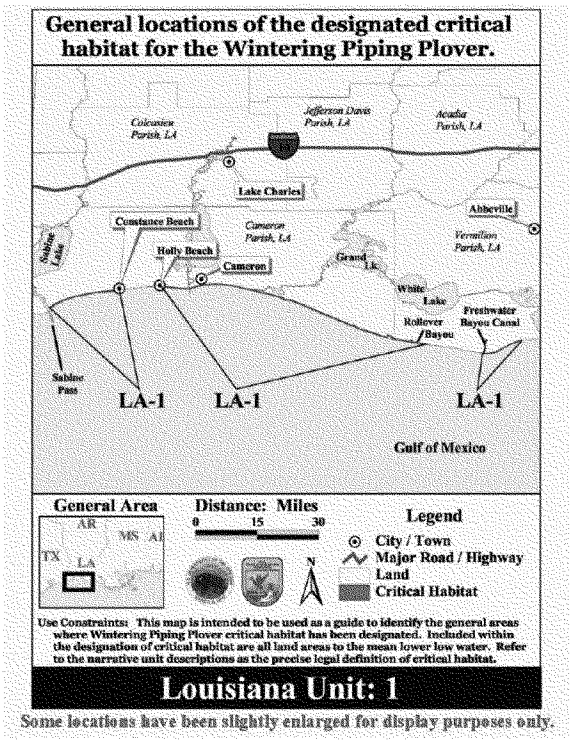


Figure 4-1 Piping plover critical habitat in the project area

Rufa red knot (*Calidris canutus rufa*)
In a 11 December 2014 final rule, the USFWS made a final determination to protect the rufa subspecies of the red knot as threatened under the ESA, with an effective date of 12 January 2015. All of the following information regarding red knot is summarized from the Rufa Red Knot Ecology and Abundance (USFWS 2014a) and final rule 50 CFR Part 17 (USFWS 2014b) and is in reference to the rufa red knot, unless otherwise stated.

The rufa red knot migrates annually between its breeding grounds in the Canadian Arctic and several wintering regions, including the Southeast U.S., the Northeast Gulf of Mexico, northern Brazil, and Tierra del Fuego at the southern tip of South America. During both the northbound (spring) and southbound (fall) migrations, rufa red knots use key staging and stopover areas to rest and feed (USFWS 2014a, 2014b).

Louisiana is a migration stopover for red knots in both spring and fall, and some birds may overwinter in small numbers. In the U.S., the rufa red knot is found principally in intertidal marine habitats, especially near coastal inlets, estuaries, and bays, or along resting formations (i.e., intertidal shelf typically formed of densely-packed dirt blown by strong, offshore winds). Within the U.S., rufa red knot migratory and wintering habitats are principally utilized for resting and foraging activities. In the Southeastern U.S., rufa red knots commonly forage on bivalves, gastropods, and crustaceans along sandy beaches, tidal mudflats, salt marshes, and peat banks (USFWS 2014b).

Sprague's Pipet (*Anthus spragueii*)
The Sprague's pipit, is a candidate species for federal listing as a threatened or endangered species. It winters in Louisiana, arriving from its northern breeding grounds in September and remaining until April. Sprague's pipit exhibits a strong preference for open grassland (i.e., native prairie) with native grasses of intermediate height and thickness, and it avoids areas with too much shrub encroachment. The Sprague's pipit is known to or believed to occur in all parishes within the project area.

West Indian Manatee (*Trichechus manatus*)
The West Indian manatee was listed as endangered throughout its range for both the Florida and Antillean subspecies in 1967, and received Federal protection with the passage of the ESA in 1973. Critical habitat was designated in 1976, 1994, 1998, 2002, and 2003 for the Florida subspecies. This species is also protected as a depleted stock under the Marine Mammal Protection Act of 1972 (16 U.S.C. 1361-1407).

Manatees inhabit both salt and freshwater of sufficient depth (5 feet [1.5 meters] to usually less than 20 feet [6.1 meters]) throughout their range. Shallow grassbeds with ready access to deep channels are preferred feeding areas in coastal and riverine habitats (USFWS 2001b). They may also be encountered in canals, rivers, estuarine habitats, saltwater bays, and have been observed as much as 3.7 miles (6.0 kilometers) off the Florida gulf coast. Between October and April, Florida manatees concentrate in areas of warmer water. During warmer months they appear to choose areas based on an adequate food supply, water depth, and proximity to fresh water (USFWS 2001b). During summer months, they migrate as far north as coastal Virginia on the east coast and the Louisiana coast in the Gulf of Mexico (O'Shea 1988).

Sightings of the West Indian manatee in Louisiana have occurred in the Amite, Blind, Tchefuncte, and Tickfaw Rivers, Mississippi River Gulf Outlet (MRGO), and in canals within the adjacent coastal marshes of Louisiana. However, there is no known population thriving in the state. On 9 July 2001, a manatee was observed passing safely through the Inner Harbor

Navigation Canal (IHNC) Lock and into the Mississippi River, and one was sighted in Contraband Bayou in Calcasieu Parish in February, 2010.

Gulf Sturgeon (*Acipenser oxyrinchus*)
On September 30, 1991, the Gulf sturgeon was listed as a threatened species under the Endangered Species Act (ESA) (56 FR 49653).

Gulf sturgeon sightings are rare in the proposed project area; however, the LDWF (1979) reported that an Atlantic sturgeon was caught by a Mr. Hugh Mhire in an otter trawl while shrimping in the Gulf of Mexico off the mouth of the Mermentau River, Cameron Parish, LA. This specimen was probably a Gulf sturgeon (Paruka, 2000). In 1990 a commercial fisherman reported trawling up a Gulf sturgeon three miles out from Last Island (Raccoon Island), Terrebonne Parish, LA (D. Walther, personal communication). The Gulf sturgeon is known to or believed to occur in Cameron and Vermilion Parishes within the project area.

Green Sea Turtle (*Chelonia mydas*)
The green sea turtle was listed as endangered/threatened on July 28, 1978. The breeding populations off Florida and the Pacific coast of Mexico are listed as endangered while all others are threatened (USFWS 1991). This species' current status is listed as threatened in Louisiana.

Although green sea turtles are found worldwide in oceans and gulfs with water temperatures greater than 68°F (20°C), their distribution can be correlated to grassbed distribution, location of nesting beaches, and associated ocean currents (Hirth 1971). Long migrations are often made between feeding and nesting grounds (Carr and Hirth 1962). Within Louisiana waters, these turtles probably occur all along the coast and may nest on the Chandeleur Islands (Dundee and Rossman 1989). Green sea turtles feed in shallow water areas with abundant seagrasses or algae. The turtles migrate from nesting areas to feeding grounds, which are sometimes several thousand miles away. Most turtles migrate along the coasts, but some populations are known to migrate across the ocean from nesting area to feeding grounds. The major nesting beaches are always found in places where the seawater temperature is greater than 77°F (25°C) (NMFS 1991).

Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)
On 2 December 1970 the Kemp's ridley sea turtle was designated as endangered across its entire range (USFWS 1991) and has continued to decline in Louisiana (USFWS 1990). This species is currently listed as endangered in Louisiana. Critical habitat has been proposed for this species, but it has not been finalized to date.

This small sea turtle is believed to be the most frequently encountered (Dundee and Rossman 1989), if not the most abundant sea turtle, off the Louisiana coast (Viosca 1961). Kemp's ridley sea turtles have been found along coastal Louisiana from Lake Borgne, Barataria and Terrebonne Bays, and near Calcasieu Pass (Dundee and Rossman 1989). Adult Kemp's ridley sea turtles are usually confined to the Gulf of Mexico. Post-pelagic stages are commonly found over crab-rich, sandy, or muddy bottoms. Juveniles can be found in bays, coastal lagoons, and river mouths. In Louisiana, adults are found seasonally near the Mississippi river outlet. The main nesting grounds for the Kemp's ridley turtle occur on the northeastern coast of Mexico. Occurrence of these sea turtles in bays and estuaries along the Louisiana coast would not be unexpected, as many of their primary food items occur there.

Leatherback Sea Turtle (*Dermochelys coriacea*)

The leatherback sea turtle was listed as an endangered species throughout its range in June 1970 (USFWS 199l), and it is currently listed as endangered in Louisiana. Critical habitat has been established for shoreline and adjacent waters of the U.S. Virgin Islands (50 CFR 17.95; 50 CFR 226.207).

The leatherback sea turtle occurs mostly in continental shelf waters, but will occasionally enter shallow waters and estuaries. Adults are highly migratory, and are believed to be the most pelagic of all sea turtles. Habitat requirements for juvenile and post-hatchling leatherbacks are unknown (NMFS and USFWS 1992b). In Louisiana, leatherbacks are believed to occur offshore in deep waters; however, they have been sighted in Cameron Parish, Atchafalaya Bay, Timbalier Bay, and Chandeleur Sound (Dundee and Rossman 1989). No nesting has been reported in Louisiana (Gunter 1981, Dundee and Rossman 1989).

Loggerhead Sea Turtle (*Caretta caretta*)
The loggerhead sea turtle was listed as a threatened species in July 1978 (USFWS 1991), and it is currently listed as threatened in Louisiana. Critical habitat was established for this species in July 2014 within the Atlantic Ocean and the Gulf of Mexico (50 CFR 226; 79 FR 39855-39912) and within the terrestrial environment of the U.S. Atlantic and Gulf of Mexico coasts (50 CFR 17; 79 FR 39755-39854). These critical habitat areas contain one or a combination of habitat types: nearshore reproductive habitat, winter area, breeding areas, constricted migratory corridors, and/or *Sargassum* habitat.

Loggerheads are capable of living in a variety of environments, such as in brackish waters of coastal lagoons and river mouths. The major nesting beaches are located in the southeastern U.S., primarily along the Atlantic coast of Florida, North Carolina, South Carolina, and Georgia. Only minor and solitary nesting has been recorded along the coasts of the Gulf of Mexico (NMFS AND USFWS 2008).

Loggerheads probably range all along the Louisiana coast; however, Dundee and Rossman (1989) reported specimens only from Chandeleur Sound, Barataria Bay, and Cameron Parish. Nesting on the gulf coast occurs between the months of April and August, with 90 percent of the nesting effort occurring on the south-central gulf coast of Florida (Hildebrand 1981). Although loggerheads have been documented as nesting on the Chandeleurs in 1962 and Grand Isle in the 1930s, it is doubtful whether this species currently successfully nests on the Louisiana coast (Hildebrand 1981, Dundee and Rossman 1989). Loggerhead Critical Habitat (*Sargassum* habitat) exists in the southern (offshore) portion of the SWC project area (see **Figure 4-2** below). This critical habitat expands the entire length of the project (west to east) and the closest points range from approximately 4 miles to 9 miles offshore.

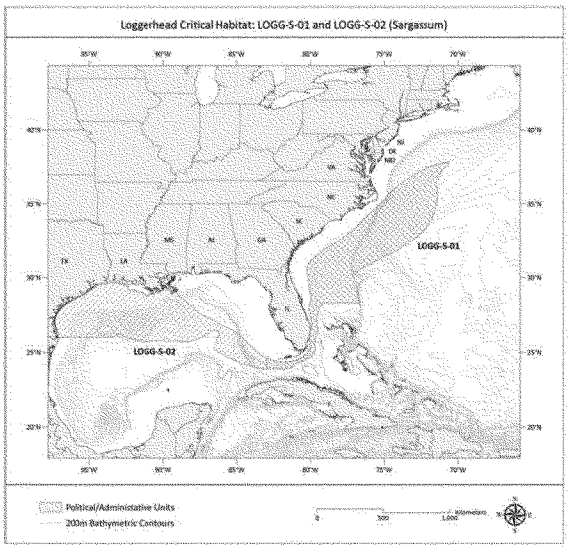


Figure 4-2 Loggerhead Sea Turtle critical habitat in the project area

Hawksbill Sea Turtle (*Eretmochelys imbricata*)
The hawksbill was listed as an endangered species in June 1970 (USFWS 1991), and it is currently listed as endangered in Louisiana.

The hawksbill occurs in tropical and subtropical seas of the Atlantic, Pacific, and Indian Oceans. Only one record of a hawksbill in Louisiana has been reported (Fuller and Tappen 1986). Florida is considered foraging habitat for those turtles, and Texas may be foraging habitat for hatchlings and juveniles (77 observations of small turtles were reported between 1972 and 1984) from the nesting sites in Mexico (NMFS AND USFWS 1993). Hawksbills are observed in Florida with some regularity on the reefs off Palm Beach County and in the Florida Keys. Texas is the only other state where hawksbills are sighted with any regularity. Most sightings involve post hatchlings and juveniles, which are believed to originate from nesting beaches in Mexico (NMFS AND USFWS 1993).

V. EFFECTS ANALYSIS

The potential exists that any of the endangered or threatened species listed in the previous section may be present in the project area during proposed construction activities. However, while individuals may be affected by the proposed construction activities, whole populations would not be adversely affected by implementation of the TSP. The implementation of TSP features (i.e., marsh restoration, shoreline protection, chenier reforestation, and hydraulic and salinity control features) could impact the piping plover, rufa red knot, Sprague's pipit, West Indian Manatee, Gulf sturgeon and sea turtles but is not expected to impact the RCW.

Red-cockaded Woodpecker (*Picoides borealis*)

The NED construction activities would be rather small and localized such as the raising of homes or construction of small berms on developed land. Although the red-cockaded woodpecker may occur in Calcasieu Parish, it is unlikely to be impacted by any SWC TSP features as the habitat it is dependent upon is found in the far north of the parish and near the project features.

Due to the lack of old pine forests near the project features, it is the USACE's determination that the TSP is expected to have *"no effect"* on the RCW.

Piping Plover (*Charadrius melodus*)

The TSP would involve activities in the critical habitat of the piping plover. However, the activities are temporary and minimal (temporary placement of pipeline on the surface) and therefore it is the USACE's determination that the proposed TSP would constitute a *"may affect, but will not likely adversely affect"* determination for the species and its critical habitat. Potential project-induced impacts may result from incidental interaction with the piping plover during the following construction activities: marsh restoration features 47a1, 47a2, and 47c1 would temporarily utilize Gulf of Mexico shoreline for the placement of pipeline to deliver offshore sediment to the onshore marsh restoration areas. Approximately 0.14 acres (200 feet long by 30 feet wide) of critical habitat is expected to be impacted temporarily by these three measures. Another feature that would also temporarily utilize Gulf of Mexico shoreline for temporary pipeline placement is 124c, approximately 0.34 acres (500 feet long by 30 feet wide) of critical habitat is expected to be impacted. Due to their mobility, piping plovers would be able to avoid the aforementioned small areas of temporary disturbance by using abundant adjacent areas for foraging and roosting. Additionally, there is a considerable amount of critical habitat area within the SWC project area that could be utilized (see **Figure 4-1**).

All harmful activities (e.g., pipeline crossings) could be temporarily suspended until the bird(s) moves out of the project area. Any disturbance to the piping plover would be temporary during construction activities, and would result in temporary displacement. The piping plover would likely move and relocate to other nearby areas for foraging or roosting purposes.

Construction of the TSP is anticipated to begin in 2025, and would last up to ten years. During construction of the TSP, construction activities would include placement of hydraulically-dredged material for marsh restoration features. A marsh buggy would be used to place the pipeline across the beach. The noise and disturbance during construction activities would cause the displacement of wildlife in the construction area and nearby vicinity.

Rufa red knot (*Calidris canutus rufa*)

The TSP would involve activities in suitable habitat of the rufa red knot. However, the activities would be temporary and minimal and therefore it is the USACE's determination that the

proposed TSP would constitute a *"may affect, but will not likely adversely affect"* determination for the species. Potential project-induced impacts may result from incidental interaction with the rufa red knot during the following construction activities: marsh restoration features 47a1, 47a2, and 47c1 would temporarily utilize Gulf of Mexico shoreline for the placement of pipeline to deliver offshore sediment to the onshore marsh restoration areas. Approximately 0.14 acres (200 feet long by 30 feet wide) of shoreline habitat is expected to be impacted temporarily by these three measures. Other features that would also temporarily utilize Gulf of Mexico shoreline for temporary pipeline placement are: 124c, approximately 0.34 acres of suitable habitat is expected to be impacted; 306a1 and 127c3, approximately 1.10 acres of suitable habitat is expected to be impacted. Due to their mobility, rufa red knots would be able to avoid the aforementioned small areas of temporary disturbance by using abundant adjacent areas for foraging and roosting. Additionally, there is a considerable amount of habitat within the SWC project area that could be utilized (see **Figure 4-1**).

Because the piping plover and rufa red knot share similar foraging/roosting behaviors and utilize similar coastal habitats within Louisiana, the effects of the action would be very similar for both species.

Sprague's Pipit (*Anthus spragueii*)
The USACE has determined that the proposed TSP would constitute a *"may affect, but will not likely adversely affect"* determination for candidate species, Sprague's pipit. Depending on final designs of the NED TSP, potential indirect and minimal impacts could occur to the species. These impacts would include the temporary displacement of any birds that may be present due to construction activity and noise. The NER TSP could cause minimal indirect impacts to the species, if present during planting operations on chenier grasslands. It is assumed that the birds would relocate to adjacent or nearby suitable foraging/roosting areas.

West Indian Manatee (*Trichechus manatus*)
Due to the rarity of the manatee within the project area, MVN concludes that the proposed action *"may affect, but will not likely adversely affect"* the West Indian manatee. However, should any manatees be encountered during the proposed activities, an on-board observer would notify the proper personnel, and harmful activities (e.g., dredging) would be temporarily suspended until the animal(s) moves out of the project area. Any disturbance to the manatee would only be temporary during construction activities, and would result in temporary displacement. The manatees would likely move and relocate to other nearby areas for foraging or resting purposes.

Because the West Indian manatee may occur in the project area, the Contractor shall instruct all personnel associated with the project of the potential presence of manatees in the area, and the need to avoid collisions with these animals. All construction personnel shall be advised that there are civil and criminal penalties for harming, harassing, or killing manatees, which are protected under the MMPA of 1972 and the ESA of 1973. The Contractor shall be held responsible for any manatee harmed, harassed, or killed as a result of construction activities not conducted in accordance with these specifications. See **Annex B** for special operating conditions if manatees are present in the project area.

Gulf Sturgeon
Due to the rarity of the Gulf sturgeon within the project area, MVN concludes that the proposed action *"may affect, but will not likely adversely affect"* the Gulf sturgeon. However, all contract personnel associated with the project would be informed of the potential presence of Gulf

sturgeon and best management practices (**Annex B**) would be implemented to avoid impacts to the listed species.

Sea Turtles
It is anticipated that the contractor will utilize a hydraulic cutterhead dredge and booster pump(s) to excavate sediment from available offshore borrow area(s) and then transport it through a submerged sediment pipeline to the marsh restoration areas. Hopper dredges are not being proposed. Incidental takes of sea turtles have only been documented from hopper dredge operations that use trailing suction dragheads. Thus far, no incidental takes of sea turtles have been reported from clamshell (mechanical dredge), pipeline cutterhead (hydraulic dredge), or other types of dredges operating in southeastern coastal channels. Operational differences between these dredge types contribute to the differences in potential impacts to sea turtles. The relatively slow dredging motion of clamshell and pipeline dredges present minimal risk for sea turtle takes (Diskerson et al. 2004). Environmental laws protecting sea turtles could require the cessation of work for a limited time if the allowable number of sea turtle mortalities is exceeded during dredging. Additionally, sediment used to construct the containment dikes will be dredged from existing material inside the marsh creation area rather than from offshore borrow areas and therefore dredging operations associated with containment dikes are not expected to adversely impact sea turtles.

By implementing the above-mentioned monitoring and avoidance program, it is the USACE's determination that the proposed TSP plan *"may affect, but will not likely adversely affect"* some sea turtles and have *"no effect"* on others.

Green Sea Turtle (*Chelonia mydas*)
Due to the lack of extensive seagrass beds in and near the project area, the lack of major nesting colonies along coastal Louisiana, and the low incidence of sightings and strandings along coastal Louisiana (NMFS 1991), it is the USACE's determination that the TSP is expected to have *"no effect"* on the green sea turtle population.

Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)
The proposed wetland restoration/nourishment and shoreline protection features would provide a more suitable inshore foraging habitat (i.e., characterized by low salinity, high turbidity, and high organic content – where shrimp and blue crabs are abundant) for this species (NMFS and USFWS 1992a). Given the Kemp's ridley sea turtle has been found along Louisiana's coast, it is possible that the dredging of borrow material for the marsh creation features would have an effect; however, the Kemp's ridley sea turtle would likely avoid the borrow areas during construction. It is the USACE's determination that the proposed TSP plan *"may affect, but will not likely adversely affect"* the Kemp's Ridley sea turtle population.

Leatherback Sea Turtle (*Dermochelys coriacea*)
Leatherback sea turtles occur mostly in continental shelf waters more than 164 feet (50 meters) in depth and are uncommon in shallow Gulf of Mexico waters along Louisiana. There are no known nesting records for this species reported for Louisiana (NMFS and USFWS 1992b). Therefore, it is the USACE's determination that the TSP is expected to have *"no effect"* on the leatherback sea turtle population.

Loggerhead Sea Turtle (*Caretta caretta*)
The project area does not contain suitable nesting habitat and no suitable habitat will be created by the TSP. Loggerhead sea turtle Critical Habitat (*Sargassum* habitat) exists in the southern

(offshore) portion of the SWC project area (see Figure 4-2). The closest proximity the critical habitat comes to the shoreline is approximately 4 miles. Given the location of the loggerhead sea turtle's Critical Habitat (*Sargassum* habitat), and the fact that dredging activities would be limited to approximately 3 miles offshore avoiding impacts to critical habitat, it is the USACE's determination that the proposed TSP would have "no effect" on loggerhead critical habitat. The loggerhead sea turtle would likely avoid the borrow areas during construction minimizing the potential of impacts to the species. It is the USACE's determination that the proposed TSP plan *"may affect, but will not likely adversely affect"* the loggerhead sea turtle population.

Hawksbill Sea Turtle (*Eretmochelys imbricata*)
Due to its rarity along the Louisiana coast and its preference for nesting on beaches in Puerto Rico and the U.S. Virgin Islands (NMFS AND USFWS 1993), it is the USACE's determination that the TSP is expected to have *"no effect"* on the hawksbill sea turtle population.

Effects on Other Species of Concern
MVN has assessed the environmental impacts of the proposed action on species found in the project area that are protected under the MMPA of 1972, the MBTA of 1918, and the Migratory Bird Conservation Act of 1929.

MVN has determined that, with use of guidelines from USFWS and nesting bird abatement plan (if necessary), the proposed action would have no adverse impacts on protected birds (see **Section IV** for discussions on colonial nesting birds and shore birds).

MVN has determined that, with use of the best management practices (**Annex B**) established in coordination with NMFS, the proposed action would have no adverse impacts on bottlenose dolphins (see **Section IV** for discussions on bottlenose dolphins).

VI. CONCLUSION AND DETERMINATION OF EFFECTS
Based on the above information, the MVN has determined that the proposed action *"may affect but will not likely adversely affect"* the piping plover or it's critical habitat, red knot, West Indian manatee, Gulf sturgeon, loggerhead and Kemps Ridley sea turtles; would have no effect on the Red-cockaded woodpecker, green, leatherback, and hawksbill sea turtles or loggerhead critical habitat and would not adversely impact other species of concern that could potentially be found in the project area. MVN requests your concurrence on the aforementioned determinations.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506
March 20, 2015

Ms. Joan M. Exnicios
Chief, Environmental Planning Branch
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Ms. Exnicios:

Please reference your letter dated March 11, 2015, and the attached Biological Assessment (BA) on the Southwest Coastal Louisiana Project. In that BA, you have determined that the project "may affect but will not likely adversely affect" the piping plover or it's critical habitat, red knot, West Indian manatee, Gulf sturgeon, loggerhead and Kemps Ridley sea turtles, and would have "no effect" on the red-cockaded woodpecker, green, leatherback, and hawksbill sea turtles or loggerhead critical habitat.

The Service concurs with that determination. No further ESA consultation with the Service will be necessary for the proposed action, unless there are significant changes in the scope or location of the proposed project or the project has not been initiated one year from the date of this letter. If the proposed project has not been initiated within one year, follow-up consultation (via telephone call or e-mail) should be accomplished with the Service prior to making expenditures because our threatened and endangered species information is updated annually. If the scope or location of the proposed project is changed significantly, consultation should occur as soon as such changes are made.

If you have any further questions, please contact Mr. Ronny Paille of this office (337-291-3117).

Sincerely,

Jeffrey D. Weller
Supervisor
Louisiana Ecological Services Office

cc: LA Dept. of Wildlife and Fisheries, Baton Rouge, LA
LA Dept. of Natural Resources (CMD), Baton Rouge, LA

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO ATTENTION OF

July 17, 2015

Regional Planning and
Environmental Division South
New Orleans Environmental Branch

Jeffrey D. Weller
Supervisor, Louisiana Field Office
US Fish and Wildlife Service
646 Cajundome Blvd. - Suite 400
Lafayette, Louisiana 70506

Dear Mr. Weller:

The U.S. Army Corps of Engineers, New Orleans District (CEMVN) is submitting a request for consultation on the National Economic Development portion of the Southwest Coastal Louisiana Project. A Biological Assessment with a determination of "*may affect but will not likely adversely affect*" the Sprague's pipit "*no effect*" on the Red-cockaded woodpecker, and would not adversely impact other species of concern that could potentially be found in the project area has been prepared by the CEMVN and is enclosed for your review and opinion. Consultation on the National Environmental Restoration portion of the project was completed on March 20, 2015 (see attached).

Questions and/or concerns should be directed to Ms. Tammy Gilmore; U.S. Army Corps of Engineers; Planning Division; Environmental Planning Branch; CEMVN-PDN-CEP; P.O. Box 60267; New Orleans, Louisiana 70160-0267. Ms. Gilmore may also be contacted by e-mail tammy.h.gilmore@usace.army.mil or phone (504) 862-1002.

Sincerely,

Joan M. Exnicios
Chief, Environmental
Planning Branch

Encls.

Biological Assessment

I. INTRODUCTION

The U.S. Army Corps of Engineers (USACE), New Orleans District (MVN), has prepared this Biological Assessment (BA) to evaluate the potential impacts associated with the proposed hurricane and storm surge damage risk reduction measures and ecosystem restoration features within Calcasieu, Cameron, and Vermilion Parishes in southwest Louisiana referred to as the Southwest Coastal Louisiana Study (the "SWC project").

The low elevation and proximity to the Gulf of Mexico places the unique environment and cultural heritage of southwest Louisiana communities at risk from storm surge flooding and coastal erosion. Land subsidence and rising sea level is expected to increase the potential for coastal flooding, shore erosion, saltwater intrusion, and loss of wetlands and chenier habitats.

II. ACTION AREA

The project area (**Figure 2-1**) is located in southwest Louisiana and includes all of Calcasieu, Cameron, and Vermilion parishes and small portions of Beauregard, Jefferson Davis, and Iberia parishes encompassing approximately 4,700 square miles.

Cameron Parish is located in the southwest corner of Louisiana. The southern boundary of the parish is the Gulf of Mexico. Eighty-two percent of Cameron Parish is coastal marshes. Geographically, it is one of the largest parishes in Louisiana. The parish is chiefly rural and the largest communities are Cameron and Hackberry. Cameron is located along Louisiana Highway 82 (LA-82), while Hackberry is located along LA-27. Other smaller communities include Creole, Johnsons Bayou, and Holly Beach.

Calcasieu Parish is located due north of Cameron Parish. The town of Lake Charles is the parish seat, which is the largest urban area in the project area. Only a small portion of the parish is located in the coastal zone.

Vermilion Parish is located due east of Cameron Parish. The southern boundary of the parish is the Gulf of Mexico. Large expanses of Vermilion Parish are open water (lakes, bays, and streams). Approximately 50 percent of the land is coastal marshes. The parish is chiefly rural and the town of Abbeville is the parish seat as well as the largest urban area in the parish. Other communities include Delcambre, Kaplan, and Gueydan, which are all located along LA-14 in the northern part of the project area. Pecan Island and Forked Island are smaller communities, both located along LA-82 in lower Vermilion Parish. Located along LA-333, Intracoastal City is the nearest access to Vermilion Bay and the Gulf of Mexico in this region and supports the area's oil and shrimp industries.

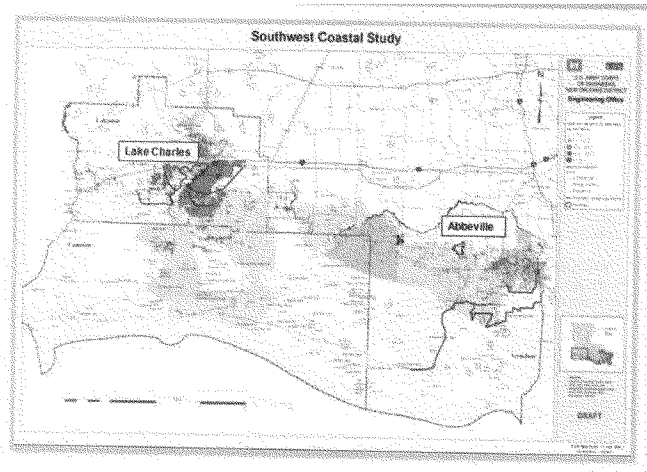


Figure 2-1 SWC Project Area

III. PROJECT DESCRIPTION

The SWC project includes both a National Economic Development (NED) and a National Ecosystem Restoration (NER) component. The NED component is non-structural and has been developed to address damages associated with hurricane and coastal storm surge flooding in Calcasieu, Cameron and Vermilion Parishes. Details of the NED TSP are below and in Figure 3-1:

- Nonstructural measures include:
  - Elevating residential structures*
  - Flood proofing non-residential structures (public and commercial facilities)*
  - Building small berms around warehouses
  - Potentially acquiring structures

  (* Note that some residential structures could be flood-proofed and some commercial structures could be elevated)

- Structures eligible for nonstructural measures have first-floor elevations at or below the 25-year flood zone, based on year 2025 hydrology. Eligible structures would be raised to the 100-year base flood elevation based on year 2075 hydrology.

- The TSP would reduce flood risk for 3,961 structures, comprised of 3,462 residential structures, 342 non-residential structures, and 157 warehouses.

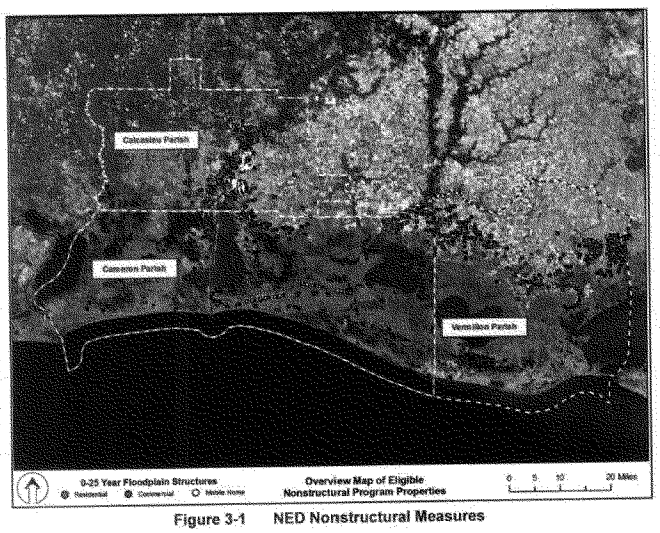


Figure 3-1 NED Nonstructural Measures

IV. SPECIES CONSIDERED

One endangered species, one candidate species and one delisted species are known to or believed to occur within the SWC NED project area (**Table 4-1**). Colonial nesting water birds could also occur in the SWC NED project area.

Bald Eagle

The bald eagle (*Haliaeetus leucocephalus*) was removed from the list of Threatened and Endangered species on 8 August 2007. Bald eagles nest in Louisiana from October through mid-May and typically nest in mature trees (such as bald cypress, sycamore, willow, etc.) near fresh to intermediate marshes or open water (USFWS 2013). The bald eagle continues to be protected under the Migratory Bird Treaty Act of 1918 (MBTA) and the Bald and Golden Eagle Protection Act. Forested portions of the project area may provide habitat for the bald eagle. Most active bald eagle nesting sites have been historically located to the east of the SWC project area. However, as of 2002 only one nest was documented within the project area in Calcasieu Parish. (source: http://www.lsuagcenter.com/en/communications/publications/agmag/Archive/2002/Spring/Bald+Eagles+Make+Comeback+in+South+Louisiana.htm). Surveys would be conducted before construction to determine if any active eagle nests exist within the 660 foot buffer of any of the

project sites. If, during construction an eagle's nest is found, a no-work zone of 660 feet must be implemented and the Corps must be immediately notified.

Colonial Nesting Water Birds

Colonial nesting water birds, including but not limited to; herons, egrets, cormorants, ibis may occur near structures that are adjacent to water. These birds and their nests are protected by the migratory bird treaty act of 1918, as amended (MBTA). Surveys would be conducted before construction to determine if any active water nests exist within the 1,000 foot buffer of any of the project sites. If, during construction any nests are found, a no-work zone of 1,000 feet must be implemented and the Corps must be immediately notified.

Table 4-1 Threatened and Endangered Species within the SWC NED Project Area

Common Name	Scientific Name	Critical Habitat	Agency	Status
Sprague's Pipit*	*Anthus spragueii*		USFWS	Candidate
red-cockaded woodpecker	*Picoides borealis*		USFWS	Endangered

* Candidate species are those taxa for which the Service has on file sufficient information regarding biological vulnerability and threat(s) to support issuance of a proposal to list

The SWC NED TSP could potentially impact the red-cockaded woodpecker, sprague's pipet and bald eagle. The project area does not encompass critical habitat for any species mentioned in **Table 4-1** above. Descriptions of the species that could potentially be impacted by the SWC TSP are described below.

Red-cockaded Woodpecker (*Picoides borealis)*

The RCW was listed as endangered in 1970 (35 FR 16047 16048). The RCW is a permanent resident of Louisiana and is dependent on a very specific habitat type. Old stand longleaf pine forests are preferred; however, all of the southern pine species can harbor RCWs. The birds may forage on pines of most sizes but only the oldest fungus infested pines are used as cavity trees. Old pine forests have declined substantially due to the lumber industry, development and agriculture. The red-cockaded woodpecker is known to occur in Calcasieu Parish.

Sprague's Pipit (*Anthus spragueii)*

The Sprague's pipit, is a candidate species for federal listing as a threatened or endangered species. It winters in Louisiana, arriving from its northern breeding grounds in September and remaining until April. Sprague's pipit exhibits a strong preference for open grassland (i.e., native prairie) with native grasses of intermediate height and thickness, and it avoids areas with too much shrub encroachment. The Sprague's pipit is known to or believed to occur in all parishes within the project area.

V. EFFECTS ANALYSIS

The potential exists that any of the endangered or threatened species listed in the previous section may be present in the project area during proposed construction activities. However, while individuals may be affected by the proposed construction activities, whole populations would not be adversely affected by implementation of the NED TSP. The implementation of NED TSP features (i.e.) could impact the Sprague's pipit, colonial nesting birds and bald eagle, but is not expected to impact the RCW.

Red-cockaded Woodpecker (*Picoides borealis)*

The NED construction activities would be rather small and localized such as the raising of homes or construction of small berms on developed land. Although the red-cockaded woodpecker may occur in Calcasieu Parish, it is unlikely to be impacted by any SWC TSP features as the habitat it is dependent upon is found in the far north of the parish and not near the project features.

Due to the lack of old pine forests near the project features; it is the USACE's determination that the TSP is expected to have *"no effect"* on the RCW.

Sprague's Pipit (*Anthus spragueii*)
The USACE has determined that the proposed TSP would constitute a *"may affect, but will not likely adversely affect"* determination for candidate species, Sprague's pipit. Potential indirect and minimal impacts could occur to the species. These impacts would include the temporary displacement of any birds that may be present due to construction activity and noise. It is assumed that the birds would relocate to adjacent or nearby suitable foraging/roosting areas.

Other Species of Concern
The USACE has determined that the proposed TSP would not adversely impact any species of concern. Surveys would be conducted prior to construction to determine if any active eagle or water bird nests are present. If nests are found, the appropriate buffer zones would be implemented or the timing of construction would be adjusted. In addition, impacts to wetlands would be avoided during construction of the NED plan. During construction there could be temporary impacts to roosting and/or foraging birds. These impacts would include the temporary displacement of any birds that may be present due to construction activity and noise. It is assumed that the birds would relocate to adjacent or nearby suitable foraging/roosting areas.

VI. CONCLUSION AND DETERMINATION OF EFFECTS

Based on the above information, the MVN has determined that the proposed action *"may affect but will not likely adversely affect"* the Sprague's pipit; would have no effect on the Red-cockaded woodpecker and would not adversely impact other species of concern that could potentially be found in the project area. MVN requests your concurrence on the aforementioned determinations.

VII. LITERATURE CITED

[USFWS] U.S. Fish and Wildlife Service. 2013. U.S Fish and Wildlife Service Draft Coordination Act Report. Prepared by Ronald Paille. U.S. Fish and Wildlife Service Ecological Services. Lafayette, Louisiana.

[USFWS] U.S. Fish and Wildlife Service. 2015. Environmental Online Conservation System. http://ecos.fws.gov/ecos/home.action. Last accessed on 8 January 2015.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506
August 25, 2015

Ms. Joan M. Exnicios
Chief, Environmental Planning Branch
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Ms. Exnicios:

Please reference your letter dated July 17, 2015, and the attached Biological Assessment (BA) on the National Economic Development (NED) portion of the Southwest Coastal Louisiana Project. In that BA, you have determined that the NED measures, consisting of non-structural flood risk reduction measures, "may affect but will not likely adversely affect" the Sprague's pipit, a candidate species for listing as a threatened or endangered species. The BA also contains the determination that the proposed non-structural measures would have no effect on the Red-cockaded woodpecker, and would not adversely impact other species of concern that could potentially be found in the project area.

Although the Sprague's pipit is not listed as a threatened or endangered species, the Service agrees with your conclusions regarding impacts of the proposed measures on the Spragues' pipit.

The Service concurs with the Red-cockaded woodpecker determination. No further ESA consultation with the Service will be necessary for the proposed action, unless there are significant changes in the scope or location of the proposed project or the project has not been initiated one year from the date of this letter. If the proposed project has not been initiated within one year, follow-up consultation (via telephone call or e-mail) should be accomplished with the Service prior to making expenditures because our threatened and endangered species information is updated annually. If the scope or location of the proposed project is changed significantly, consultation should occur as soon as such changes are made.

If you have any further questions, please contact Mr. Ronny Paille of this office (337-291-3117).

Sincerely,

Jeffrey D. Weller
Supervisor
Louisiana Ecological Services Office

cc: LA Dept. of Wildlife and Fisheries, Baton Rouge, LA
LA Dept. of Natural Resources (CMD), Baton Rouge, LA

3. NMFS COORDINATION

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO ATTENTION OF

March 11, 2015

Regional Planning and
Environmental Division South
New Orleans Environmental Branch

David Bernhart
NMFS - Protected Species Division
263 13th Avenue South
St. Petersburg, FL 33701

Dear Mr. Bernhart:

The U.S. Army Corps of Engineers, New Orleans District (CEMVN) is submitting a request for consultation on the Southwest Coastal Louisiana Project. A Biological Assessment with a determination of *"may affect but will not likely adversely affect"* the piping plover or it's critical habitat, red knot, West Indian manatee, Gulf sturgeon, loggerhead and Kemps Ridley sea turtles; would have *"no effect"* on the Red-cockaded woodpecker, green, leatherback, and hawksbill sea turtles or loggerhead critical habitat and would not adversely impact other species of concern that could potentially be found in the project area has been prepared by the CEMVN and is enclosed for your review and opinion.

Questions and/or concerns should be directed to Ms. Tammy Gilmore; U.S. Army Corps of Engineers; Planning Division; Environmental Planning Branch; CEMVN-PDN-CEP; P.O. Box 60267; New Orleans, Louisiana 70160-0267. Ms. Gilmore may also be contacted by e-mail tammy.h.gilmore@usace.army.mil or phone (504) 862-1002.

Sincerely,

Joan M. Exnicios
Chief, Environmental
Planning Branch

Encls.

Biological Assessment

I. INTRODUCTION

The U.S. Army Corps of Engineers (USACE), New Orleans District (MVN), has prepared this Biological Assessment (BA) to evaluate the potential impacts associated with the proposed hurricane and storm surge damage risk reduction measures and ecosystem restoration features within Calcasieu, Cameron, and Vermilion Parishes in southwest Louisiana referred to as the Southwest Coastal Louisiana Study (the "SWC project").

The low elevation and proximity to the Gulf of Mexico places the unique environment and cultural heritage of southwest Louisiana communities at risk from storm surge flooding and coastal erosion. Land subsidence and rising sea level is expected to increase the potential for coastal flooding, shore erosion, saltwater intrusion, and loss of wetlands and chenier habitats.

II. ACTION AREA

The project area (**Figure 2-1**) is located in southwest Louisiana and includes all of Calcasieu, Cameron, and Vermilion parishes and small portions of Beauregard, Jefferson Davis, and Iberia parishes encompassing approximately 4,700 square miles.

Cameron Parish is located in the southwest corner of Louisiana. The southern boundary of the parish is the Gulf of Mexico. Eighty-two percent of Cameron Parish is coastal marshes. Geographically, it is one of the largest parishes in Louisiana. The parish is chiefly rural and the largest communities are Cameron and Hackberry. Cameron is located along Louisiana Highway 82 (LA-82), while Hackberry is located along LA-27. Other smaller communities include Creole, Johnsons Bayou, and Holly Beach.

Calcasieu Parish is located due north of Cameron Parish. The town of Lake Charles is the parish seat, which is the largest urban area in the project area. Only a small portion of the parish is located in the coastal zone.

Vermilion Parish is located due east of Cameron Parish. The southern boundary of the parish is the Gulf of Mexico. Large expanses of Vermilion Parish are open water (lakes, bays, and streams). Approximately 50 percent of the land is coastal marshes. The parish is chiefly rural and the town of Abbeville is the parish seat as well as the largest urban area in the parish. Other communities include Delcambre, Kaplan, and Gueydan, which are all located along LA-14 in the northern part of the project area. Pecan Island and Forked Island are smaller communities, both located along LA-82 in lower Vermilion Parish. Located along LA-333, Intracoastal City is the nearest access to Vermilion Bay and the Gulf of Mexico in this region and supports the area's oil and shrimp industries.

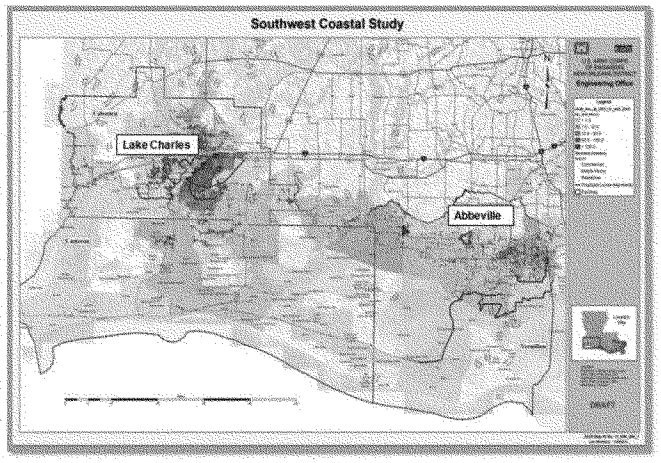


Figure 2-1 SWC Project Area

III. PROJECT DESCRIPTION

The SWC project includes both a National Economic Development (NED) and a National Ecosystem Restoration (NER) component. The NED tentatively selected plan (TSP) is programmatic and nonstructural. The program has been developed to address damages associated with hurricane and coastal storm surge flooding in Calcasieu, Cameron and Vermillion Parishes. The NED TSP is subject to parish-specific codes and regulations, additional NEPA compliance, and participation agreements. Consultation would be reinitiated, as necessary, upon further design of the NED plan and during preparation of additional NEPA compliance. Details of the NED TSP are below and in Figures 3-1.

- Nonstructural measures include:
  - Elevating residential structures*
  - Flood proofing non-residential structures (public and commercial facilities)*
  - Building small berms around warehouses
  - Potentially acquiring structures

  (* Note that some residential structures could be flood-proofed and some commercial structures could be elevated)

- Structures eligible for nonstructural measures have first-floor elevations at or below the 25-year flood zone, based on year 2025 hydrology. Eligible structures would be raised to the 100-year base flood elevation based on year 2075 hydrology.

- The TSP would reduce flood risk for 4,952 residential and non-residential structures (4,219 residential; 396 non-residential; 337 warehouses).

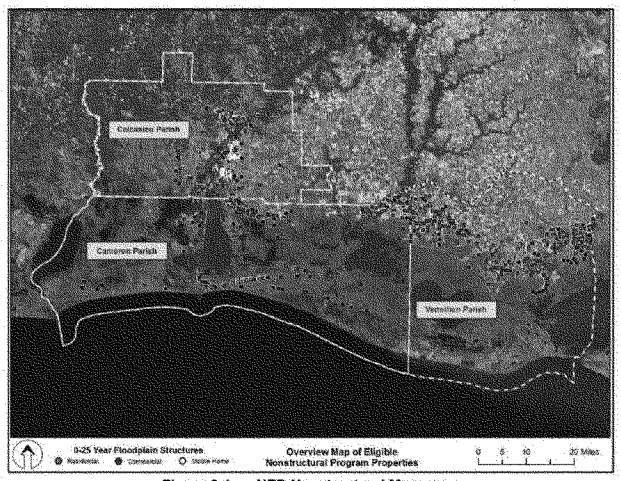


Figure 3-1 NED Nonstructural Measures

The NER TSP is Small Integrated Restoration (Plan CM-4), a comprehensive ecosystem restoration plan that attempts to address land loss problems and ecosystem degradation. The plan is cost effective, and is the least cost comprehensive best buy plan. The plan goal is to minimize land loss; enhance plant productivity by reducing major stressors; and to reinforce and protect critical landscape features. Details of the TSP are listed below and in Figures 3-2 and 3-3.

- A total of 51 ecosystem restoration features
  - 9 marsh restoration features
  - 35 chenier reforestation features
  - 5 shoreline protection features
  - 1 hydrologic / salinity control feature
  - The Calcasieu Ship Channel Salinity Barrier Navigation Study is recommended as an additional long-range study

Details of the construction of the NER plan features are included in the Enclosures section (**Annex A**).

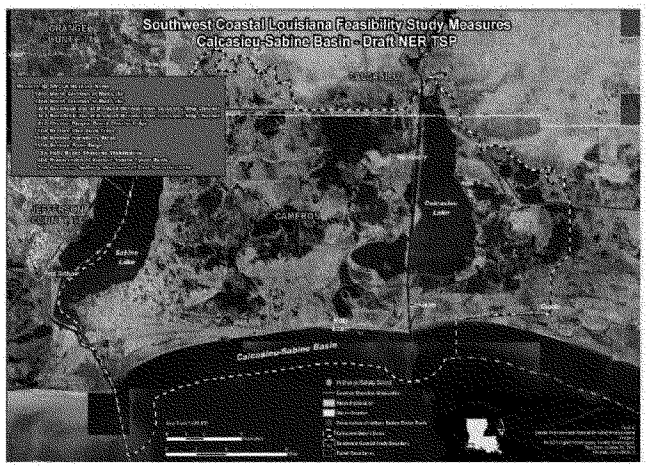


Figure 3-2 NER TSP features (Calcasieu)

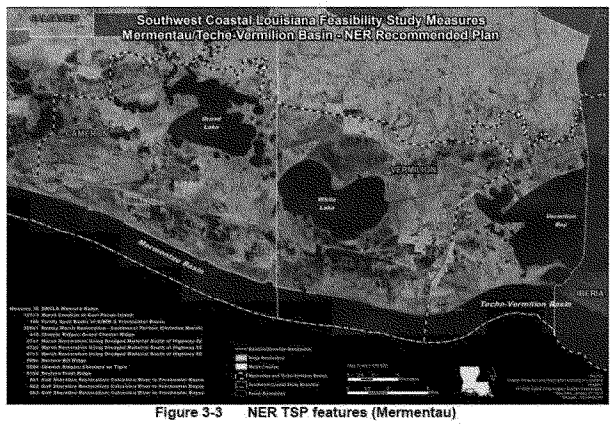


Figure 3-3 NER TSP features (Mermentau)

IV. SPECIES CONSIDERED

Eleven threatened or endangered species and one candidate species are known to or believed to occur within the SWC project area (**Table 4-1**). With the exception of the red-cockaded woodpecker (RCW), all of the species provided in **Table 4-1** below were listed in the November 2013 USFWS Draft Fish and Wildlife Coordination Act Report (USFWS 2013).

Cetaceans

A total of 28 cetaceans have been reported in the Gulf of Mexico waters (Davis et al. 2002). Of these, five Mysticeti (e.g., baleen whales including blue whale (*Balaenoptera musculus*), humpback whale (*Megaptera novaeangliae*), finback whale (*Balaenoptera physalus*), and sei whale (*Balaenoptera borealis*); and Odontoceiti (e.g., toothed whales, including sperm whale (*Physeter macrocephalus*) have been reported in the Gulf of Mexico and all are listed as endangered species. Infrequent, shallow water, historical sightings and strandings in the Gulf of Mexico of these endangered cetaceans suggest that most of these species are rare, accidental, or uncommon in this area (Davis et al. 2002). All whales are principally marine deepwater species and would not likely be impacted by the SWC TSP.

Bald Eagle

The bald eagle (*Haliaeetus leucocephalus*) was removed from the list of Threatened and Endangered species on 8 August 2007. Bald eagles nest in Louisiana from October through mid-May and typically nest in mature trees (such as bald cypress, sycamore, willow, etc.) near fresh to intermediate marshes or open water (USFWS 2013). The bald eagle continues to be protected under the Migratory Bird Treaty Act of 1918 (MBTA) and the Bald and Golden Eagle

Protection Act. Forested portions of the project area may provide habitat for the bald eagle. Most active bald eagle nesting sites have been historically located to the east of the SWC project area (source: http://www.lsuagcenter.com/en/communications/publications/agmag/Archive/2002/Spring/Bald+Eagles+Make+Comeback+in+South+Louisiana.htm). No known nests are located near any project features, however, if an eagle's nest is found, a no-work zone of 660 feet must be implemented and the Corps must be immediately notified.

Brown Pelican and Colonial Nesting Water Birds

The brown pelican (*Pelecanus occidentalis*) was removed from the list of Threatened and Endangered species on 17 December 2009. Their nests continue to be protected under the Migratory Bird Treaty Act (MBTA) of 1918. The brown pelican and a variety of colonial nesting water birds including but not limited to: herons, egrets, ibis, anhinga, double crested cormorants, and roseate spoonbill may nest within the project area. In general, the nesting season for these species runs from February 15 through September 1. The area is also known to support various species of shore birds including but not limited to: Sanderlings, sandpipers, gulls, and terns. These birds and their nests are protected under the MBTA and adverse impacts would be avoided. No known rookeries are located near any project features, however, if any nests are found, a no-work zone of 1,000 feet would be implemented. Additionally, if needed, a bird abatement plan would be developed and implemented, in coordination with USFWS, to deter colonial nesting water birds and shore birds from nesting within project boundaries.

Bottlenose Dolphin

The western north Atlantic bottlenose dolphin (*Tursiops truncatus*) populations found along the mid-Atlantic coast have been designated as depleted under the Marine Mammal Protection Act (MMPA) and, therefore, are stringently managed (NOAA 2015). In addition, the National Marine Fisheries Service (NMFS) has classified five U.S. stocks of bottlenose dolphins as "*strategic*" stocks, they are: Eastern Gulf of Mexico Coastal; Western Gulf of Mexico Coastal; Northern Gulf of Mexico Coastal; Gulf of Mexico Bay, Sound and Estuarine; and Western North Atlantic Coastal (NOAA 2015). Atlantic bottlenose dolphins inhabit temperate and tropical waters, and are found in the United States from Cape Cod to the Gulf of Mexico (tMMS 2015). These marine mammals are protected under the MMPA of 1972 and therefore impacts should be avoided. **Annex B** provides entrapment prevention measures for the Atlantic bottlenose dolphins.

Table 4-1 Threatened and Endangered Species within the SWC Project Area

	Common Name	Scientific Name	Critical Habitat	Agency	Status
Birds	*Sprague's Pipit	*Anthus spragueii*		USFWS	Candidate
	red-cockaded woodpecker	*Picoides borealis*		USFWS	endangered
	piping plover	*Charadrius melodus*	yes	USFWS	threatened
	rufa red knot	*Calidris canutus rufa*		USFWS	threatened
	**whooping crane	*Grus americana*		USFWS	endangered
Fishes	Gulf sturgeon	*Acipenser oxyrinchus desotoi*		NOAA/NMFS	threatened

	Common Name	Scientific Name	Critical Habitat	Agency	Status
Mammals	West Indian manatee	*Trichechus manatus*		USFWS	endangered
Reptiles	green sea turtle	*Chelonia mydas*		NOAA/NMFS	threatened
	Kemp's ridley sea turtle	*Lepidochelys kempii*		NOAA/NMFS	endangered
	leatherback sea turtle	*Dermochelys coriacea*		NOAA/NMFS	endangered
	loggerhead sea turtle	*Caretta caretta*	yes	NOAA/NMFS	threatened
	hawksbill sea turtle	*Eretmochelys imbricata*		NOAA/NMFS	endangered

* Candidate species are those taxa for which the USFWS has on file sufficient information regarding biological vulnerability and threat(s) to support issuance of a proposal to list.

**This is an *"experimental population, nonessential"* designation.

Sources:
http://ecos.fws.gov/ecos/home.action
http://www.nmfs.noaa.gov/pr/species/criticalhabitat.htm

The SWC TSP could potentially impact the piping plover (*Charadrius melodus*), rufa red knot (*Calidris canutus rufa*), West Indian manatee (*Trichechus manatus*), Gulf sturgeon and sea turtles. The project area encompasses critical habitat for the piping plover and for the loggerhead sea turtle (*Caretta caretta*). Only a very small area in the extreme southern off-shore portion of the project area encompasses Sargassum critical habitat for the loggerhead sea turtle. The project area does not encompass critical habitat for any other species mentioned in **Table 4-1** above. Descriptions of the species that could potentially be impacted by the SWC TSP are described below.

Red-cockaded Woodpecker (*Picoides borealis*)
The RCW was listed as endangered in 1970 (35 FR 16047 16048). The RCW is a permanent resident of Louisiana and is dependent on a very specific habitat type. Old stand longleaf pine forests are preferred; however, all of the southern pine species can harbor RCWs. The birds may forage on pines of most sizes but only the oldest fungus infested pines are used as cavity trees. Old pine forests have declined substantially due to the lumber industry, development and agriculture. The red-cockaded woodpecker is known to occur in Calcasieu Parish.

Piping Plover (*Charadrius melodus*)
On December 11, 1985, the USFWS published the final rule (50 CFR 50720) that listed the piping plover as endangered in the Great Lakes watershed (Illinois, Indiana, Michigan, northeastern Minnesota, New York, Ohio, Pennsylvania, Wisconsin, and Ontario, Canada) and as threatened elsewhere within its range. This listing includes piping plovers breeding in Canada, with their status under the Endangered Species Act (ESA) of 1973 determined by whether they breed in the watershed of the Great Lakes (endangered) or elsewhere (threatened). Piping plovers on migratory routes outside of the Great Lakes watershed or on their wintering grounds are considered threatened (USFWS 2001a).

The International Piping Plover Coordination Group facilitates the International Piping Plover Census (IPPC) of breeding and wintering piping plovers throughout their range (Elliott-Smith et al 2006). The IPPC has taken place in 1991, 1996, 2001, 2006, and 2011. (Results from 2011 have not yet been published.) (B. Firmin 2014 personal communication) Survey results for

Louisiana have varied in intensity and number of sites visited over the years due to poor weather conditions, lack of personnel, and logistical constraints for site access (USFWS 2011). Results of those IPPC surveys for Louisiana range from a high of 750 birds in 1991 to a low of 226 birds in 2006; those numbers, however, do not reflect the variations in survey intensity or the number of sites visited (USFWS 2011).

In Louisiana, the 2006 IPPC recorded only 226 piping plovers, the lowest numbers in the State in IPPC history. The substantial decline in numbers of wintering piping plover along the Louisiana coast could be attributed to habitat loss as a result of Hurricanes Katrina and Rita; however, lack of personnel and poor weather conditions also affected survey intensity in the State that year (B. Firmin, USFWS, personal communication 2014). Approximately 40 piping plovers were reported in Cameron Parish in the 2006 Census.

Piping plovers arrive on wintering grounds in July, with some late-nesting birds arriving in September. Migration is poorly understood, but most piping plovers probably migrate non-stop from interior breeding areas to wintering grounds (Haig 1992). The habitats used by wintering birds include beaches, mud flats, sand flats, algal flats, and washover passes (areas where breaks in the sand dunes result in an inlet). Wintering plovers are dependent on a mosaic of habitat patches, and move among these patches depending on local weather and tidal conditions (USFWS 2001a). In late February, piping plovers begin leaving the wintering grounds to migrate back to breeding sites. Northward migration peaks in late March, and by late May most birds have left the wintering grounds (USFWS 2001a).

On July 10, 2001, the USFWS designated 137 areas along the coasts of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana (piping plover critical habitat within the project area is shown in **Figure 4-1**), and Texas as critical habitat for the wintering population of the piping plover. This includes approximately 1,798.3 miles of mapped shoreline and approximately 165,211 acres of mapped area along the gulf and Atlantic coasts and along margins of interior bays, inlets, and lagoons. Approximately 6,548 acres of the aforementioned are located within Cameron and Vermilion Parishes (LA-1 Figure 4-1) (66 FR 36074). All piping plovers are considered threatened species under the Act when on their wintering grounds.

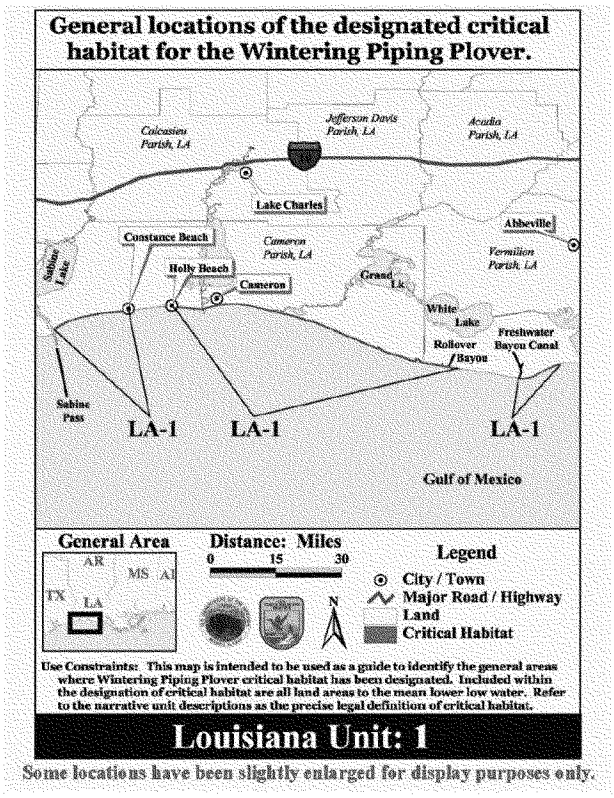


Figure 4-1 Piping plover critical habitat in the project area

Rufa red knot (*Calidris canutus rufa*)
In a 11 December 2014 final rule, the USFWS made a final determination to protect the rufa subspecies of the red knot as threatened under the ESA, with an effective date of 12 January 2015. All of the following information regarding red knot is summarized from the Rufa Red Knot Ecology and Abundance (USFWS 2014a) and final rule 50 CFR Part 17 (USFWS 2014b) and is in reference to the rufa red knot, unless otherwise stated.

The rufa red knot migrates annually between its breeding grounds in the Canadian Arctic and several wintering regions, including the Southeast U.S., the Northeast Gulf of Mexico, northern Brazil, and Tierra del Fuego at the southern tip of South America. During both the northbound (spring) and southbound (fall) migrations, rufa red knots use key staging and stopover areas to rest and feed (USFWS 2014a, 2014b).

Louisiana is a migration stopover for red knots in both spring and fall, and some birds may overwinter in small numbers. In the U.S., the rufa red knot is found principally in intertidal marine habitats, especially near coastal inlets, estuaries, and bays, or along resting formations (i.e., intertidal shelf typically formed of densely-packed dirt blown by strong, offshore winds). Within the U.S., rufa red knot migratory and wintering habitats are principally utilized for resting and foraging activities. In the Southeastern U.S., rufa red knots commonly forage on bivalves, gastropods, and crustaceans along sandy beaches, tidal mudflats, salt marshes, and peat banks (USFWS 2014b).

Sprague's Pipet (*Anthus spragueii*)
The Sprague's pipit, is a candidate species for federal listing as a threatened or endangered species. It winters in Louisiana, arriving from its northern breeding grounds in September and remaining until April. Sprague's pipit exhibits a strong preference for open grassland (i.e., native prairie) with native grasses of intermediate height and thickness, and it avoids areas with too much shrub encroachment. The Sprague's pipit is known to or believed to occur in all parishes within the project area.

West Indian Manatee (*Trichechus manatus*)
The West Indian manatee was listed as endangered throughout its range for both the Florida and Antillean subspecies in 1967, and received Federal protection with the passage of the ESA in 1973. Critical habitat was designated in 1976, 1994, 1998, 2002, and 2003 for the Florida subspecies. This species is also protected as a depleted stock under the Marine Mammal Protection Act of 1972 (16 U.S.C. 1361-1407).

Manatees inhabit both salt and freshwater of sufficient depth (5 feet [1.5 meters] to usually less than 20 feet [6.1 meters]) throughout their range. Shallow grassbeds with ready access to deep channels are preferred feeding areas in coastal and riverine habitats (USFWS 2001b). They may also be encountered in canals, rivers, estuarine habitats, saltwater bays, and have been observed as much as 3.7 miles (6.0 kilometers) off the Florida gulf coast. Between October and April, Florida manatees concentrate in areas of warmer water. During warmer months they appear to choose areas based on an adequate food supply, water depth, and proximity to fresh water (USFWS 2001b). During summer months, they migrate as far north as coastal Virginia on the east coast and the Louisiana coast in the Gulf of Mexico (O'Shea 1988).

Sightings of the West Indian manatee in Louisiana have occurred in the Amite, Blind, Tchefuncte, and Tickfaw Rivers, Mississippi River Gulf Outlet (MRGO), and in canals within the adjacent coastal marshes of Louisiana. However, there is no known population thriving in the state. On 9 July 2001, a manatee was observed passing safely through the Inner Harbor

Navigation Canal (IHNC) Lock and into the Mississippi River, and one was sighted in Contraband Bayou in Calcasieu Parish in February, 2010.

Gulf Sturgeon (*Acipenser oxyrinchus*)
On September 30, 1991, the Gulf sturgeon was listed as a threatened species under the Endangered Species Act (ESA) (56 FR 49653).

Gulf sturgeon sightings are rare in the proposed project area; however, the LDWF (1979) reported that an Atlantic sturgeon was caught by a Mr. Hugh Mhire in an otter trawl while shrimping in the Gulf of Mexico off the mouth of the Mermentau River, Cameron Parish, LA. This specimen was probably a Gulf sturgeon (Paruka, 2000). In 1990 a commercial fisherman reported trawling up a Gulf sturgeon three miles out from Last Island (Raccoon Island), Terrebonne Parish, LA (D. Walther, personal communication). The Gulf sturgeon is known to or believed to occur in Cameron and Vermilion Parishes within the project area.

Green Sea Turtle (*Chelonia mydas*)
The green sea turtle was listed as endangered/threatened on July 28, 1978. The breeding populations off Florida and the Pacific coast of Mexico are listed as endangered while all others are threatened (USFWS 1991). This species' current status is listed as threatened in Louisiana.

Although green sea turtles are found worldwide in oceans and gulfs with water temperatures greater than 68°F (20°C), their distribution can be correlated to grassbed distribution, location of nesting beaches, and associated ocean currents (Hirth 1971). Long migrations are often made between feeding and nesting grounds (Carr and Hirth 1962). Within Louisiana waters, these turtles probably occur all along the coast and may nest on the Chandeleur Islands (Dundee and Rossman 1989). Green sea turtles feed in shallow water areas with abundant seagrasses or algae. The turtles migrate from nesting areas to feeding grounds, which are sometimes several thousand miles away. Most turtles migrate along the coasts, but some populations are known to migrate across the ocean from nesting area to feeding grounds. The major nesting beaches are always found in places where the seawater temperature is greater than 77°F (25°C) (NMFS 1991).

Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)
On 2 December 1970 the Kemp's ridley sea turtle was designated as endangered across its entire range (USFWS 1991) and has continued to decline in Louisiana (USFWS 1990). This species is currently listed as endangered in Louisiana. Critical habitat has been proposed for this species, but it has not been finalized to date.

This small sea turtle is believed to be the most frequently encountered (Dundee and Rossman 1989), if not the most abundant sea turtle, off the Louisiana coast (Viosca 1961). Kemp's ridley sea turtles have been found along coastal Louisiana from Lake Borgne, Barataria and Terrebonne Bays, and near Calcasieu Pass (Dundee and Rossman 1989). Adult Kemp's ridley sea turtles are usually confined to the Gulf of Mexico. Post-pelagic stages are commonly found over crab-rich, sandy, or muddy bottoms. Juveniles can be found in bays, coastal lagoons, and river mouths. In Louisiana, adults are found seasonally near the Mississippi river outlet. The main nesting grounds for the Kemp's ridley turtle occur on the northeastern coast of Mexico. Occurrence of these sea turtles in bays and estuaries along the Louisiana coast would not be unexpected, as many of their primary food items occur there.

Leatherback Sea Turtle (*Dermochelys coriacea*)

The leatherback sea turtle was listed as an endangered species throughout its range in June 1970 (USFWS 1998), and it is currently listed as endangered in Louisiana. Critical habitat has been established for shoreline and adjacent waters of the U.S. Virgin Islands (50 CFR 17.95; 50 CFR 226.207).

The leatherback sea turtle occurs mostly in continental shelf waters, but will occasionally enter shallow waters and estuaries. Adults are highly migratory, and are believed to be the most pelagic of all sea turtles. Habitat requirements for juvenile and post-hatchling leatherbacks are unknown (NMFS and USFWS 1992b). In Louisiana, leatherbacks are believed to occur offshore in deep waters; however, they have been sighted in Cameron Parish, Atchafalaya Bay, Timbalier Bay, and Chandeleur Sound (Dundee and Rossman 1989). No nesting has been reported in Louisiana (Gunter 1981, Dundee and Rossman 1989).

Loggerhead Sea Turtle (*Caretta caretta*)
The loggerhead sea turtle was listed as a threatened species in July 1978 (USFWS 1991), and it is currently listed as threatened in Louisiana. Critical habitat was established for this species in July 2014 within the Atlantic Ocean and the Gulf of Mexico (50 CFR 226; 79 FR 39855-39912) and within the terrestrial environment of the U.S. Atlantic and Gulf of Mexico coasts (50 CFR 17; 79 FR 39755-39854). These critical habitat areas contain one or a combination of habitat types: nearshore reproductive habitat, winter area, breeding areas, constricted migratory corridors, and/or *Sargassum* habitat.

Loggerheads are capable of living in a variety of environments, such as in brackish waters of coastal lagoons and river mouths. The major nesting beaches are located in the southeastern U.S., primarily along the Atlantic coast of Florida, North Carolina, South Carolina, and Georgia. Only minor and solitary nesting has been recorded along the coasts of the Gulf of Mexico (NMFS AND USFWS 2008).

Loggerheads probably range all along the Louisiana coast; however, Dundee and Rossman (1989) reported specimens only from Chandeleur Sound, Barataria Bay, and Cameron Parish. Nesting on the gulf coast occurs between the months of April and August, with 90 percent of the nesting effort occurring on the south-central gulf coast of Florida (Hildebrand 1981). Although loggerheads have been documented as nesting on the Chandeleurs in 1962 and Grand Isle in the 1930s, it is doubtful whether this species currently successfully nests on the Louisiana coast (Hildebrand 1981, Dundee and Rossman 1989). Loggerhead Critical Habitat (*Sargassum* habitat) exists in the southern (offshore) portion of the SWC project area (see **Figure 4-2** below). This critical habitat expands the entire length of the project (west to east) and the closest points range from approximately 4 miles to 9 miles offshore.

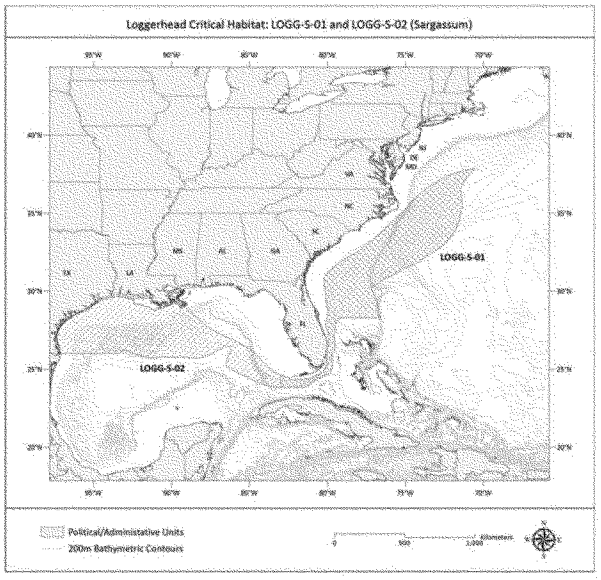


Figure 4-2 Loggerhead Sea Turtle critical habitat in the project area

Hawksbill Sea Turtle (*Eretmochelys imbricata*)
The hawksbill was listed as an endangered species in June 1970 (USFWS 1991), and it is currently listed as endangered in Louisiana.

The hawksbill occurs in tropical and subtropical seas of the Atlantic, Pacific, and Indian Oceans. Only one record of a hawksbill in Louisiana has been reported (Fuller and Tappen 1986). Florida is considered foraging habitat for those turtles, and Texas may be foraging habitat for hatchlings and juveniles (77 observations of small turtles were reported between 1972 and 1984) from the nesting sites in Mexico (NMFS AND USFWS 1993). Hawksbills are observed in Florida with some regularity on the reefs off Palm Beach County and in the Florida Keys. Texas is the only other state where hawksbills are sighted with any regularity. Most sightings involve post hatchlings and juveniles, which are believed to originate from nesting beaches in Mexico (NMFS AND USFWS 1993).

V. EFFECTS ANALYSIS

The potential exists that any of the endangered or threatened species listed in the previous section may be present in the project area during proposed construction activities. However, while individuals may be affected by the proposed construction activities, whole populations would not be adversely affected by implementation of the TSP. The implementation of TSP features (i.e., marsh restoration, shoreline protection, chenier reforestation, and hydraulic and salinity control features) could impact the piping plover, rufa red knot, Sprague's pipit, West Indian Manatee, Gulf sturgeon and sea turtles but is not expected to impact the RCW.

Red-cockaded Woodpecker (*Picoides borealis*)

The NED construction activities would be rather small and localized such as the raising of homes or construction of small berms on developed land. Although the red-cockaded woodpecker may occur in Calcasieu Parish, it is unlikely to be impacted by any SWC TSP features as the habitat it is dependent upon is found in the far north of the parish and near the project features.

Due to the lack of old pine forests near the project features, it is the USACE's determination that the TSP is expected to have *"no effect"* on the RCW.

Piping Plover (*Charadrius melodus*)

The TSP would involve activities in the critical habitat of the piping plover. However, the activities are temporary and minimal (temporary placement of pipeline on the surface) and therefore it is the USACE's determination that the proposed TSP would constitute a *"may affect, but will not likely adversely affect"* determination for the species and its critical habitat. Potential project-induced impacts may result from incidental interaction with the piping plover during the following construction activities: marsh restoration features 47a1, 47a2, and 47c1 would temporarily utilize Gulf of Mexico shoreline for the placement of pipeline to deliver offshore sediment to the onshore marsh restoration areas. Approximately 0.14 acres (200 feet long by 30 feet wide) of critical habitat is expected to be impacted temporarily by these three measures. Another feature that would also temporarily utilize Gulf of Mexico shoreline for temporary pipeline placement is 124c, approximately 0.34 acres (500 feet long by 30 feet wide) of critical habitat is expected to be impacted. Due to their mobility, piping plovers would be able to avoid the aforementioned small areas of temporary disturbance by using abundant adjacent areas for foraging and roosting. Additionally, there is a considerable amount of critical habitat area within the SWC project area that could be utilized (see **Figure 4-1**).

All harmful activities (e.g., pipeline crossings) could be temporarily suspended until the bird(s) moves out of the project area. Any disturbance to the piping plover would be temporary during construction activities, and would result in temporary displacement. The piping plover would likely move and relocate to other nearby areas for foraging or roosting purposes.

Construction of the TSP is anticipated to begin in 2025, and would last up to ten years. During construction of the TSP, construction activities would include placement of hydraulically-dredged material for marsh restoration features. A marsh buggy would be used to place the pipeline across the beach. The noise and disturbance during construction activities would cause the displacement of wildlife in the construction area and nearby vicinity.

Rufa red knot (*Calidris canutus rufa*)

The TSP would involve activities in suitable habitat of the rufa red knot. However, the activities would be temporary and minimal and therefore it is the USACE's determination that the

proposed TSP would constitute a *"may affect, but will not likely adversely affect"* determination for the species. Potential project-induced impacts may result from incidental interaction with the rufa red knot during the following construction activities: marsh restoration features 47a1, 47a2, and 47c1 would temporarily utilize Gulf of Mexico shoreline for the placement of pipeline to deliver offshore sediment to the onshore marsh restoration areas. Approximately 0.14 acres (200 feet long by 30 feet wide) of shoreline habitat is expected to be impacted temporarily by these three measures. Other features that would also temporarily utilize Gulf of Mexico shoreline for temporary pipeline placement are: 124c, approximately 0.34 acres of suitable habitat is expected to be impacted; 306a1 and 127c3, approximately 1.10 acres of suitable habitat is expected to be impacted. Due to their mobility, rufa red knots would be able to avoid the aforementioned small areas of temporary disturbance by using abundant adjacent areas for foraging and roosting. Additionally, there is a considerable amount of habitat within the SWC project area that could be utilized (see **Figure 4-1**).

Because the piping plover and rufa red knot share similar foraging/roosting behaviors and utilize similar coastal habitats within Louisiana, the effects of the action would be very similar for both species.

Sprague's Pipit (*Anthus spragueii*)
The USACE has determined that the proposed TSP would constitute a *"may affect, but will not likely adversely affect"* determination for candidate species, Sprague's pipit. Depending on final designs of the NED TSP, potential indirect and minimal impacts could occur to the species. These impacts would include the temporary displacement of any birds that may be present due to construction activity and noise. The NER TSP could cause minimal indirect impacts to the species, if present during planting operations on chenier grasslands. It is assumed that the birds would relocate to adjacent or nearby suitable foraging/roosting areas.

West Indian Manatee (*Trichechus manatus*)
Due to the rarity of the manatee within the project area, MVN concludes that the proposed action *"may affect, but will not likely adversely affect"* the West Indian manatee. However, should any manatees be encountered during the proposed activities, an on-board observer would notify the proper personnel, and harmful activities (e.g., dredging) would be temporarily suspended until the animal(s) moves out of the project area. Any disturbance to the manatee would only be temporary during construction activities, and would result in temporary displacement. The manatees would likely move and relocate to other nearby areas for foraging or resting purposes.

Because the West Indian manatee may occur in the project area, the Contractor shall instruct all personnel associated with the project of the potential presence of manatees in the area, and the need to avoid collisions with these animals. All construction personnel shall be advised that there are civil and criminal penalties for harming, harassing, or killing manatees, which are protected under the MMPA of 1972 and the ESA of 1973. The Contractor shall be held responsible for any manatee harmed, harassed, or killed as a result of construction activities not conducted in accordance with these specifications. See **Annex B** for special operating conditions if manatees are present in the project area.

Gulf Sturgeon
Due to the rarity of the Gulf sturgeon within the project area, MVN concludes that the proposed action *"may affect, but will not likely adversely affect"* the Gulf sturgeon. However, all contract personnel associated with the project would be informed of the potential presence of Gulf

sturgeon and best management practices (**Annex B**) would be implemented to avoid impacts to the listed species.

Sea Turtles
It is anticipated that the contractor will utilize a hydraulic cutterhead dredge and booster pump(s) to excavate sediment from available offshore borrow area(s) and then transport it through a submerged sediment pipeline to the marsh restoration areas. Hopper dredges are not being proposed. Incidental takes of sea turtles have only been documented from hopper dredge operations that use trailing suction dragheads. Thus far, no incidental takes of sea turtles have been reported from clamshell (mechanical dredge), pipeline cutterhead (hydraulic dredge), or other types of dredges operating in southeastern coastal channels. Operational differences between these dredge types contribute to the differences in potential impacts to sea turtles. The relatively slow dredging motion of clamshell and pipeline dredges present minimal risk for sea turtle takes (Diskerson et al. 2004). Environmental laws protecting sea turtles could require the cessation of work for a limited time if the allowable number of sea turtle mortalities is exceeded during dredging. Additionally, sediment used to construct the containment dikes will be dredged from existing material inside the marsh creation area rather than from offshore borrow areas and therefore dredging operations associated with containment dikes are not expected to adversely impact sea turtles.

By implementing the above-mentioned monitoring and avoidance program, it is the USACE's determination that the proposed TSP plan *"may affect, but will not likely adversely affect"* some sea turtles and have *"no effect"* on others.

Green Sea Turtle (*Chelonia mydas*)
Due to the lack of extensive seagrass beds in and near the project area, the lack of major nesting colonies along coastal Louisiana, and the low incidence of sightings and strandings along coastal Louisiana (NMFS 1991), it is the USACE's determination that the TSP is expected to have *"no effect"* on the green sea turtle population.

Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)
The proposed wetland restoration/nourishment and shoreline protection features would provide a more suitable inshore foraging habitat (i.e., characterized by low salinity, high turbidity, and high organic content – where shrimp and blue crabs are abundant) for this species (NMFS and USFWS 1992a). Given the Kemp's ridley sea turtle has been found along Louisiana's coast, it is possible that the dredging of borrow material for the marsh creation features would have an effect; however, the Kemp's ridley sea turtle would likely avoid the borrow areas during construction. It is the USACE's determination that the proposed TSP plan *"may affect, but will not likely adversely affect"* the Kemp's Ridley sea turtle population.

Leatherback Sea Turtle (*Dermochelys coriacea*)
Leatherback sea turtles occur mostly in continental shelf waters more than 164 feet (50 meters) in depth and are uncommon in shallow Gulf of Mexico waters along Louisiana. There are no known nesting records for this species reported for Louisiana (NMFS and USFWS 1992b). Therefore, it is the USACE's determination that the TSP is expected to have *"no effect"* on the leatherback sea turtle population.

Loggerhead Sea Turtle (*Caretta caretta*)
The project area does not contain suitable nesting habitat and no suitable habitat will be created by the TSP. Loggerhead sea turtle Critical Habitat (*Sargassum* habitat) exists in the southern

(offshore) portion of the SWC project area (see Figure 4-2). The closest proximity the critical habitat comes to the shoreline is approximately 4 miles. Given the location of the loggerhead sea turtle's Critical Habitat (*Sargassum* habitat), and the fact that dredging activities would be limited to approximately 3 miles offshore avoiding impacts to critical habitat, it is the USACE's determination that the proposed TSP would have "no effect" on loggerhead critical habitat. The loggerhead sea turtle would likely avoid the borrow areas during construction minimizing the potential of impacts to the species. It is the USACE's determination that the proposed TSP plan *"may affect, but will not likely adversely affect"* the loggerhead sea turtle population.

Hawksbill Sea Turtle (*Eretmochelys imbricata*)
Due to its rarity along the Louisiana coast and its preference for nesting on beaches in Puerto Rico and the U.S. Virgin Islands (NMFS AND USFWS 1993), it is the USACE's determination that the TSP is expected to have *"no effect"* on the hawksbill sea turtle population.

Effects on Other Species of Concern
MVN has assessed the environmental impacts of the proposed action on species found in the project area that are protected under the MMPA of 1972, the MBTA of 1918, and the Migratory Bird Conservation Act of 1929.

MVN has determined that, with use of guidelines from USFWS and nesting bird abatement plan (if necessary), the proposed action would have no adverse impacts on protected birds (see **Section IV** for discussions on colonial nesting birds and shore birds).

MVN has determined that, with use of the best management practices (**Annex B**) established in coordination with NMFS, the proposed action would have no adverse impacts on bottlenose dolphins (see **Section IV** for discussions on bottlenose dolphins).

VI. CONCLUSION AND DETERMINATION OF EFFECTS

Based on the above information, the MVN has determined that the proposed action *"may affect but will not likely adversely affect"* the piping plover or it's critical habitat, red knot, West Indian manatee, Gulf sturgeon, loggerhead and Kemps Ridley sea turtles; would have no effect on the Red-cockaded woodpecker, green, leatherback, and hawksbill sea turtles or loggerhead critical habitat and would not adversely impact other species of concern that could potentially be found in the project area. MVN requests your concurrence on the aforementioned determinations.

VII. LITERATURE CITED

Ackerman, B.B. 1995. Aerial surveys of manatees: a summary and progress report. Pages 13-33 in T. J. O'Shea, B. B. Ackerman, and H. F. Percival (eds.). Population Biology of the Florida Manatee. National Biological Service, Information and Technology Report No. 1. Washington, D.C.

Burger, J., C. Jeitner, K. Clark, and L.J. Niles. 2004. The effect of human activities on migrant shorebirds: successful adaptive management. Environmental Conservation 31(4):283-288.

Caldwell, D.K.A., A. Carr, and T.R. Heller, Jr. 1955. Natural history notes on the Atlantic loggerhead turtle, Caretta caretta caretta. Quart. J. Fla. Acad. Sci. 18(4): Pages 292-302.

Carr, A. 1980. Some problems of sea turtle ecology. American Zoologist 20: Pages 489-498.

Carr, A.F. 1952. Handbook of turtles -- the turtles of the United States, Canada, Baja California. Comstock Publishing Association, New York.

Carr, A.F. and H. Hirth. 1962. The ecology and migrations of sea turtles, five comparative features of green turtle nesting colonies. Am. Mus. Noviates. 2091: Pages 1-42.

Davis, T.H. 1983. 1, Loons to sandpipers. Pages 372-375 In J. Farrand, ed. The Audubon Society master guide to birding, Knopf, New York.

Davis, R.W, J.G. Ortega-Ortiz, C.A. Ribic, W.E. Evans, D.C. Briggs, P. H. Ressler, R. B. Cady, R.R. Leben, K. D. Mullin, B. Wursig. 2002. Cetacean habitat in northern oceanic Gulf of Mexico. Deep-Sea Research I 49 (2002) Pages 121-141.

Dickerson, D., M. Wolters, C. Theriot, and C. Slay. 2004. Dredging impacts on sea turtles in the southeastern USA: A historical review of protection. Presented during World Dredging Congress XVII – Dredging in Sensitive Environment. Congress Centre Hamburg, Germany. September 2004.

Dobie, J.L., L. H. Ogren, and J.F. Fitzpatrick. 1961. Food notes and records of the Atlantic Ridley turtle (Lepidochelys kempi) from Louisiana. Copeia 1961: Pages 109-110.

Dundee, H.A. and D.A. Rossman. 1989. The Amphibians and Reptiles of Louisiana. Louisiana State University Press, Baton Rouge.

Ernst, L.H. and R.W. Barbour. 1972. Turtles of the United States. University Press of Kentucky, Lexington, Kentucky. Page 347.

Frazier, J.G. 1980. Marine turtles and problems in coastal management. Pages 2395-2422 in B.L. Edge (ed.). Coastal Zone 80: Proc. of the second symp. on coastal and ocean management. Vol. III. American Society of Civil Engineers, N.Y.

Fritts, T.H., W. Hoffman, and M.A. McGehee. 1983. The distribution and abundance of marine turtles in the Gulf of Mexico and nearby Atlantic waters. Journal of Herpetology 17(4): Pages 327-344.

Fuller, D.A. 1978. Appendix A: The habitats, distribution, and incidental capture of sea turtles in the Gulf of Mexico. Prepared as a working paper on sea turtles for the Task Force developing the Draft Shrimp Management Plan of the U.S. Gulf of Mexico. Center for Wetland Resources, LSU, Baton Rouge. Page 32 LSU-CFI-86-28.

Fuller, D.A. and A.M. Tappan. 1986. The occurrence of sea turtles in Louisiana coastal waters. LSU Center for Wetland Resources, Coastal Fisheries Institute. LSU-CFI-86-28.46.

Gosselink, J.G., J.M. Coleman, R.E. Stewart, Jr. Coastal Louisiana. 1998. In USGS: Status and Trends of the Nation's Biological Resources. Page 58.

Gunter, G. 1981. Status of turtles on the Mississippi Coast. Gulf Res. Rep. 7: Pages 89-92.

Haig, S.M. 1985. The status of the piping plover in Canada. Report to the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), National Museum of Canada, Ottawa, Ontario.

Haig, S.M. 1992. Piping plover. In, The Birds of North America, No. 2. A. Poole, P. Stettenheim, and F. Gill (eds.). Acad. of Nat. Sciences, Philadelphia, PA and Amer. Ornith. Union, Washington, D.C. Pages 1-18.

Haig, S.M. and J.H. Plissner. 1993. Distribution and abundance of piping plovers: Results and implications of the 1991 international census. The Condor 95: Pages 145-156.

Harrington, B.A. 2001. Rufa red knot, Calidris canutus rufa. In: Poole, A. (ed) The birds of North America online. Cornell Laboratory of Ornithology, Ithaca, New York.

Hartman, D.S. 1979. Ecology and behavior of the manatee (Trichechus manatus) in Florida. American Society of Mammalogists Special Publication No. 5. Page 153.
Hendrickson, J.R. 1980. The ecological strategies of sea turtles. American Zoologist 20: Page 597-608.

Hildebrand, H.H. 1981. A historical review of the status of sea turtle populations in the western Gulf of Mexico. Pp. 447-453 in K. A. Bjomdal (ed.) Biology and Conservation of Sea Turtles, Washington, D.C.

Hirth, H.F. 1971. Synopsis of the biological data on the green sea turtle, Chelonia mydas (Linneaus 1758). FAD Fisheries Synopsis No. 85.

Hirth, H.F. 1980. Some aspects of the nesting behavior and reproductive biology of sea turtles. American Zoologist 20: Pages 507-523.

Hughes, G.R. 1972. The olive Ridley sea-turtle (Lepidochelys olivacea) in south-east Africa. Biol. Cons. 4(2): Pages 128-134.

Husar, S.L. 1977. The West Indian manatee (Trichechus manatus). U.S. Fish and Wildlife Service. Wildlife Resource Report No. 7: Pages 1-22.

[IMMS] Institute for Marine Mammal Studies. 2015. http://www.imms.org/atlanticbottlenosedolphins.php. Accessed 6 February 2015.

King, F.W. 1981. Historical review of the decline of the green turtle and the hawksbill. Pp. 183-188 in K.A. Bjomdal (ed.) Biology and Conservation of Sea Turtles. Washington, D.C.

Landry, A. 1986. Stranding and natural history of sea turtles in the northern Gulf of Mexico. Presented at Seventh Annual Minerals Management Service, Gulf of Mexico OCS Region, Information Transfer Meeting. Session IV. D. Sea turtle problems in the Gulf of Mexico, 5 November, 1986.

Meyers, Ronald J., and Ewel, John J. 990, Ecosystems of Florida, University of Central Florida Press, Orlando.

Miller, J.D., C.J. Limpus, and M.H. Godfrey. 2000. Nest site selection, oviposition, eggs, development, hatching and emergence of loggerhead turtles. University of Florida Press. Pages 47.

Nelson, D.A. 1986. Life history and environmental requirements of loggerhead sea turtles. - Technical Report EL-86-2, U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg. Pages 40.

Nicholls, J.L. 1989. Distribution and other ecological aspects of piping plovers (Charadrius melodus) wintering along the Atlantic and Gulf Coasts. M.S. Thesis. Auburn Univ., Auburn. Pages 164.

Niles, L. J., H. P. Sitters, A. D. Dey, P. W. Atkinson, A. J. Baker, K. A. Bennett, R. Carmona, K. E. Clark, N. A. Clark, C. Espoz, P.M. González, B. A. Harrington, D. E. Hernández, K. S. Kalasz, R. G. Lathrop, R. N. Matus, C. D. T. Minton, R. I. G. Morrison, M. K. Peck, W. Pitts, R. A. Robinson and I. L. Serrano. 2008. Status of the rufa red knot, Calidris canutus rufa, in the western hemisphere. Report to the U.S. Fish and Wildlife Service. New Jersey Department of Environmental Protection, Division of Fish and Wildlife, Endangered and Nongame Species Program, Trenton, New Jersey. 236 pp. + Appendix.

[NMFS and USFWS] National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1991. Recovery Plan for U.S Population of Atlantic Green Turtle. National Marine Fisheries Service, Washington, D.C.

[NMFS and USFWS] National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1992a. Recovery Plan for the Kemp's Ridley Sea Turtle (Lepidochelys kempii) National Marine Fisheries Service, St. Petersburg, FL.

[NMFS and USFWS] National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1992b. Recovery Plan for Leatherback Turtles in the U.S. Caribbean, Atlantic and Gulf of Mexico. National Marine Fisheries Service, Washington, D.C.

[NMFS and USFWS] National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1993. Recovery Plan for Hawksbill Turtles in the U.S. Caribbean Sea, Atlantic Ocean and Gulf of Mexico. National Marine Fisheries Service, St. Petersburg, FL.

[NMFS and USFWS] National Marine Fisheries Service and U.S. Fish and Wildlife Service. 2008. Recovery plan for the northwest Atlantic population of the loggerhead sea turtle (Caretta caretta), second revision. National Marine Fisheries Service, Silver Spring, MD.

[NMFS, USFWS, and SEMARNAT] National Marine Fisheries Service, U.S. Fish and Wildlife Service, and Secretariat of Environment & Natural Resources. 2011. Bi-National Recovery Plan for the Kemp's Ridley Sea Turtle (Lepidochelys kempii), Second Revision. National Marine Fisheries Service. Silver Spring, Maryland 156 pp. + appendices.

[NOAA] National Oceanic and Atmospheric Administration. 2015. Bottlenose Dolphin (Tursiops truncatus). Website: http://www.nmfs.noaa.gov/pr/species/mammals/dolphins/bottlenose-dolphin.html Accessed 6 February 2015.

O'Shea, T.J. 1988. The past, present, and future of manatees in the southeastern United States: realities, misunderstandings, and enigmas. Pages 184-204 in Odum, R.R., K.A. Riddleberger, and J.C. Ozier (eds.). Proceedings of the Third Southeastern Nongame and Endangered Wildlife Symposium. Georgia Department of Natural Resources. Social Circle, Georgia.

O'Shea, T.J., B.B. Ackerman, and H.F. Percival (eds.). 1992. Interim report of the technical workshop on manatee population biology. Manatee Population Research Report No. 10. Florida Cooperative Fish and Wildlife Research Unit. Gainesville, Florida. Page 83.

Pritchard, P.C.H. 1971. The leatherback or leathery turtle, Dermochetys coriacea. IUCN Monograph, Marine Turtle Series (1): Pages 1-39.

Pritchard, P.C.H. and R. Marquez. 1973. Kemp's Ridley turtle or Atlantic Ridley. IUCN Monograph No. 2. Marine Turtle Series. Page 30.

Rabalais, S.C. and N.N. Rabalais. 1980. The occurrence of sea turtles on the south Texas coast. Contrib. Mar. Sci. 23: Pages123-129.

Rebel, T.P. 1974. Sea turtles and the turtle industry of the West Indies, Florida, and the Gulf of Mexico. Univ. Miami Press, Coral Gables, Florida. Page 250.

Renaud, M. L. 1995. Movements and submergence patterns of Kemp's Ridley turtles (Lepidochelys kempii). Journal of Herpetology 79(3): Pages 370-374.

Reynolds, J.E. III and J.R. Wilcox. 1987. People, power plants, and manatees. Sea Frontiers 33(4): Pages 263-269.

Tomkovich, P.S. 1992. An analysis of the geographic variability in Knots Calidris canutus rufa based on museum skins. Wader Study Group Bull. 64 (Suppl.): 17-23.

[USFWS] U.S. Fish and Wildlife Service. 1988. Great Lakes and Northern Great Plains piping plover recovery plan. U.S. Dept. Interior, Twin Cities. Page160.

[USFWS] U.S. Fish and Wildlife Service. 1990. Report to Congress: Endangered and threatened species recovery program. U.S. Dept. Interior. Washington, D.C. Page 406.

[USFWS] U.S. Fish and Wildlife Service. 1991. Endangered and threatened wildlife and plants. 50CFR 17.11 and 17.12. U.S. Dept. Interior, Washington, D.C. Page 37.

[USFWS] U.S. Fish and Wildlife Service. 2001a. Endangered and threatened wildlife and plants; final determinations of critical habitat for wintering piping plovers; final rule. Federal Register 66(132): Pages 36037-36086.

[USFWS] U.S. Fish and Wildlife Service. 2001b. Florida manatee recovery plan. Southeast Region, U.S. Fish and Wildlife Service, Atlanta, Georgia. Page 144 + Appendices.

[USFWS] U.S. Fish and Wildlife Service. 2009. Piping plover (Charadrius melodus) 5-year review summary and evaluation U.S. Fish and Wildlife Service, Northeast Region, Hadley, Massachusetts and the Midwest Region's East Lansing Field Office, Michigan.

[USFWS] U.S. Fish and Wildlife Service. 2013. U.S Fish and Wildlife Service Draft Coordination Act Report. Prepared by Ronald Paille. U.S. Fish and Wildlife Service Ecological Services. Lafayette, Louisiana.

[USFWS] U.S. Fish and Wildlife Service. 2014a. Endangered and threatened wildlife and plants; threatened species status for the rufa red knot; final rule. Federal Register 79(238): Pages 73706-73748.

[USFWS] U.S. Fish and Wildlife Service. 2014b. Ecology and abundance; supplement to: endangered and threatened wildlife and plants; threatened species status for the Rufa red knot (Calidris canutus rufa rufa). Docket No. FWS–R5–ES–2013–0097; RIN 1018–AY17.

[USFWS] U.S. Fish and Wildlife Service. 2015. Environmental Online Conservation System. http://ecos.fws.gov/ecos/home.action. Last accessed on 8 January 2015.

Viosca, P., Jr. 1961. Turtles, tame and truculent. La. Conserv. 13: Pages 5-8.

Zwinenberg, A.J. 1977. Kemp's Ridley, Lepidochelys kempi (Gar-man 1880), undoubtedly the most endangered marine turtle today (with notes on the current status of Lepidochelys olivacea). Bull. Maryland Herp.Soc. 13: Pages 170-192.

Annex B

Special Operating Conditions

and

Best Management Practices

Special Operating Conditions If Manatees Are Present in the Project Area:

(1) If a manatee(s) is sighted within 100 yards (91 m) of the project area, all appropriate precautions shall be implemented by the Contractor to ensure protection of the manatee. These precautions shall include the operation of all moving equipment no closer than 50 ft (15.2 m) of a manatee. If a manatee is closer than 50 ft (15.2 m) to moving equipment or the project area, the equipment will be shut down and all construction activities will cease to ensure protection of the manatee. Construction activities will not resume until the manatee has departed and the 50-foot (15.2 m) buffer has been re-established.

(2) If a manatee(s) is sighted in the project area, all vessels associated with the project shall operate at "no wake/idle" speeds at all times while in waters where the draft of the vessel provides less than a four-foot (1.2 m) clearance from the bottom, and vessels will follow routes of deep water whenever possible. Boats used to transport personnel shall be shallow-draft vessels, preferably of the light displacement category, where navigational safety permits.

(3) If siltation barriers are used, they will be made of material in which manatees cannot become entangled, are properly secured, and are regularly monitored to avoid manatee entrapment.

(4) Manatee Signs. Prior to commencement of construction, each vessel involved in construction activities shall display at the vessel control station or in a prominent location, visible to all employees operating the vessel, a temporary sign at least 8-1/2" x 11" (21.6 x 27.9 cm) reading, "CAUTION: MANATEE HABITAT/IDLE SPEED IS REQUIRED IN CONSTRUCTION AREA." In the absence of a vessel, a temporary 3' x 4' (0.9 x 1.2 m) sign reading "CAUTION: MANATEE AREA" will be posted adjacent to the issued construction permit. A second temporary sign measuring 8-1/2" x 11" (21.6 x 27.9 cm) reading "CAUTION: MANATEE HABITAT. EQUIPMENT MUST BE SHUT DOWN IMMEDIATELY IF A MANATEE COMES WITHIN 50 FEET OF OPERATION" will be posted at the dredge operator control station and at a location prominently adjacent to the issued construction permit. The Contractor shall remove the signs upon completion of construction.

Protected Marine Species Entrapment Prevention Measures

Bottlenose dolphins, sea turtles and Gulf sturgeon (NOAA Trust Species) are known to inhabit coastal Louisiana waters. Bottlenose dolphins are protected under the Marine Mammal Protection Act of 1972 (MMPA) and sea turtles and Gulf sturgeons are protected under the Endangered Species Act (ESA). Because of the potential for these protected species to become entrapped within construction sites in coastal Louisiana waters, projects that utilize shallow open water areas for the construction of enclosed facilities and wetland creation will utilize the following measures to minimize and/or prevent the potential for such entrapment:

1. Prior to construction, the Corps of Engineers (COE) Technical Manager, the Contracting Officer Representative (COR) and the Contractors should conduct a site visit and meeting to develop a mutual understanding relative to compliance with the MMPA and the ESA.

2. Contractors will instruct all personnel associated with the project of the potential presence of Trust Species in the area, and the need to prevent entrapment of these animals. All construction personnel will be advised that there are civil and criminal penalties for harming, harassing, or killing these protected species. The Contractor shall be held responsible for any Trust species harassed or killed as a result of construction activities not conducted in accordance with these specifications.

3. Contractor will observe the area to be enclosed for Trust Species at least 24 hours prior to and during closure of any levee, dike or structure. This is best accomplished by small vessel or aerial surveys, with at least two experienced marine observers on board scanning for Trust species. Large areas (e.g. >300 acres) will likely require the use of more than one vessel or aerial surveys to insure full coverage of the area. These surveys will occur in a best sea state (BSS) of 3 feet or less, as Trust species are difficult to sight in choppy water.

4. Any Trust Species sighted within the area to be enclosed triggers all appropriate precautions to be implemented by the Contractor to ensure protection of the animal(s). These precautions shall include avoiding direct contact with the Trust species.

5. Any sightings of Trust Species within an enclosed project site shall be reported immediately to the COE. The point of contact within the COE will be Tammy Gilmore, (504) 862-1002 or email at tammy.h.gilmore@usace.army.mil. Coordination by the COE personnel with the National Marine Fisheries Service (NMFS) Marine Mammal Health and Stranding Response (MMHSRP) and the Louisiana State Coordinator for the Sea Turtle Stranding and Salvage Network (STSSN) will be conducted, as applicable, to determine what further actions may be required.

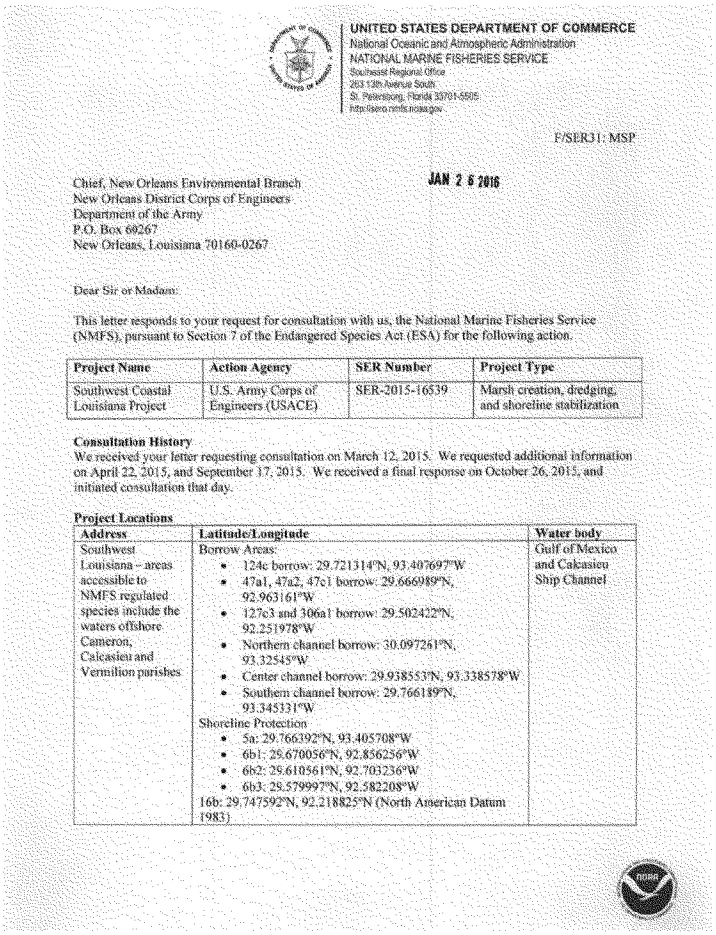
6. During enclosure construction, the Contractor will leave or construct at least one escape route in retention structures to allow any Trust species to exit shallow open water areas during construction activities. Escape routes in retention structures would be constructed to lead directly to open water outside the disposal site with a minimum width of 100 feet and have a depth as deep as the deepest natural entrance into the disposal site.

7. Escape routes in retention structures would remain open until visual inspections of the enclosure have determined that no Trust species are present within the structure.

8. If observers note entrapped animals are not leaving the area, but are visually disturbed, stressed, or their health is compromised then COE may require any pumping activity to cease until the animals either leave on their own or are moved under the direction of NMFS.

    a. In coordination with the local stranding networks and other experts, NMFS will conduct an initial assessment to determine the number of animals, their size, age (in the case of dolphins), body condition, behavior, habitat, environmental parameters, prey availability and overall risk.
    b. If the animal(s) is/are not in imminent danger they will need to be monitored by the Stranding Network for any significant changes in the above variable.
    c. The contractor may not attempt to scare, herd, disturb, or harass the Trust species to encourage them to leave the area. Coordination by the COE with the NMFS SER Stranding Coordinator may result in authorization for these actions.
    d. NMFS may intervene (catch and release and/or rehabilitate) if the Trust Species are in a situation that is life threatening and evidence suggests the animal is unlikely to survive in its immediate surroundings.
    e. Surveys will be conducted throughout the area at least twice or more in calm surface conditions (BSS 3 feet or less), with experienced marine observers, to determine whether Trust species are no longer present in the area.

9. Any Trust Species observed dead must immediately be reported to the COE (Tammy Gilmore 504-862-1002) who will then report to NMFS and/or STSSN coordinator.



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701-5505
http://sero.nmfs.noaa.gov

F/SER31: MSP

JAN 2 6 2016

Chief, New Orleans Environmental Branch
New Orleans District Corps of Engineers
Department of the Army
P.O. Box 60267
New Orleans, Louisiana 70160-0267

Dear Sir or Madam:

This letter responds to your request for consultation with us, the National Marine Fisheries Service (NMFS), pursuant to Section 7 of the Endangered Species Act (ESA) for the following action.

Project Name	Action Agency	SER Number	Project Type
Southwest Coastal Louisiana Project	U.S. Army Corps of Engineers (USACE)	SER-2015-16539	Marsh creation, dredging, and shoreline stabilization

Consultation History
We received your letter requesting consultation on March 12, 2015. We requested additional information on April 22, 2015, and September 17, 2015. We received a final response on October 26, 2015, and initiated consultation that day.

Project Locations

Address	Latitude/Longitude	Water body
Southwest Louisiana – areas accessible to NMFS regulated species include the waters offshore Cameron, Calcasieu and Vermilion parishes	Borrow Areas: • 124c borrow: 29.721314°N, 93.407697°W • 47a1, 47a2, 47c1 borrow: 29.666989°N, 92.963161°W • 127c3 and 306a1 borrow: 29.502422°N, 92.251978°W • Northern channel borrow: 30.097261°N, 93.32545°W • Center channel borrow: 29.938553°N, 93.338578°W • Southern channel borrow: 29.766189°N, 93.345331°W Shoreline Protection • 5a: 29.766392°N, 93.405708°W • 6b1: 29.670056°N, 92.856256°W • 6b2: 29.610561°N, 92.703236°W • 6b3: 29.579997°N, 92.582208°W 16b: 29.747592°N, 92.218825°N (North American Datum 1983)	Gulf of Mexico and Calcasieu Ship Channel

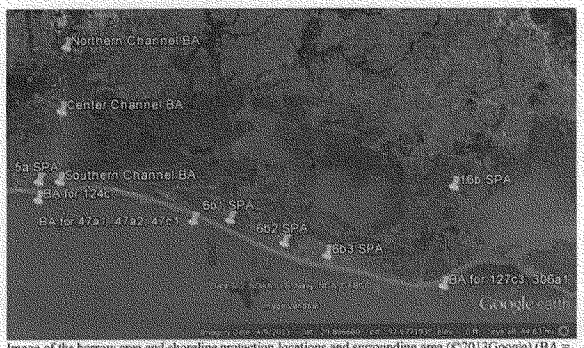


Image of the borrow area and shoreline protection locations and surrounding area (©2013Google) (BA = borrow areas; SPA = shoreline protection areas).

Existing Site Conditions

According to the USACE, the Louisiana shoreline is currently degrading at a rate estimated to be equivalent to a football field an hour. This is resulting in an extensive loss of marsh habitat. Numerous restoration projects have occurred along the Louisiana coast to armor shorelines against future erosion from wave action, and to create and restore interior marshes. The applicant states that the sediments within the borrow and the shoreline protection areas are composed primarily of silt, clay, and sand. There are no seagrasses, sponges, or corals within the borrow sites or shoreline protection areas.

Project Description

The Southwest Coastal Louisiana Project is designed to provide hurricane and storm damage risk reduction, as well as coastal ecosystem restoration in the southwest portion of Louisiana. The proposed project includes potential implementation of non-structural storm damage reduction measures (i.e., raising buildings, flood-proofing) in developed upland locations. The proposed project also includes numerous coastal restoration elements:

- 9 marsh restoration features
- 35 chenier[1] reforestation features
- 5 shoreline protection features
- 1 hydrologic/salinity control feature

The proposed non-structural storm damage and chenier reforestation reduction measures are located in upland areas. The proposed hydrologic salinity control feature is located in an interior waterbody over 10 miles (mi) from the Gulf of Mexico.

The proposed project also includes wetland restoration and creation in 9 interior locations. Marshes will be created with material obtained from offshore borrow areas using only hydraulic dredges. The dredged material (a mixture of silt, clay, and sand) will be transported by submerged pipeline to interior marsh creation/restoration areas. The applicant states that the total volume to be hydraulically dredged is 63,928,988 cubic yards (yd^3). There are 3 borrow areas located in the Gulf of Mexico; these sites will be dredged to a depth of 15 feet (ft) below the mudline with side slopes of no less than a 4H:1V ratio to minimize the potential for the formation of hypoxic conditions. The applicant states that dredged material generated from USACE maintenance dredging of the federally-authorized Calcasieu Ship Channel (CSC) will also be used as sediment for marsh creation sites.

The proposed project also includes construction of approximately 47.64 mi of segmented (i.e., not continuous) shoreline protection along 5 separate reaches of the Gulf of Mexico shoreline. Rock will be placed parallel to shore using a barge-mounted crane. Approximately 2,083 acres (ac) of temporary access canals will be dredged by clamshell/bucket dredges to allow barge access to place the rock material. Locations for shoreline protection are shown in the image above and listed below:

- 5a Holly Beach shoreline stabilization
- 6b1 Gulf shoreline restoration – Calcasieu River to Freshwater Bayou
- 6b2 Gulf shoreline restoration – Calcasieu River to Freshwater Bayou
- 6b3 Gulf shoreline restoration – Calcasieu River to Freshwater Bayou
- 16b Intracoastal shoreline stabilization - Freshwater Bayou to Gulf Intracoastal Waterway

Construction Conditions
Construction is anticipated to begin in 2025, and could last up to 10 years. The applicant proposes to adhere to the following operating conditions and best management practices:

- Shoreline protection will be constructed in segments each measuring 280 ft long with 175-ft wide gaps between each segment.
- Prior to the start of mechanical dredging activities, the contractor will be required to drop the bucket (or similar equipment) into the water and retrieve it empty once. After the bucket has been dropped and retrieved, a 1-minute, no-work period will be observed. During this no-work period, personnel will carefully observe the work area in an effort to visually detect listed species. If listed species are sighted, no bucket dredging will be initiated until the listed species have left the work area. If the water turbidity makes such visual sighting impossible, work will proceed after the 1-minute no-work period has elapsed. If more than 15 minutes elapses with no work, then the empty bucket drop/retrieval process will be performed again prior to construction commencing.
- Hydraulic dredging would be limited to the borrow areas located approximately 3 mi offshore avoiding impacts to Loggerhead critical habitat (LOGG-S-02), which contains *Sargassum* habitat.

Effects Determinations for Species the USACE or NMFS Believes May Be Affected by the Proposed Action

Species	ESA Listing Status	USACE Effect Determinations	NMFS Effect Determinations
Sea Turtles			
Kemp's ridley	E	NLAA	NLAA
Loggerhead (Northwest Atlantic Ocean distinct population segment [DPS])	T	NLAA	NLAA
Fish			
Gulf sturgeon (Atlantic sturgeon, Gulf subspecies)	T	NLAA	NP
E = endangered; T = threatened; NLAA = may affect, not likely to adversely affect; NP = not present			

Critical Habitat
The project is not located in designated critical habitat, and there are no potential routes of effect to any designated critical habitat.

Analysis of Potential Routes of Effects to Species
The proposed non-structural storm damage reduction and chenier reforestation measures will not have effects on resources managed under the ESA due to the location of these activities in uplands. The proposed hydrologic/salinity control feature is located in an interior waterbody over 10 miles from the Gulf of Mexico and ESA-listed species managed by NMFS are not likely to be found in the project area. Therefore, these proposed features are not analyzed in this consultation.

Marsh creation activities will occur in interior wetland locations which are not accessible to sea turtles and therefore the marsh creation and placement of dredged material in these areas will not be analyzed further.

The proposed use of dredged material from the CSC has been previously considered under the Gulf of Mexico Regional Biological Opinion (GRBO). The GRBO evaluated the effects of maintenance dredging within authorized federal navigation channels. Therefore, all aspects of on-going maintenance dredging of the CSC are evaluated under the GRBO. This consultation evaluates those portions and effects of the project not covered in the GRBO, as well as any potential cumulative and indirect effects to the species that may result from the additional project components. We do not anticipate any additional synergistic effects would result from the proposed use of dredged material from the CSC for the purpose of marsh creation and restoration. The applicant does not propose any additional maintenance dredging in the CSC as part of the proposed action, and the marsh creation activities will occur in interior locations not accessible to sea turtles. Accordingly, the proposed use of these CSC borrow areas is not analyzed further in this consultation.

The use of hydraulic dredges and mechanical dredges to generate sediment for marsh creation and construct temporary channels to allow equipment access to shoreline protection sites may affect sea turtles by injury or death as a result of interactions with mechanical and cutterhead dredging equipment, rock placement or barges. We believe the chance of effects from interactions with these activities is discountable. NMFS has previously determined in Biological Opinions that non-hopper type dredging methods (e.g., mechanical, clamshell/bucket, cutterhead, pipeline, and sidecast dredging) are unlikely to adversely affect motile listed species, and deems the risk of interactions with motile protected species to be discountable. NMFS has no new information that would change the basis of our conclusion.

Mechanical dredging or the placement of rock has the potential to kill or injure sea turtles if the bucket or rock is dropped onto a sea turtle that enters the dredging area and is directly beneath the bucket when it is dropped. NMFS believes this risk is extremely low and discountable as sea turtles are highly mobile and are likely to avoid the active construction area.

While dredging may result in temporary and localized increases in turbidity, we believe any risk of injury due to increased turbidity is insignificant. The existing borrow site conditions are normally highly turbid, and we anticipate that increased turbidity would occur only temporarily in the immediate vicinity of dredging areas. We anticipate any increase in turbidity would not be measurable and therefore is insignificant.

The project may affect sea turtles by reducing forage resources through dredging activities and the installation of breakwaters. However, it is extremely unlikely that sea turtles use the project area for foraging due to the naturally occurring turbid characteristics of the water and the lack of seagrasses and other forage resources used by sea turtles. Additionally, there are large expanses of similar habitat nearby, and throughout the Gulf of Mexico. Therefore, we believe this effect will be discountable.

Conclusion

Because all potential project effects to listed species were found to be discountable, insignificant, or beneficial, we conclude that the proposed action is not likely to adversely affect listed species under NMFS's purview. This concludes your consultation responsibilities under the ESA for species under NMFS's purview. Consultation must be reinitiated if a take occurs or new information reveals effects of the action not previously considered, or if the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat in a manner or to an extent not previously considered, or if a new species is listed or critical habitat designated that may be affected by the identified action. NMFS's findings on the project's potential effects are based on the project description in this response. Any changes to the proposed action may negate the findings of this consultation and may require reinitiation of consultation with NMFS.

We have enclosed additional relevant information for your review. We look forward to further cooperation with you on other projects to ensure the conservation of our threatened and endangered marine species and designated critical habitat. If you have any questions on this consultation, please contact Michelle Press, Consultation Biologist, at (727) 209-5977, or by email at Michelle.Press@noaa.gov.

Sincerely,

Roy E. Crabtree, Ph.D.
Regional Administrator

Enc.: 1. *Sea Turtle and Smalltooth Sawfish Construction Conditions* (Revised March 23, 2006)
2. *PCTS Access and Additional Considerations for ESA Section 7 Consultations* (Revised March 10, 2015)

File: 1514-22.F.6

SEA TURTLE AND SMALLTOOTH SAWFISH CONSTRUCTION CONDITIONS

The permittee shall comply with the following protected species construction conditions.

a. The permittee shall instruct all personnel associated with the project of the potential presence of these species and the need to avoid collisions with sea turtles and smalltooth sawfish. All construction personnel are responsible for observing water-related activities for the presence of these species.

b. The permittee shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing sea turtles or smalltooth sawfish, which are protected under the Endangered Species Act of 1973.

c. Siltation barriers shall be made of material in which a sea turtle or smalltooth sawfish cannot become entangled, be properly secured, and be regularly monitored to avoid protected species entrapment. Barriers may not block sea turtle or smalltooth sawfish entry to or exit from designated critical habitat without prior agreement from the National Marine Fisheries Service's Protected Resources Division, St. Petersburg, Florida.

d. All vessels associated with the construction project shall operate at "no wake/idle" speeds at all times while in the construction area and while in water depths where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will preferentially follow deep-water routes (e.g., marked channels) whenever possible.

e. If a sea turtle or smalltooth sawfish is seen within 100 yards of the active daily construction/dredging operation or vessel movement, all appropriate precautions shall be implemented to ensure its protection. These precautions shall include cessation of operation of any moving equipment closer than 50 feet of a sea turtle or smalltooth sawfish. Operation of any mechanical construction equipment shall cease immediately if a sea turtle or smalltooth sawfish is seen within a 50-ft radius of the equipment. Activities may not resume until the protected species has departed the project area of its own volition.

f. Any collision with and/or injury to a sea turtle or smalltooth sawfish shall be reported immediately to the National Marine Fisheries Service's Protected Resources Division (727-824-5312) and the local authorized sea turtle stranding/rescue organization.

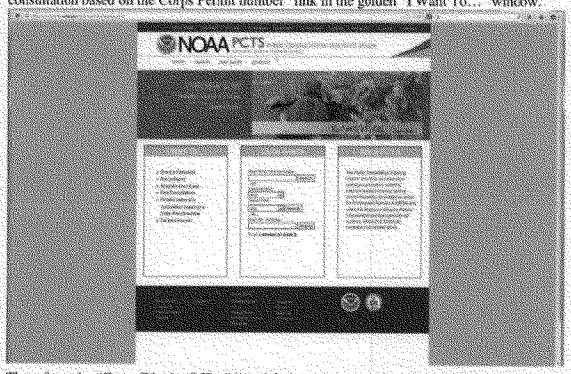
g. Any special construction conditions, required of your specific project, outside these general conditions, if applicable, will be addressed in the primary consultation.

Revised: March 23, 2006

PCTS Access and Additional Considerations for ESA Section 7 Consultations
(Revised 03-10-2015)

Public Consultation Tracking System (PCTS) Guidance: PCTS is a Web-based query system at **https://pcts.nmfs.noaa.gov/** that allows all federal agencies (e.g., U.S. Army Corps of Engineers - USACE), project managers, permit applicants, consultants, and the general public to find the current status of NMFS's Endangered Species Act (ESA) and Essential Fish Habitat (EFH) consultations which are being conducted (or have been completed) pursuant to ESA Section 7 and the Magnuson-Stevens Fishery Conservation and Management Act's (MSA) Sections 305(b)2 and 305(b)(4). Basic information including access to documents is available to all.

The PCTS Home Page is shown below. For USACE-permitted projects, the easiest and quickest way to look up a project's status, or review completed ESA/EFH consultations, is to click on either the "Corps Permit Query" link (top left); or, below it, click the "Find the status of a consultation based on the Corps Permit number" link in the golden "I Want To…" window.



Then, from the "Corps District Office" list pick the appropriate USACE district. In the "Corps Permit #" box, type in the 9-digit USACE permit number identifier, with no hyphens or letters. Simply enter the year and the permit number, joined together, using preceding zeros if necessary after the year to obtain the necessary 9-digit (no more, no less) number. For example, the USACE Jacksonville District's issued permit number SAJ-2013-0235 (LP-CMW) must be typed in as 201300235 for PCTS to run a proper search and provide complete and accurate results. For querying permit applications submitted for ESA/EFH consultation by other USACE districts, the procedure is the same. For example, an inquiry on Mobile District's permit MVN201301412 is entered as 201301412 after selecting the Mobile District from the "Corps District Office" list. PCTS questions should be directed to Kelly Shotts at Kelly.Shotts@noaa.gov or (727) 551-5603.

EFH Recommendations: In addition to its protected species/critical habitat consultation requirements with NMFS' Protected Resources Division pursuant to Section 7 of the ESA, prior to proceeding with the proposed action the action agency must also consult with NMFS' Habitat Conservation Division (HCD) pursuant to the MSA requirements for EFH consultation (16 U.S.C. 1855 (b)(2) and 50 CFR 600.905-.930, subpart K). The action agency should also ensure that the applicant understands the ESA and EFH processes; that ESA and EFH consultations are separate, distinct, and guided by different statutes, goals, and time lines for responding to the action agency; and that the action agency will (and the applicant may) receive separate consultation correspondence on NMFS letterhead from HCD regarding their concerns and/or finalizing EFH consultation.

Marine Mammal Protection Act (MMPA) Recommendations: The ESA Section 7 process does not authorize incidental takes of listed or non-listed marine mammals. If such takes may occur an incidental take authorization under MMPA Section 101 (a)(5) is necessary. Please contact NMFS' Permits, Conservation, and Education Division at (301) 713-2322 for more information regarding MMPA permitting procedures.

SOUTHWEST COASTAL LOUISIANA
INTEGRATED FINAL FEASIBILITY REPORT
AND
ENVIRONMENTAL IMPACT STATEMENT

APPENDIX A

Annex L

Adaptive Management and Monitoring Plan

1. **INTRODUCTION**
INTRODUCTION TO ADAPTIVE MANAGEMENT AND MONITORING
1.1 ADAPTIVE MANAGEMENT AND MONITORING PROCESS
1.2 AUTHORIZATION AND IMPLEMENTATION GUIDANCE
1.3 ADAPTIVE MANAGEMENT AND MONITORING PROGRAM STRUCTURE
1.4 COMMUNICATION STRUCTURE FOR IMPLEMENTATION OF ADAPTIVE MANAGEMENT

2. **ADAPTIVE MANAGEMENT AND MONITORING PLANNING**
2.1 CONCEPTUAL ECOLOGICAL MODEL FOR MONITORING AND ADAPTIVE MANAGEMENT
2.2 PROJECT GOALS, OBJECTIVES AND CONSTRAINTS
2.3 MANAGEMENT AND RESTORATION ACTIONS —TENTATIVELY SELECTED PLAN
2.4 SOURCES OF UNCERTAINTY AND ASSOCIATED RISKS
2.5 RATIONALE FOR ADAPTIVE MANAGEMENT/ UNCERTAINTY AND RISK MANAGEMENT

3. **MONITORING**
3.1 MONITORING PLAN ELEMENTS

4. **ASSESSMENT**
4.1 ASSESSMENT PROCESS
4.2 DOCUMENTATION AND REPORTING

5. **DATA MANAGEMENT**

6. **ADAPTIVE MANAGEMENT AND DECISION MAKING PROCESSES**

7. **LESSONS LEARNED**

8. **COSTS FOR IMPLEMENTATION OF ADAPTIVE MANAGEMENT AND MONITORING**

9. **REFERENCES**

INTRODUCTION

Wetland loss in Southwest Louisiana experienced approximately 20 percent of the total wetland loss observed in Louisiana from 1932-2010 (Couvillion et al., 2011). The processes of sea level rise, ground subsidence, saltwater intrusion, and erosion of wetlands have caused significant adverse impacts to the study area (Figure 1). The continued land loss and ecosystem degradation threaten the productivity of the Southwest's ecosystems, the economic viability of its industries, and the safety of its residents. Without action, this highly productive coastal ecosystem, composed of diverse habitats and wildlife, is not sustainable. The goal of the Southwest Coastal Louisiana Feasibility Study is to develop a comprehensive plan for Southwest Louisiana for that will provide hurricane storm surge damage risk reduction and provide coastal restoration measures to achieve ecosystem sustainability.

Initially, two separate studies were underway in the Southwest Coastal project area—one for coastal restoration under the LCA program and one for hurricane risk reduction following the impacts of Hurricane Rita in 2005. Recognizing the importance of coastal restoration for hurricane risk reduction and to reduce redundancies, the two projects were integrated. The Southwest Coastal project will produce both a National Economic Development (NED) plan for hurricane storm surge risk reduction and a National Ecosystem Restoration (NER) plan for ecosystem restoration. Please refer to Chapter 1 Section 7 of the Final Integrated Feasibility Report and PEIS for additional information on the authorities for the Southwest Coastal Study.

Since the restoration in the Southwest Coastal area is a large-scale project that may influence regional conditions, an Adaptive Management and Monitoring (AM&M) Program will be implemented before, during, and after construction. Such monitoring will allow the USACE to assess the progress of restoration and will provide the necessary information to adjust project performance through adaptive management (AM), if necessary, to better meet project goals and objectives, and will ultimately provide information to better design and maintain coastal resources in the future.

In accordance with the Water Resources Development Act of 2007 Section 2036, Section 2039 and subsequent implementation guidance (CECW-PB Memorandum dated August 31, 2009), AM&M are required for both National Ecosystem Restoration (NER) project components and for any Mitigation Plan required for the National Economic Development (NED) component. This AM&M Plan describes the monitoring design proposed to evaluate NER project progress towards meeting the restoration objectives, describes the organizational structure for the AM&M process, identifies key uncertainties, and describes potential AM actions. A separate plan is not needed for the NED since mitigation is not currently anticipated to be required.

Many factors such as ecosystem dynamics, engineering applications, institutional requirements, and many other key uncertainties can change and/or evolve over a project's life. The AM&M Plan will be regularly updated to reflect monitoring-acquired and other new information as well as resolution of and progress on resolving existing key uncertainties or identification of any new uncertainties that might emerge. Specifically, this AM&M Plan will be revised and updated and project measure specific plans developed during the feasibility level of design phase and further in the pre-construction engineering and design (PED) phase as more detailed project designs are developed and uncertainties are better understood. The AM&M plan will then be used during and after project construction to adjust the project, as necessary, to better achieve goals, objectives, and restoration/management outputs/results.

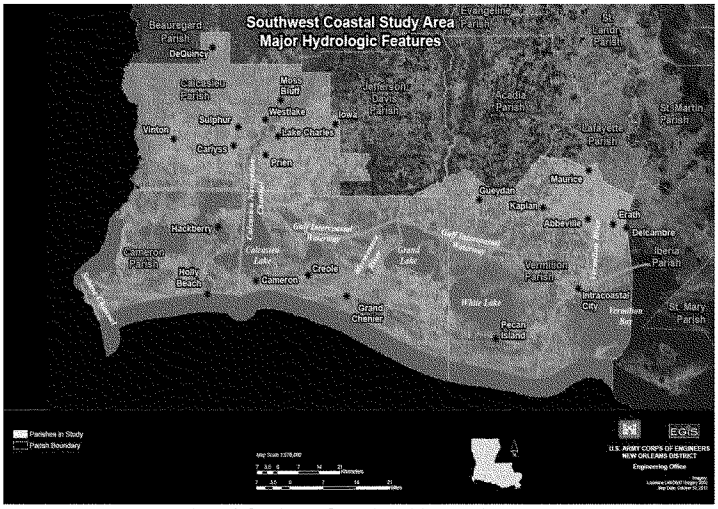


Figure 1: Southwest Coastal Louisiana study area.

Introduction to Adaptive Management and Monitoring

Adaptive Management and Monitoring (AM&M) provides a directed iterative approach to achieving restoration project goals and objectives by focusing on strategies promoting flexible decision making that can be adjusted in the face of uncertainties as outcomes from restoration management actions and other events become better understood. Initiating a formal AM&M process early in the study process enables the Project Delivery Team (PDT) to identify and resolve key uncertainties and other potential issues that can positively or negatively influence project outcomes during every stage of the planning and project implementation process. Hence, early implementation of AM and monitoring will result in a project that can better succeed under a wide range of uncertain conditions and can be adjusted as necessary. Furthermore, careful monitoring of project outcomes both advances scientific understanding and helps adjust policies and/or operations as part of an iterative learning process (National Research Council 2004).

Learning from the management experience is certainly not a new idea; but the purposeful and systematic pursuit of knowledge to address identified uncertainties has rarely been practiced. Adaptive management acknowledges the uncertainty about how ecological systems function and how they may respond to management actions. Nevertheless, AM is not a random trial-and-error process; it is not ad-hoc or simply reactionary. An essential element of AM is the development and execution of a monitoring and assessment program to analyze and understand responses of the system to implementation of the project as restoration progresses. The AM&M Program for the Southwest Coastal Project Ecosystem Restoration/NER components was developed and will be used to:

- Allow scientists and managers to collaboratively design plans for managing complex and incompletely understood ecological systems
- Reduce uncertainty over time
    - Acknowledgement, identification, and characterization of risks and uncertainties

  - Uncertainty can be analyzed and exploited to identify key gaps in information and understanding
- Implement systematic monitoring of outcomes and impacts
  - Scientific information obtained through continued monitoring is used to evaluate and manage uncertainties to achieve desired goals and objectives
  - Explicitly stated goals and measurable indicators of progress toward those goals
  - Demonstrate to others that the project is meeting or exceeding performance goals; "ecological success"
  - Detect detrimental system responses as early as possible in order to minimize the adverse effects of these responses
  - Evaluate hypotheses and performance measures and revise conceptual ecological models as appropriate
- Incorporate an iterative approach to decision-making
  - The monitoring data is used to influence future management decisions
  - Feedback loops are developed so that monitoring and assessment produce continuous and systematic learning that in turn is incorporated into subsequent decision-making
  - Projects and programs can be implemented in phases to allow for course corrections based on new information to allow for management flexibility
- Provide a basis for identifying options for improvements in the design, construction and operation of Southwest Coastal Restoration through AM
- Develop reports on the status and progress of the Southwest Coastal Restoration for the agencies involved, the public, Congress, and stakeholders
- Enhance predictive capability through improvements in simulation models before and after project construction
- Provide information to summarize and develop lessons learned to optimize restoration strategies in the future; "lessons learned"
- Ensure interagency collaboration and productive stakeholder participation as they are key elements to success. AM encourages defining agency objectives for stakeholder involvement, deciding upon a strategy for stakeholder involvement, clearly communicating this to the public, and maintaining long-term collaboration among stakeholders. Continued communication with key stakeholders helps identify and reduce socio-economic uncertainties, measure project progress towards objectives, and adaptively manage projects (Knight *et al.*, 2008, Smith *et al.*, 2009, Nkhata and Breen 2010)

1.1 Adaptive Management and Monitoring Process

The developed AM&M program and process is complimentary to the USACE Project Life Cycle (planning, design, construction and operation and maintenance). The AM&M process is not elaborate or duplicative and enhances activities that already take place. The basic process of AM&M for USACE projects (Figure 2) was adapted from the DRAFT USACE Adaptive Management Technical Guide (USACE 2011) and includes:

- **Planning** a program or project;
- **Designing** the corresponding project;
- **Building** the project (construction and implementation);
- **Operating** and maintaining the project; and
- **Monitoring** and **assessing** the project performance;
- **Continue** project implementation as originally designed; or
- **Adjust** the project if goals and objectives are not being achieved
- **Complete** project if goals and objectives and success criteria are achieved, or it is determined the project has successfully produced the desired outcomes
- Project **Termination** is possible if project goals and objectives are not being achieved and the decision is made not to adjust the project or no adjustments are possible

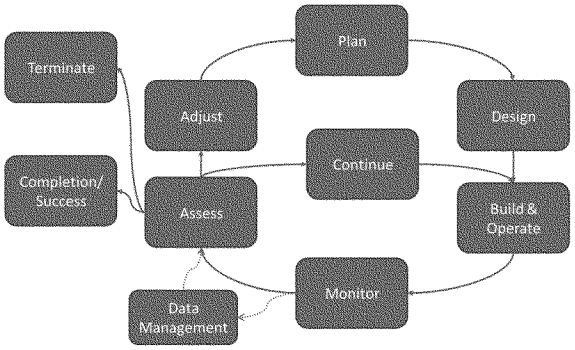


Figure 2: Adaptive management monitoring and process for the USACE Civil works.

1.2 Authorization and Implementation Guidance

Section 2039 of the Water Resources Development Act (WRDA) of 2007 and implementation guidance for Section 2039, in the form of a CECW-PB Memo dated 31 August 2009; require ecosystem restoration projects to develop a plan for monitoring the success of the ecosystem restoration and to develop an AM Plan (contingency plan).

The Monitoring Plan

The purpose of the Monitoring Plan is to assess performance and determine the ecological success of the restoration and management measures.

- Specifically, the Monitoring Plan will assess project performance towards the particular objectives developed for the project. (Project Objectives are specified in Chapter 2 Section 2.1 of the main report.)
- The plan must specify the nature, duration, and periodicity of monitoring, disposition of monitoring and analysis, costs, and responsibilities.
- Scope and duration should include the minimum monitoring actions necessary to evaluate success.
- Monitoring plan will be reviewed during Agency Technical Review (ATR) and Independent External Peer Review (IEPR) as necessary.
- Monitoring will be continued until "restoration success" is documented by the USACE District Engineer in consultation with federal and state resource agencies and determined by USACE Mississippi Valley Division Commander.
- Success is determined by an evaluation of predicted ecological success outcomes as compared to actual results.
- Financial and implementation responsibilities for monitoring will be included in the Project Partnership Agreement (PPA).
- Section 2039 and implementation guidance allows for but does not require a 10 year cost shared Monitoring Plan. Necessary monitoring for a period not to exceed 10 years, monitoring can end sooner if ecological success is determined, will be considered a project cost and will be cost shared and funded under Construction.
- Any cost shared monitoring costs cannot increase the Federal cost, and cannot increase the Federal cost beyond the authorized dollar limit.

- Post Construction monitoring that may be needed beyond 10 years is a 100% non-Federal responsibility.

Adaptive Management/Contingency Plan

- Adaptive management plan must be appropriately scoped to project scale.
- The rationale and cost of AM and anticipated adjustments will be reviewed as part of the decision document.
- Identified physical modifications will be cost-shared and must be agreed upon by the sponsor.
- Changes to the AM plan approved in the decision document must be coordinated with USACE Headquarters (HQUSACE).
- Significant changes needed to achieve ecological success that can't be addressed through operational changes or the AM plan may be examined under other authorities.
- Costly AM plans may lead to re-evaluation of the project.

The importance of Adaptive Management was reinforced with the release of the Civil Works *Strategic Plan 2011-2015: Sustainable Solutions to America's Water Resources Needs* which identified Adaptive Management as a strategy to support the USACE moving towards Integrated Water Resources Management.

1.3 Adaptive Management and Monitoring Program Structure

The U.S. Army Corps of Engineers (USACE), New Orleans District (MVN), Louisiana Coastal Protection and Restoration Authority (CPRA), and the US. Geological Survey (USGS) collaborated to establish a general framework for adaptive management to be applied to all USACE Regional Planning Division South (RPDS) restoration projects. The framework for AM&M is consistent with the previously mentioned authority, implementation guidance, and is consistent with and supports the guidance provided by:

- Technical Letter: Procedures to Evaluation Sea Level Change: Impacts Responses and Adaptation (ETL 1100-2-1)
- DRAFT U.S. Army Corps of Engineers: A Systems Approach to Adaptive Management USACE Technical Guide (USACE 2011)
- U.S. Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration's (NOAA) "Availability of a Final Addendum to the Handbook for Habitat Conservation Planning and Incidental Take Permitting Process" (Federal Register vol. 65, No. 106 35242)
- Planning Guidance Notebook (Engineering Regulation [ER] 1105-2-100) (USACE 2000)
- Planning Manual (Institute for Water Resources [IWR] Report 96-R-21; (Yoe and Orth 1996), Civil Works Ecosystem Restoration Policy (ER 1165-2-501)
- Ecosystem Restoration – Supporting Policy Information (EP 1165-2-502).

Please note that a Standard Operating Procedure (SOP) providing guidance for integration of Adaptive Management and Monitoring into Ecosystem Restoration and Mitigation Projects is being developed for the USACE Regional Planning & Environmental Division, South and will be incorporated in further versions of this AM&M plan once approved.

Adaptive Management and Monitoring Framework

The AM&M Framework includes both a Set-up Phase (Figure 2) and an Implementation Phase (Figure 3). The Set-up Phase proceeds concurrently with the USACE's traditional six-step planning process. While planners are identifying problems and opportunities, inventorying and forecasting resource conditions, evaluating and comparing alternative formulations, and selecting a recommended plan, the AM&M Plan for the project will be developed concurrently. In addition to the items developed during the planning process a conceptual ecological model (CEM) will be developed, uncertainties will be identified; and performance measures, targets, and decision criteria (triggers and thresholds) will be developed. See subsequent Sections of the AM&M plan for the CEM and performance measures developed thus far.

The implementation phase of the AM&M Framework subsequently puts the developed AM&M Plan into action. Projects will be designed, constructed, monitored and assessed to understand responses of the system to implementation of the project relative to stated targets, goals, objectives and success project criteria. Leadership will then decide whether to alter the project and implement AM actions to improve plan performance based on assessment results. Potential AM actions for the project are identified in Section 6.

Baseline monitoring will begin during PED prior to project construction and continue during construction when possible. Although not typical there may be some need for AM actions during construction. Unexpected detrimental events may alter the project site, requiring consideration of corrective measures. For example, a tropical event impacting a project site or invasion of an exotic species may necessitate management actions. A decision will be required on how to address the change in conditions. In addition, since it is expected that construction/implementation will be phased over a long period of time, there is greater potential for changing conditions due to construction methods, deviations from selected methods, or development of new information. It will need to be determined if these need to be corrected, whether they are acceptable, or whether they enhance the site. Using an AM strategy in this situation may increase the chances of overall project success. Design changes during construction may require changes to the AM&M Plan.

Post Construction, the project will enter the iterative cycle of AM where the project will be monitored. The results of the monitoring program will be used to assess system responses to management, evaluate overall project performance, and assemble Assessment Reports and project Report Cards as outlined in the AM&M Plans (Sections 5 & 6). These monitoring results and reports will guide decision making. The projects' Operation and Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) manuals should clearly communicate the AM&M Plans and process including: monitoring parameters, frequency and duration of monitoring and assessment, decision criteria, and options for adjustment to increase project success.

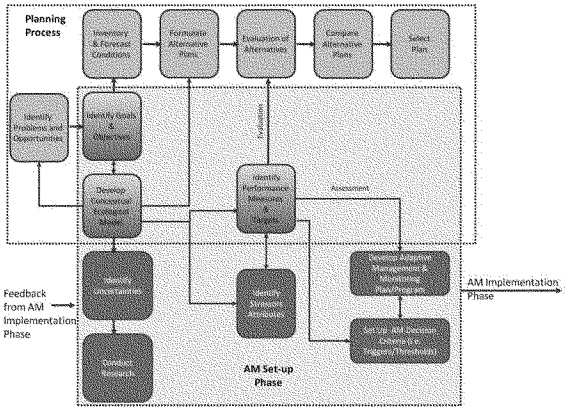


Figure 3: Set-up phase of adaptive management and monitoring program framework.

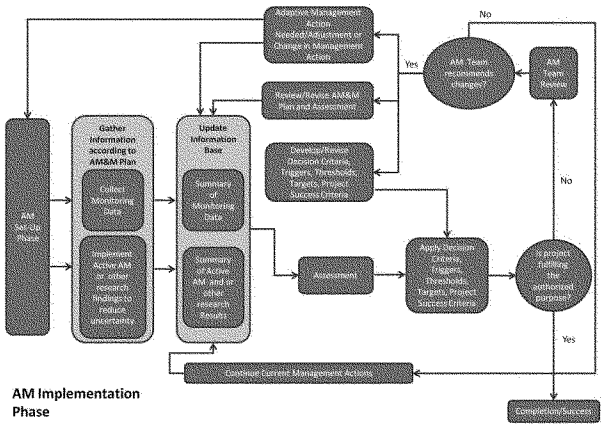


Figure 4: Implementation phase of adaptive management and monitoring program framework.

1.4 Communication Structure for Implementation of Adaptive Management

An implementation structure has been identified (Figure 4) to execute AM&M for USACE Regional Planning Division South (RPEDS) Ecosystem Restoration projects. The structure establishes lines of communication that facilitates coordination between Program Management, the PDT, the Adaptive Management and Monitoring Planning Team, the USACE Science Advisor, and stakeholders. Please note that a detailed governance structure and decision making process for RPEDS AM&M is being developed. This information once approved will be included in subsequent revisions to this AM&M plan.

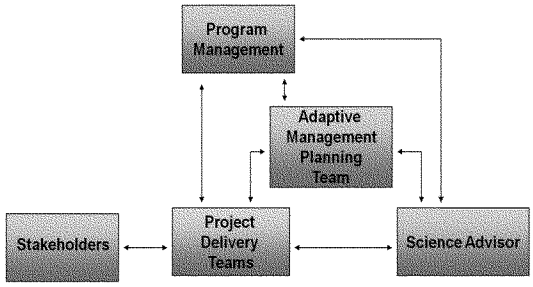


Figure 5: Communication structure for implementation of adaptive management and monitoring.

Adaptive Management and Monitoring Team- An interagency Adaptive Management and Monitoring Team (AM&M Team) will be established as part of the implementation structure (Figure 4). The AM&M Team, in collaboration with the PDT, will lead all project and program efforts to determine AM and monitoring recommendations. The AM&M Team is responsible for ensuring that monitoring data and assessments are properly used in the AM decision-making process. If the AM&M Team determines specific AM actions are needed, the AM&M Team will coordinate a path forward with the PDT, USACE Science Advisor and Program Management Team. The AM&M Team will also facilitate coordination between restoration projects and coordination among PDTs, and Program Management.

Program Management Team- The Program Management Team is composed of the Executive Director of the non-federal sponsor and the District Commander of USACE-MVN. The Program Management Team will vet program and project level issues, consider recommendations for AM actions, make final decisions on whether AM actions are required, and implement recommended final management actions.

Science Advisor- The purpose of the USACE Science Advisor will be to effectively address system-wide coastal ecosystem restoration needs and to provide a strategy, organizational structure, and process to facilitate integration of science and technology into the system-wide planning and the AM process.

Project Delivery Team- It is not necessary that the PDT, Project Managers, Plan Formulators, Environmental Planners or Engineers become AM&M experts. However, they need a general understanding of AM&M principles as they are key players in the integration of AM into planning and project development and implementation. The PDT is responsible for the development of the AM&M Plans in coordination with the AM&M Team. The PDT is also responsible for integrating Project-level AM&M activities into Project Management Plans, SMART Planning project documents, Feasibility Reports, NEPA and permit documents, Project Operating Manuals, and other project-related documentation.

To accomplish these tasks, the PDT will:

- lead the discovery of uncertainties;
- lead the engagement of stakeholders;
- consult with Program Management and the AM&M team;
- develop and execute strategies for resolving uncertainties; and
- develop, review, and update the AM&M Plan as necessary.

The PDT will likely be re-established during the project implementation phase to further refine monitoring, assessment and AM decisions; identify new uncertainties; re-evaluate and re-formulate and implement, as necessary, specific or overall project performance and management measures and features.

Stakeholders- Engagement with stakeholders throughout a project's planning and implementation phases is critical to developing and maintaining common understandings of the goals and objectives, expectations of results, and potential commitment of resources. All phases of the AM&M process must be open, transparent and accessible to stakeholders. Such interaction fosters the mutual understanding of events and appreciation of the time and patience required to fully realize the benefits of restoration projects and to manage unrealized expectations. A strong effort must be made to identify and engage all appropriate stakeholders. PDTs should continually seek to identify governmental and non-governmental organizations, groups and other interested parties who could affect, be affected by, and/or be able to contribute knowledge, data, and/or resources to project-related activities (e.g., planning, design, implementation, and monitoring).

ADAPTIVE MANAGEMENT AND MONITORING PLANNING

A small team with members from the USACE and the US Geological Survey (USGS) developed the draft AM&M plan for the project for review by the interagency PDT. The level of detail in this plan is based on currently available project data and information developed during plan formulation as part of the feasibility

study. Some uncertainties remain concerning the exact project features, project implementation, monitoring elements, and adaptive management opportunities. As uncertainties are addressed in the latter stages of the feasibility study and as specific project measures are developed, the AM&M Team will be formed and a detailed AM&M plan, including detailed cost estimates, monitoring protocols, AM triggers and thresholds and AM actions will be developed.

2.1 Conceptual Ecological Model for Monitoring and Adaptive Management

As part of the AM and project planning process, a conceptual ecological model (CEM; Appendix A; Annex L; Attachment 1) was developed to help explain the general functional relationships among the essential components of the Southwest Coastal Louisiana area. The Director of Civil Works 13 August 2008 Memorandum "Policy Guidance on Certification of Ecosystem Output Models" adopted recommendations from the Ecosystem Planning Center of Expertise (ECO-PCX) regarding the importance, use and review of conceptual models in ecosystem planning. CEMs are a means of:

(1) simplifying complex ecological relationships by organizing information and clearly depicting system components and interactions;
(2) integrating to more comprehensively implicit ecosystem dynamics;
(3) Aids in identifying which species will show ecosystem response;
(4) interpreting and tracking changes in restoration/management targets; and
(5) communicating these findings in multiple formats.

This CEM assists with identifying those aspects where the project can effect change. Specifically, the CEM identifies those major stressors, ecosystem drivers, and critical thresholds of ecological processes and attributes of the natural system likely to respond to restoration features. This project CEM was used to help identify problems, opportunities, and help refine project objectives and restoration management actions as well as selecting those attributes to be used as performance measures, modeling for alternative analysis, and monitoring for project success. The project CEM represents the current understanding of these factors and will be updated and modified, as necessary, as new information becomes available to assist with developing AM and monitoring during project planning and implementation.

Factors identified for the Southwest Coastal project area are listed below and further detailed in Appendix A, Annex L, Attachment 1.

Drivers

D1: Relative Sea Level Rise (Sea Level Rise and Subsidence)
D2: Numerous *Hurricanes and Storms*
D3: Hydrologic Alteration
D4: Sediment Supply to the Chenier Plain
D5: Mineral and Sediment Extraction

Ecological Stressors

ES1: Increased Flood Duration
ES2: Storm Surge
ES3: Saltwater/ Salinity
ES4: Shoreline Erosion
ES5: Marsh fragmentation.
ES6: Increased Tidal Prism or Amplitude.
ES7: Altered Circulation

Ecological Effects

EE1 Wetland Loss
EE2 Decreased Primary Productivity
EE3 Habitat Conversion and Changes in Biological Community Composition

EE4 Loss of Ridges and Cheniers

Attributes and Performance Measures

A1 Land Cover/ Land Change

Performance Measures: Relative Change in Land Cover

A2 Vegetation Distribution and Diversity

Performance Measures: Community Composition and Relative Abundance

A3 Elevation

Performance Measures: Surface Elevation and Vertical Sediment Accretion

2.2 Project Goals, Objectives and Constraints

The study goals, objectives, and constraints were developed to comply with the study authority and to respond to the problems and opportunities for the Southwest Coastal Study Area. In consultation with the non-Federal sponsor and other interested parties, goals and objectives were developed during steps one and two of the planning process. These goals, objectives and constraints, and the CEM were used during the AM&M planning process to develop the performance measures and risk endpoints for the project. See Section 3.1.

Overarching Project Goal: To reduce storm surge flooding and coastal storm surge damagesand to provide sustainable ecosystem restoration.

Planning Objectives:

- NED Objective 1. Reduce the risk of damages and losses from hurricane and storm surge flooding.
  Metric: reduction in annual damage costs.
  Data required: average annual expenditures on repairs due to hurricane storm surges.
  Data collection: inputs for HEC-FDA, HEC-RAS, state master plan, and ADCIRC.

Please note that Objective 1 is not addressed by the NER components and is therefore not addressed within this AM&M plan.

- NER Objective 2. Manage tidal flows to improve drainage and prevent salinity from exceeding 2 ppt for fresh marsh and 6 ppt for intermediate marsh.

Please note that Objective 2 will not be monitored as it would be addressed by the hydrologic and salinity control project features recommended for further study.

- NER Objective 3. Increase wetland productivity in fresh and intermediate marshes to maintain function by reducing the time water levels exceed marsh surfaces.

Please note that Objective 3 will not be monitored as it would be addressed by the hydrologic and salinity control project features recommended for further study.

- NER Objective 4. Reduce shoreline erosion and stabilize canal banks to protect adjacent wetlands.

- NER Objective 5. Restore landscapes, including marsh, shoreline, and cheniers to maintain their function as wildlife habitat and improve their ability to serve as protective barriers.

Planning Constraints

The NED and NER plans are limited by the following constraints that are to be avoided or minimized:

- Commercial navigation. The Calcasieu and Sabine Ship Channels and the Gulf Intracoastal Waterway (GIWW) carry significant commercial navigation traffic. Measures that would cause shipping delays would result in negative NED impacts. In addition, the ability of authorized navigation projects to fulfill their purpose, such as the operation of locks along the GIWW, may be impacted by project features.
- Federally threatened and endangered species and their critical habitats includes consideration of dredge pipeline placement onto designated piping plover critical wintering habitat and consideration of dredging operations with regard to sea turtles.
- Must include consideration of other species of concern and development of a bird abatement plan to prevent nesting by shorebirds during construction activities.
- Marine Mammal Protection Act Best Management Practices (BMP) guidance; sea turtle and gulf sturgeon Protection Measures during dredging activities; avoidance of bald eagle nests, and colonial nesting waterbirds rookeries.

- Essential fish habitat (EFH), especially intertidal wetlands. Conversion of one EFH type to another should be done without adversely impacting various fish species.
- Historic and cultural resources. Ninety-nine archeological sites have been identified within a one-mile buffer of NED and NER alternatives, including one historic site ("Arcade Theater") listed on the National Register of Historic Places (NRHP) and six potentially eligible prehistoric sites. Twelve historic properties listed on the NRHP have been identified within the one-mile buffer, including the Charpentier (Lake Charles) Historic District, as well as four eligible standing structures. Hundreds of standing structures in the area have a minimum age of 50 years and have not been assessed for eligibility.

2.3 Management and Restoration Actions — Recommended Plan

The PDT performed a thorough plan formulation process to identify restoration and management actions that best meet project goals and objectives. For more information on the plan formulation process see Chapter 2 of the Feasibility Report. For more information on the NER Recommended Plan (RP) see Chapter 4 of the Feasibility Report.

The NER RP is comprised of 3 ecosystem restoration measure types as follows and described in Table 1:

- 9 Marsh restoration features totaling 7,900 acres.
- 35 Chenier reforestation locations totaling 1,413 acres. Measures would reforest chenier forests and improve a net total of 1,132 acres of habitat in the Calcasieu-Sabine Basin and 282 acres of habitat in the Mermentau/Teche-Vermilion Basin.
- 5 shoreline protection projects (6,135 acres).

Other project feature recommendations include:

- The Calcasieu Ship Channel Salinity Barrier Feature is recommended for long-term study.
- The Cameron-Creole Spillway Control Structure feature is recommended for long-term study.

Two marsh creation features at Mud Lake (124d) and Cameron Creole (3c1) and located partially on U.S. Fish and Wildlife Service property are recommended for Congressional authorization and funding by the USFWS.

Table 1. NER Project Features

Feature	Description	Acres Restored/ Nourished/ Protected
	Marsh Restoration	
47a1	Marsh restoration using dredged material south of LA-82, about 4.5 miles west of Grand Chenier. 933 marsh acres would be restored and 88 acres would be nourished from 3M cubic yards of dredged material with one renourishment cycle.	895
47a2	Marsh restoration using dredged material south of LA-82, approximately 4.5 miles west of Grand Chenier. 1,297 marsh acres would be restored and 126 acres would be nourished from 8.8M cubic yards of dredged material with one renourishment cycle.	1,218
47c1	Marsh restoration using dredged material south of LA-82, approximately 4.5 miles west of Grand Chenier. 1,304 marsh acres would be restored and 4 acres would be nourished from 8.6M cubic yards of dredged material with one renourishment cycle.	1,135
127c3	Marsh restoration at Pecan Island, west of the Freshwater Bayou Canal and approximately 5 miles north of the Freshwater Bayou locks. 832 marsh acres would be restored and 62 acres would be nourished from 7.3M cubic yards of dredged material with one renourishment cycle.	735
306a1	Rainey marsh restoration at Christian Marsh, east of the Freshwater Bayou Canal and approximately 5 miles north of the Freshwater Bayou locks. 627 marsh acres would be restored	743

Feature	Description	Acres Restored/ Nourished/ Protected
	and 1,269 acres would be nourished from 8.1M cubic yards of dredged material with one renourishment cycle.	
3a1	Beneficial use of dredged material from the Calcasieu Ship Channel. Located adjacent to the south shore of the GIWW west of the Calcasieu Ship Channel near Black Lake. Restore 599 marsh acres with 5.3M cubic yards of dredged material with one renourishment cycle.	454
3c1	Beneficial use of dredged material from the Calcasieu Ship Channel. Located adjacent to the eastern rim of Calcasieu Lake and situated within the Cameron-Creole Watershed area. 1,765 marsh acres would be restored and 450 acres would be nourished from 10.2M cubic yards of dredged material with one renourishment cycle.	1,324
124c	Marsh restoration at Mud Lake. Located adjacent and north of Highway 82 and east of Mud Lake. 1,908 marsh acres would be restored and 734 acres would be nourished from 11.1M cubic yards of dredged material with one renourishment cycle.	1,228
124d	Marsh restoration at Mud Lake. Located west of the Calcasieu Ship Channel and adjacent to the south rim of West Cove. 159 marsh acres would be restored and 448 acres would be nourished from 1.4M cubic yards of dredged material with one renourishment cycle.	168
Chenier Reforestation		
CR	35 separate chenier locations would be replanted. Approximately 435 seedlings per acre, at 10 ft x 10 ft spacing, with invasive species control incorporated.	1,413
Shoreline Protection/ Stabilization		
5a	Holly Beach Shoreline Stabilization Breakwaters. Construction of 8.7 miles of rock and low action breakwaters and is a continuation of existing breakwaters. Crown elevation of +1.5 ft with a crown width of 30 ft. Two maintenance lifts will be required.	26
6b1	Gulf shore protection/stabilization from Calcasieu River to Freshwater Bayou. 11.1 miles of Gulf shore protection consisting of a reef breakwater with a lightweight aggregate core. Located ~150 ft offshore consisting of geotextile fabric and stone built to an 18 ft crest width.	2,140
6b2	Gulf shore protection/stabilization from Calcasieu River to Freshwater Bayou. 8.1 miles of Gulf shoreline protection consisting of a reef breakwater with a lightweight aggregate core. Located ~150 ft offshore using geotextile fabric and stone built to an 18 ft crest width.	1,583
6b3	Gulf shore protection/stabilization from Calcasieu River to Freshwater Bayou. 7.2 miles of Gulf shoreline protection consisting of a reef breakwater with a lightweight aggregate core. Located ~150 ft offshore using geotextile fabric and stone built to an 18 ft crest width.	1,098
16b	Fortify spoil banks of Freshwater Bayou. Approximately 15.4 miles of rock revetment at three critical locations to prevent shoreline breaching. Rock revetment would be built to +4 ft with a 4 ft crown. Two maintenance lifts will be required.	1,288

Construction of the NER project features will be phased. The RP project features will be implemented in 3 sequential tiers to avoid potential borrow, staging and construction issues. All projects within a Tier could be constructed concurrently with the exception of shoreline protection features which would be constructed prior to marsh creation features in order to provide immediate protection of the marsh creation features. Subsequent phases of construction would be instituted after completion of projects in the previous Tier. The implementation plan assumes that all construction funds would be available, multiple construction contracts could be let at one time, and an adequate supply of all materials to facilitate construction.

Tier I Projects:

- Holly Beach Shoreline Stabilization – Breakwaters (5a)
- Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou (6b1)
- Fortify Spoil Banks of the GIWW and Freshwater Bayou (16bSE)
- Fortify Spoil Banks of the GIWW and Freshwater Bayou (16bNE)
- Fortify Spoil Banks of the GIWW and Freshwater Bayou (16bW)

- Beneficial Use of Dredged Material from the Calcasieu Ship Channel (3a1)
- Marsh Restoration at Mud Lake (124d)[1]
- Marsh Restoration at Pecan Island (127c3)
- Chenier Ridges: Grand Chenier Ridge (416)[2]
- Restore Bill Ridge (509c)[2]
- Chenier Ridges: Cheniere au Tigre (509d)[2]
- Restore Blue Buck Ridge (510a)[2]
- Restore Hackberry Ridge (510b)[2]
- Restore Front Ridge (510d)[2]

Tier II Projects:
- Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou (6b2)
- Marsh Restoration at Mud Lake (124c)
- Rainey Marsh Restoration Southwest Portion (Christian Marsh) (306a1)

Tier III Projects:
- Beneficial Use of Dredged Material from the Calcasieu Ship Channel (3c1)[1]
- Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou (6b3)
- Marsh Restoration Using Dredged Material South of Highway 82 (47a1)
- Marsh Restoration Using Dredged Material South of Highway 82 (47a2)
- Marsh Restoration Using Dredged Material South of Highway 82 (47c1)

Recommended for Further Study:
- Calcasieu Ship Channel Salinity Control Structure
- Cameron-Creole Spillway Structure

[1]- *Recommended for independent Congressional authorization and appropriation for construction by USFWS*
[2]- *Individual features that comprise the chenier reforestation measure*

2.4 Sources of Uncertainty and Associated Risks

A fundamental tenet underlying AM is decision making and achieving desired project outcomes in the face of uncertainties. The AM&M Program provides a framework for identifying, analyzing and managing the uncertainties for the Southwest Coastal Restoration Project. Scientific uncertainties and technological challenges are inherent with any large-scale restoration project with the principal sources of uncertainty typically including (1) incomplete description and understanding of relevant ecosystem structure and function, (2) imprecise relationships between project management actions and corresponding outcomes, (3) engineering challenges in implementing project alternatives, and (4) ambiguous management and decision-making processes. It is important to determine the type of risk each uncertainty comprises and to discern what constitutes sufficient knowledge to proceed considering those risks.

Identified uncertainties and risks associated with the Southwest Coastal Restoration Project include:
- Relative sea level rise (subsidence plus eustatic variability)
- Climate change, such as drought conditions and variability of tropical storm frequency, intensity, and timing
- Inherent natural variability in ecological and physical processes
- Subsidence, accretion salinity, and water level trends and impacts:
    - Subsidence rates (+/-) throughout the project life and the impacts on constructed project features

  - Accretion rates (+/-) throughout the project life and the impacts on constructed project features
  - Water level trends (+/-) throughout the project life and the impacts on constructed project features
  - Variable salinities that impact vegetation
- Wetland water, sediment, and nutrient requirements:
  - Magnitude and duration of inundation
  - Annual sediment requirements
  - Nutrients required for desired productivity
- Impacts to belowground and aboveground biomass due to changes in hydro period and duration
- Vegetation impacts due to herbivory, grazing and girdling
- Potential failure of vegetative plantings due to salt water intrusion
- Vegetation impacts due to invasive species removal including spraying
- Ability to infer operational changes based on data collected, especially from variable metrics such as aboveground and belowground biomass measurements (applies to the hydrological and salinity control projects recommended for long term study)
- Unanticipated cumulative effects
- Impacts of existing mitigation areas within project area
- Potential sinking of construction project features including shoreline protection and breakwaters
- Socio-economic and cultural
  - Changes to commercial activity
  - Effect on recreational activities
  - Potential impacts to historic and cultural resources
  - Ramifications to traditional activities, especially for indigenous and minority groups
  - Changes to community structure and integrity
- Development in or near the restoration sites, in particular oil and gas development, mining, and vegetation removal from cheniers
- Ecological and engineering challenges of hydrologic and salinity control in southwest Louisiana
- Project feature implementation including schedule and timeline, availability of construction funds, availability or multiple construction contracts and an adequate supply of all materials to facilitate construction and dredge plant availability.
- Potential loss of additional land during project feature implementation due to implementation plan and schedule. For example delaying construction of shoreline protection features until Tier II or Tier III may result in additional land loss.
- Potential unintended construction impacts to existing marsh and critical habitat for species such as of piping plover and red knot
- Implementation of marsh creation features 124d and 3c1. Currently these features are recommended to be independently authorized and funded by Congress at the recommendation of USFWS for its implementation
- Potential development of hypoxic conditions by dredging borrow areas
- Construction of the shoreline protection features may create tombolos and impact longshore sediment transport. There is a possibility that longshore transport may be disrupted by the creation of tombolos. In other words, sediment may eventually fill in the lee of the breakwater and form a tombolo; the breakwater-tombolo formation may then act as a groin which might disrupt the longshore sediment transport in the area.

Issues such as climate change, sea level rise, and regional subsidence are significant scientific uncertainties for all coastal Louisiana projects. These uncertainties were incorporated in the plan formulation process and will be monitored by gathering data on water levels, salinities, and land elevation. Specifically, for relative sea level rise (RSLR) USACE EC-1165-2-21 provides an 18-step process for developing a "low", "intermediate" and

"high" future relative sea level rise scenario and provides guidance to incorporate these potential effects into project management, planning, engineering, design, construction, operation and maintenance. The PDT evaluated the final array of alternatives under three potential future RSLR scenarios in accordance with EC-1165 (See Feasibility Study Engineering Appendix B). This information will be assessed and will inform AM actions (see Section 6). In addition, procedures to evaluate sea level change impacts, response and adaptation will continued to be examined under USACE ETL 1100-2-1 which provides guidance for understanding the direct and indirect physical and ecological effects of projected future sea level change on USACE projects and systems of projects and considerations for adapting to those effects.

2.5 Rationale for Adaptive Management/ Uncertainty and Risk Management

The primary reason for implementing AM&M is to increase the likelihood of achieving desired project outcomes given the uncertainties identified in Section 2.4. Adaptive management works best when it is tailored to the specific problem(s), designed to ensure accountability and enforceability, used to promote useful learning, and supported by sufficient funding (Doremus *et al.*, 2011). Although all restoration projects are required to consider AM, there may be some projects or increments of a project for which AM may not be applicable. AM is warranted when there are consequential decisions to be made, when there is an opportunity to apply learning, when the objectives of management are clear, when the value of reducing uncertainty is high, and when a monitoring system can be put in place to reduce uncertainty (Williams *et al.*, 2007). Adaptive management should not be used where or when mistakes may be irreversible, when learning is unlikely on the relevant time scale, or where no opportunity exists to revise or reevaluate decisions (Doremus *et al.*, 2011).

Several questions were considered to determine if AM should be applied to the project, given identified uncertainties:

1) Are the ecosystems to be restored sufficiently understood in terms of hydrology and ecology, and can project outcomes be accurately predicted given recognized natural and anthropogenic stressors?
2) Can the most effective project design and operation to achieve project goals and objectives be readily identified?
3) Are the measures of this restoration project performance well understood and agreed upon by all parties?
4) Can project management actions be adjusted in relation to monitoring results?

There are significant ecological and engineering challenges associated with hydrologic and salinity control in southwest Louisiana, especially when confronting critical uncertainties associated with the effects of climate change and relative sea level rise. Previous hydrologic restoration efforts in southwest Louisiana have illustrated the sensitivity of these coastal marsh systems to hydrologic modification, whether through natural or anthropogenic events, and the importance of sufficient data to actively make decisions regarding management actions over time.

A 'NO' answer to questions 1-3 and a "YES" answer to question 4 qualifies the project as a candidate that could benefit from AM. The AM&M Team and the PDT determined that the Southwest Coastal Restoration Project meets these qualifications, and, therefore, is a candidate for AM and the AM&M plan would be developed to reduce critical uncertainties and provide the data necessary to make decisions to adjust project performance in response to monitoring results.

3. MONITORING

Independent of AM, an effective monitoring program is required to determine if project outcomes are consistent with original restoration goals and objectives. The strength of a monitoring program developed to support AM lies in the establishment of feedback between continued project monitoring and corresponding project management. The CECW-PB Memo dated 31 August 2009, requires monitoring that: *"…includes the systemic collection and analysis of data that provides information useful for assessing project performance, determining whether ecological success has been achieved, or whether Adaptive Management may be needed to attain project benefits."*

Pre-construction/baseline date, during construction, and post-construction monitoring will be utilized to determine restoration success. Monitoring will continue until the trajectory of ecological change and/or other measures of project success are determined as defined by project-specific objectives. Section 2039 of the WRDA 2007 allows ecological success monitoring to be cost-shared for up to ten years post-construction. Once ecological success has been achieved, which may occur in less than ten years post-construction, no further monitoring would be performed. If ecological success cannot be determined within the ten-year post construction period of monitoring, any additional required monitoring will be a non-Federal responsibility.

Monitoring activities will utilize all existing data where possible and available, such as remotely sensed data, where necessary to assess changes resulting from restoration. When possible, project monitoring and information needs will be integrated with existing monitoring efforts that are underway in coastal Louisiana. For example, the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) program has been monitoring restoration and coastal wetland protection projects throughout coastal Louisiana since 1990 (Steyer and Stewart 1992, Steyer et al., 1995). The CWPPRA monitoring program incorporates a system-level wetland assessment component called the CRMS (Wetlands, Steyer et al., 2003). CRMS-Wetlands provides system-wide performance measures that are evaluated to help determine the cumulative effects of restoration and protection projects throughout much of coastal Louisiana. Consequently, the project Monitoring Plan incorporates existing monitoring networks to the extent practicable. Such participation can maintain the data consistencies necessary to conduct not only individual restoration project but also coast wide programmatic AM&M. Additional data will be collected as part of Southwest Coastal (1) if required (i.e., if CRMS data is unavailable), or (2) only if scientifically defensible to achieve a complete dataset in which to compare post-restoration success.

3.1 Monitoring Plan Elements

Defining and assessing progress towards meeting project objectives are crucial components of the AM&M program. Project Objectives are specified in Chapter 2 Section 2.1 of the main report. Table 2 outlines the proposed performance measure metrics, desired outcomes and monitoring design needed to measure restoration progress, determine ecological success and support the AM program should changes need to be made to improve project performance. The elements described in this section are based on the available project information and will be updated and refined further during the detailed feasibility level of design phase as the details of the individual project measures are available. Regional/Basin and feature specific plans and details will be developed in PED.

Table 2: Proposed NER performance measures, desired outcomes and monitoring design

Project Objective 1. Reduce the risk of damages and losses from hurricane storm surge flooding. (Objective 1 is related to the NED project component and will not be monitored or adaptively managed and thus is not incorporated into this MAM plan design).	
Project Objective 2. Manage tidal flows to improve drainage and prevent salinity from exceeding 2 ppt for fresh marsh and 6 ppt for intermediate marsh. (Objective 2 will not be monitored as it would be addressed by the hydrologic and salinity control project features recommended for further study).	
Project Objective 3. Increase wetland productivity in fresh and intermediate marshes to maintain function by reducing the time water levels exceed marsh surfaces. (Objective 3 will not be monitored as it would be addressed by the hydrologic and salinity control project features recommended for further study).	
Objective 4.* Reduce shoreline erosion and stabilize canal banks to protect adjacent wetlands.** ***NER Project features: This objective would be addressed by 5 shoreline protection features under the Recommended Plan.	
Performance Measure:	Reduce Post-Construction Shoreline Erosion Rates as compared to pre-Construction by 50% by year 5.
Desired Outcome:	All offshore breakwater measures are expected to reduce shoreline erosion rates by approximately 50% based on previous experiences with this type of structure at Holly Beach and other nearby areas (See Section 3.3.1 of the main report).
Monitoring Design:	Historic erosion rates at each shoreline protection site will be established from historic aerial photography. Photography and DGPS surveys will be

Table 2: Proposed NER performance measures, desired outcomes and monitoring design	
	used to determine post construction erosion rates at each shoreline protection site at years TY1, TY3, and TY5. Shoreline surveys will be conducted at each shoreline protection sites and in immediately surrounding and to-be-identified reference areas. One pre-construction and three post-construction surveys (years TY1, TY3, and TY5) will be obtained.
Objective 3. **Restore landscapes, including marsh, shoreline, and cheniers to maintain their function as wildlife habitat and improve their ability to serve as protective barriers.** ***NER Project features: This objective would be addressed by the 9 marsh restoration features, 5 shoreline protection features, and 35 Chenier reforestation features under the Recommended Plan.***	
Performance Measure:	Provide 251,528 linear feet of shoreline protection by year 1.
Desired Outcome:	Success will be protection of 6,135 acres of marsh in year 6.
Monitoring Design:	To determine the linear feet or shoreline protection satellite and aerial imagery will be used. For each shoreline protection site, land:water acreage will be classified using satellite Landsat TM scenes. Vegetated habitats (protected by shoreline features) will be classified using digital orthophoto aerial imagery for 1 pre- and 2 post-project years (years TY1 and TY6).
Performance Measure:	Increase acreage of marsh by 7,900 acres by year 6.
Desired Outcome:	Success will be measured by an increase of marsh acreage by 7,900 acres by year 6.
Monitoring Design:	To determine the increase in acreage, satellite and aerial imagery will be used. For each marsh restoration site, land:water acreage will be classified using satellite Landsat TM scenes. Vegetated habitats will be classified using digital orthophoto aerial imagery for 1 pre- and 2 post-project years (years TY1 and TY6).
Performance Measure:	Establish Marsh Elevation Post Construction sufficient for healthy marsh; elevation between 12.6 to 26.8 cm for brackish marsh, and 16.3 to 31.0 cm for saline marsh consistent with (Couvillion and Beck 2013).
Desired Outcome:	Based on local conditions, the scientific literature of the area and especially with consideration of the factors causing high wetland land loss throughout the project area, the interdisciplinary/interagency PDT determined the following necessary for sustainability: Marsh elevation on restored marsh acreage (following de-watering and settlement) sufficient to support vegetation and marsh establishment is between 12.6 to 26.8 cm for brackish marsh, and 16.3 to 31.0 cm for saline marsh consistent with Couvillion and Beck (2013).
Monitoring Design:	To measure elevation (including accretion and subsidence) at each marsh restoration site, one rod-surface elevation table (SET), replicate feldspar stations and settlement plates will be established within the constructed marsh footprint to measure changes in elevation. Elevation will be sampled bi-annually for a period of 2 years pre-project and for a period of 10 years post-project or until desired ecological success is achieved, whichever occurs first. Elevation, accretion and subsidence measured at existing CRMS stations located near each marsh restoration site will also be utilized, as appropriate.
Performance Measure:	Average cover of 80% vegetation on marsh restoration sites at year 5 compared to pre-construction.
Desired Outcome:	One year following completion of final construction activities achieve a minimum average cover of 25%, comprised of native herbaceous species. Three years following completion of construction achieve a minimum average cover of 75% native species. For the period beginning 5 years following completion of final mitigation construction activities and continuing through project success, maintain a minimum average cover of 80%, comprised of native herbaceous species.

Table 2: Proposed NER performance measures, desired outcomes and monitoring design	
Monitoring Design:	Vegetation will be sampled annually, at the 9 marsh restoration sites and the 5 sites where marsh will be protected by constructed shoreline stabilization. Permanent vegetation monitoring stations be established for assessing the vegetation community at each site. In addition to community composition, these stations will be sampled for above and below ground biomass, water level, salinity, and soil characteristics. Sites will be sampled for a two year period pre-construction (to assess pre-project conditions) and sampled annually during the post construction period until success is determined. Stations at each restoration site will be co-located at existing CRMS stations if appropriate and possible.
Performance Measure:	Increase Chenier Tree Coverage on 1,413 acres by year 5.
Desired Outcome:	Success will be measured by restoration of 1,413 acres of chenier forest at year 5. Planting survival and an increase in diameter of chenier plantings is required for success. Planting and survivorship criteria: Each chenier measure site would be planted with live oak (Quercus virginiana) and hackberry (Celtis occidentalis). Bare-root seedlings would be planted on 10x10-foot spacing (435 trees per acre), which assumes 57% survival. For a given planting, a minimum of 250 seedlings/saplings per acre must be present (with a 60:40 hard mast to soft mast ratio) at the end of the fourth year (i.e., TY5) following successful attainment of the one year survivorship criteria. Trees established through natural recruitment may be included in this tally; however, no less that 125 hard mast-producing seedlings per acre must be present. Surviving hard mast seedlings must be representative of the species composition and percentage identified in this Plan. Exotic/invasive species may not be included in this tally. By Year 5 (four years following successful attainment of the one-year survivorship criteria) the perimeter would be virtually free (approximately 5% or less on an acre-by-acre basis) of exotic/invasive vegetative species.
Monitoring Design:	At each chenier reforestation site diameter at breast height (dbh) and overstory tree % cover will be measured two pre-construction years and two post-construction years estimated at TY1 and TY5. At each chenier reforestation site, understory vegetation (herbaceous, seedling, and sapling) will be measured at two pre-construction and two post-construction years estimated at TY1 and TY5, to assess regeneration and changes in cover classes. At each chenier reforestation site, exotic/invasive vegetation will be measured at two pre-construction and two post-construction years estimated at TY1 and TY5, to determine if exotic/invasive species control efforts are needed to meet performance measures.

4. ASSESSMENT

The assessment phase of the implementation framework (Figure 3) compares the results of the monitoring efforts to the desired project performance measures and/or acceptable risk endpoints (i.e., decision criteria) that reflect the goals and objectives of the management or restoration action.

This assessment process will regularly measure the progress of the project in relation to the stated project objectives, performance measures and desired outcomes. Thorough and complete assessments are critical to the AM&M Program. The assessments will continue through the life of the project or until it is has been determined that the project has successfully achieved (or cannot achieve) its goals and objectives (Figure 2).

4.1 Assessment Process

During PED, the Assessment Team assigned will identify a combination of qualitative (i.e., professional judgment) and quantitative methods for comparing the values of the performance measures produced by monitoring with the selected values of these measures that define criteria for decision-making.

Appropriate statistical comparisons (e.g., hypothesis testing, ANOVA, multivariate methods, etc.) will be used to summarize monitoring data and compare these data with the stated metrics. These continued assessments will be documented as part of the project reporting and data management system.

The Assessment Team will collaborate with project managers and decision-makers to define magnitudes of difference (e.g., statistical differences, significance levels) between the values of monitored performance measures and the desired values that will constitute variances. Meaningful comparisons between monitoring results and desired performance will require characterization of historical and current spatial-temporal variability that define baseline conditions. Variances (or their absence) will be used to recommend AM actions, including (1) continuation of the project without modification, (2) modification of the project within original design specifications, (3) development of new alternatives, or (4) termination of operation of the Southwest Coastal project.

The CEM (Attachment 1) helps describe the linkages between stressors and performance measures and may be used to further define management actions based on the monitored results. The assessments will help determine if the observed responses are linked to the project; if the responses are undesirable (e.g., are moving away from restoration goals); or if the responses have met the specified success criteria. If performance measures are not responding as desired, for example because the stressor has not changed enough in the desired direction, then recommendations should be made for modifications to the project. If the stressor has changed as expected/desired and the performance measure has not, additional research may be necessary to understand why.

During the PED phase, the frequency of assessments for the Southwest Coastal project will be determined by the relevant ecological scales of each performance measure. The project technical support staff will identify for each performance measure the appropriate timescale for assessment. An initial project assessment will be completed before construction. There will be post-construction project assessments as needed during the post-construction period; however the level of detail will depend on the timescale of expected responses, and frequency of data collection. At this time it is estimated that assessments will be, on average, every three years.

4.2 Documentation and Reporting

The Assessment Team will document each of the performed assessments and communicate the results of its deliberations to the managers and decision-makers designated for the Southwest Coastal Restoration Project. The Assessment Team will produce periodic reports that will measure progress towards project goals and objectives as characterized by the selected performance measures. The reporting of monitoring results and AM evaluations will be in the form of both Assessment Reports to include a high level of detail and science and management friendly summary Report Cards.

5. DATA MANAGEMENT

Data management is a vital component of the long-term monitoring plan and the overall adaptive management process. To maintain lasting value of the data collected, the data must be stored, organized, and archived in an efficient and intuitive structure, so that it may be used in the Assessment process (Section 4) to determine progress towards meeting project goals and be used to inform decision making and adaptive management actions (Section 6). Each distinct data type collected must comply with its specific data format, delivery, and metadata standard. These standards will be prescribed by the Data Management Team and managed by the AM&M Team. The detailed Data Management Plan will be developed during PED.

6. ADAPTIVE MANAGEMENT AND DECISION MAKING PROCESSES

Scientific, technological, socio-economic, engineering, and institutional uncertainties are challenges inherent with any large-scale ecosystem restoration project. A structured monitoring design for the Southwest Coastal Restoration Project will be implemented to provide the feedback necessary to inform decisions about future project adjustments. The project report card, drafted by the Assessment Team, will be used to evaluate project status and any potential adaptive management needs. The Assessment Team may submit recommendations for AM actions to the AM&M Team. The AM&M Team will investigate and further refine AM recommendations and present them to the Program Management Team. During project implementation and operation, it will be up to the District Commander and Non-Federal Sponsor to make a recommended AM action. If Project monitoring determines that a management trigger has been "activated" then there are three possible response pathways:

1. determine that more data is required and continue (or modify) monitoring;
2. identify and implement a remedial action; or
3. modify project goals and objectives (this option would *only* be considered as a last resort and upon careful consideration by and consensus of the Project Management Team).

The Phased Implementation and Tiering of the project features as described in Section 2.3 will allow for Adaptive Design and implementation of subsequent project features and Tiers. Lessons learned during the implementation of the initial project features in the earlier Tiers can be used to adjust the design and implementation of the later projects to better ensure project success. For example Marsh elevation targets can be revised based on amount of compaction and dewatering that occur in different marsh types/soil types/subsidence zones.

Additionally, potential adaptive management actions have been identified to account for the identified risks, uncertainties and unexpected environmental conditions that have been identified for the project. Implementation of these actions as a contingency plan will better ensure that the project is successful and able to meet the project stated objectives. These potential AM actions/contingency plan actions are presented below. The actions will be further evaluated and refined for inclusion in the final AM&M plan once the necessary project feature details become available. At that time specific triggers and thresholds will be developed for implementing the AM/contingency actions:

1. Early implementation of all shoreline protection features in Tier I to reduce risk of potential land loss to the interior marsh.
2. Increasing wetland elevation by re-nourishment (sediment lifts) of marsh creation areas with dredge material.
3. Vegetative plantings for marsh features may be needed due to risks such as herbivory, inundation and salinity impacts.
4. Additional vegetative plantings for Chenier features may be needed due to risks such as grazing, saltwater impacts, harvesting, and lack of available diverse plant stock at time of initial plantings.
5. Repair or reinforcement of shoreline protection features as needed to protect interior marsh
6. Vegetative invasive species control on the marsh and Chenier features maybe needed in cases where the success of native species are impacted.
7. Further degradation of spoil banks to ensure successful ingress and egress for aquatic species if they do not degrade naturally within 3-5 years.

Project planning was based on the intermediate RSLR scenario. Based on the October 2011 guidance below projects adjustments to high RSLR may fall under AM. Potential options for AM actions based on RSLR increases include raising wetland elevation (AM Action #2).

CECW Guidance Memorandum "Policy Guidance Request for Addressing Sustainability of Ecosystem Restoration Projects in Louisiana" (October 2011), indicates *while different levels of RSLR are evaluated during the*

course of a study to determine the robustness of the proposed solution, our current investment decisions are based on a discrete level of RSLR. Conceptually, if the rate of RSLR exceeds the rate used as the basis for the investment decision, then adaptive management measures above and beyond OMRR&R may be appropriate. This concept will have to be carefully vetted on a project by project basis so as to negate inappropriate transfers of cost from OMRR&R to adaptive management.

Under this project potential adaptive management actions will continue to be developed in consideration of the guidance provided in the USACE ETL 1100-2-1 titled "Procedures to Evaluate Sea Level Change Impacts, Response and Adaption. The technical letter provides guidance for understanding the direct and indirect physical and ecological effects of projected future sea level change on USACE projects and considerations for adapting to those effects including consideration of a longer planning horizon and incorporating more robust management actions. Relevant sections are included below.

"Longer Planning Horizon. The planning, design, and construction of a large water resources infrastructure project can take decades. Though initially justified over a 50-year economic period of analysis, USACE projects can remain in service much longer. The climate for which the project was designed can change over the full lifetime of a project to the extent that stability, maintenance, and operation may be impacted, possibly with serious consequences, but also potentially with beneficial consequences. Given these factors, the project planning horizon (not to be confused with the economic period of analysis) should be 100 years, consistent with ER 1110-2-8159."

"Responses or Management Approaches. Uncertainty about the future can be identified not just with regard to sea level change or wider climate change processes but also with regard to morphological, ecological, and socioeconomic change. An overall adaptive management approach provides a process for dealing with all of these uncertainties and involves developing plans for the future that envisage a range of futures, incorporate ongoing monitoring, and permit transitions from one engineering approach to another. The approach gives freedom for different decision pathways to be followed depending on the magnitude and rate of sea level and other changes. This flexible and responsive adaptive management philosophy may require the consideration of modifications to how we think about project life, maintenance actions, ongoing decision-making, and funding methods, including increasing use of nonstructural measures for reducing the consequence element of risk."

7. LESSONS LEARNED

Collecting, identifying and documenting lessons learned is a goal of the AM&M program. The AM&M planning team will help develop and compile lessons learned, best practices and experiences concerning the implementation of the restoration program, technical and organizational challenges, and monitoring and adaptive management. Lessons and experiences will be clearly documented with recommendations where applicable so that they can be easily applied to future ecosystem restoration programs and projects. Documenting the lessons learned ultimately aims to reduce recurring, technical or programmatic issues that negatively impact cost, schedule, restoration project performance and success.

8. COSTS FOR IMPLEMENTATION OF ADAPTIVE MANAGEMENT AND MONITORING

The AM&M program establishes a feedback mechanism whereby monitored conditions will be used to adjust or refine construction and or maintenance actions to better achieve project goals and objectives. This AM&M Plan includes the minimum monitoring actions determined necessary to evaluate project success and provide the information needed to inform the adaptive management program. Section 2039 of the WRDA 2007 allows monitoring to be cost-shared for up to ten years post-construction.

Monitioring and adaptive management are not to be used as a substitute for Operations, Maintenance, Repair, Rehabilitation, and Replacement (OMRR&R). Per WRDA 1986, as amended by Section 210 of WRDA 1996, the non-Federal sponsor would be responsible for all OMRR&R. This includes routine O&M that provides day-to-day activities necessary to properly operate a component of a system and routine maintenance activities needed to keep the system operating as designed. This also includes non-routine or beyond the scope of typical O&M activities of repair or fixing damage caused by an event; rehabilitation or fixing long-term wear and tear; and replacement of component when useful life is exceeded. In contrast, periodic

monitoring of performance indicators which contains trigger values informs the iterative process of implementing specified adaptive management measures to help achieve ecological success. CEMVN's experience with marsh creation and shoreline protection has determined that the ecological success of marsh restoration and shoreline protection is generally realized within three to five years post-construction. However, the project area is susceptible to several uncertainties that could significantly impact the ecological success of constructed restoration features including: high energy associated with Gulf waters, hurricanes and storms, subsidence and sinking of placed rock for shoreline. Section 2039 of the WRDA 2007 allows monitoring to be cost-shared for up to ten years post-construction. Therefore for cost estimating purposes the maximum cost-shared period of monitoring of 10 years will be assumed for all features. Based on previous restoration experience with marsh creation and shoreline protection, it is anticipated that ecological success would be much less than ten years (likely five to six years post-construction). Once ecological success has been established, monitoring would cease. The need for additional monitoring would be assessed at the end of the cost-shared period, and any additional required monitoring would be a 100 percent non-Federal responsibility.

Costs (Table 3) associated with implementing this AM&M Program were estimated based on available data and additional details regarding the proposed monitoring, AM opportunities and management actions and detailed costs estimates will continue to be revised and developed as additional information becomes available. Because uncertainties remain as to the exact project features, monitoring elements, and AM opportunities and management actions and detailed costs estimates, will need to be developed during the feasibility study in the feasibility level of design phase. For planning purposes cost for AM&M costs are currently budgeted at approximately $62,807,000. This estimate includes the monitoring necessary to determine project success, data management and program and potential adaptive management actions.

The cost estimate was identified based on the large geographic scale of the project, costs for similar programs, and accounts for the identified risks and uncertainties described in Section 2.4 and the potential need for the Adaptive Management actions described in Section 6. The significant ecological and engineering challenges of restoration in southwest Louisiana, especially when confronting critical uncertainties associated with the effects of climate change and relative sea level rise were considered when developing the estimated costs. Previous restoration efforts in southwest Louisiana have illustrated the sensitivity of these coastal marsh systems to modification, whether through natural or anthropogenic events, and the importance of sufficient data to actively make decisions regarding management actions over time.

Table 3. Monitoring and Adaptive Management Cost Estimates

Element	Cost
Monitoring Plan Implementation and Management*	$1,200,000
Data Collection*	$12,904,000
Data Management & Visualization*	$1,000,000
Data Assessment & Decision Making*	$1,200,000
Adaptive Management Contingency Actions	$46,503,000 (Range $13,153,000- $61,159,000)**
Total AM&M Costs	$ 62,807,000 (Range $29,457,000-$92,679,000)***

**Costs are included to cover pre-construction, during and 10 years post construction and may vary depending on the duration of the construction period.*
***There is a 90% chance the proposed AM actions as outlined will range between $29,457,000 - $63,029,000.*
****Although not a requirement, traditionally 3% of the total project cost has been used as a guideline to develop AM&M costs; 3% of the NER cost are equal to $52,301,792, which is within the above expected cost range.*

9. REFERENCES

Couvillion, B.R. and H. Beck. 2013. Marsh collapse thresholds for Coastal Louisiana estimated using elevation and vegetation index data. Journal of Coastal Research, SI 64: 58-67.

Doremus, H., Andreen, W., Camacho. A., Farber. D., Glicksman. R., Goble, D., Karkkainen, B., Rohlf, R., Tarlock, A., Zellmer, S., Jones, S., and Yee Huang 2011. Making good use of adaptive management. Center for Progressive Reform White Paper #1104.

Fischenich, C., *et al.*, 2012. *The application of Adaptive Management to ecosystem restoration projects.* EBA Technical Notes Collection. ERDC TN-EMRRP-EBA-10. Vicksburg, MS: U.S. Army Engineer Research and Development Center. www.wes.army.mil/el/emrrp.

Knight, A.T., Cowling R.M., Rouge, M., Balmford A., Lombard A.T., Campbell B.M. 2008. Knowing but not doing: Selecting priority conservation areas and the research-implementation gap. Conservation Biology 22, 610-617.

National Research Council. 2004. Adaptive Management for Water Resources Project Planning. National Academies Press, Washington, D.C., 138 pp

Nkhata, B., and Breen C. 2010. A Framework for Exploring Integrated Learning Systems for the Governance and Management of Public Protected Areas. Environmental Management 45, 403-413.
Smith, R.J., Verissimo D., Leader-Williams N., Cowling R.M., Knight A.T. 2009. Let the Locals Lead. Nature 462, 280-281.

Steyer, G.D., and R.E. Stewart, Jr. 1992. Monitoring Program for Coastal Wetlands Planning, Protection, and Restoration Act projects. U.S. Fish and Wildlife Service, National Wetlands Research Center Open-File Report 93-01. 85 pp.

Steyer, G.D., R.C. Raynie, D.L. Steller, D. Fuller, and E. Swenson. 1995. Quality management plan for the Coastal Wetlands Planning, Protection, and Restoration Act Monitoring Program. Open-file report no. 95-01. Baton Rouge: Louisiana Department of Natural Resources, Coastal Restoration Division. 97 pp. plus appendices.

Steyer, G.D., C.E. Sasser, J.M. Visser, E.M. Swenson, J.A. Nyman, and R.C. Raynie. 2003. A Proposed Coast-wide Reference Monitoring System for Evaluating Wetland Restoration Trajectories in Louisiana. *Environmental Monitoring and Assessment.* 81:107-117

U.S. Army Corps of Engineers (USACE) 2011a. DRAFT U.S. Army Corps of Engineers: A Systems Approach to Adaptive Management USACE Technical Guide U.S. Army Corps of Engineers (USACE) 2011b. CERP Guidance Memorandum Guidance for integration of Adaptive Management into comprehensive everglades restoration plan project implementation reports, Appendix A Jacksonville District.

U.S. Army Corps of Engineers (USACE) 2011b. Policy Guidance Request for Addressing Sustainability of Ecosystem Restoration Projects in Louisiana (October 7, 2011) and associated Memorandum for Record (October 20 2011).

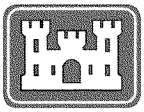
Williams, B.K., R.C. Szaro, and C.D. Shapiro. 2007. Adaptive Management: The U.S. Department of the Interior technical guide. Washington, DC: Adaptive Management Working Group, U.S. Department of the Interior.

Southwest Coastal Louisiana Feasibility Study

Conceptual Ecological Model

February 2011

Edited April 2014





Prepared by



J. Craig Fischenich and Soupy Dalyander
Engineer Research Development Center-Environmental Laboratory

and
Tomma K. Barnes
Wilmington District, USACE

1. INTRODUCTION

1.1 Conceptual Ecological Model (CEM) Definition

A conceptual model is a tentative description of a system or sub-system that serves as a basis for intellectual organization and represents the modeler's current understanding of the relevant system processes and characteristics (Fischenich 2008). These models, as applied to ecosystems (Conceptual Ecological Models or CEMs), should be simple, qualitative models, represented by a diagram which describes general functional relationships among the essential components of an ecosystem. CEMs typically document and summarize current understanding of, and assumptions about, ecosystem function. When applied specifically to ecosystem restoration projects, these models can be used as a basis for establishing the "Future-without Project Condition" and the benefits of proposed alternatives. To describe ecosystem function, a CEM usually diagrams relationships between major anthropogenic and natural stressors, biological indicators, and target ecosystem conditions.

A 2008 USACE Ecosystem Planning Center of Expertise White Paper on the certification of ecosystem output models recommended that conceptual models "be developed for all ecosystem restoration projects" (USACE 2008a). Further, they recommended that these models be reviewed as part of the normal ITR process and do not need certification". The 2008 Memorandum on Policy Guidance on Certification of Ecosystem Output Models (USACE) adopted this recommendation (USACE 2008b).

1.2 Purpose and Function of Conceptual Ecological Models

Conceptual Ecological Models have been widely used in other regions of North America in planning several large-scale restoration projects (Rosen et al 1995, Gentile 1996, Chow-Fraser 1998, Ogden and Davis 1999, Ogden et al 2003). The same approach can be used for a variety of restoration scales as the elements of conceptual models are common. CEMs created for restoration programs/projects should include:

- Those physical, chemical, and biological attributes of the system that determine its dynamics;
- The ways in which ecosystem drivers, both internal and external cause change with particular emphasis on those aspects of the system where the proposed project can effect change;
- Critical thresholds of ecological processes and environmental conditions;
- Assumptions and gaps in the state of knowledge, especially those that limit the predictability of restoration outcomes; and
- Current characteristics of the system that may limit the achievement of management outcomes.

The USACE is using CEMs to provide assistance with ecosystem simplification, communication, plan formulation, and science, monitoring, and adaptive management. The CEM format utilized here follows a top-down hierarchy of information using the format established by Ogden and Davis (1999) (Figure 1). It should be noted that CEM development is an iterative process, and that CEMs developed for USACE projects during early plan formulation may be modified through the life of the project.

1.2.1 Model Components

The schematic organization of the CEM is depicted in Figure 1 and includes the following components:

Drivers - This component includes major external driving forces that have large-scale influences on natural systems. Drivers may be natural (e.g., eustatic sea level rise) or anthropogenic (e.g., hydrologic alteration) in nature.

Ecological Stressors - This component includes physical or chemical changes that occur within natural systems, which are produced or affected by drivers and are directly responsible for significant changes in biological components, patterns, and relationships in natural systems.

Ecological Effects - This component includes biological, physical, or chemical responses within the natural system that are produced or affected by stressors. CEMs propose linkages between one or more ecological stressors and ecological effects and attributes to explain changes that have occurred in ecosystems.

Attributes- This component (also known as indicators or end points) is a prudent subset of all potential elements or components of natural systems representative of overall ecological conditions. Attributes may include populations, species, communities, or chemical processes. Performance measures and restoration objectives are established for each attribute. Post-project status and trends among attributes are measured by a system-wide monitoring and assessment program as a means of determining success of a program in reducing or eliminating adverse effects of stressors.

Performance Measures - This component includes specific features of each attribute to be monitored to determine the degree to which attribute is responding to projects designed to correct adverse effects of stressors (i.e., to determine success of the project).

This CEM does not attempt to explain all possible relationships or include all possible factors influencing the performance measure targets within natural systems in the study area. Rather, the model attempts to simplify ecosystem function by containing only information deemed most relevant to ecosystem monitoring goals.

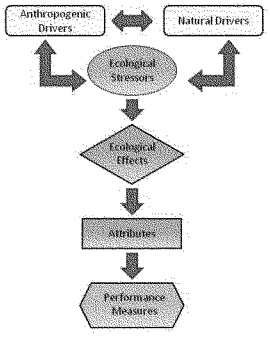


Figure 1: Conceptual ecological model schematic diagram

2. PROJECT BACKGROUND

2.1 Project Goals and Objectives

The goal of the study is to formulate a comprehensive plan for Southwest Coastal Louisiana that provides hurricane and storm damage risk reduction and coastal restoration measures to achieve ecosystem sustainability. Specific objectives include:

- Objective 1. Reduce the risk of damages and losses from hurricane and storm surge flooding.
- Objective 2. Manage tidal flows to improve drainage and prevent salinity from exceeding 2 ppt for fresh marsh and 6 ppt for intermediate marsh.
- Objective 3. Increase wetland productivity in fresh and intermediate marshes to maintain function by reducing the time water levels exceed marsh surfaces.
- Objective 4. Reduce shoreline erosion and stabilize canal banks to protect adjacent wetlands.
- Objective 5. Restore landscapes, including marsh, shoreline, and cheniers to maintain their function as wildlife habitat and improve their ability to serve as protective barriers.

The project area of the Southwest Coastal Louisiana study includes the Parishes of Cameron, Calcasieu, and Vermilion (Figure 2). This area includes approximately 4,700 square miles and a population of 117,100.

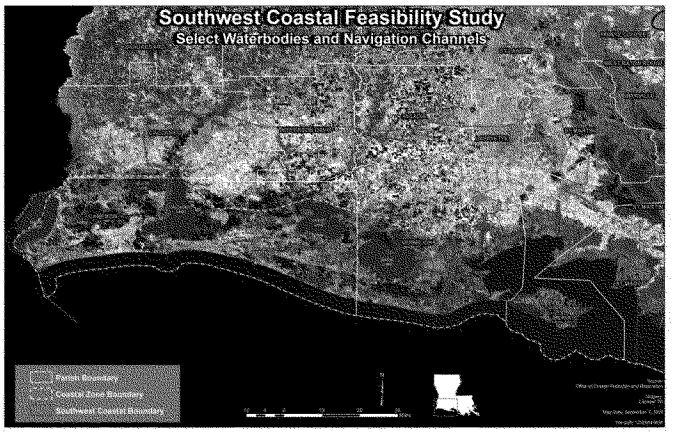


Figure 2: Southwest Coastal Louisiana – case study area map

3. CONCEPTUAL ECOLOGICAL MODEL DEVELOPMENT

The Southwest Coastal Louisiana CEM was developed by a New Orleans District led interagency team assisted by the Engineer Research and Development Center (ERDC) Environmental Lab. Prior to development of the model, the team reviewed existing information on ecological conditions in the project area. Using a workshop format, the team met to identify and discuss anthropogenically and naturally-driven alterations in the study area, stressors caused by these alterations, and consequent ecological effects. Additionally, key ecological attributes and indicators of project success were identified, along with potential performance measures. This information was used to form a set of working hypotheses and to consider the importance of each relationship **(Table 1)**.

The project team used these hypotheses and lists of components to develop the model and to prepare this supporting narrative document to explain the organization of the model and science supporting the hypotheses.

Table 1: Working Hypotheses

NATURAL DRIVERS	
Hurricanes and Storms	The storm surge associated with hurricanes and storms causes increased erosion and subsequently a direct loss of the ridge / Chenier barrier system.
	The storm surge associated with hurricanes and storms causes increased saltwater intrusion to the coastal system which results in reduced primary productivity.
	Increased frequency and intensity of hurricanes and storms results in fragmentation of and eventually loss of wetlands.
Relative Sea Level Rise	The combination of sea level rise and subsidence leads to an amplification of the tidal prism/amplitude which can result in wetland degradation and an eventual conversion to open water.
	The combination of sea level rise and subsidence over the long term leads to saltwater intrusion into areas that would otherwise be fresh or brackish. This will cause changes in the biological community composition and an eventual conversion of marsh habitat to open water.
	The combination of sea level rise and subsidence over the long term leads to marsh fragmentation and eventually loss of wetlands.
ANTHROPOGENIC DRIVERS	
Hydrologic Alteration	Alterations in the natural hydrology of coastal Louisiana, including the creation of navigation channels and water control structures, have resulted in altered circulation patterns which have led to habitat conversion and changes in the biological community composition.
	Alterations in the natural hydrology of coastal Louisiana, including the creation of navigation channels and water control structures, have resulted in an increased tidal prism/amplitude which has led to an increase in wetland loss.
	Alterations in the natural hydrology of coastal Louisiana, including the creation of navigation channels and water control structures, have resulted in saltwater intrusion which has led to habitat conversion and changes in the biological community composition.
	Alterations in the natural hydrology of coastal Louisiana, including the creation of navigation channels and water control structures, have caused an increase in flood duration which has led to habitat conversion and changes in the biological community composition.
	Alterations in the natural hydrology of coastal Louisiana, including the creation of navigation channels and water control structures, have caused an increase in flood duration which has led to a reduction in primary productivity.
	Alterations in the natural hydrology of coastal Louisiana, including the creation of navigation channels and water control structures, have resulted in marsh fragmentation and eventually wetland loss.
Mineral/Sediment Extractions	Mineral and Sediment extractions from the Chenier Plain has resulted in a direct loss of the ridge and Chenier barrier system.
	Mineral and Sediment extractions from the Chenier Plain has resulted in an increase susceptibility to saltwater intrusion into areas that would otherwise be fresh or brackish. This will cause changes in the biological community composition and an eventual conversion of marsh habitat to open water.
	Mineral and Sediment extractions from the Chenier Plain has resulted in an increase susceptibility to storm surge from hurricanes and storms which could result in a direct loss of the ridge and Chenier barrier system.
Sediment Supply	A decrease in sediment supply due to alterations in the Mississippi River for flood control and navigation exacerbates shoreline erosion. This results in an increase in the loss of the ridge and Chenier barrier system and coastal wetlands.
	A decrease in sediment supply due to alterations in the Mississippi River for flood control and navigation contributes to the fragmentation and ultimately the loss of coastal marshes.

JA 37-899 804 10/04/2019

4. CONCEPTUAL ECOLOGICAL MODEL

The CEM developed by the team for the Southwest Coastal Louisiana Feasibility Study is presented below (**Figure 3**). The model depicts the series of working hypotheses formed by the team (**Table 1**), arranged in a conceptual diagram. Relationships expressed with thicker or bolder arrows are more certain than those represented by thinner arrows. Model components are identified and discussed in the following subsections along with further explanation of the relationships between the components.

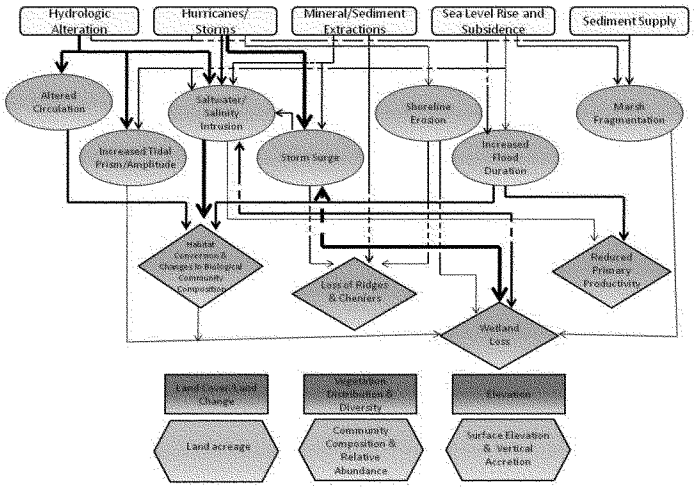


Figure 3. Southwest Coastal Louisiana conceptual model

4.1 Drivers

Drivers are the major external driving forces that have large-scale influences on Southwest Louisiana's coastal system. Anthropogenic drivers (e.g., hydrologic alteration) provide opportunities for finding solutions to problems. For instance, hydrologic alterations can be undone through modification of channels and canals either temporarily or permanently, and mineral/sediment extraction practices can be changed. Natural drivers, however, cannot be influenced directly; e.g. we cannot change the frequency or intensity of tropical storms or change how high or fast sea level rises. Some drivers are both anthropogenic and natural in nature. On a large, historical scale, sediment deposition has been determined by geological forces. On a local scale, sediments can be brought into the system from outside the system, or can be moved from where they are a hindrance (navigation channels) to where they are beneficial (marsh restoration sites).

The study team identified five main drivers that influence the project area on a large scale.

D1: Relative Sea Level Rise (Sea Level Rise and Subsidence)

D2: Numerous Hurricanes and Storms

D3: Hydrologic Alteration

D4: Sediment Supply to the Chenier Plain

D5: Mineral and Sediment Extraction

4.1.1 Relative Sea Level Rise

Relative sea level rise (RSLR) consists of eustatic sea level rise combined with subsidence. Eustatic sea level rise is defined as the global increase in oceanic water levels primarily due to changes in the volume of major ice caps and glaciers, and expansion or contraction of seawater in response to temperature changes. The International Panel on Climate Change (IPCC) estimates that average eustatic sea level rise since 1961 has been 1.8 mm per year, and since 1993, 3.1 mm per year (IPCC 2007). Additionally, there is a projected rise between 182 and 610 mm in the next century (IPCC 2007). In coastal Louisiana, this rise in sea level is exasperated by rapid changes in land elevation.

Subsidence is the decrease in land elevations due to compaction of Holocene deposits, consolidation of sediments, and faulting. Anthropogenic activities such as sub-surface fluid extraction and drainage for agriculture, flood protection, and development are also contributors to land elevation decreases. Forced drainage of wetlands results in lowering of the water table resulting in accelerated compaction and oxidation of organic material Areas under forced drainage can be found throughout coastal Louisiana and the study area. Each process produces a range of subsidence rates dependent on local environmental factors and each process occurs across a unique set of scale (Reed and Yuill 2009). The mean subsidence rate for Louisiana is 11 mm (0.43inches) per year (Berman 2005).

This combination of sea level rise and rapid subsidence, as well as natural and man induced erosional processes, has resulted in extensive wetland loss in coastal Louisiana. Rates for RSLR along coastal Louisiana are currently estimated to be between 1 to 1.2 m/century (USACE 2004). These are the highest rates of RSLR along the contiguous United States.
RSLR affects project area marshes by gradually inundating marsh plants. Marsh soil surfaces must vertically accrete to keep pace with the rate of relative sea level rise. Changes in land elevation vary spatially along coastal Louisiana, however in areas where subsidence is high and riverine influence is minor or virtually nonexistent wetland habitats sink and convert to open water.

Land elevations increase as a result of sediment accretion (riverine and littoral sources) and organic deposition from vegetation. Vertical accretion in most of the study area, however, is insufficient to offset subsidence. The combination of subsidence and eustatic sea level rise is likely to cause the landward movement of marine conditions into estuaries, coastal wetlands, and fringing uplands (Day and Templet 1989; Reid and Trexler 1992).

4.1.2 Hurricanes and Storms

The Gulf Coast region is affected by tropical and extra-tropical storms. These atmospherically driven storm events can directly and indirectly contribute to coastal land loss through: 1) erosion and breaches from increased wave energies; 2) removal and/or scouring of vegetation from storm surges; and 3) storm induced saltwater intrusion into interior wetlands. These destructive processes can result in the loss and degradation of large areas of coastal habitats in relatively short periods of time (days and weeks versus years). Since 1893, over 130 tropical storms and hurricanes have struck or indirectly impacted Louisiana's coastline. On average, a tropical storm or hurricane affects Louisiana every 1.2 years. The most recent tropical cyclones to affect the study area were Hurricanes Katrina and Rita, which occurred in August 2005 and September 2005, respectively, and Hurricanes Gustav and Ike, which occurred in September 2008. Storm surge and wave field associated with the 2005 storms eroded 527 km^2 of wetlands within the Louisiana coastal plain (Barras et al 2008).

Hurricane Rita was the fourth-most intense Atlantic hurricane ever recorded and the most intense tropical ever observed in the Gulf of Mexico. The storm generated a surge of up to 5 meters in some areas, driving saltwater tens of kilometers inland killing wetlands in artificially impounded areas. Rita made landfall between Sabine Pass, Texas and Johnson's Bayou, Louisiana causing extensive damage to Louisiana's southwest coastal parishes. Coastal communities in Cameron Parish were destroyed; the communities of Holly Beach, Hackberry, Creole, Grand Chenier, and Cameron were severely impacted. The Calcasieu Parish communities of Sulphur, Westlake, and Vinton also suffered significant damage and parts of the City of Lake Charles experienced 2 to 3 meter deep flooding associated with surge propagating up a ship channel.. Six people lost their lives and 10,000 structures were flooded. Rita caused $9.4 billion in damage along the Louisiana and southeastern Texas coasts.

Additionally, hurricane impacts to coastal environments can include sediment overwash, ripped and torn marsh, erosion of pond and lake margins, wrack (large amounts of plant debris) deposition, and lateral compression of marshes. Substantial sediment deposition associated with the passage of the storm can result in the burial of the pre-storm surface and the smothering of vegetation (Dunbar et al. 1992, Jackson et al. 1992). This same effect may occur as a result of burial by wrack. Extensive areas of marsh can be pushed against firm barriers (for example, levees and firmly grounded marsh) and can result in a ridge and trough. Freshwater marsh species can experience a "burning" effect (aboveground portions of the plants are killed) if exposed to saline waters (Dunbar et al. 1992, Jackson et al. 1992, Stone et al. 1993, Stone et al. 1997). In some marsh zones, unconsolidated or weakly rooted marsh has been eroded. Storms and hurricanes, depending on strength and intensity, can also blow over, defoliate, and/or cause major structural damage to trees well beyond the coastal zone (Lovelace 1998).

4.1.3 Hydrologic Alterations

Hydrologic alterations, including navigation channels and water control structures, are predominant sources of stress on the southwest Louisiana coastal system. These alterations cause disruptions in the natural coastal hydrological processes causing changes in circulation and tidal prism, and by increasing saltwater intrusion into the freshwater interior.

Altered hydrology is exacerbated by additional physical changes made in the watershed, which include canal, roads, and levees. Canals and associated spoil banks, constructed for navigation and/or oil and gas development, can be found throughout the project area. Canals impact wetlands by changing the normal hydrologic pattern. Canals deprive existing natural channels of water and allow more rapid runoff of water than the slower shallower natural channels do. This allows for greater fluctuation in the marsh and a lowering of the minimum water level which dry the marsh (Mitsch and Gosslink 2000).

These hydrologic alterations (e.g. cutting channels and canals, and the artificial creation of spoil banks) have also led to increased coastal habitat fragmentation. Hydrologic connectivity in the Chenier Plain has been disrupted by several activities, most notably the creation of navigational channels, such as the Sabine/Neches Waterway, Calcasieu Ship Channel, GIWW, Mermentau Ship Channel, and Freshwater Bayou Canal Navigational channel, and the creation of water control structures, such as the Calcasieu and Leland Bowman locks, the Freshwater Bayou Canal Lock, the Schooner Bayou Canal Structure, and the Catfish Point Control Structure. These channels have disrupted the hydrology of the region by facilitating saltwater intrusion into the historic freshwater interior. Water control structures were subsequently constructed in part to control the amount of saltwater intrusion into the interior, but further altered the hydrology by managing water flow. Together, these alterations have acted to change the hydrologic pattern of the Chenier Plain.

Through the creation of dredge material banks, roads and highways, and flood protection levees, some wetland habitats within the Chenier Plain have also become hydrologically isolated. During extreme water events, such as tropical storms, these habitats are particularly vulnerable due to their slow drainage patterns and the often resultant ponding of salt water throughout the wetlands. In such cases, the typical result has been ponding of water over the wetlands, often with high salinity content. This excessive ponding over an extended period of time in certain types of wetland habitats can kill the vegetative communities and result in wetland loss and

eventual conversion to open water. Near 100percent mortality of marsh vegetation in many areas has been documented as a result of high salinity water brought in by storm surge.

The spoil banks associated with these channels and canals reduce sheetflow of water across the wetlands (Swenson and Turner 1987) and prevent the exchange of sediment and nutrients and cause artificially prolonged flooding. These effects combine to eliminate soil-building processes necessary to counteract subsidence (USACE 2004, USACE 2010). In addition canal constructions can cause secondary indirect impacts such as accelerating erosion rates along the channel and canal banks.

Channels and canals provide avenues for higher salinity water to move into previously freshwater marshes, which ultimately leads to habitat degradation and land loss. By altering salinity gradients and patterns of water and sediment flow through marshes, channel and canal dredging indirectly changed the processes essential to a healthy coastal ecosystem and led to habitat conversion. Channels and canals that stretch from the Gulf of Mexico inland to freshwater areas allow saltwater to penetrate much farther inland, particularly during droughts and storms, which has had severe effects on freshwater wetlands (Wang 1987). Extreme salinity changes can stress fresh and intermediate marshes to the point where vegetation dies and the wetlands convert to open water (Flynn et al. 1995).

4.1.4 Sediment Supply

The Chenier Plain was developed as the result of the interplay of three coastal plain rivers (Sabine, Calcasieu, and Mermentau Rivers), cycles of Mississippi River Delta development, and the Gulf of Mexico. During periods of active Mississippi River delta building, Gulf of Mexico currents transported fine-grained sediments (clay and silt) in an East to West direction along the Louisiana coast. When delta formation occurred in shallow waters of bays or the inner continental shelf along the western reaches of the Deltaic Plain, longshore currents carried the fine-grained sediment west in a mudstream towards the Chenier Plain. These sediments were then brought into coastal estuaries and marshes along the gulf shoreline by tidal processes and storms which were deposited along the shore to form mudflats (Gagliano and van Beek 1970). This newly formed land was colonized by wetland vegetation, which further promoted the land-building process. Wave action and occasional storm events also deposited sand and shells onto the newly built land.

Alteration of the Mississippi River for navigation and flood control now limits the delivery of sediments onto the continental shelf and, thus, the redistribution of those sediments westward through littoral processes., with wide-ranging secondary effects. However, since 1973, delta-building processes at the mouth of the Atchafalaya River have initiated a new interval of land building via the formation of extensive mudflats along the eastern part of the Chenier Plain.

4.1.5 Mineral and Sediment Extraction

The production, refinement, and transport of oil and gas have resulted in both short- and long-term negative environmental impacts to coastal Louisiana. Recent findings have indicated that oil and gas fluid withdrawal has resulted in regional subsidence and fault reactivation causing wetland losses in coastal Louisiana (Morton et al. 2005). This induced subsidence coupled with sea level rise can lead to elevation changes, increased flooding, and eventual habitat switching and loss.

Secondary impacts result from canal construction for oil and gas extraction and the subsequent associated spoil banks which have altered the hydrology of the area (Jones et al. 2002). These barriers limit the exchange of water sediment, nutrients between the water pathways and the marsh. Hydrologic barriers such as roads, levee, and culverts obstruct the flow of water and can modify inundation patterns on either side of the barrier (Harvey et al. 2010).

4.2 Ecological Stressors

ES1: Increased Flood Duration

ES2: Storm Surge

ES3: Saltwater/Salinity

ES4: Shoreline Erosion

ES5: Marsh fragmentation.

ES6: Increased Tidal Prism or Amplitude.

ES7: Altered Circulation

4.2.1 Increased Flood Duration

Hydrologic modifications in the project area, especially the construction of roads, levees, and other similar features has altered normal drainage patterns. This had led to a condition whereby flood durations are increased in many wetland areas. This is especially problematic in the wake of a hurricane, when highly saline storm surge waters are impounded for long periods, causing stress and eventual loss of the affected wetland communities.

4.2.2 Storm Surge

Tropical cyclone events exert a stochastic but severe stress upon the swamp habitat through salinity spikes associated with saline storm surge events. The introduction of saline storm surge water into impounded areas results in reduced biomass production and impaired health, which in turn causes increased vegetation mortality, decreased soil production and integrity, and a consequent increase in relative subsidence. Saline storm surge waters become impounded by the spoil banks, roads and levees in the area. Consequently, these periodic influxes of saline storm surge waters result in cumulative increases in salinity in impounded waters and soils in the study area. Saltwater introduction into freshwater wetlands has been demonstrated to reduce productivity for short-term periods and cause the loss of wetland vegetation altogether for longer periods of inundation.

The elevation of the storm surge within a coastal basin depends upon the meteorological parameters of the hurricane as well as the physical characteristics existing within the basin. The physical factors include the basin bathymetry, roughness of the continental shelf, configuration of the coastline, and the existence of significant natural or man-made barriers. With the loss of marsh and chenier features, storm surge can become larger at points further inland, including areas of dense development.

While the study area has periodically experienced localized flooding from excessive rainfall events, the primary cause of the flooding events has been the tidal surges from hurricanes and tropical storms. During the past eight years, the planning area has been greatly impacted by storm surges associated with three Category 2 or higher hurricanes—Lili, Rita, and Ike, which inundated structures and resulted in billions of dollars in damages to southwest coastal Louisiana.

Hurricane surge also causes significant damage to wetlands. Hurricane surge has formed ponds in stable, contiguous marsh areas and expanded existing, small ponds, as well as removed material in degrading marshes (Barras 2009). Fresh and intermediate marshes appear to be more susceptible to surge impacts (Barras 2006, Howes et al. 2010).

4.2.3 Saltwater/Salinity Intrusion

Salinity levels exist along a gradient, which declines as the saltwater moves inland from the Gulf of Mexico. Distinct zones of plant communities, or vegetative habitat types, differing in salinity tolerance, exist along that gradient, with the species diversity of those zones increasing from salt to fresh environments. Saltwater intrusion changes the salinity gradient, which results in habitat changes.

The combined effects of hydrologic alterations and hurricanes in the near term as well as sea level rise and subsidence over the long term lead to saltwater intrusion into areas that would otherwise remain fresh or intermediate.

Decreased freshwater inputs and increase channelization allows tidal water to intrude farther upstream, causing significant damage to freshwater wetland systems and changing freshwater wetlands to brackish or saline

marshes. This is the principle factor in the conversion of freshwater systems and in extreme cases salt intolerant vegetation cannot replaced the freshwater species before the marsh converts to open water (Mitsch and Gosslink 2000, Flynn et al. 1995).

Changes to the salinity gradient are caused by a number of factors, including: the construction of levees, man-made channels, and canals, and degraded wetland areas. Tropical storm events can introduce saltwater into fresher areas, damaging large amounts of habitat in a short period of time.

4.2.4 Shoreline Erosion

Shoreline erosion is a normal consequence of natural tidal processes, wind generated waves, and surge from storm events, but can be accelerated by marsh breakdown and stress from other factors such as saltwater intrusion, flooding, and relative sea level rise. When these natural causes are combined with man-made activities (navigation/access channels) inland areas are subjected to more dramatic tidal forces and wave action, increasing erosion.

In the past 100 years, the total barrier island area in Louisiana has declined 55percent at a rate of 155 acres per year (Williams et al. 1992), largely due to storm overwash and wave erosion. In many ways the bays and lakes and the banks of canals and streams are even more vulnerable to erosion than the barrier islands. The Louisiana coast has approximately 350 miles of sandy shoreline along its barrier islands and gulf beaches; however, there are about 30,000 miles of land-water interface along bays, lakes, canals, and streams. Most of these consist of muddy shorelines and bank lines, and virtually all are eroding. In many instances, rims of firmer soil around lakes and bays, and natural levees along streams have eroded away leaving highly organic marsh soils directly exposed to open water wave attack.

4.2.5 Increased Tidal Prism or Amplitude

Tidal currents in Louisiana are relatively small, due to the small tidal amplitude. In the absence of wind, density effects and barometric pressure gradients, these currents reach magnitudes of approximately 10 – 15 cm/s (0.3 - 0.5 ft/s). Although small in magnitude in open coastal waters, tidal currents can reach speeds of approximately 50 cm/s (1.7 ft/s) at estuary and barrier island inlets, depending on the inlet dimensions. Generally, tidal exchange between back-barrier bays and the Gulf of Mexico has increased along the delta plain since at least the 1880s due to widespread conversion of wetlands and salt marsh to open water areas.

4.2.6 Altered Circulation Patterns

Circulation of coastal waters depends on driving forces such as tides, wind, and atmospheric pressure. Along the complex Louisiana coast, circulation mechanisms go beyond these driving forces to include high rainfall; the large volume of fresh water introduced by the Mississippi and Atchafalaya Rivers; currents induced by density differences and mixing processes of these two masses of water; local shoreline and bathymetric features such as the Mississippi River mouth, barrier islands, marshes, inlets, bays, and so forth. More locally, the loss of wetlands coupled with the effects of canals, ridge gapping, and other landscape alterations can significantly alter circulatory patterns.

4.2.7 Marsh Habitat Fragmentation

Habitat fragmentation is the disruption of continuous blocks of habitat into less continuous habitat as a result of human disturbances and conversion of vegetation from one type to another. Climate change, hydrologic alterations, and diminishing sediment supply individually or combined are causes of coastal degradation and habitat fragmentation in Louisiana. These impacts are worsened by human intervention at various scales

Two components of climate change that will continue to effect ecosystem connectivity are sea level rise and the increased frequency and intensity of wind-driven storm events (Hitch and Leberg 2008). Impacts are and will continue to be exasperated by human activities that have modified water and sediment delivery from watersheds to the coastal systems. Relative sea level rise is key factor contributing to the fragmentation of coastal marshes. Inundation, resulting from seal level rise and subsidence, cause conversion of vegetated surfaces to open water thus decreasing the amount of available wetland habitat.

Marshes of the project area provide habitat and a food source for fish and wildlife species. Marsh loss implies an imbalance between sea level and marsh accretion rates – a primary factor is a decrease in or lack of sediment supply (Blum and Roberts 2009). Additionally, dredging of channels has increased water depths thereby strengthening tidal currents, enhancing erosion, and trapping sediments that would otherwise be deposited on the marsh surfaces in deeper areas.

4.3 Ecological Effects

EE1 Wetland Loss

EE2 Decreased Primary Productivity

EE3 Habitat Conversion and Changes in Biological Community Composition

EE4 Loss of Ridges and Cheniers.

4.3.1 Wetland Loss

Wetland loss in the project area can be the result of gradual decline of marsh vegetation due to inundation and saltwater intrusion eventually leading to complete loss of marsh vegetation or the result of storm surge events. As marsh vegetation is lost, underlying soils are more susceptible to erosion and are typically lost as well, leading to deeper water and precluding marsh regeneration. Significant accretion of sediments is then required in order for marsh habitat to reestablish.

The accelerated loss of Louisiana's wetlands has been ongoing since at least the early 1900s with equal harmful effects on the ecosystem and possible future negative impacts to the economy of the region and the Nation (LCA 2004).

The LCA Study (2004) estimated coastal Louisiana would continue to lose land at a rate of approximately 6,600 acres per year over the next 50 years. It is estimated that an additional net loss of 328,000 acres may occur by 2050, which is almost 10 percent of Louisiana's remaining coastal wetlands.

Wetland degradation and loss are the result of both natural factors and anthropogenic activities, producing conditions where wetland vegetation can no longer survive and wetlands are lost (Barras et al. 2003, Barras et al. 1994; Dunbar et al. 1992). Natural causes contributing to coastal land loss include: wave erosion, sea level rise, subsidence resulting from compaction of muddy and organic sediment, geologic faulting, river floods, and tropical storm events. Human activities that have impacting coastal wetland loss include: flood control modifications including the Mississippi River levee system, navigation channels and structures, oil and gas infrastructure, and direct water quality impacts.

In the project area, the process for wetland loss can start with the be the result of gradual decline of marsh vegetation due to inundation and saltwater intrusion eventually leading to complete loss of marsh vegetation or the result of storm surge events. As marsh vegetation is lost, underlying soils are more susceptible to erosion and are typically lost as well, leading to deeper water and precluding marsh regeneration. Significant accretion of sediments is then required in order for marsh habitat to reestablish.

Perhaps the most serious and complex problem in the study area is the rate of land and habitat loss. The Louisiana coastal plain contains one of the largest expanses of coastal wetlands in the contiguous United States and accounts for 90 percent of the total coastal marsh loss in the nation (USACE 2004). Across much of the Louisiana coast, wetland loss and shoreline erosion continue largely unabated, resulting in accelerated coastal land loss and ecosystem degradation.

4.3.2 Reduced Primary Productivity

Decreased productivity in vegetative communities in the study area is thought to be a biological response to the lack of nutrients and sediment inputs, and saline stress from flooding following storm surge.

There has been a reduction in frequency of nutrient and sediment rich waters into and across the wetlands as a result of flood protection and water control structures, and channelization for navigation and oil and gas infrastructure. Instead, the nutrient rich water is delivered directly into the coastal bays or into the Gulf of Mexico, and often as a result, coastal wetlands lack the required nutrients necessary to maximize productivity. Increased productivity results in higher organic soil formation, which then leads to increased deposition and vertical accretion.

Salinity induced stress decreases primary production and biomass in freshwater marshes (Smart and Barko 1980, Linthurst and Seneca 1981, Pezeshki et al. 1987, McKee and Mendelssohn 1989, Spalding and Hester 2007) and therefore organic matter and vertical accretion rates are compromised following saltwater intrusion. Maintaining a balanced position in the coastal landscape requires that marshes accrete vertically as sea level rises and the marsh surface sinks because of subsidence. In coastal Louisiana, the amount of sedimentation required to keep pace with sea level rise is high compared to regions of the United States (Stevenson et al. 1986).

4.3.3 Habitat Conversion and Changes in Biological Community Composition

Habitat conversion can be the result of several drivers acting independently or collectively. The conversion of habitat can make an area more susceptible to storms and erosion as well as altering the type of fauna expected to occur in the area. Freshwater marsh can be susceptible to saltwater intrusion. The effects of invasive species can damage or displace native vegetation.

Coastal marshes also provide habitat for a variety of vertebrate wildlife including fish, birds, mammals, and reptiles. Teal (1986) stated that one of the most important functions of coastal marshes was to provide habitat for migrant and resident bird populations. Some wildlife species inhabiting tidal marshes are also important game animals, valuable furbearers, and provide recreational opportunities for birdwatchers, nature enthusiasts, and wildlife photographers (USACE 2010).

The majority of species that utilize the wetlands have neither commercial nor recreational value, but simply are ecologically important members of the ecosystem. Many of the organisms that use the marsh ecosystem are highly mobile and serve as a transfer mechanism for nutrients and energy to adjacent terrestrial or aquatic ecosystems. Some of the larger vertebrates, including the muskrat and nutria, consume large amounts of forage and, at high densities, can have significant impacts on marsh vegetation structure (USACE 2008).
Tidal marshes provide forage habitat, spawning sites, a predation refuge, and a nursery for resident and nonresident fishes and macrocrustaceans. These organisms use tidal marshes or adjacent subtidal shallows either year round or during a portion of their life history. These organisms are consumed by nektonic and avian predators and are considered to represent an important link in the marsh-estuarine trophic dynamics (USACE 2008).

4.3.5 Loss of Ridges and Cheniers

The Chenier Plain of SW Louisiana consists of multiple shore-parallel, sand rich ridges that are balanced on and physically separated from one another by relatively finer grain, clay-rish sediments. Cheniers are unique and critical components of the local environment. They support a diversity of wildlife and, because of their location along important migration pathways, are especially significant for migrating birds, as well as providing natural protection against salt water intrusion, storm surge, and flooding (Providence Engineering Group Cheniers and Natural Ridges Study 2009).

Formed over thousands of years by the deltaic processes of the Mississippi River and other streams, the chenier ridges of southwest Louisiana run laterally to the modern shoreline and rise above the surrounding marshes by as little as a few inches or as much as 10 ft (Gould and McFarlan 1959, Byrne et al. 1959). These ridges range from 2 to 15 ft thick and from 100 to 1,500 ft wide, with some ridges extending along the coast for a distance of up to 30 miles. Live oak and hackberry are dominate canopy species, and others common species are red maple, sweet gum, water oak, green ash, and American elm.
Cheniers have been severely impacted by human activities such as deforestation for conversion to cattle pasture or development. They have also been threaten by coastal erosion and wetland loss resulting from salt water

intrusion, subsidence, hurricanes, debris from oil and gas infrastructure by storms, navigation channels, and invasive species.

4.4 Attributes and Performance Measures

A1 Land Cover/ Land Change

Performance Measures: Relative Change in Land Cover

A2 Vegetation Distribution and Diversity

Performance Measures: Community Composition and Relative Abundance

A3 Elevation

Performance Measures: Surface Elevation and Vertical Sediment Accretion

4.4.1 Land Cover

Land cover has been identified as a key indicator of project success with respect to preventing habitat conversion and future land loss. Comparison of pre-project land cover characteristics with post-project land cover characteristics would serve to determine if the current trend in habitat conversion and land loss within the study area experiences a post-project decline or ceases altogether. Additionally, post-project land cover analysis would determine if areas within the study area that had previously gone through a conversion, undergo a post-project reversion.

Spatial analysis has been identified as an assessment performance measure for the determination of the response of land cover to the proposed project. Spatial analysis may involve comparative analysis of pre-project and post-project aerial or satellite imagery and may utilize Landsat Thematic Mapper analysis to determine relative changes in land cover within the study area.

4.4.2 Vegetation Distribution and Diversity

Plant distribution and diversity has been identified as a key indicator of project success with respect to preventing, reducing, or reversing wetland loss in the study area. Comparison of pre-project vegetation monitoring data with post-project vegetation monitoring data would serve to determine if plant communities within the study area change in response to project features.

Relative abundance is a measure of the abundance or dominance of each species present in a sample. Relative abundance can be used to document the degree of impact in an area by measuring both species dominance and evenness. Relative abundance can be used to assess ecosystem health by comparing plant density before and after project implementation. The Braun-Blanquet method (Mueller-Dombois and Ellenberg 1974) as described in Steyer et al. (1995) will be utilized to measure relative abundance.

A post-project stabilization of relative abundance within the study area would be an indication of significant project success, while a post-project reduction in the rate of decline of relative abundance would be an indication of moderate project success. Conversely, no change in the rate of decline of relative abundance post-project would indicate that the project did not succeed in increasing vegetation productivity.

4.4.3 Elevation

Ground surface elevation has been identified as a key indicator of project success with respect to increasing sediment and nutrient load within the study area. Comparison of pre-project elevations with post-project elevations would serve to determine if sediment input and soil accretion is occurring within the study area in response to project features. A post-project decrease in the rate of elevation decline would implicitly indicate the introduction of nutrients and sediment into the marshes as a result of the project. Two performance measures have been identified for this attribute, including surface elevation table (SET) measurements and feldspar marker horizon measurements.

Surface Elevation Table (SET) measurements provide a constant reference plane in space from which the distance to the sediment surface can be measured by means of pins lowered to the sediment surface. Repeated

measurements of elevation can be made with high precision because the orientation of the table in space remains fixed for each sampling. Elevation change measured by the SET is influenced by both surface and subsurface processes occurring within the soil profile.

Feldspar marker horizon measurements involve the placement of a cohesive layer of feldspar clay on the ground surface. Soil borings are extracted at the marker horizon location periodically to measure the amount of soil deposition and/or accretion that has occurred above the horizon since placement. Significant quantities of soil atop marker horizons are indicative of soil building within the area, which in turn indicates an increase in relative elevation. A post-project stabilization of elevation as evidenced by SET measurements or documented soil accretion atop a marker horizon within the study area would be an indication of significant project success, while a post-project decrease in the rate of decline in elevation would be an indication of moderate project success. Conversely, no change in the rate of elevation decline post-project within the study area would indicate that the project did not succeed in offsetting subsidence and, by extension, habitat conversion and future land loss.

5. LITERATURE CITED

Barras, J.A., J.C. Bernier, and R.A. Morton, 2008. Land area changes in coastal Louisiana- A multi decadal perspective (from 1956-2006). U.S. Geological Survey Scientific Investigations Map 3019, 14 scale 1:250,000.

Barras, J.A., P.E. Bourgeois, and L.R. Handley, 1994. Land loss in coastal Louisiana, 1956-1990. National Biological Survey, National Wetlands Research Center Open File Report 94-01. Lafayette, LA.

Barras, J.A., S. Beville, D. Britsch, S. Hartley, S. Hawes, J. Johnston, P. Kemp, Q. Kinler, A. Martucci, J. Porthouse, D. Reed, K. Roy, S. Sapkota, and J. Suhayda. 2003. Historical and projected coastal Louisiana land changes: 1978-2050: USGS Open File Report 03-334.

Barras, J.A. 2009. Land area change and overview of major hurricane impacts in coastal Louisiana, 2004-08: U.S. Geological Survey Scientific Investigations Map 3080, scale 1:250,000, 6 p.

Berman, A. E., 2005, Anatomy of a Silent Disaster: Ongoing Subsidence and Inundation of the Northern Margin of the Gulf of Mexico: Houston Geological Society Bulletin, 47(6): 31-47.

Blum, M.D. and H.H. Roberts, 2009. Drowning of the Mississippi Delta due to insufficient sediment supply and global sea level rise. Nature Geoscience. www.nature.com. 28 June 2009.

Busch and J.C. Trexler (eds.). Monitoring Ecosystems, Island Press, Washington, D.C.
Pezeshki, S.R., 1990. A comparative study of the response of Taxodium distichum and Nyssaaquatica to soil anaerobiosis and salinity. Forest Ecology and Management 33/34: 531-541.

Byrne, J.V., D.O. LeRoy, and C.M. Riley, 1959. The chenier plain and its stratigraphy, southwestern Louisiana. Transactions, Gulf Coast Association of Geological Societies 9: 237-260.

Chow-Fraser, P. 1998. A conceptual ecological model to aid restoration of Cootes Paradise Marsh, a degraded coastal wetland of Lake Ontario, Canada. Wetlands Ecology and Management 6: 43–57.

Day, J. and P. Templet, 1990. Consequences of sea level rise: Implications from the Mississippi Delta. Pp 155-165. In J.J. Beubema et al. (eds), Expected Effects of Climate Change on Marine Coastal Ecosystems. Kluwer Academic Publishers, Dordrecht, The Netherlands. (Reprinted from Coastal Management 17: 241-257.

Dunbar, J.B., L.D. Britsch, and E.B. Kemp III, 1992. Land Loss Rates: Report 3, Louisiana Coastal Plain. Technical Report GL-90-2. New Orleans: USACE New Orleans District. 28 p.
Fischenich, J.C., 2008. The Application of Conceptual Models to Ecosystem Restoration. Engineer Research and Development Center Publication TN-EMRRP-EBA-01. U.S. Army Corps of Engineers, Vicksburg District, Vicksburg, MS.

Flynn, K.M., K.L. McKee, and I.A. Mendelssohn, 1995 Recovery of freshwater marsh vegetation after a saltwater intrusion event. Oecologia 103: 63–72

Gagliano, S. M., and J.L. van Beek, 1970. Geologic and Geomorphic Aspects of Deltaic Processes, Mississippi Delta System. In Hydrologic and Geologic Studies of Coastal Louisiana. Vol. I. Baton Rouge, LA: Coastal Studies Institute, Louisiana State University.

Gentile, J. H. 1996. Workshop on South Florida Ecological Sustainability Criteria. Final Report. University Miami, Center for Marine and Environmental Analysis, Rosenstiel School of Marine and Atmospheric Science, Miami, Florida, 54 pp.

Gould, H. R. and E. McFarlan, Jr., 1959. Geologic History of the Chenier Plain, Southwestern Louisiana. Transactions, Gulf Coast Assn. Of Geological Societies. 9: 261-272.

Harvey, R.G., W.F. Loftus, J.S. REhage, and F.J. Mazzotti. 2010. Effects of Canals and Levees on Everglades Ecosystems. University of Florida WEC304. http://edis.ifas.ufl.edu.

Hitch, A.T. and P.L. Leberg, 2007. Breeding distributions of North American bird species moving north as a result of climate change. Conservation Biology, 21: 534-539.

Howard, R.J., and I.A. Mendelssohn, 1999. Salinity as a constraint on growth of oligohaline marsh macrophytes. I. Species variation in stress tolerance: American Journal of Botany, 86(6): 85–794.

Howes, N.C., D.M. Fitzgerald, Z.J Hughes, I.Y. Georgiou, M.A. Kulp, M.D. Miner, J.M. Smith, and J.A. Barras, 2010. Proceedings of the National Academy of Sciences of the United States of America. 107(32): 14014-14019.

Intergovernmental Panel on Climate Change, 2007. Climate Change 2007: Synthesis Report, Summary for Policy Makers

Jackson, L.L., A.L. Foote, and L.S. Ballisbrieri. 1992. Hydrological, geomorphological, and chemical effects of Hurricane Andrew on coastal marshes of Louisiana. Journal of Coastal Research Special Issue 21:306-323.

Jones, R. F., D.M. Baltz, and R.L. Allen, 2002. Patterns of resource use by fishes and macroinvertebrates in Barataria Bay, Louisiana. Marine Ecology Progress Series 237: 271-289
Linthurst, R.A., and E.D. Seneca, 1981, Aeration, nitrogen and salinity as determinants of Spartina alterniflora Loisel. growth response: Estuaries, 4(1): 53–63.

Lovelace, J.K., and B.F. McPherson. 1998. Effects of Hurricane Andrew (1992) on wetlands in southern Florida and Louisiana: National water summary on wetland resources. U.S. Geological Survey Water Supply Paper #2425. Available on the internet: http://water.usgs.gov/nwsum/WSP2425/andrew.html

McKee, K. L., and I. A. Mendelssohn. 1989 Response of a freshwater marsh plant community to increased salinity and increased water level. Aquatic Botany 34: 301–316.

Messina, M.G. and W.H. Conner (eds.), 1998. Southern Forested Wetlands: Ecology and Management. Lewis publishers, New York, NY.

Mitsch, W.J. and J.G. Gosselink. 2000. Wetlands. John Wiley and Sons. 582 pp.

Morton, R.A., J.C. Bernier, J.A. Barras, and N.F. Ferina, 2005, Rapid Subsidence and Historical Wetland Loss in the Mississippi Delta Plain: Likely Causes and Future Implications: Open-File Report 2005-1216, U.S. Department of the Interior, U.S. Geological Survey.

Mueller-Dombois, D. and H. Ellenberg, 1974. Aims and Methods of Vegetation Ecology. John Wiley and Sons, NY

Ogden, J.C., and S.M. Davis, 1999. The Use of Conceptual Ecological Landscape Models as Planning Tools for the South Florida Ecosystem Restoration Programs. South Florida Water Management District, West Palm Beach, FL.

Ogden, J.C., S.M. Davis, and L.A. Brandt, 2003. Science strategy for a regional ecosystem monitoring and assessment program: the Florida Everglades example. Pages 135-163. In D.E.

Providence Engineering and Environmental Group LLC, 2009. Cheniers and Natural Ridges Study prepared for LDNR.

Reed, D.J., and B. Yuill, 2009. Synthesizing and Communicating Subsidence Rates in Coastal Louisiana: Technical Synthesis Report. University of New Orleans – prepared for the Louisiana Coastal Area Science and Technology Program.
Reid, W.V. and M. C. Trexler, 1992. Responding to potential impacts of climate change on the U.S. coastal biodiversity. Coastal Management 20(2): 117-142.

Rosen, B.H., P. Adamus, and H. Lal 1995. A conceptual model for the assessment of depressional wetlands in the prairie pothole region. Wetlands Ecology and Management 3:195–208.

Smart, R.M., and J.W. Barko, 1980. Nitrogen nutrition and salinity tolerance of Distichlis spicata and Spartina alterniflora: Ecology, 61(3): 630–638.

Spalding, E. A., and Hester, M. W. 2007. Interactive effects of hydrology and salinity on oligohaline plant species productivity: Implications of relative sea-level rise. Estuaries and Coasts, 30(2): 214-225.

Stevenson, J.C., L.G. Ward, and M.S. Kearney. 1986. Vertical accretion in marshes with varying rates of sea level rise, p 241-259. In D.A. Wolfe (ed.), Estuarine Variability. Academic Press, New York.

Steyer, G. D., R. C. Raynie, D. L. Steller, D. Fuller, and E. Swenson, 1995. Quality management plan for the Coastal Wetlands Planning, Protection, and Restoration Act Monitoring Program. Open-file report no. 95-01. Baton Rouge: Louisiana Department of Natural Resources, Coastal Restoration Division. 97 pp. plus appendices.

Stone, G.W., J.M. Grymes, K.D. Robbins, S.G. Underwood, G.D. Steyer, and R.A. Muller. 1993. A chronological overview of climatological and hydrological aspects associated with Hurricane Andrew and its morphological effects along the Louisiana Coast. U.S.A. Shore and Beach 61(2):2-12.

Stone, G.W., J.M. Grymes, J.R. Dingler, and D.A. Pepper. 1997. Overview and significance of hurricanes on the Louisiana coast U.S.A. Journal of Coastal Research 13(3):656-669.
Swenson, E. M. and R. E. Turner, 1987. Spoil Banks: Effects on coastal marsh water level regime. Estuar. Coastal Shelf Sci. 24: 599-609.

Teal, J.M., 1986. The ecology of regularly flooded salt marshes of New England: a community profile. US Fish and Wildlife Service Biological Report 85(7.4). 61 pp.

U.S. Army Corps of Engineers, 2004. Louisiana Coastal Area (LCA) Ecosystem Restoration Study. New Orleans District. New Orleans, LA.

U.S. Army Corps of Engineers, 2008a. ECO-PCX White Paper: Recommendations to Headquarters, U.S. Army Corps of Engineers on Certification of Ecosystem Output Models (May 2, 2008).

U.S. Army Corps of Engineers, 2008b. Memorandum – Policy Guidance on Certification of Ecosystem Output Models (Aug 13, 2008).

U.S. Army Corps of Engineers, 2010. Comprehensive Plan and Integrated Programmatic Environmental Impact Statement, Mississippi Coastal Improvements Program (MsCIP) Hancock, Harrison, and Jackson Counties, Mississippi.

Wang, J. D. 1978. Real time flow in unstratified shallow water. J. Watwy. Port Coast. Ocean Div. ASCE, 104(WW1): 53–68.

Williams, S.J., S. Penland, A.H. Sallenger, Jr. (eds.) 1992. Atlas of shoreline changes in Louisiana from 1853-1989. U.S. Geological Survey, Reston, VA.

SOUTHWEST COASTAL LOUISIANA
INTEGRATED FINAL FEASIBILITY REPORT
AND
ENVIRONMENTAL IMPACT STATEMENT

APPENDIX A

Annex M

Reserved

SOUTHWEST COASTAL LOUISIANA
INTEGRATED FINAL FEASIBILITY REPORT
AND
ENVIRONMENTAL IMPACT STATEMENT

APPENDIX A

Annex N

Recreational Resources

1. RECREATION RESOURCES

Historic and Existing Conditions

Recreational features and opportunities vary throughout the coastal zone, habitat and culture playing significant roles in the diversity of activities. From the games and competitions of Native Americans, to the influence of diverse immigrant cultures, traditional recreation in Louisiana has been a product of its people. Nearly 10,000 years ago, people began living off the ample resources of Louisiana. The means by which Louisiana's early residents lived, hunting and fishing for food, utilizing high ground for camps, and building vessels for transportation, shaped what is now recognized as traditional recreation in southern Louisiana.

State parks *within the Gulf Coast Prairie and Forested Terraced Uplands* physiographic regions include Palmetto Island and Sam Houston Jones parks. There are no Federal National Wildlife Refuges (NWR) or Wildlife Refuges (WR) within the regions. Sixteen boat launches are located within these regions.

Federal NWRs or State WRs within or adjacent to the Gulf Coast Marsh physiographic region include Sabine, Cameron Prairie, and Lacassine NWR and White Lake Wetlands Conservation Area. Public and private boat launches are located throughout the study area.

Recreation areas within or adjacent to the Gulf Coast Marsh physiographic region that provide access to high quality recreational resources include three National Wildlife Refuges, one Wildlife Management Area, one State Wildlife Refuge, and one State Park. See Map N1. From east to west, the region includes the 13,000-acre State Wildlife Refuge, the 71,544-acre White Lake Wetlands Conservation Area, the 76,000-acre Rockefeller WR, the Lacassine National Wildlife Refuge NWR, Cameron Prairie NWR, and the 124,511-acre Sabine NWR. Outside but adjacent to the area is Cypremont State Park, Shell Keys NWR and Marsh Island WR. These areas represent more than 329,000 acres that are visited more than 460,000 times annually. Recreation areas include trails for hiking and biking, five boat ramps (within recreation parks), three visitor centers, picnic shelters, one classroom, and one campground that is rented more than 36,700 times annually. Recreation areas also provide opportunities for hunting, boating, bird watching, fishing, crabbing, crawfishing, education, picnicking, education, camping, and playing.

Access into the WMAs and Refuges is generally by car or boat. Consumptive recreation includes hunting, fishing for freshwater and saltwater species and trapping alligators and nutria. Non-consumptive recreation includes bird watching, sightseeing, boating and environmental education/interpretation. Many of the parks offer hiking trails, camping and picnic shelters.

In addition to the high quality recreational fishing and hunting in the parks in the region, several lakes and inland marshes offer opportunities for hunting and catching both freshwater and saltwater species. Grand, White, Sabine and Calcasieu Lakes, Freshwater Bayou and Vermillion Bay are prime fishing spots for recreational species such as redfish and speckled trout as well as flounder and brown and white shrimp. White Lake is a remote open lake and can only be accessed by the Schooner Bayou Canal, the old Intracoastal Canal north of Pecan Island or via the Superior Canal west of Pecan Island. The Calcasieu Lake area offers 10 of the 35 public or private boat launches in the area.

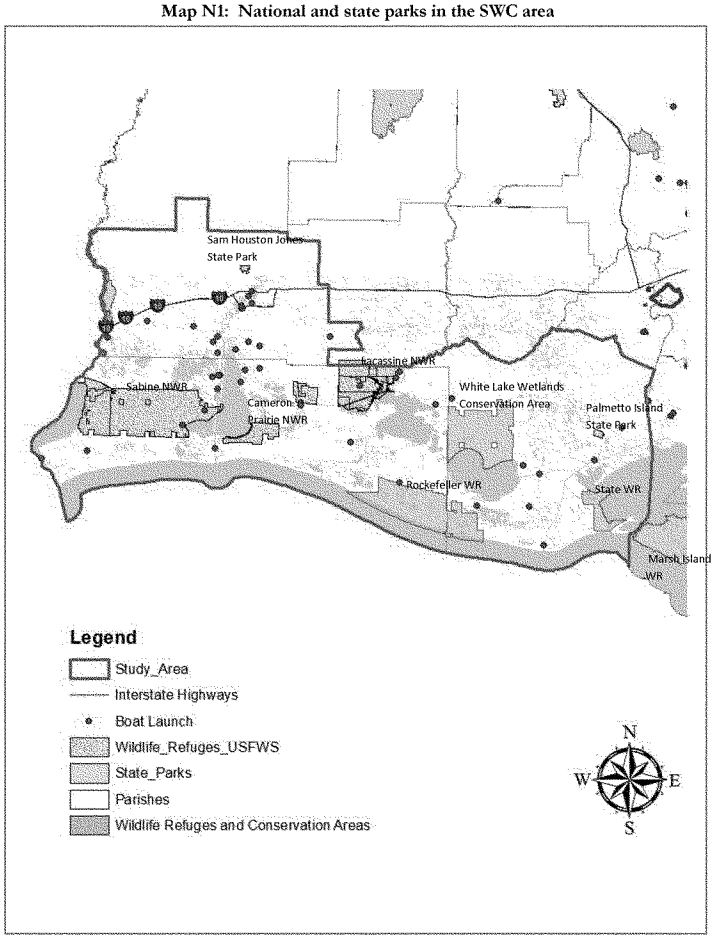
Bird watching is also an important recreational resource in southern Louisiana. A global initiative of BirdLife International, implemented by Audubon and local partners in the United States, the Important Bird Areas Program (IBAs) is an effort to identify and conserve areas that are vital to birds and other biodiversity. In the NER area, Audubon lists the entire Chenier Plain as a globally IBA (source: http://netapp.audubon.org/iba, accessed 25 September 2013). Many of the IBAs recognized are located within state or federally operated areas. Federal parks within the Chenier Plain that are globally IBAs include Lacassine NWR, Cameron Prairie NWR and Sabine NWR. The sanctuary provided at Lacassine Pool, a very popular birding site, is critical to the long-term viability of continental pintail populations and is one of the key pintail wintering areas in the continent, with a wintering pintail population that has reached almost 400,000 (source: http://www.fws.gov/

swlarefugecomplex/lacassine/, accessed 25 September 2013). Also in the area is the Baton Rouge Audubon Society 40-acre Peveto Woods Sanctuary located along the Louisiana coast in Cameron Parish. The Peveto Woods Bird & Butterfly Sanctuary site is the most heavily birded locale in Louisiana and was the first Chenier sanctuary for migratory birds established in Louisiana. Each spring and fall, Peveto Woods hosts most migratory songbirds native to eastern North America (source: http://www.braudubon.org/peveto-woods-sanctuary.php, accessed 25 September 2013). The sanctuary is a favorite birding spot in southwest Louisiana, as well as a location for viewing the many butterfly species that migrate to the region.

The State of Louisiana owns and operates the White Lakes Conservation Area, Rockefeller WR and the State Wildlife Refuge (SWR), all located in the Chenier Plain and all globally IBAs. Rockefeller Wildlife Refuge is one of the most biologically diverse wildlife areas in the nation. Historically, Rockefeller wintered as many as 400,000-plus waterfowl annually, but severe declines in the continental duck population due to poor habitat quality on the breeding grounds have altered Louisiana's wintering population (source: http://www.wlf.louisiana.gov/refuge/ rockefeller-wildlife-refuge, accessed 25 September 2013). The Audubon/Paul J. Rainey Wildlife Sanctuary is located to the west and the Marsh Island Wildlife Refuge to the east of the SWR. The Little Pecan Island Preserve, located between Lacassine and Rockefeller WRs near White Lake is managed by The Nature Conservancy and contains 1,810 acres of gulf coast prairies and marshes in Cameron Parish. Palmetto Island State Park is an IBA.

Designated within the area is the Creole Nature Trail National Scenic Byway, a 105- mile driving and walking tour touching four state and national wildlife refuges and a bird sanctuary. Finally, public and private boat launches are located throughout the entire NER area.

Map N1: National and state parks in the SWC area



Future Without-Project Conditions (No Action Alternative)
Direct, Indirect, and Cumulative Impacts: Recreational resources in the Louisiana coastal zone that will be most affected in the Future Without Action are those related to loss of wetlands/marshes and habitat diversity. Many recreational activities are based on aquatic resources and directly related to the habitat and species in an area.

There would be no direct impacts. Indirectly, the continued loss of wetlands/marshes and habitat diversity affects recreational opportunities. Storm surge and saltwater could have a negative impact on freshwater forests and habitats and could reduce recreational resources (e.g., fishing, hunting, bird watching, and other). In general, further degradation of area marshes will continue and its associated negative impacts on recreation activities will increase.

Recreational infrastructure would remain vulnerable to surges. Another major impact of storm surge is land loss and the possible loss of facilities and infrastructure that support or are supported by recreational activities. Land loss can result in the loss of park land, boat launches, parking areas, access roads, as well as marinas and supply shops. In general, further degradation of area marshes will continue and its associated negative impacts on wildlife activities will increase. Additionally, saltwater intrusion and predicted sea-level rise will continue to cause land loss. As existing freshwater wetland/marsh areas convert to saltwater marsh, then to open water, the recreational opportunities will change accordingly.

HURRICANE STORM DAMAGE RISK REDUCTION NATIONAL ECONOMIC DEVELOMENT (NED) PLAN
Alternative —Nonstructural 0-25-Year Floodplain - Recommended Plan (RP)

Nonstructural measures as part of the RP include elevation of residential structures and flood proofing of non-residential structures. There would be no direct impacts on recreational resources from structure elevation that results in storm surge passing safely below a structure. By elevating residential recreational structures, such as camps, damage from storm surge is less likely to occur. Additionally, elevated structures should create less debris that must be removed following a storm surge event. Elevation requirements may lead to fewer camps and hunting clubs in the region because elevated structures would most likely be more costly to erect. This may negatively affect recreation opportunities because people would have to travel further to access locations for activities such as hunting, fishing, boating, and birding.

A direct impact from flood proofing park buildings is the recreational use may be temporarily unavailable during flood proofing activities. Flood proofing at parks could affect recreational structures at the White Lake Wetlands Conservation Area, the Lacassine, Cameron Prairie, and Sabine National Wildlife Refuges and Sam Houston Jones State Park. Once flood proofing is complete, park structures would reopen more quickly following storm surge events.

See Map N2 for National and State Parks in the study area and NED RP structures.

Cumulative Impacts: Depending on the number of structures affected, recreational resources impacts could include fewer camps and features at parks as cost associated with elevation or flood proofing may result in fewer recreational opportunities, outside of fishing and hunting.

ECOSYSTEM RESTORATION (NER) PLANS
Alternative CM4 — Comprehensive Small Integrated Restoration (RP)
Direct and Indirect Impacts:

Marsh Restoration: Any direct impacts to recreational fishing, hunting and other recreational resources would be temporary and occur during construction activities. However, since there are many other areas for recreational fishing and hunting in the coastal region, impacts are expected to be minimal.

An indirect effect of marsh restoration and nourishment is the potential for limiting access to fishing areas as boaters would have to navigate around newly created land area. Recreationalists may have to circumvent the marsh restoration project area when traveling to a destination due to construction activities limiting or delaying access. It is assumed floating pipelines would convey dredge material from borrow areas to sites being restored. These pipelines may, in some cases, block access to fishing areas and fisherman may have to travel longer distances to arrive at their preferred destination. However, canals that are frequently used by fisherman should not be blocked as the pipeline crossing these locations may be submerged.

Marsh restoration projects proposed for Cameron Prairie NWR East Cove Unit and to a lesser extent in Sabine NWR may improve fishing and hunting opportunities once the projects have a chance to mature into productive fishery and wildlife habitats. See Map N2 for National and State Parks in the study area and NER RP Measures. Marsh restoration measures proposed along Freshwater Bayou should provide additional habitat to birds and other wildlife in the Paul J. Rainey Wildlife Sanctuary. In general, measures that create marsh habitat and improve hydrology of wetlands are more likely to improve recreational fishing opportunities by enhancing the sustainability of productive nursery habitats. Marsh restoration, while improving nursery habitat for juveniles in the interior marshes, could improve recreational fishing opportunities in off-shore waters as adults move to deeper depths. Development of additional marsh habitat is potentially beneficial to bird watching as it would support more birds and increase the diversity of species in the area. Potential negative effects include temporary turbidity associated with construction of marsh projects and excavation of borrow material in the Calcasieu Ship Channel, Calcasieu Lake, Freshwater Bayou, and the Gulf of Mexico.

Shoreline Protection: Any direct impacts to recreational fishing and hunting would be temporary and occur during construction activities. Bank fishing in areas proposed for shoreline protection or spoil bank fortification measures could be affected. Holly Beach shoreline stabilization offshore breakwater along the Gulf of Mexico shoreline from the western jetty of the Calcasieu Ship Channel to just west of the town of Holly Beach may temporarily disrupt recreational use on the beach during construction activities as will the reef breakwater along the Gulf of Mexico shoreline of the Rockefeller Wildlife Management Area and Game Preserve. The breakwaters would help reduce the risk of storm surge and saltwater damage to recreational opportunities within the preserve thereby helping preserve recreational resources of the park.

Indirect impacts of the spoil bank fortification projects for the GIWW and Freshwater Bayou Canal, designed to reduce erosion of canal banks, could help protect recreational resource lands from effects of coastal storm surge and minimize the loss of valuable fishery habitat. Potential effects of shoreline protection measures would include the temporary displacement of fish populations due to increased turbidity both near the shorelines and near borrow areas during project implementation. Spoil bank fortification with rock dikes along the Freshwater Bayou Canal may cause temporary disruption to recreational use in the project vicinity.

Cheniers: Chenier reforestation measures support wildlife and system structure. Restoration of natural ridges would improve bank stabilization and potentially provide additional habitat for deer, small game and birds, which could be beneficial for hunting and bird watching. Restored ridges would also enhance protection available to adjacent swamps and marshes during coastal storms, which could also potentially benefit recreational resources and infrastructure such as boat launches.

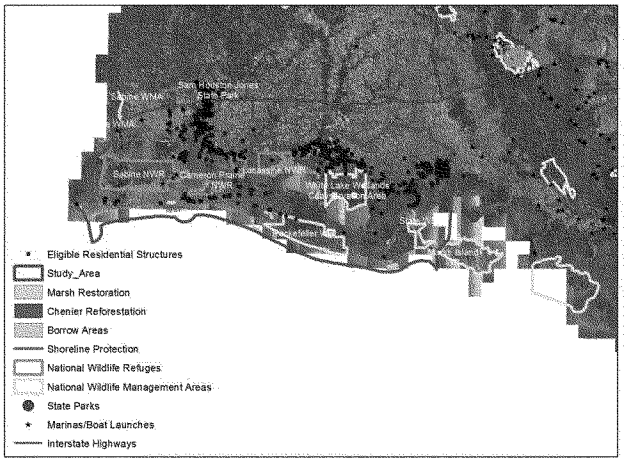
Cumulative Impacts:
The cumulative impacts of other ongoing and planned ecosystem restoration measures are expected to be generally beneficial to recreation as the risk of destruction of recreation resources by storm surge is reduced and habitat areas supporting fish and wildlife resources are enhanced. Temporary negative impacts of restoration activities due to construction activities, increased turbidity and possible boating access issues are mediated by the presence of other productive and popular recreation areas throughout the coastal region of Louisiana. Long-term positive cumulative impacts are expected to occur as restoration enhances the sustainability of valuable nursery habitats.

Alternative M4 Comprehensive Small Integrated Restoration for Mermentau Basin

Direct and indirect impacts to recreational resources from the restoration measures for Alternative M4 would be similar to and less than impacts described for the RP. Additionally, impacts are less than those expected for the RP because Alternative M4 has fewer restoration measures and therefore more minimal direct and indirect impacts to recreational resources.

Cumulative Impacts: Cumulative impacts to recreational resources from Alternative M4 would be similar to impacts described for the RP.

Map N2: National and State Parks in SWCL Area and NED/NER Measures



SOUTHWEST COASTAL LOUISIANA
REVISED DRAFT INTEGRATED FEASIBILITY REPORT
AND
ENVIRONMENTAL IMPACT STATEMENT

APPENDIX A

Annex O

Environmental Justice

CONTENTS

1. INTRODUCTION 3
2. METHODOLOGY 3
2.1 HISTORIC AND EXISTING CONDITIONS: 4
2.2 FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE) 5
3. ENVIRONMENTAL CONSEQUENCES 5
3.1 ALTERNATIVE —NONSTRUCTURAL 0-25-YEAR FLOODPLAIN RECOMMENDED PLAN (RP) 5
3.2 ALTERNATIVE C4+M4 — COMPREHENSIVE SMALL INTEGRATED RESTORATION – RECOMMENDED PLAN (RP) 7
3.3 ALTERNATIVE M4 — COMPREHENSIVE SMALL INTEGRATED RESTORATION FOR MERMENTAU BASIN 8
4. MITIGATION FOR ADVERSE IMPACTS 8

1. INTRODUCTION

An environmental justice (EJ) analysis was conducted which focused on the potential for disproportionately high and adverse impacts to minority and low-income populations during the construction and normal operation of the proposed risk-reduction system. The assessment identified the occurrence of minority and low-income populations within the study area. Overall, the assessment used Census Tract and block group level data. Environmental Justice Communities are identified within the study area. This analysis details whether the proposed federal action would disproportionately impact the EJ communities as defined by minority composition and percent of population below the federal poverty level.

A disproportionately high and adverse effect means the impact is appreciably more severe or greater in magnitude on minority or low-income populations than the adverse effect suffered by the non-minority or non-low-income populations after taking offsetting benefits into account.

This appendix will provide information on Census Tract and block group EJ analysis. As the National Economic Development (NED) implementation process is further assessed prior to implementation, additional EJ-related analysis will be performed to ensure adequate consideration of the potential for EJ-related impacts across the study area.

2. METHODOLOGY

Environmental Justice is institutionally significant because of Executive Order 12898 of 1994 (E.O. 12898) and the Department of Defense's Strategy on Environmental Justice of 1995, which direct Federal agencies to identify and address any disproportionately high adverse human health or environmental effects of Federal actions to minority and/or low-income populations. Minority populations are those persons who identify themselves as Black, Hispanic, Asian American, American Indian/Alaskan Native, Pacific Islander, some other race, or a combination of two or more races. A minority population exists where the percentage of minorities in an affected area either exceeds 50 percent or is meaningfully greater than in the general population.

Low-income populations as of 2010 are those whose income are $22,113 for a family of four and are identified using the Census Bureau's statistical poverty threshold. The Census Bureau defines a "poverty area" as a census tract or block group with 20 percent or more of its residents below the poverty threshold and an "extreme poverty area" as one with 40 percent or more below the poverty level. This resource is technically significant because the social and economic welfare of minority and low-income populations may be positively or disproportionately impacted by the proposed actions. This resource is publicly significant because of public concerns about the fair and equitable treatment (fair treatment and meaningful involvement) of all people with respect to environmental and human health consequences of Federal laws, regulations, policies, and actions.

The methodology, consistent with E.O. 12898, to accomplish this EJ analysis includes identifying low-income and minority populations within the study area using up-to-date economic statistics, aerial photographs, and U.S. Census Bureau 2007-2011 American Community Survey (ACS) estimates. The newly released ACS estimates provide the latest socioeconomic community characteristic data, including poverty level, released by the U.S. Census Bureau and are based on data collected between January 2007 and December 2011. Race and ethnicity data at the Census block group level was compiled from the 2010 U.S. Census data. The 2010 U.S. Census dataset was chosen because it is more complete and based on actual counts.

All Census Tracts and Census block groups located within the study area are identified as the EJ study area. Calcasieu, Cameron, and Vermilion Parishes are considered the reference communities of comparison.

2.1 Historic and Existing Conditions:

High poverty rates negatively impact the social welfare of residents and undermine the community's ability to provide assistance to residents in times of need. The 2007-2011 ACS data indicate that 17% of households in Calcasieu Parish, 9% in Cameron Parish, and 18% in Vermilion Parish fell below the poverty line. The 2007-2011 ACS data indicate that there are:

- 17 poverty areas and 2 extreme poverty areas (block groups) in Calcasieu Parish
- 0 poverty areas or extreme poverty areas (block groups) in Cameron Parish
- 7 poverty areas and 1 extreme poverty areas (block groups) in Vermilion Parish

Southwest Coastal Study Area Residential Structures and Percent Majority Population by US Census Block Group

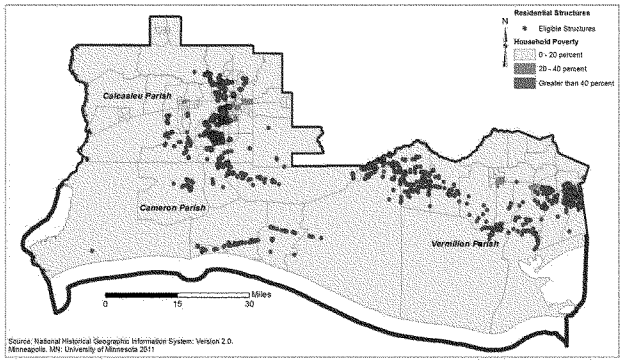


Figure 1: EJ percent below poverty by block group

Race and Ethnicity continue to play an important role in the everyday lives of Americans. Unequal access to social and political resources may affect preparing for and recovering from storm damage and flood events for certain groups. **Table 1** shows the racial characteristics of the three parishes according to the 2010 U.S. Census.

Table 1: Racial characteristics of the three affected parishes

Racial Characteristics							
Parish	White	African American	American Indian/ Alaska Native	Asian	Hawaiian/ Pacific Islander	Total	Percent Minority
Calcasieu	136,514	47,782	898	2,073	93	192,768	29%
Cameron	6,546	119	36	6	0	6,839	4%
Vermilion	46,922	8,286	209	1,160	5	57,999	20%

According to the 2010 U.S. Census data there are 41 block groups in Calcasieu Parish where 50% or more of the population identify themselves as part of a minority group. There are no block groups in Cameron Parish where more than 1% of the population identify themselves as part of a minority group. There are 8 block groups in Vermilion Parish where 50% of the population identify themselves as part of a minority group. See

Figure 2.

Southwest Coastal Study Area Residential Structures and Percent Majority Population by US Census Block Group

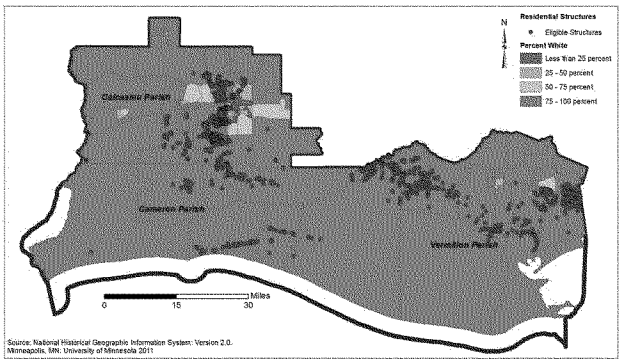


Figure 2- EJ racial majority by block group

2.2 Future Without-Project Conditions (No Action Alternative)

Direct, Indirect, and Cumulative Impacts: The No Action Alternative would not provide hurricane storm damage risk reduction, or reduce flooding induced by storm surge, or provide ecosystem restoration that improves ecosystem sustainability. There would be no direct impact on minority and/or low-income populations under this alternative. Indirect impacts under the No Action Alterative include a higher potential for temporary displacement of minority and/or low-income populations because residents within the study area would remain vulnerable to flooding and may be forced to relocate to areas with risk reduction measures in place. Storm surge increase due to subsidence and sea level rise will exacerbate the vulnerability to flooding across the area. Low-income populations may find it more difficult to bear the cost of evacuation. This alternative would not contribute to any additional EJ issues when combined with other Federal, state, local, and private risk reduction efforts.

3. ENVIRONMENTAL CONSEQUENCES

3.1 Alternative —Nonstructural 0-25-Year Floodplain Recommended Plan (RP)

The EJ assessment of the nonstructural plan to reduce storm surge risk includes all residential structures located in the 0-25 year floodplain. Owners of residential structures in the floodplain can voluntarily take part in the plan to receive financial assistance in raising/elevating their residential structure. Relocations benefits are not available under Public Law 91646 to those receiving nonstructural measures under the Project (except for tenants living in structures at which nonstructural measures would be implemented).

Direct, Indirect, and Cumulative Impacts:

A direct impact to those who benefit from the nonstructural measures includes reduced risk of hurricane storm surge-related damage due to the home being elevated. Direct impacts to owners of eligible structures include having to temporarily relocate during the elevation of the residential structure. Residents would be required to leave their home during the elevation and seek temporary quarters for the period of time necessary to elevate the structure. Temporary relocation benefits would not be made available to these residents (except for tenants living in these structures). Household income could be a factor in the decision to pursue nonstructural measures since temporary relocation costs could potentially be cost prohibitive for lower income residents. A direct impact to those whose homes are not eligible for the nonstructural measures or to those who choose not to pursue the nonstructural measures includes continuing vulnerability to hurricane storm surge related damage. This vulnerability may increase based on the actual rate of relative sea level rise (RSLR).

Indirect impacts to those choosing to forego the nonstructural measures include the potential to experiencing storm surge related damage from a 25-year storm event or possible even a lesser storm. Indirect impacts to those who benefit from the nonstructural measures would include a decrease in risk of damage from 1 percent (and more frequent) exceedance storm events. Population groups residing or working near the construction site (elevating homes) itself may experience direct impacts due to the added traffic congestion and construction noise and dust. Finally, indirect impacts may include effects on residential market value, insurability, potential impacts to community cohesion, and a more sustainable local economy and tax base as more fully detailed in Chapter 3 of the Report.

Positive cumulative impacts to minority and/or low-income populations associated with providing risk reduction are expected to occur as a result of the lower hurricane storm surge–related risk in the area under this alternative. If this alternative encourages regional economic growth, any additional jobs created may benefit minority and/or low-income groups living within the study area.

Identifying EJ Communities:

According to guidance set forth in Executive Order 12898, Federal Actions to Address Environmental Justice in Minority and Low-Income Populations, minority and low-income residential communities must be identified and a determination made if these communities suffer a disproportionate impact. A comparison of minority residents and low-income households in the larger study area and in the impact area helps determine if there is a proportionate or disproportionate distribution of impacts.

EJ Study Area
The EJ study area includes the three-parish area of Calcasieu, Cameron, and Vermillion. The total population of the study area is approximately 256,000 people, an estimated 26% of which are minority. The number of low-income households in the study area is approximately 8,800, an estimated 9% of which are households at or below the poverty threshold. In the event that significant adverse impacts are identified, these two percentages, 26% minority and 9% low-income, provide a baseline against which we would measure impact when determining whether the impacts would be disproportionate. See Table 2.

EJ Impact Area
The EJ impact area is defined as those Census Block Groups within the three-parish study area that contain the 3,445 residential structures within the 0-25-year floodplain that are eligible for the nonstructural plan (Note: there are additional structures located in these Census Block Groups that are not located within the 0-25 year floodplain). Currently, a vast majority of these structures would be able to pursue non-structural measures if their structures meet the eligibility requirements.

There are approximately 105,000 residents in the impact area, as defined by the Census Block Groups; approximately 26% are minority residents. See Table 2. The larger study area also is made up of about 26% minority residents, indicating no potential for a disproportionate impact.

Table 2. Relationship between the Study Area and the Impact Area for EJ Analysis

Criteria	Three Parish Study Area*	Impact Area**	Percent in Study Area	Percent in Impact Area
Total Population	255,634	104,846	100%	41%
White	189,945	87,974	74%	46%
Minority***	65,689	16,872	26%	26%
Total Households	96,259	39,995	100%	42%
Low-Income Households****	8,783	659	9%	7%

*Study Area data is for Calcasieu, Vermillion and Cameron Parishes.
**Impact Area consists of Block Groups within 0-25 year floodplain
***Minority includes non-Hispanic black and other non-white races and Hispanics.
**** Below poverty level
Source: US Census 2010 Data, US Census ACS 2007 - 2011

The following analysis identifies if there is a disproportionate impact on low-income residents from Project implementation.

To determine if there is a disproportionate impact on low-income residents, the eligible structures located in census block groups identified as EJ communities/poverty areas are considered. If an eligible owner of a residential structure in the 0-25-year floodplain is below the poverty level, they are less likely to be able to afford the temporary relocation costs and therefore less likely to benefit from this Project than those above the poverty threshold. Additionally, residents below the poverty level may not have adequate transportation to their jobs if the only affordable temporary relocation option is not near public transit.

There are approximately 660 structures in the 0-25-year floodplain that are located within census block groups that meet the EJ criteria for "poverty areas" or that at least 20% of the households are below the poverty threshold.

About 9% of the households in the study area are low-income (below the poverty threshold). Seven percent of households in the impact area are below the poverty threshold. There is a similar percentage of low income residents in the impact area compared to the study area. The analysis does not show a disproportionate impact to low-income residents in the impact area.

However, this determination is made using Census Block Group (CBG) income data which reveals the percentage of households in the geographic area with incomes below the poverty threshold. The specific households that are below the threshold are unknown. We assume all 660 eligible structures that are located within block groups where at least 20% are below the poverty threshold are in fact low-income. Structures that are located in CBG that are above the poverty threshold but may in fact be occupied by low-income residents are not included in this analysis. Only those eligible structures (660) in CBG with at least 20% of individuals below poverty are included in the EJ analysis. In this case, 7% of all impact area households and 9% of all study area households are at least 20% below the poverty level which are very comparable rates and a proportionate impact.

3.2 Alternative C4+M4 — Comprehensive Small Integrated Restoration – Recommended Plan (RP)

Direct, Indirect, and Cumulative Impacts: Many of the areas in which these activities will occur are sparsely populated or devoid of permanent structures and/or population. Access to some areas due to marsh restoration and nourishment activities may be temporarily interrupted. Impacts due to shoreline protection construction would also be temporary. Temporary impacts from construction activities due to increased turbidity, noise, and access interruption are compensated for by the opportunity for long-term positive cumulative impacts as other restoration programs improve the habitat and sustainability of coastal Louisiana. The long-term benefits of

marsh restoration, shoreline protection, bank stabilization, and chenier reforestation would improve wetland habitat which would subsequently improve leisure and recreation opportunities to all residents of the area. The proposed action would have no disproportionate adverse impacts on minority and low-income populations.

3.3 Alternative M4 — Comprehensive Small Integrated Restoration for Mermentau Basin

Direct, Indirect, and Cumulative Impacts: The direct, indirect, and cumulative impacts would be similar to those described for the RP but smaller given the fewer number of measures in this alternative.

4. MITIGATION FOR ADVERSE IMPACTS

At this time, no EJ issues have been identified and as such, no mitigation measures are necessary.

SOUTHWEST COASTAL LOUISIANA
REVISED INTEGRATED DRAFT FEASIBILITY REPORT
AND
ENVIRONMENTAL IMPACT STATEMENT

APPENDIX A

Annex P

Other Social Effects

CONTENTS

1. INTRODUCTION 3
1.1 PURPOSE 3
1.1.1 Study Area 3
1.1.2 Overview of Other Social Effects 3
1.1.3 Organization of Appendix 4
2. OTHER SOCIAL EFFECTS STUDY AREA CHARACTERISTICS 4
2.1 SOCIOECONOMIC CHARACTERISTICS OF THE STUDY AREA 4
2.1.1 Population and Households 4
2.1.2 Employment Opportunities 4
2.1.3 Social Profile of Communities 5
2.1.4 Health and Safety (Stress, Loss-of-Life, Health Care and Emergency Facilities) 5
2.1.5 Economic Vitality 5
2.1.6 Social Connectedness 5
2.1.7 Social Vulnerability/Resiliency 6
2.1.8 Leisure and Recreation 7
3. OTHER SOCIAL EFFECTS EVALUATION OF ALTERNATIVES 7
3.1 SOCIAL IMPLICATIONS OF THE ALTERNATIVES 7
4. SUMMARY OF ALTERNATIVE ANALYSIS 8
4.1 ALTERNATIVE — NED NONSTRUCTURAL PLAN (TSP) 8
4.1.1 Alternative C4+M4 — Entry Salinity Control Plan (TSP) 9
4.1.2 Alternative M4 — Entry Salinity Control for Mermentau Basin 9
5. REFERENCES 9

5. INTRODUCTION

This appendix presents a socioeconomic evaluation of the alternatives being considered for coastal storm damage risk reduction for the Southwest Coastal Louisiana evaluation area, which includes three parishes in the state of Louisiana. It was prepared in accordance with Engineering Regulation (ER) 1105-2-100, Planning Guidance Notebook, ER 1105-2-101, Planning Guidance, Risk Analysis for Flood Damage Reduction Studies, and Engineering Circular (EC) 1105-2-409.

Given the area's low elevation, flat terrain, and proximity to the Gulf of Mexico, the people, economy, unique environment and cultural heritage of Southwest Louisiana are at risk of storm surge flooding and wave impacts from tropical storms. Land subsidence, combined with rising sea level, is expected to increase the potential for coastal flooding, shoreline erosion, saltwater intrusion, and loss of wetland and Chenier habitats in the future.

Because of that risk, alternatives to provide hurricane storm surge risk reduction have been evaluated for Southwest Louisiana. Opportunities to incorporate non-structural solutions to reduce vulnerability, damages, and economic losses have been studied through the Southwest Coastal Louisiana Feasibility Study conducted by the U.S. Army Corps of Engineers (USACE) New Orleans District (MVN) and Regional Planning and Environmental District South (RPEDS).

1.1 Purpose

The purpose of this appendix is to describe the Other Social Effects (OSE) account of the SWC Project. The OSE account considers the potential social ramifications of Corps actions so that decision makers and stakeholders are able to evaluate the social implications of each alternative and choose an alternative that will be judged as complete, effective, and fair.

1.1.1 Study Area

The area covers over 4,700 square miles in Louisiana's Chenier Plain. It lies in the southwest corner of the state in Calcasieu, Cameron, and Vermilion parishes. The Gulf Intracoastal Waterway (GIWW) dissects the area horizontally, mostly coterminous with the existing coastal zone boundary.

The Gulf of Mexico coastline is another major water resource of the area. The major highways are LA Highway 82 and LA Highway 27. Population centers include many small towns, the largest of which are Lake Charles, Sulphur, Grand Lake, and Abbeville.

Communities located within the study area include the city of Lake Charles, the towns of Sulphur, Vinton, Iowa, and Bell City in Calcasieu Parish, the towns of Cameron, Creole, Grand Chenier, and Grand Lake in Cameron Parish, the city of Abbeville, and the towns of Erath, Delcambre, Kaplan, and Pecan Island in Vermilion Parish. All three parishes have historically suffered extensive hurricane and tropical storm surge damage. The impact of preparing for, mitigating, and recovering from these damages has placed a significant physical and emotional burden on individuals and has been devastating for communities. The goals of the proposed project are to provide storm damage risk reduction to residents within the study area from the damaging effects of storm surges while also protecting and preserving the fragile and rapidly deteriorating coastal wetlands.

1.1.2 Overview of Other Social Effects

The USACE views "social well-being factors as constituents of life that influence personal and group definitions of satisfaction, well-being, and happiness. The distribution of resources; the character and richness of personal and community associations; the social vulnerability and resilience of individuals, groups, and communities; and the ability to participate in systems of governance are all elements that help define well-being and influence to what degree water resources solutions will be judged as complete, effective, acceptable, and fair." (USACE 2009). It is the OSE account that considers these elements and assures that they are properly weighted, balanced, and considered during the planning process under the USACE's Four Accounts Planning Framework.

This appendix follows the guidance set forth by the USACE Institute for Water Resources (IWR) in *Applying Other Social Effects In Alternatives Analysis* (USACE, 2013). The handbook describes the procedures for analyzing and using OSE criteria in the planning process by identifying seven social factors that describe the social fabric of a community. The social factors are based on conventional psychological Human Needs Theory and Abraham Maslow's Hierarchy of Needs. Table 1 lists and describes the social factors. These social factors are covered in the Socioeconomic and Other Social Effects sections of the main report.

Table 1: Social Factors

Social Factor	Description
Health and Safety	Refers to perceptions of personal and group safety and freedom from risks
Economic Vitality	Refers to the personal and group definitions of quality of life, which is influenced by the local economy's ability to provide a good standard of living
Social Connectedness	Refers to a community's social networks within which individuals interact; these networks provide significant meaning and structure to life
Identity	Refers to a community member's sense of self as a member of a group, in that they have a sense of definition and grounding
Social Vulnerability and Resiliency	Refers to the probability of a community being damaged or negatively affected by hazards, and its ability to recover from a traumatic event
Participation	Refers to the ability of community members to interact with others to influence social outcomes
Leisure and Recreation	Refers to the amount of personal leisure time available and whether community members are able to spend it in preferred recreational pursuits

Source: Applying Other Social Effects In Alternatives Analysis (USACE, 2013)

1.1.3 Organization of Appendix

The OSE appendix is organized as follows:

- Section 1 provides an introduction to OSE.
- Section 2 provides a description of the existing socioeconomic characteristics, and the existing and future without-project social factors of the study area.
- Section 3 provides an OSE analysis of the project alternatives.

2. OTHER SOCIAL EFFECTS STUDY AREA CHARACTERISTICS

This section provides a description of the existing and future without-project socioeconomic characteristics and other social factors of the study area.

2.1 Socioeconomic Characteristics of the Study Area

In this section, socioeconomic data for Calcasieu, Cameron, and Vermilion Parishes are presented in order to provide a context from which to evaluate the potential social impacts of the proposed project. A more detailed explanation of socioeconomic characteristics is available in the main report socioeconomic section.

2.1.1 Population and Households

Population increases in the three parish area between 2000 and 2010 are likely the result of population influx under normal growth conditions. The three parish total population in 2012 was 259,918 residents, although there has been a decline of population in Cameron Parish since 2000. Most of the population is located in the metropolitan areas. Major communities include: Lake Charles, the largest urban area in the study, in Calcasieu Parish; Cameron (which serves as the parish seat) in Cameron Parish; and Abbeville in Vermilion Parish.

2.1.2 Employment Opportunities

Leading employment sectors include education, healthcare, petroleum and petrochemical and service industries. Industries providing employment include education, health and social services (20%), manufacturing (15%), arts, entertainment, accommodations and food services (12%), and retail trade (12%).

2.1.3 Social Profile of Communities

This section provides a baseline profile of existing and future without project conditions for the social communities in the study area. Data for the social profile were obtained from a variety of sources including 2010 U.S. Census records, the 2007-2011 U.S. Census Bureau's American Community Survey (ACS) estimates, ESRI data, public meetings, interviews with local representatives, and aerial photography. The baseline characteristics are considered the existing and future-without project conditions.

2.1.4 Health and Safety (Stress, Loss-of-Life, Health Care and Emergency Facilities)

Severe storm surge events threaten the health and safety of residents living within the study area. Loss of life, injury, and post flood health hazards may occur in the event of catastrophic flooding. For example, the study area was severely impacted by Hurricane Rita in 2006 and Hurricane Ike in 2008. The Louisiana Recovery Authority estimated that 120 fatalities occurred associated with Hurricane Rita (one in Louisiana) and $8 billion in damages in Louisiana alone. Hurricane Ike was more costly in terms of lives lost and damages incurred, claiming 195 deaths in four countries and ranking as the third costliest storm in US history according to the National Hurricane Center. When facilities that provide critical care or emergency services are impacted by storm surge events, residents are at an even greater risk for experiencing negative health outcomes. Hurricanes Rita and Ike reduced the accessibility and availability of health facilities and services and required additional first-responder (fire and police) protection. During Rita and Ike, police stations were destroyed by storm surge and/or required to relocate because of flood risk. In addition to the damages of Rita and Ike to hospitals, police stations, and fire stations, many employees providing related services lost their homes reducing the staff needed to operate health and safety services.

The number of medical facilities, police stations, and fire stations located within the study area were obtained using 2010 ESRI data (latest year available).

Medical Care Facilities: There are 8 medical care facilities within Calcasieu Parish, 4 medical care facilities in Cameron Parish, and 6 medical care facilities in Vermilion Parish.

Police Stations: Calcasieu Parish has 8 police stations/sheriff's offices located within the study area, Cameron Parish has 5 police stations/sheriff's offices, and Vermilion Parish has 6 police stations/sheriff's offices, according to ESRI data.

Fire Stations: There are 29 fire stations (parish and volunteer) located within the study area—9 in Calcasieu Parish, 8 in Cameron Parish, and 12 in Vermilion Parish.

2.1.5 Economic Vitality

Growth in employment, business and industrial activity is expected to follow economic trends in the local, regional, and national economies. An additional 11,940 jobs are projected by the year 2038. However, without flood risk management alternatives, the stability of employment, business and industrial activity could be adversely affected.

2.1.6 Social Connectedness

The degree to which communities are able to instill a shared sense of belonging and purpose among residents is in large part determined by the communities' civic infrastructure. The presence of social institutions such as libraries, places of worship, and schools provide residents an opportunity for civic participation and engagement which allows residents to come together and work toward a common goal. The number of libraries and schools located within the study area were obtained using 2010 ESRI data (latest year available).

Civic Infrastructure: According to ESRI data, Calcasieu Parish has 7 libraries and 34 schools. There are 2 libraries and 2 schools located within the study area in Cameron Parish. ESRI data also show that there are 9 libraries and 9 schools located within the study area in Vermilion Parish.

2.1.7 Social Vulnerability/Resiliency

The devastation left behind after Hurricanes Rita and Ike brought attention to the salience of the related concepts of social vulnerability and resiliency when evaluating water resources projects (USACE 2008). Social vulnerability is a characteristic of groups or communities that limits or prevents their ability to withstand adverse impacts from hazards to which they are exposed.

Resiliency, in turn, refers to the ability of groups or communities to cope with and recover from adverse events. The factors that contribute to vulnerability often reduce the ability of groups or communities to recover from a disaster; therefore, more socially vulnerable groups or communities are typically less resilient.

Several factors have been shown to contribute to an area's vulnerability/resiliency, including poverty, racial/ethnic composition, educational attainment, and proportion of the population over the age of 65.

Poverty Rate: High poverty rates negatively impact the social welfare of residents and undermine the community's ability to assist residents in times of need. The 2007-2011 U.S. Census data indicate that 17 percent of the population of Calcasieu, 9 percent of the population in Cameron Parish, and 18 percent of the population in Vermilion Parish fell below the poverty line.

Racial / Ethnic Composition: Race/ethnicity continues to play an important role in the everyday lives of Americans. Unequal access to social resources and language barriers may affect preparing for and recovering from storm surge events for certain groups. In all parishes, according to the 2010 U.S. Census, the majority of the population is white (71% in Calcasieu Parish, 96% in Cameron Parish, and 80% in Vermilion Parish), followed by black (29% in Calcasieu Parish, 4% in Cameron Parish, and 20% in Vermilion Parish).

Social Vulnerability Index: The Hazards and Vulnerability Research Institute at the University of South Carolina created an index that compares the social vulnerability of U.S. counties/parishes to environmental hazards. The variables included in the index are based on previous research which has found that certain characteristics (e.g., poverty, racial/ethnic composition, educational attainment, and proportion over the age of 65) contribute to a community's vulnerability when exposed to hazards. According to the IWR OSE handbook (USACE, 2008), the Social Vulnerability Index (SoVI®)[1] is a valuable tool that can be used to identify areas that are socially vulnerable and whose residents may be less able to withstand adverse impacts from hazards.

The SoVI® was computed as a comparative measure of social vulnerability for all counties/parishes in the U.S., with higher scores indicating more social vulnerability than lower scores. Calcasieu Parish has a SoVI® 2006-10 score[2] of -1.21 (0.28 national percentile), Cameron Parish has a SoVI® 2006-10 score of -3.59 (.08 national percentile), and Vermilion Parish has a SoVI® 2006-10 score of -0.04 (0.49 national percentile). Calcasieu Parish is more socially vulnerable than roughly 72 percent of counties/parishes in the U.S., Cameron Parish is more socially vulnerable than about 92 percent of counties/parishes in the U.S., and Vermilion Parish is more socially vulnerable than roughly 51 percent of counties/parishes in the U.S. In comparison, Orleans Parish—notorious for its enduring levels of high poverty—has a SoVI® 2005-09 score of -0.92 with making it more socially vulnerable than 33 percent of counties/parishes in the nation ranked more socially vulnerable.

Stated another way, Cameron Parish is the most socially vulnerable to coastal storm damage consequences, Calcasieu Parish is the next most socially vulnerable, and Vermilion Parish is the least socially vulnerable and all three Parishes are more socially vulnerable to coastal storm damage consequences than Orleans Parish.

The study area's social vulnerability, however, is expected to increase over time if subsidence and sea level rise continue to occur, and the population in the study area increases as it is projected to do. The absolute number of socially vulnerable people (e.g., low-income, minority, less-educated, and over the age of 65) at risk for storm

[1] More information on the methodology and data used to calculate the SoVI® can be found here: http://webra.cas.sc.edu/hvri/products/sovi.aspx

[2] Data can be found here: http://webra.cas.sc.edu/hvri/products/sovi2010_data.aspx

surge events will increase. This, in turn, may lead to an increased burden placed on local, state, and federal agencies to ensure that these socially vulnerable populations have access to resources before, during, and after these events.

2.1.8 Leisure and Recreation

Having personal leisure time available and having access to recreational areas contributes to residents' quality of life and is therefore an important aspect of well-being. The number of recreational areas within the study area was obtained using 2011 ESRI data (latest year available).

The three parish study area is home to a State Wildlife Refuge, the 71,544-acre White Lake Wetlands Conservation Area, the 76,000-acre Rockefeller Wildlife Refuge (WR), the Lacassine National Wildlife Refuge (NWR), Cameron Prairie NWR, and the 124,511-acre Sabine NWR. State Parks in the study area include Palmetto Island and Sam Houston Jones parks.

Recreational fishing and hunting are very important to the area. In addition to the high quality recreational fishing and hunting in the wildlife refuges and parks in the study area, several lakes and inland marshes offer opportunities for hunting and catching both freshwater and saltwater species. Grand, White, and Calcasieu Lakes and Vermillion Bay are prime fishing spots. The high quality of the recreational fishery, especially an abundance of red fish and trout, has made this an important leisure time activity for residents. Inland saltwater fish species, crabs, and shrimp are also available in the more brackish water. Game species hunted in the area include waterfowl, deer, rabbit, squirrels, rail, gallinule, and snipe.

3. OTHER SOCIAL EFFECTS EVALUATION OF ALTERNATIVES

3.1 Social Implications of the Alternatives

This section provides an OSE analysis of the project alternatives. The evaluation is based on the differential impact that each alternative is expected to have on the socioeconomic characteristics and other social factors of the study area presented in the previous section.

The study area's social vulnerability is expected to increase over time if subsidence and sea level rise continue to occur, and the population in the study area increases as it is projected to do. The absolute number of socially vulnerable people (e.g., low-income, minority, less-educated, and over the age of 65) at risk for storm surge events will increase. This, in turn, may lead to an increased burden placed on local, state, and federal agencies to ensure that the most socially vulnerable populations have access to resources before, during, and after flood events.

Table 2: Other Social Effects (OSE) Account

Social Factor	No Action	Nonstructural	NER
Health and Safety	High level of flood risk in entire region with associated stress and anxiety, risk to regional health care system, and impacts to emergency access during floods. High potential for loss of life during storm events.	Project would reduce risk of hurricane storm surge damage to regional healthcare system and stress in Southwest Louisiana.	Project would contribute to a lower stress level due to improved habitat.
Economic Vitality	Current regional economy is moderate. If a catastrophic flood occurs, economic impacts will be extensive and long-lasting.	Project would benefit the regional economy.	The regional economy will benefit from improved habitat and increased storm surge resiliency.
Social Connectedness	High levels of instrumental social support will continue throughout the region. Population of coastal communities will continue to decline after storm events	Residents would experience social disruption during storm events or flooding, however social	Residents would benefit socially and economically from improved habitat.

	following historic trends, and social connectedness would be reduced.	connectedness would likely improve population retention.	
Social Vulnerability and Resiliency	Region is highly vulnerable to Storm damage, but residents would likely band together during recovery. Resilience of rural communities may be lower due to lack of temporary housing options. Low -income residents are more vulnerable to short-term impacts of flood fighting.	Project would significantly reduce the area's vulnerability to hurricane storm surge damage for those choosing to participate in the Project. . The ability of lower income groups to participate in the Project could be impacted by out of pocket expenses associated with ineligible Project costs including costs associated with temporary relocation during structure elevation, and any additional costs that would be required in order to meet the Project eligibility criteria, (i.e., costs associated with any necessary structural repair or asbestos abatement). (See Appendix L of the Final Report for Project eligibility criteria and a description of eligible and ineligible Project costs.) This could potentially offset, to some degree, the reduction in overall social vulnerability brought about by the Project at least as it relates to lower income communities	Project would increase the area's resiliency to storm surge events.
Leisure and Recreation	Residents of the region are active. Recreational opportunities would continue to be provided in the communities as currently planned	Project measures would help protect existing recreational opportunities.	Project measures would increase long-term recreational opportunities.

4. SUMMARY OF ALTERNATIVE ANALYSIS

4.1 No Action Alternative

Under the No Action Alternative, hurricane storm surge risk reduction and ecosystem restoration would not be implemented. However, the direct, indirect, and cumulative impacts of other existing, authorized, and reasonably foreseeable future action would continue. These would include hurricane storm damage risk reduction (HSDRR) projects and ecosystem restoration projects expected to be completed near and around the project areas. (See Section 1.9 of the Final Report.) The OSE associated with these have been documented in reports referenced in Section 1.9 and would generally include reduce the risk to health and safety factors, provide or benefit local and regional economies, provide for or enhance social connectedness, and protect existing recreational opportunities. Additional OSE information is available in documents referenced in Section 1.9. Information on the Recommended Plan for NED and NER is presented below.

4.2 NED Alternative — Nonstructural 0-25 Year Floodplain Plan (RP)

Direct, Indirect, and Cumulative Impacts: Under this alternative, the study area would experience storm surge risk reduction via nonstructural measures. This alternative would reduce the risks associated with damages to housing units, public facilities, and commercial structures during storm events as well as improve the health and safety of residents living within the study area. The area's social vulnerability would be reduced under this alternative with the possible exception of populations unwilling to participate or unable to participate in the Project due to ineligible Project costs. Reduced social vulnerability leads to the potential for enhanced long-term growth and sustainability. Also, the area would be at a reduced risk of incurring the costs associated with clean-up, debris removal, and building and infrastructure repair as a result of storm surge events.

Plan 8 Alternative – Nonstructural 100-Year Floodplain
The impacts from this alternative are similar to the impacts identified in connection with the Modified Plan 8 Nonstructural 0-25-Year Floodplain Plan (NED RP) alternative but greater in scale because of the larger numbers of structures that would be included in the Project under this alternative as compared to the NED RP, as described above

4.2.1 NER Alternative CM-4 — Comprehensive Small Integrated Restoration (RP)

Direct, Indirect, and Cumulative Impacts: This alternative would reduce the risks associated with habitat damage via saltwater intrusion, shoreline retreat, and loss of geomorphologic infrastructure. The area's social vulnerability would be reduced under this alternative via improved leisure and recreation opportunities, economic vitality, and reduced stress. Thus, the potential for long-term growth and sustainability would be enhanced.

4.2.2 NER Alternative M4 — Mermentau Small Integrated Restoration

Direct, Indirect, and Cumulative Impacts: The direct, indirect, and cumulative impacts would be similar to those described for the CM4 alternative but to a lesser extent due to the smaller size /fewer number of ecosystem restoration features in the MR as compared to the RP.

5. REFERENCES

Hazards and Vulnerability Research Institute. SoVI® 2006-10 Index.
http://webra.cas.sc.edu/hvri/products/sovi2010_data.aspx Accessed on 03 Oct 2013.

U.S. Army Corps of Engineers. 2013. Applying Other Social Effects in Alternatives Analysis.

U.S. Army Corps of Engineers. 2008. Handbook on Applying "other Social Effects" Factors in Corps of Engineers Water Resources Planning.

U.S. Bureau of the Census, 2010. U.S. Census of Population and Housing, SF1 and SF3 data tables.
http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml. Accessed 16 Sept 2013.

U.S. Bureau of the Census, 2007-2011 American Community Survey.
http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml. Accessed 16 Sept 2013.

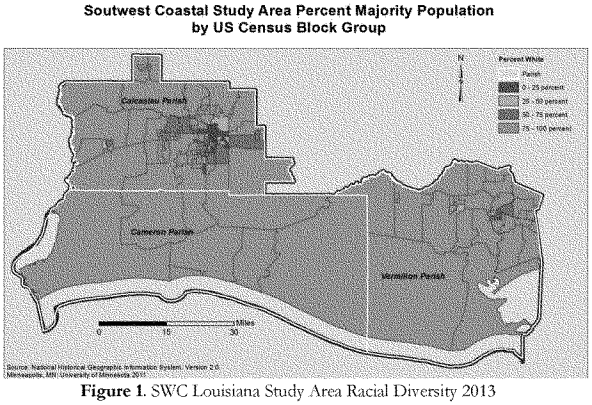


Figure 1. SWC Louisiana Study Area Racial Diversity 2013

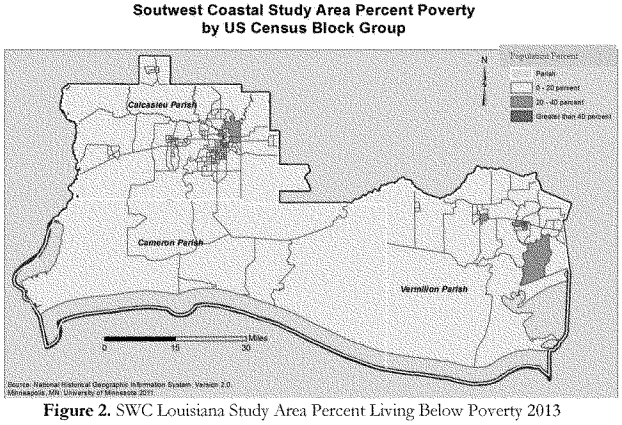


Figure 2. SWC Louisiana Study Area Percent Living Below Poverty 2013

SOUTHWEST COASTAL LOUISIANA
REVISED INTEGRATED DRAFT FEASIBILITY REPORT
AND
ENVIRONMENTAL IMPACT STATEMENT

APPENDIX A

Annex Q

Best Management Practices and Avoidance Procedures

MIGRATORY BIRD TREATY ACT and
BALD AND GOLDEN EAGLE PROTECTION ACT
BEST MANAGEMENT PRACTICES

Colonial nesting wading birds (including but not limited to, herons, egrets, and Ibis), seabirds/water-birds (including, but not limited to terns, gulls, Black Skimmers, and Brown Pelicans) and bald eagles are known to roost, forage, and nest in the project area. The birds and their nests are protected by the Migratory Bird Treaty Act (MBTA) and must not be disturbed or destroyed. As such, in areas near known rookeries, nesting prevention measures may be necessary in order to insure the success of the nesting season. These measures would be developed by the U.S. Army Corps of Engineers New Orleans District (CEMVN) in coordination with the U.S. Fish and Wildlife Service (USFWS) and Louisiana Department of Wildlife and Fisheries (LDWF) and would be implemented by a trained biologist. The nesting activity period extends from 15 February through 1 September for colonial nesting wading and seabirds/water birds, and September to May for bald eagles. Therefore, the nesting prevention measures should begin well before February.

CEMVN and USFWS biologists will conduct surveys prior to construction to determine the presence and/or location of any eagle's nests, colonial nesting wading/water birds and/or rookeries and if nesting prevention measures would be necessary. Nest prevention measures shall be intended to deter birds from nesting within applicable the designated buffer zone of construction areas without physically harming birds or disturbing any existing nests. Nest prevention measures may be used in combination and/or adjusted to be most effective. At minimum, nest prevention measures shall include, but not be limited to the following:

- Flagging/Streamers
- Vehicular/Pedestrian Traffic
- Clapping and Yelling
- Horn Blowing

Once work has commenced, the presence of nesting eagles, wading birds and/or seabirds/water-birds within the minimum distances from the work area, as specified in paragraph entitled "No Work Distances", shall be immediately reported to the Environmental Technical Manager, Ms. Tammy Gilmore, of the U.S. Army Corps of Engineers at (504) 862-1002 email address tammy.h.gilmore@usace.army.mil

No Work Distances

No-work distance restrictions are as follows:
- o Terns, Gulls, and Black Skimmers -1,300 feet;
- o Colonial nesting wading birds -1,000 feet;
- o Brown Pelicans -2,000 feet; and,
- o Bald Eagles -660 feet.

Coordination by CEMVN personnel with the USFWS may result in a reduction or relaxing of these no-work distances depending on the species of birds found nesting at the work site and specific site conditions.

MANATEE PROTECTION MEASURES COORDINATED WITH USFWS:

All contract personnel associated with the project would be informed of the potential presence of manatees and the need to avoid collisions with manatees. All construction personnel would be responsible for observing water-related activities for the presence of manatees. Temporary signs would be posted prior to and during all construction/dredging activities to remind personnel to be observant for manatees during active construction/dredging operations or within vessel movement zones (i.e., the work area), and at least one sign would be placed where it is visible to the vessel operator. Siltation barriers, if used, would be made of material in which manatees could not become entangled and would be properly secured and monitored. If a manatee

is sighted within 100 yards of the active work zone, special operating conditions would be implemented, including: moving equipment would not operate within 50 ft of a manatee; all vessels would operate at no wake/idle speeds within 100 yards of the work area; and siltation barriers, if used, would be re-secured and monitored. Once the manatee has left the 100-yard buffer zone around the work area of its own accord, special operating conditions would no longer be necessary, but careful observations would be resumed. Any manatee sighting would be immediately reported to the USFWS (337/291-3100) and the LDWF, Natural Heritage Program (225/765-2821).

SEA TURTLE PROTECTION MEASURES

1. Hopper dredging is being conducted under the "Gulf of Mexico Regional Biological Opinion" (RBO) which can be viewed at the following link: http://el.erdc.usace.army.mil/seaturtles/refs-bo.cfm.

It should be noted that incidental takes of sea turtle and gulf sturgeon are authorized on a Fiscal Year (FY) (October 1 – September 30) basis to be metered out by the Division Commander, South Atlantic Division, U.S. Army Corps of Engineers for the southeastern United States for Federal, military, and permitted projects. If care is not taken, the take limits could be reached by any of these parties and hopper dredging would cease for the remainder of that FY. The Permittee understands and agrees that, even where it is in full compliance with the terms and conditions of the RBO, incidental take by the Permittee may require suspension of the permit by the Corps of Engineers. The amount of incidental take that will trigger suspension, and the need for any such suspensions, shall be determined at the time in the sole discretion of the Corps of Engineers. The Permittee understands and agrees on behalf of itself, its agents, contractors, and other representatives, that no claim, legal action in equity or for damages, adjustment, or other entitlement against the Corps of Engineers shall arise as a result of such suspension or related action.

2. Prior to the commencement of hopper dredging, and throughout the dredging operations, a Corps of Engineers-approved Inspector shall inspect specific sea turtle protection requirements. The list of inspections the Inspector will perform is identified on a sea turtle inspection checklist entitled "USACE Sea Turtle Inspection Checklist for Hopper Dredges" that can be found at the following link: http://el.erdc.usace.army.mil/seaturtles/index.cfm. All identified deficiencies shall be corrected prior to the commencement of hopper dredging activities. An inspection shall also be performed following each sea turtle incidental take. Results of inspections shall be provided to Mr. Edward Creef (Edward.D.Creef@usace.army.mil) as soon as they are completed.

3. No dredging shall be performed by a hopper dredge without the inclusion of a rigid sea turtle deflector device. The Permittee shall electronically submit drawings showing the proposed device and its attachment to Mr. Edward Creef at Edward.D.Creef@usace.army.mil. Mr. Creef can be contacted by phone at (504) 862-2521. These drawings shall include the approach angle for any and all depths to be dredged during the dredging. A copy of the approved drawings and calculations shall be available on the vessel during the dredging. No dredging work shall be allowed to commence until approval of the turtle deflector device has been granted by the New Orleans District U.S. Army Corps of Engineers. Sample turtle deflector design details may be viewed at the web site indicated in condition number 1.

The leading v-shaped portion of the deflector shall have an included angle of less than 90 degrees. Internal reinforcement shall be installed in the deflector to prevent structural failure of the device. The leading edge of the deflector shall be designed to have a plowing effect of at least 6" depth when the draghead is being operated. Appropriate instrumentation or indicator shall be used and kept in proper calibration to ensure the critical "approach angle" (Information only note: The design "approach angle" or the angle of lower draghead pipe relative to the average sediment plane is very important to the proper operation of the deflector. If the lower draghead pipe angle in actual dredging conditions varies tremendously from the design angle of approach used in the development of the deflector, the 6" plowing effect does not occur. Therefore, every effort should be made to insure this design "approach angle" is maintained with the lower drag pipe.).

If adjustable depth deflectors are installed, they shall be rigidly attached to the draghead using either a hinged aft attachment point or an aft trunnion attachment point in association with an adjustable pin front attachment point or cable front attachment point with a stop set to obtain the 6" plowing effect. This arrangement allows fine-tuning the 6" plowing effect for varying depths. After the deflector is properly adjusted there shall be NO openings between the deflector and draghead that are more than 4" X 4".

4. The Permittee shall install baskets or screening over the hopper inflow(s) with no greater than 4" X 4" openings. The method selected shall depend on the construction of the dredge used and shall be approved by the Corps of Engineers-approved Inspector prior to commencement of dredging. The screening shall provide 100% screening of the hopper inflow(s). The screens and/or baskets shall remain in place throughout the performance of the work. The turtle deflector device and inflow screens shall be maintained in operational condition for the entire dredging operation.

5. When initiating dredging, suction through the dragheads shall be allowed just long enough to prime the pumps, and then the dragheads must be placed firmly on the bottom. When lifting the dragheads from the bottom, suction through the dragheads shall be allowed just long enough to clear the lines, and then must cease. Pumping water through the dragheads shall cease while maneuvering or during travel to / from the disposal area (Information Only Note: optimal suction pipe densities and velocities occur when the deflector is operated properly. If the required dredging section includes compacted fine sands or stiff clays, a properly configured arrangement of teeth may enhance dredge efficiency, which reduces total dredging hours, and potential for "turtle takes". The operation of a draghead with teeth must be monitored for each dredged section to insure that excessive material is not forced into the suction line. When excess high-density material enters the suction line, suction velocities drop to extremely low levels causing conditions for plugging of the suction pipe. Dredge operators should configure and operate their equipment to eliminate all low-level suction velocities. Pipe plugging in the past was easily corrected, when low suction velocities occurred, by raising the draghead off the bottom until the suction velocities increased to an appropriate level. Pipe plugging cannot be corrected by raising the draghead off the bottom. Arrangements of teeth and / or the reconfiguration of teeth should be made during the dredging process to optimize suction velocities.

6. Raising the draghead off the bottom to increase suction velocities is not acceptable. The primary adjustment for providing additional mixing water to the suction line should be through water ports. To insure suction velocities do not drop below appropriate levels, production meters shall be monitored throughout the job and adjustments primarily made to the number and opening sizes of water ports. Water port openings on top of the draghead or on raised standpipes above the draghead shall be screened before they are utilized on the dredging project. If a dredge section includes sandy shoals on one end of a tract line and mud sediments on the other end of the tract line, the equipment shall be adjusted to eliminate draghead pick-ups to clear the suction line.

7. During turning operations, the pumps must either be shut off or reduced in speed to the point where no suction velocity or vacuum exists. These operational procedures are intended to stress the importance of balancing the suction pipe densities and velocities in order to keep from taking sea turtles.

8. All hopper dredges shall be equipped with the National Dredging Quality Management Program (DQM) system, formerly known as Silent Inspector, for hopper dredge monitoring. The DQM system must have been certified by the Engineer Research and Development Center (ERDC) within the last year. Questions regarding certification should be addressed to the DQM support team at 877-840-8024. The DQM is an automated dredge monitoring system comprised of both hardware and software developed by the U.S. Army Corps of Engineers (Corps). The Corps developed the DQM as a low cost, repeatable, impartial system for automated dredge monitoring. The DQM consists of three major components: The Dredge Specific System (DSS), the Ship Server, and the Shore Server. The DSS collects and displays various dredge sensor data for the dredge crew to monitor dredge progress and quality control. The other major task of the DSS is to send data to the Ship Server. Most dredging contractors already have a computer system and sensors onboard for control or positioning that can be used as the DSS. The dredging contractor supplies and owns the DSS and all associated

sensors. The Ship Server acts as the dredged-based data archive and report creation center by storing the data from the DSS and performing automated review of the data. The Ship Server can produce many different reports including dredge location history, volume history, and an operational status. Additional information about DQM can be found at: http://dqm.usace.army.mil/. The data collected by the DQM system shall, upon request, be made available to the Operations Division Technical Support Branch of the New Orleans District U.S. Army Corps of Engineers.

All hopper dredge(s) shall be equipped with recording devices for each draghead that capture real time draghead elevation, slurry density, and at least two of the following: Pump(s) slurry velocity measured at the output side, pump(s) vacuum, and / or pump(s) RPM. The Permittee shall record continuous real time positioning of the dredge, by plot or electronic means, during the entire dredging cycle including dredging area and disposal area. Dredge location accuracy shall meet the requirements of the latest version of EM 1110-1-1003. A copy of the EM can be downloaded from the following website: http://www.hnd.usace.army.mil/techinfo/engpubs.htm.The recording system shall be capable of capturing data at variable intervals but with a frequency of not less than every 60 seconds. All data shall be time correlated to a 24-hour clock and the recording system shall include a method of daily evaluation of the data collected. This data shall be made available at the request of the New Orleans District U.S. Army Corps of Engineers.

The practice of dropping an empty dredge bucket can be taken as a precaution during construction to avoid impacts to sea turtles. A bucket (or similar equipment) will be dropped into the water and retrieved empty one time. After the bucket has been dropped and retrieved, a one-minute no work period must be observed. During this no work period, personnel would carefully observe the work area in an effort to visually detect listed species. If listed species are sighted, no bucket dredging would be initiated until the listed species have left the work area. If the water turbidity makes such visual sighting impossible, work would proceed after the one-minute no work period has elapsed. If more than fifteen minutes elapses with no work, then the empty bucket drop/retrieval process would be performed again prior to work commencing.

9. **Dredging operations shall cease immediately upon the first incidental take, and thereafter as directed by the Corps, until the District Engineer, or his designee, notifies the Permittee to resume dredging.** The Permittee shall immediately notify Mr. Edward Creef by phone (504-862-2521) and e-mail (Edward.D.Creef@usace.army.mil) that an incidental take has occurred. The Sea Turtle Mortality Report, available on the web site indicated in condition number 1, will be filled out by the National Marine Fisheries (NMFS)-Approved Protected Species Observer immediately (within 6 hours) and sent to Edward Creef electronically at the e-mail address listed above.

10. During dredging operations, NMFS-Approved Protected Species Observers shall be aboard to monitor for the presence of sea turtles, sturgeon, and whales. Observer coverage shall be 100% (24 hr/day) and shall be conducted year round. During transit to and from the disposal area, the Observer shall monitor from the bridge during daylight hours for the presence of endangered species. During dredging operations, while dragheads are submerged, the Observer shall continuously monitor the inflow and / or outflow screening for turtles and / or turtle parts. Upon completion of each load cycle, dragheads should be monitored as the draghead is lifted from the sea surface and is placed on the saddle in order to assure that sea turtles that may be impinged within the draghead are not lost and unaccounted for. Observers shall physically inspect dragheads and inflow and overflow screening / boxes for threatened and endangered species takes.

11. Monitoring Reports: The results of the monitoring shall be recorded on the appropriate observation sheets. There is a sheet for each load, a daily summary sheet, and a weekly summary sheet. In addition, there will be a post dredging summary sheet. Observation sheets will be completed regardless of whether any takes of sturgeon, whales, or sea turtles occur. In the event of any sea turtle or sturgeon takes by the dredge, appropriate incident reporting forms shall be completed. Additionally, all specimens shall be photographed with a digital camera. These photographs shall be attached to the respective reports for documentation. Dredging of subsequent loads shall not commence until all appropriate reports are completed from the previous dredging load to ensure completeness and thoroughness of documentation associated with the incidental take. Reports

shall be submitted to the Corps within 24-hours of the take. Copies of the form shall be legible. Observer forms may be accessed on the web site indicated in condition number 1.

a. NMFS-Approved Protected Species Observers: A list of protected species observer-biologists that have been NMFS-approved to monitor threatened / endangered species takes by hopper dredges can be obtained by contacting NOAA Fisheries Northeast Region, Protected Resources Division. The main contact is Ms, Julie Crocker; she can be reached at Julie.Crocker@noaa.gov or 978-281-9300 ext. 6530. A current list of NMFS-Approved Protected Species Observer companies is provided at the end of this document.

b. The Contractor shall provide a digital camera, with an image resolution capability of at least 300 dpi, in order to photographically report incidental takes, without regard to species, during dredging operations. Immediately following the incidental take of any threatened or endangered species, images shall be provided via e-mail, CD, or DVD to Mr. Edward Creef electronically at Edward.D.Creef@usace.army.mil in a .JPG or .TIF format and shall accompany incidental take forms. The nature of findings shall be fully described in the incidental take forms including references to photographs.

12. Manatee, Sea Turtle, and Whale Sighting Reports.

Any take concerning a manatee, sea turtle, sturgeon, or whale; or sightings of any injured or incapacitated manatees, sea turtles, or whales shall be reported immediately to the Corps Regulatory Section Chief, Martin Mayer electronically at martin.s.mayer@usace.army.mil, and to Mr. Edward Creef electronically at Edward.D.Creef@usace.army.mil.

13. Disposition of Sea Turtles or Turtle Parts

a. Turtle taken by hopper dredge

(1) Dead turtles – upon removal of sea turtle and / or parts from the draghead or screening, Observers shall take photographs as to sufficiently document major characteristics of the turtle or turtle parts including but not limited to dorsal, ventral, anterior, and posterior views. For all photographs taken, a backdrop shall be prepared to document the dredge name, observer company name, contract title, time, date, species, load number, location of dredging, and specific location taken (draghead, screening, etc.). Carcass / turtle parts shall also be scanned for flipper and Passive Integrated Transponder (PIT) tags. Any identified tags shall be recorded on the "Sea Turtle Incidental Take Form" that is included in the "Endangered Species Observer Program Forms" located on the web site indicated in condition number 1. Turtle parts which cannot be positively identified to species on board the dredge or barge(s) shall be preserved by the observer(s) for later identification. A tissue sample shall be collected from any lethally taken sea turtle and submitted under the process stated in the "Protocol for Collecting Tissue Samples from Turtles for Genetic Analysis" on the web site indicated in condition number 1. After all data collection is complete, the sea turtle / parts should be marked (spray paint works well), weighted down and disposed of in direction of the contracting officer.

(2) Live Turtles - Observer(s) shall measure, weigh, scan for PIT tags, tag (Inconel flipper and PIT tags - if PIT tag is not located during scan and only if observer is qualified to tag using PIT tags), and photograph any live turtle(s) incidentally taken by the dredge. Observer(s), or their authorized representative, shall coordinate with the contracting officer's representative and environmental branch staff to transport as soon as possible the live turtle(s) taken by the dredge to an approved rehabilitation facility such as the Aquarium of the Americas in New Orleans, Louisiana.

14. Relocation Trawling of Sea Turtles

Sea turtle relocation trawling efforts to aid in the prevention of sea turtle takes during dredging operations would be performed by the Permittee as deemed necessary. An initial sea turtle relocation trawling effort would be performed 2 to 3 days prior to the start of hopper dredging activities to determine if sea turtles are present at the dredging site. Based on the results of this trawling effort, the Permittee may be required to implement sea turtle relocation trawling either at the start of hopper dredging activities, or following the first sea turtle take by the hopper dredge. Captured sea turtles either would be relocated approximately 5 miles away from the dredging site, or, if injured, transported to the Aquarium of the Americas located in New Orleans, Louisiana. A NMFS-Approved Protected Species Observer shall supervise the relocation trawling efforts. If relocation trawling in Louisiana territorial waters occurs outside of the shrimping season, the approved sea turtle relocation trawling supervisor must possess a Scientific Collecting Permit from the Louisiana Department of Wildlife and Fisheries (point of contact is Ms. Karen Foote at 225-765-2384).

Trawling operations shall be performed in front of the working hopper dredge, with trawlers operating a safe distance from the hopper dredge. Trawling efforts shall be performed with and against the tidal flow at a speed not to exceed 3.5 knots using repetitive trawls in the dredging area with each trawling effort not to exceed 42 minutes duration.

Methods and equipment shall be standardized including data sheets, nets, trawling direction to tide, length of station, length of tow, and number of tows per station. Data on each tow shall be recorded using the Sea Turtle Trawling Report found at the website (http://el.erdc.usace.army.mil/seaturtles/docs/trawlingforms.pdf). The trawler shall be equipped with 60-foot nets constructed from 8-inch mesh (stretch) fitted with mud rollers and flats as specified in the Turtle Trawl Nets Specifications appended to the end of this Section. Paired net tows shall be made for 24 hours per day. The tows shall be performed in shifts, and the trawler shall be available for operation 24 hours a day. Positions at the beginning and end of each tow shall be determined from GPS Positioning equipment.

At least one crewmember who is a NMFS-Approved Protected Species Observer shall be on board the trawler during the trawl. The Observer shall be responsible for handling of captured sea turtles. Each captured turtle shall be identified, scanned for PIT tags, measured, tagged, tissue sampled and released, and data recorded on the Sea Turtle Tagging and Relocation Report, which can be found at the following website: (http://el.erdc.usace.army.mil/seaturtles/docs/taggingforms.pdf). Presence of PIT tags shall be scanned for by using a multi-frequency scanner capable of reading multiple frequencies (including 125-, 128-, 134-, and 400-kHz tags) and reading tags deeply embedded in muscle tissue. Turtle measurements shall be recorded and shall include, at a minimum, weight, straight-line length, straight-line width, and tail length. Turtles shall be tagged with NMFS #681 Inconel tags in each of the front flippers according to NMFS protocol. Aseptic conditions shall be maintained for tags and tag attachment. The Contractor shall be responsible for obtaining any and all permits related to trawling from the appropriate state and Federal agencies. All aspects of the trawling shall be coordinated with Mr. Edward Creef (504-862-2521).

Anyone handling sea turtles infected with fibropapilloma tumors shall either: 1) clean all equipment that comes in contact with the turtle with mild bleach solution between the processing of each turtle, or 2) maintain a separate set of sampling equipment for handling turtles displaying fibropapilloma tumors or lesions.

Water temperature measurements shall be taken at the water surface each day using a laboratory thermometer. Weather conditions shall be recorded from visual observations and instruments on the trawler. Weather conditions, air temperature, wind velocity and direction, sea state-wave height, and precipitation shall be recorded on the Sea Turtle Trawling Report. High and low tides shall be recorded.

a. Repair and Replacement of Damaged Trawl Nets
The Contractor, at the time of mobilization, shall provide trawl nets that meet the requirements specified in the Turtle Trawl Net Specifications at the end of this section. Tools, supplies and materials for repairing nets shall be kept aboard the trawler. In the event of damage to trawl nets, one hour will be allowed to either repair or replace them. The Contractor shall have at least one set of

replacement nets immediately available at all times, to insure that the dredging work is not adversely delayed due to trawler down-time for replacing damaged nets. It is recommended that a second set of replacement nets be available aboard the trawler.

b. Suspension of Dredging and Relocation Trawling
Should there be a tearing of nets, or breakdown of other equipment that would cause the trawler to leave the area where dredging is underway during any period of time where relocation trawling is required, the dredge may continue to operate for up to 48 hours, as long as no turtles are taken. Should there be dangerously high seas that would cause the trawler to leave the dredging area when relocation trawling is required the dredge may continue to operate, as long as no turtles are taken.

c. Turtle Excluder Devices
Approval for trawling for sea turtles without Turtle Excluder Devices (TEDs) must be obtained from NMFS (contact Eric Hawk at 727-551-5773). Any necessary State or Federal clearances for the capture and relocation of sea turtles must also be obtained. Approvals must be submitted to Mr. Edward Creef electronically at Edward.D.Creef@usace.army.mil prior to trawling.

d. Reporting
Immediately after completing each day of relocation trawling, if possible, the Contractor shall notify Mr. Edward Creef by telephone (504-862-2521) or email (Edward.D.Creef@usace.army.mil) conveying the results of the trawl. The results of each trawl shall be recorded on the Sea Turtle Trawling Report. The Sea Turtle Trawling Report also shall be furnished by the Contractor to Mr. Edward Creef within 24 hours after completing the relocation trawl. Following completion of the project, a copy of the Contractor's log regarding sea turtles shall be forwarded to Mr. Edward Creef within 10 working days.

15. Report Submission.

The Contractor shall maintain a log detailing all incidents, including sightings, collisions with, injuries, or killing of manatees, sea turtles, sturgeon, or whales occurring during the contract period. The data shall be recorded on forms provided at the web site indicated in condition number 1. All data in the original form shall be forwarded directly within 10 days of collection to Mr. Edward Creef at the address provided below. Following project completion, a report summarizing the above incidents and sightings shall be submitted to:

USACE - New Orleans District
Operations Division - Technical Support Branch
Attn Edward Creef
P.O. Box 60267
New Orleans, Louisiana, 70160-0267

Partial List of NMFS-Approved Protected Species Observer Companies

Dr. L. M. Ehrhart Dept. of Biological Science University of Central Florida P.O. Box 25000 Orlando, FL 32816 407-823-2970 Fax: 407-283-5769 lehrhart@pegasus.cc.ucf.edu	A.I.S. Inc. (P.O.C. Arv Poshkus) 19 Camden Street P.O. Box 421 Stoughton, MA 02072-0421 800-230-8032 Fax: 781-297-7669 ARVIDAS1@juno.com	Mary Jo Barkaszi ECOES, Inc. 7341 Glenwood Road Cocoa, FL 32927 321-635-8477 Fax: 321-635-8449 maryjo@ecoes.com www.ecoes.com

Jane Provancha Dynamac Corporation DYN-2 Kennedy Space Ctr., FL 32899 321-759-0935 Fax: 321-730-3455 jprovancha@dynamac.com	R. Eric Martin Ecological Associates, Inc. P.O. Box 405 Jensen Beach, FL 34958 772-334-3729 Fax: 772-334-4925 erikmartin@bellsouth.net	Roxanne Carter REMSA, Inc. * 124 W Queens Way Hampton, VA 23669 757-722-0113 ext. 25 Fax: 757-722-0638 roxy@remsameso.com
Christopher Slay, President * Coastwise Consulting (Environmental Consultants - Land, Sea, Air) 173 Virginia Avenue Athens, GA 30601 706-543-6859 904-261-8518 Fax/Tel cslay@att.net	Richard Alboth Tiny's Marine Environmental Services 7 Rogers Street Randolph, MA 02368 781-963-6308 Cellular: 321-863-6561 tinysvc@aol.com	Andrea Balla-Holden, Marine & Marine Life Consulting 5988 SE Kelsey Court Port Orchard, WA 98367 360-769-5934: Office 360-769-4195: Fax MarineMarineLife@aol.com
Trish Bargo, * East Coast Observers, Inc. P.O. Box 6192 Norfolk, VA 23508 757-227-5779 757-965-6766 Fax 757-880-7636 Cell tbargo@eastcoastobservers.com		Robert K. Metzger * Relocation Trawling Biologist 1327 N. Wheaton Dr. St. Charles, MO 63301-0881 636-946-6464 Tel/Fax 314-265-4806: Cell metzgerr@swbell.net

* Contractors that also provide sea turtle trawling and relocation services.

Turtle Trawl Net Specifications

DESIGN:	4 Seam, 4 Legged, 2 Bridal Trawl Net
WEBBING:	4 inch bar, 8 inch stretch Top – 36 Gauge Twisted Nylon Dipped Side – 36 Gauge Twisted Nylon Dipped Bottom – 84 Gauge Braided Nylon Dipped
NET LENGTH:	60 ft from cork line to cod end
BODY TAPER:	2 to 1
WING END HEIGHT:	6 feet
CENTER HEIGHT:	Dependent on depth of trawl – 14 to 18 ft
COD END:	Length 50 meshes x 4 in equals 16.7 ft Webbing 2 in bar, 4 in stretch, 84 gauge braid nylon Dipped, 80 meshes around, 40 rigged meshes with ¼ x 2 in choker rings, 1 each ½ x 4 in at end Cod End Cover – none Chaffing Gear – none
HEAD ROPE:	60 ft ½ in combination rope (braid nylon with stainless cable center)
FOOT ROPE:	65 ft ½ in combination rope
LEG LINE:	Top – 6 ft, Bottom – 6 ft
FLOATS:	Size – Tuna Floats (football style), Diameter – 7in; Length – 9 in; number 12 each; Spacing – center of top net 2 in apart
MUD ROLLERS:	Size – 5 in Diameter, 5.5 in length Number – 22 each; spacing – 3 ft attached with 3/8 in Polypropylene rope (replaced with snap on roller when broken)
TICKLER CHAINS:	NONE (Discontinued – but previously used ¼ in x 74 ft galvanized chain)
WEIGHT:	20 ft of ¼ in galvanized chain on each wing, 40 ft per net looped and tied
DOOR SIZE:	7 ft x 40 in (or 8 ft x 40 in); Shoe – 1 in X 6 in: bridles – 3/8 in high test chain
CABLE LENGTH:	(Bridle Length, Total): 7/16 in x 240-300 ft varies with bottom conditions
FLOAT BALL:	NONE
LAZY LINES:	1 in nylon
PICKUP LINES:	3/8 in polypropylene
WHIP LINES:	1 in nylon

SEA TURTLE/GULF STURGEON OBSERVER SPECIFICATIONS

As a result of consultation under Section 7 of the Endangered Species Act of 1973, as amended, the U.S. Army Corps of Engineers has agreed to report any sea turtle/gulf sturgeon activity to the National Marine Fisheries Service (NMFS). The points of contact (listed below) should be notified of any sightings, collisions with, injuries or killing of sea turtles/gulf sturgeons by telephone within 12 hours of the action. The notification should include the number and species of turtles (if known) impacted and the time the activity occurred.

New Orleans District, Operations Division,
Marine Management Section, Dredge Wheeler
Ms. Bethany Walker
(504) 862-2699 and fax (504) 862-1912
After hours number: 504-905-4573 (cell)

New Orleans District, Operations Division,
Operations Technical Support Branch,
Mr. Ed Creef
(504) 862-2521 and fax (504) 862-2317
After hours number: 504-818-0034 (home)

Observers will continuously monitor all of the hopper inflow and/or over-flow screens 24 hours per day during dredging mode, to detect turtles/sturgeons or turtle/sturgeon parts. Screen monitoring shall be conducted as required to effectively watch these screens, based on the design, configuration, and position thereof. The observers will be provided access and use of a facsimile and telephone 24 hours per day to insure, in the event of a take, the observers will be able to fulfill the requirements of the paragraph entitled "Sea Turtle/Gulf Sturgeon Reporting".

In addition to monitoring 24 hours per day during dredging mode, the observers will be responsible for assuring that:

1) temperatures in the waterway are taken, in degrees Fahrenheit, at the surface and at the mid-depth from the surface to the water bottom. The readings shall be made each eight hours for the duration of each dredging assignment. The waterway mileage and latitude/longitude shall be recorded corresponding to each temperature reading.

2) during transit of the dredge to/from the disposal site(s), after dredging has ceased, the screen observer shall assure that the hopper screens are cleaned of debris and correctly re-installed on the dredge for return to dredging mode. The observer shall report damage of the screens to the Dredge Wheeler representative immediately upon detection of such damage, and the screens shall be repaired or replaced before dredging is resumed.

3) complete turtle/sturgeon data reporting is made, as required in paragraph entitled "Sea Turtle/Gulf Sturgeon Reporting".

4) positively identified turtle/sturgeon parts are disposed of at the dredge material disposal site(s). Turtle/sturgeon parts which cannot be positively identified on board the dredge shall be color photographed by the observer(s) using instant developing film or a digital camera. The photos shall be attached to respective reports for documentation and later identification. Observer(s) shall measure, weigh, tag, and release any uninjured turtles incidentally taken by the dredge. Turtle/sturgeon handling and tagging methods shall be performed in accordance with NMFS-approved procedures. Injured turtles shall be transported to a rehabilitation facility, the Aquarium of the Americas at New Orleans, Louisiana. Observer(s) or their authorized representative shall provide NMFS-approved containers for turtle/sturgeon transport.

5) Sea Turtle/Gulf Sturgeon Reporting

The observers shall maintain a log detailing all incidents, including sightings, collisions with, injuries, or killing of sea turtles/sturgeons occurring during the contract period. The results of the monitoring shall be recorded on copies of the observation sheets attached, entitled "Endangered Species Observer Program" or similar forms. For each load, screen watch data shall be consolidated on a single sheet prior to beginning a new sheet for the next load. An observation sheet shall be completed for each load whether or not turtles are sighted in the waterway or turtle/sturgeon parts are detected on the screens. Dredging shall not commence until the consolidated report is completed from the previous dredging load. The observer(s) should notify the District points of contact (listed above) of any sightings, collisions with, injuries or killing of sea turtles by telephone and facsimile within 12 hours of the action. The notification should include the number and species of turtles impacted and the time the activity occurred. Upon completion of the dredging project, all consolidated and completed data reports shall be forwarded to the District points of contact (listed above).

The various endangered species observer program data forms are provided below.

ENDANGERED SPECIES OBSERVER PROGRAM

LOAD DATA FORM

USACE DISTRICT: _____

CONTRACT #: _____ Maintenance____/New Work _____ PROJECT start date _____

PROJECT NAME: _____ DREDGE NAME: _____

DREDGE FIRM: _____

LOAD #: _____ LOAD start date: _____ Times (24hrs): Start _____ End _____

Condition of screening : Port_____ Starboard _____ Overflow _____

Number of dragheads in use: _____ Type of dragheads used: _____Size of dragheads: _____

Draghead deflector? YES ___ NO ___ Condition of deflector: _____

Type of material dredged: _____

Weather conditions: _____

_____

Tidal stage (CIRCLE ONE): Slack Rising High Falling Low Unknown

Beaufort Sea States (Winds/Wave Height) (CIRCLE ONE)

0 = <1 knot/ 0 ft	3 = 7-10 knot/ 2 ft	6 = 22-27 knot/10 ft	9 = 41-47 knot/23 ft	12 = >63 knot/45
1 = 1- 3 knot/ 0.25 ft	4 = 11-16 knot/ 4 ft	7 = 28-33 knot/14 ft	10 = 48-55 knot/29 ft	
2 = 4- 6 knot/ 0.5 ft	5 = 17-21 knot/ 6 ft	8 = 34-40 knot/18 ft	11 = 56-63 knot/37 ft	

Waves: _____ ft Wind (speed & direction): _____

AIR TEMP: _____ °C/°F (°F = 9/5 (°C) + 32; °C = 5/9 (°F - 32))

WATER TEMP: Surface _____ °C /°F Column (mid-depth) _____ °C /°F Bottom _____ °C /°F

SCREEN TYPE

_____Inflow screening:	None	25%	50%	75%	100%
_____Overflow screening:	None	25%	50%	75%	100%
_____Other screening:	None	25%	50%	75%	100%

PORT SCREEN CONTENTS: _____

_____

_____

STARBOARD SCREEN CONTENTS: _____

_____

_____

Estimate number entrained on this load for the following:

Sturgeon (any species) _____

Shark (any species) _____

Horseshoe crab _____

Blue crab _____

TURTLE OR TURTLE PARTS PRESENT THIS LOAD: YES _____ NO _____

SPECIES OF TURTLE TAKE: Unknown Loggerhead Green Kemp's ridley Hawksbill Leatherback

Comments: _____

_____

Number observers used/24hrs: _____ % Monitoring/24 hrs: None 25% 50% 75% 100%

Observer's name: _____ Observer firm_____

Observer signature _____

Endangered Species Observer Program – Daily Report

ENDANGERED SPECIES OBSERVER PROGRAM

DAILY REPORT

USACE DISTRICT: _____
PROJECT NAME: _____ **DREDGE NAME:** _____

Date: _____ **Load #s:** _____ **Areas dredge worked:** _____

Beaufort Sea State: 0 1 2 3 4 5 6 7 8 9 10 11 12

AIR TEMP: _____ °C/°F (°F = 9/5 (°C) + 32; °C = 5/9 (°F - 32))
WATER TEMP: Surface _____ °C/°F **Column (mid-depth)** _____ °C/°F **Bottom** _____ °C/°F

Condition of deflector: _____ **Condition of screening:** _____

Were there incidents involving endangered or protected species? **YES** ____ **NO** ____

Which species? (complete incident form(s)) _____

Comments (type of material, biological specimens, unusual circumstances, etc): _____

BRIDGE WATCH SUMMARY

Time	Species	# Sightings/# Animals	Location/Comments
		/	
		/	
		/	
		/	
		/	
		/	
		/	
		/	
		/	
		/	
		/	
		/	
		/	
		/	
		/	

Observer name _____

USACE Sea Turtle/Dredging Database – Post Hopper Dredging Project Checklist follows.

USACE Sea Turtle/Dredging Database
Post-Hopper Dredging Project Checklist

(1)_____PROJECT SUMMARY

District name_____ District POC _____
Contract # _____ Maintenance ___ New Work____ Federal ____Regulatory ____

Project name _____ Dates of project _____

Dredge name _____ Dredge firm _____ Dates worked _____
Dredge name _____ Dredge firm _____ Dates worked _____
Dredge name _____ Dredge firm _____ Dates worked _____
Dredge name _____ Dredge firm _____ Dates worked _____

For total project:
 # days dredged: _____ # hours dredged:_____ # loads dredged: _____Total CY dredged_____

For dredge vessel_____
 # days dredged: _____ # hours dredged:_____ # loads dredged: _____Total CY dredged_____
For dredge vessel_____
 # days dredged: _____ # hours dredged:_____ # loads dredged: _____Total CY dredged_____
For dredge vessel_____
 # days dredged: _____ # hours dredged:_____ # loads dredged: _____Total CY dredged_____
For dredge vessel_____
 # days dredged: _____ # hours dredged:_____ # loads dredged: _____Total CY dredged_____

General project description/Disposal method(s):_____
_____
_____

Type of material dredged: (circle) silt clay sand mud shell rock other
Type of draghead(s): _____ Silent inspector: YES _____ NO _____
Mitigation measures:
Dredging within designated environmental window YES _____ NO _____ N/A _____
Draghead deflectors installed YES _____ NO _____ N/A _____
Relocation trawling conducted YES _____ NO _____ N/A _____
Pre-dredge assessment trawling conducted YES _____ NO _____ N/A _____
Monitoring measures:
Screening type(s) : _____ % material screened: None 25% 50% 75% 100%
 # observers/24hrs: _____ % monitoring/24 hrs: None 25% 50% 75% 100%

For total project:
 # Incidental sea turtle takes Loggerhead _____ Green _____ Kemp's ridley _____ Other _____ Unknown _____
 # Incidental sturgeon takes Shortnose _____ Gulf _____ Other _____ Unknown _____
Description of other endangered/sensitive species incidents: _____
_____

(2)_____ Dredge summary logs associated with dates of incidental takes

(3)_____ Endangered Species Observer Final Report(s)
(Each incidental take reported should include: Incidental Take Form, Load Data Form, Dredge Load Log, Copies of photos)

(4)_____ Relocation and/or assessment trawling Final Report(s)
(Report should include: total #/species of turtles relocated during project; total #/species of turtles relocated on date of dredging incidental take, total #/species of sturgeon collected.)

(5)_____ Reports/descriptions of other related research/studies being done during/related to project.

Endangered Species Observer Program – Sturgeon Incidental Take Data Form

ENDANGERED SPECIES OBSERVER PROGRAM

STURGEON INCIDENTAL TAKE DATA FORM

USACE DISTRICT: _____
PROJECT NAME: _____ DREDGE NAME: _____

DATE: _____ Time sturgeon take recovered (24hr): _____ Sturgeon # for project: ____

LOAD #: _____ Times (24hrs): Start _____ End _____ Load start date _____

SPECIES OF STURGEON TAKE: Shortnose _____ Gulf _____ Other _____ Unknown ____

Channel location of take: Latitude _____ Longitude _____
Other location / Channel description (e.g. buoy markers, landmarks):_____
_____

Location take recovered on dredge:_____

Number of dragheads in use at time of incident: _____ Draghead deflector? YES ____ NO ____
Condition of deflector:_____ Condition of screening: _____

Beaufort Sea State: 0 1 2 3 4 5 6 7 8 9 10 11 12

AIR TEMP: _____ °C/°F (°F = 9/5 (°C) + 32; °C = 5/9 (°F - 32))
WATER TEMP: Surface _____ °C/°F Column (mid-depth) _____ °C/°F Bottom _____ °C/°F

Condition of specimen: _____
_____
0 = Alive; 1 = Fresh dead; 2 = Moderately decomposed; 3 = Severely decomposed; 4 = skeleton/old bone; 5 = undetermined

Measurements/description of specimen:_____
_____
_____

Genetic samples taken: YES ____ NO ____ Photos taken: YES ____ NO ____
Sample frozen/preserved: YES ____ NO ____
Final disposition of specimen: _____

Comments: _____
_____
_____
_____

Load data form attached: YES ____NO ____ Dredge load log attached: YES ____NO ____

Observer's name _____

Use diagram below to illustrate specimen/part recovered:

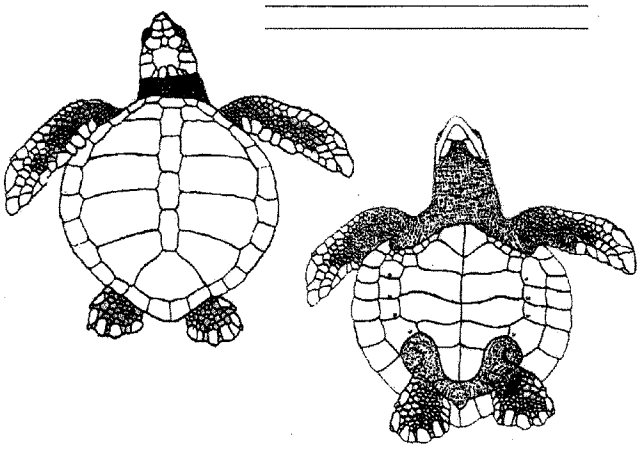


Endangered Species Observer Program Sea Turtle Take Form - Kemp's Ridley follows

Kemp's Ridley (*Lepidochelys kempii*)

Shade areas of turtle that are missing; sketch cracks and lacerations

Comments: _____



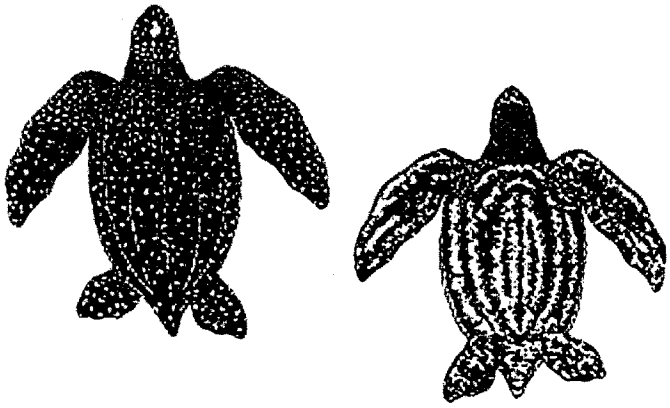
Diagrams by Tom McFarland

Endangered Species Observer Program Sea Turtle Take Form – Leatherback

Leatherback (*Dermochelys coriacea)*

Shade areas of turtle that are missing; sketch cracks and lacerations

Comments: _____



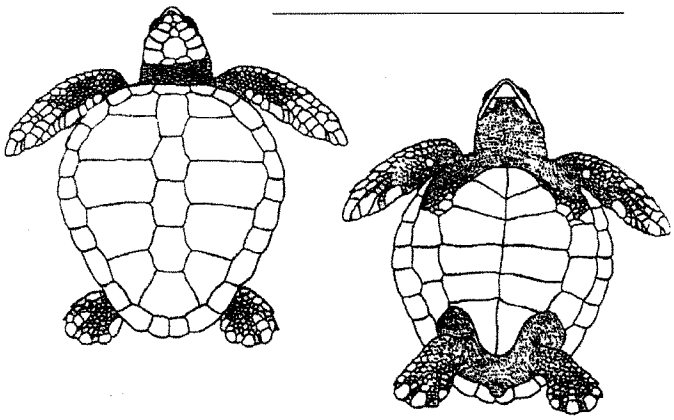
Diagrams by Tom McFarland

Endangered Species Observer Program Sea Turtle Take Form – Loggerhead

Loggerhead (*Caretta caretta)*

Shade areas of turtle that are missing; sketch cracks and lacerations

Comments: _____



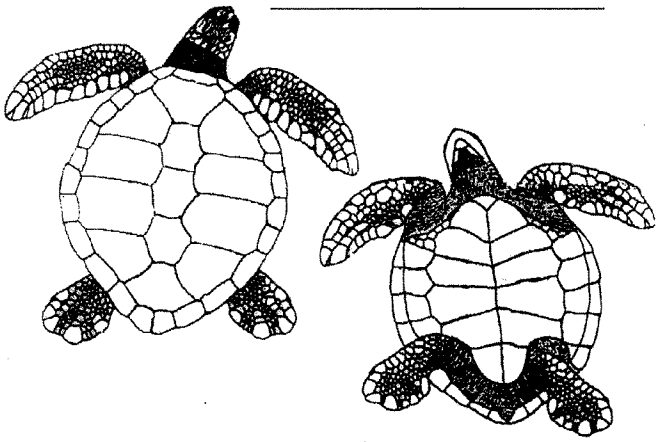
Diagrams by Tom McFarland

Endangered Species Observer Program Sea Turtle Take Form – Green turtle

Green turtle (*Chelonia mydas*)

Shade areas of turtle that are missing; sketch cracks and lacerations

Comments: _____



Diagrams by Tom McFarland

Endangered Species Protection for Sea Turtles & Gulf Sturgeon

I. Sea Turtle Trawling and Relocation

Sea Turtle Trawling and Relocation, as specified herein, will be at the option and in the discretion of the Government to aid in preventing the taking of sea turtles during dredging operations with the approved turtle deflector in place. Within 72 hours after receiving written directions from the Contracting Officer, the Contractor shall begin trawling for turtles to relocate them from the dredging project area. Relocation trawling shall be performed so as to not interfere with dredging operations in progress.

e. Approved Sea Turtle Trawling and Relocation Supervisor

A NMFS-Approved Protected Species Observer (supervisor) shall conduct sea turtle trawling. A letter of approval from NMFS shall be provided to the Contracting Officer or his/her authorized representative prior to commencement of trawling. If trawling in Louisiana territorial waters outside of the shrimping season, the approved sea turtle trawling and relocation supervisor must also possess a Scientific Collecting Permit from the Louisiana Department of Wildlife and Fisheries (point of contact is Ms. Karen Foote at 225-765-2384).

f. Sea Turtle Trawling Procedures

Any captured sea turtles either shall be transported to the Institute for Marine Mammal Studies located in Gulfport, Mississippi, or released into waters minimally impacted by presence of oil/dispersants (to be determined by the relocation trawling supervisor in coordination with Edward Creef and Dena Dickerson (601-831-0687). Any captured gulf sturgeons shall be released immediately after capture and handling for measurements away from the dredging site in waters minimally impacted by presence of oil/dispersants (to be determined at the time of capture by the trawling supervisor in coordination with Edward Creef and Dena Dickerson). Methods and equipment shall be standardized including data sheets, nets, trawling direction to tide, length of station, length of tow, and number of tows per station. Data on each tow shall be recorded using the Sea Turtle Trawling Report found at the website (http://el.erdc.usace.army.mil/seaturtles/docs/trawlingforms.pdf). The trawler shall be equipped with 60-foot nets constructed from 8-inch mesh (stretch) fitted with mud rollers and flats as specified in the Turtle Trawl Nets Specifications appended to the end of this Section. Paired net tows shall be made for 24 hours per day, as directed by the Contracting Officer or his/her authorized representative. The tows shall be performed in shifts, to be determined by the Contracting Officer or his/her authorized representative, and the trawler shall be available for operation 24 hours a day. Positions at the beginning and end of each tow shall be determined from GPS Positioning equipment. Refer to EM 1110-1-1003 "Navstar global positioning system surveying", paragraph 5.3 and Table 5-1, for acceptable GPS criteria.

g. Trawling Requirements

Trawling operations shall be conducted in the vicinity of dredge operations, but shall maintain a safe distance from that dredge. **NOTE: ALL TRAWLING ACTIVITIES, VESSELS AND EQUIPMENT SHALL COMPLY WITH THE CONTRACTOR'S ACCIDENT PREVENTION PLAN AND THE REQUIREMENTS OF EM 385-1-1, U.S. ARMY CORPS OF ENGINEERS SAFETY AND HEALTH REQUIREMENTS MANUAL.** Trawling shall be conducted with and against the tidal flow at a speed not to exceed 3.5 knots using repetitive trawls in the channel or other work area not to exceed 42-minutes (total time). Trawls shall be made in the center, green, and red sides of the channel such that the total width of the channel bottom is trawled.

h. Sea Turtle/Gulf Sturgeon Handling and Measurements

At least one crewmember who is a NMFS-Approved Protected Species Observer shall be on board the trawler during the trawl. The observer shall be responsible for handling of captured sea turtles and Gulf sturgeons.

Each captured turtle or gulf sturgeon shall be identified, scanned for PIT tags, measured, tagged, tissue sampled and released, and data recorded on the Sea Turtle Tagging and Relocation Report, which can be found at the following website: (http://el.erdc.usace.army.mil/seaturtles/docs/taggingforms.pdf). Presence of PIT tags shall be scanned for by using a multi-frequency scanner capable of reading multiple frequencies (including 125-, 128-, 134-, and 400-kHz tags) and reading tags deeply embedded in muscle tissue. Any captured sea turtles shall be transported to the Institute for Marine Mammal Studies located in Gulfport, Mississippi. Turtle measurements shall be recorded and shall include, at a minimum, weight, straight-line length, straight-line width, and tail length. Gulf sturgeon measurements shall be recorded and shall include, at a minimum, weight, total length, and fork length. Turtles shall be tagged with NMFS #681 Inconel tags in each of the front flippers according to NMFS protocol. Aseptic conditions shall be maintained for tags and tag attachment. The Contractor shall be responsible for obtaining any and all permits related to trawling from the appropriate state and Federal agencies. All aspects of the trawling shall be coordinated with Edward Creef (504-862-2521) and Dena Dickerson (601-831-0687).

i. Handling Fibropapillomatose Turtles

Anyone handling sea turtles infected with fibropapilloma tumors shall either: 1) clean all equipment that comes in contact with the turtle with mild bleach solution between the processing of each turtle, or 2) maintain a separate set of sampling equipment for handling turtles displaying fibropapilloma tumors or lesions.

j. Water Quality and Physical Measurements

Water temperature measurements shall be taken at the water surface each day using a laboratory thermometer. Weather conditions shall be recorded from visual observations and instruments on the trawler. Weather conditions, air temperature, wind velocity and direction, sea state-wave height, and precipitation shall be recorded on the Sea Turtle Trawling Report. High and low tides shall be recorded.

k. Repair and Replacement of Damaged Trawl Nets

The Contractor, at the time of mobilization, shall provide trawl nets that meet the requirements specified in the Turtle Trawl Net Specifications at the end of this section. Tools, supplies and materials for repairing nets shall be kept aboard the trawler. In the event of damage to trawl nets, one hour will be allowed to either repair or replace them. The Contractor shall have at least one set of replacement nets immediately available at all times, to insure that the dredging work is not adversely delayed due to trawler down-time for replacing damaged nets. It is recommended that a second set of replacement nets be available aboard the trawler.

l. Suspension of Dredging and Relocation Trawling

Should there be a tearing of nets, or breakdown of other equipment that would cause the trawler to leave the area where dredging is underway during any period of time where relocation trawling is required, the dredge may continue to operate for up to 48 hours, as long as no turtles are taken, and subject to the discretion of the Contracting Officer. Should there be dangerously high seas that would cause the trawler to leave the dredging area when relocation trawling is required, the dredge may continue to operate, as long as no turtles are taken and subject to the discretion of the Contracting Officer.

m. Turtle Excluder Devices

Approval for trawling for sea turtles without Turtle Excluder Devices (TEDs) must be obtained from NMFS (contact Eric Hawk at 727-551-5773). Any necessary State or Federal clearances for the capture and relocation of sea turtles must also be obtained. Approvals must be submitted to the Contracting Officer or his/her authorized representative prior to trawling.

n. Reporting

Immediately after completing each day of relocation trawling, if possible, the Contractor shall notify Dena Dickerson by telephone conveying the results of the trawl. The results of each trawl shall be recorded on the Sea Turtle Trawling Report. The Sea Turtle Trawling Report also shall be furnished by the Contractor to Mr. Edward Creef, U.S. Army Corps of Engineers, New Orleans District, within 24 hours after completing the relocation trawl (fax number 504-862-2317; email: edward.d.creef.@usace.army.mil). Following completion of the project, a copy of the Contractor's log regarding sea turtles shall be forwarded to Mr. Edward Creef within 10 working days.

Turtle Trawl Net Specifications

DESIGN:	4 Seam, 4 Legged, 2 Bridal Trawl Net
WEBBING:	4 in bar, 8 in stretch Top – 36 Gauge Twisted Nylon Dipped Side – 36 Gauge Twisted Nylon Dipped Bottom – 84 Gauge Braided Nylon Dipped
NET LENGTH:	60 ft from cork line to cod end
BODY TAPER:	2 to 1
WING END HEIGHT:	6 ft
CENTER HEIGHT:	Dependent on depth of trawl – 14 to 18 ft
COD END:	Length 50 meshes x 4 in equals 16.7 ft Webbing 2 in bar, 4 in stretch, 84 gauge braid nylon Dipped, 80 meshes around, 40 rigged meshes with ¼ x 2 in choker rings, 1 each ½ x 4 in at end Cod End Cover – none Chaffing Gear – none
HEAD ROPE:	60 ft ½ in combination rope (braid nylon with stainless cable center)
FOOT ROPE:	65 ft ½ in combination rope
LEG LINE:	Top – 6 ft, Bottom – 6 ft
FLOATS:	Size – Tuna Floats (football style), Diameter – 7 In; Length – 9 in; number 12 each; Spacing – center of top net 2 in apart
MUD ROLLERS:	Size – 5 in Diameter, 5.5 in length Number – 22 each; spacing – 3 ft attached with 3/8 in Polypropylene rope (replaced with snap on roller when broken)
TICKLER CHAINS:	NONE (Discontinued – but previously used ¼ in x 74 ft galvanized chain)
WEIGHT:	20 ft of ¼ in galvanized chain on each wing, 40 ft per net looped and tied
DOOR SIZE:	7 ft x 40 in (or 8 ft x 40 in); Shoe – 1 in X 6 in: bridles – 3/8 in high test chain
CABLE LENGTH:	(Bridle Length, Total): 7/16 in x 240-300 ft varies with bottom conditions
FLOAT BALL:	NONE
LAZY LINES:	1 in nylon
PICKUP LINES:	3/8 in polypropylene
WHIP LINES:	1 in nylon

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701-5505
(727) 824-5312, FAX (727) 824-5309
http://sero.nmfs.noaa.gov

Measures for Reducing Entrapment Risk to Protected Species

Bottlenose dolphins, sea turtles, and Gulf sturgeon (protected species) are known to inhabit coastal waters of the northern Gulf of Mexico. Bottlenose dolphins are protected under the Marine Mammal Protection Act (MMPA) and sea turtles and Gulf sturgeon are protected under the Endangered Species Act (ESA). Because of the potential for these protected species to become entrapped within coastal waters of construction sites along the northern Gulf coast, projects that enclose shallow open water areas for wetland creation or nourishment will use the following measures to minimize the potential for entrapment:

1. **Pre-construction planning.** During project design, the Federal Action Agency or project proponents must incorporate at least one escape route into the proposed retention structure(s) to allow any protected species to exit the area(s) to be enclosed. Escape routes must lead directly to open water outside the construction site and must have a minimum width of 100 feet. Escape routes should also have a depth as deep as the deepest natural entrance into the enclosure site and must remain open until a thorough survey of the area, conducted immediately prior to complete enclosure, determines no Protected Species are present within the confines of the structure (see item 5 below for details).

2. **Pre-construction compliance meeting.** Prior to construction, the Federal Action Agency, project proponents, the contracting officer representative, and construction personnel should conduct a site visit and meeting to develop a project-specific approach to implementing these preventative measures.

3. **Responsible parties.** The Federal Action Agency will instruct all personnel associated with the project of the potential presence of protected species in the area and the need to prevent entrapment of these animals. All construction personnel will be advised that there are civil and criminal penalties for harming, harassing, or killing protected species. Construction personnel will be held responsible for any protected species harassed or killed as a result of construction activities. All costs associated with monitoring and final clearance surveys are the responsibility of project proponents and must be incorporated in the construction plan.

4. **Monitoring during retention structure construction.** It is the responsibility of construction personnel to monitor the area for protected species during dike or levee construction. If protected species are regularly sighted over a 2 or 3 day period within the enclosure area during retention structure assembly, construction personnel must notify the Federal Action Agency. It is the responsibility of the Federal Action Agency

to then coordinate with the National Marine Fisheries Service (NMFS) Marine Mammal Health and Stranding Response team (1-877-WHALE HELP [1-877-942-5343]) or the appropriate State Coordinator for the Sea Turtle Stranding and Salvage Network (see http://www.sefsc.noaa.gov/species/turtles/stranding_coordinators.htm) to determine what further actions may be required. Construction personnel may not attempt to scare, herd, disturb, or harass the protected species to encourage them to leave the area.

5. **Pre-closure final clearance.** Prior to completing any retention structure by closing the escape route, the Federal Action Agency will insure that the area to be enclosed is observed for protected species. Surveys must be conducted by experienced marine observers during daylight hours beginning the day prior to closure and continuing during closure. This is best accomplished by small vessel or aerial surveys with 2-3 experienced marine observers per vehicle (vessel/helicopter) scanning for protected species. Large areas (e.g. >300 acres) will likely require the use of more than one vessel or aerial survey to insure full coverage of the area. These surveys will occur in a Beaufort sea state (BSS) of 3 feet or less, as protected species are difficult to sight in choppy water. Escape routes may not be closed until the final clearance determines the absence of protected species within the enclosure sight.

6. **Post closure sightings.** If protected species become entrapped in an enclosed area, the Federal Action Agency and NMFS must be immediately notified. If observers note entrapped animals are visually disturbed, stressed, or their health is compromised then the Action Agency may require any pumping activity to cease and the breaching of retention structures so that the animals can either leave on their own or be moved under the direction of NMFS.

   a. In coordination with the local stranding networks and other experts, NMFS will conduct an initial assessment to determine the number of animals, their size, age (in the case of dolphins), body condition, behavior, habitat, environmental parameters, prey availability and overall risk.
   b. If the animal(s) is/are not in imminent danger they will need to be monitored by the Stranding Network for any significant changes in the above variables.
   c. Construction personnel may not attempt to scare, herd, disturb, or harass the protected species to encourage them to leave the area. Coordination by the Federal Action Agency with the NMFS SER Stranding Coordinator may result in authorization for these actions.
   d. NMFS may intervene (catch and release and/or rehabilitate) if the protected species are in a situation that is life threatening and evidence suggests the animal is unlikely to survive in its immediate surroundings.
   e. Surveys will be conducted throughout the area at least twice or more in calm surface conditions (BSS 3 feet or less), with experienced marine observers, to determine whether protected species are no longer present in the area.

Revised: May 22, 2012

While NMFS recommends these best management practices to prevent the future takes of marine mammals by entrapment, use of these measures cannot guarantee a take will not occur. Following these measures does not constitute compliance with the MMPA's Incidental Take requirements and take is not authorized.

SOUTHWEST COASTAL LOUISIANA
REVISED INTEGRATED DRAFT FINAL FEASIBILITY REPORT
AND
ENVIRONMENTAL IMPACT STATEMENT

ANNEX R

2050 Coastal Wildlife Tables

Table 7-2. Region 3 wildlife functions, status, trends, and projections.

Habitat Types: OW = Open Water, AB = Aquatic Bed, FM = Fresh Marsh; IM = Intermediate Marsh; BM = Brackish Marsh; SM = Saline Marsh; FS = Fresh Swamp, HF = Hardwood Forest; BB = Barrier Beach, AU = Agriculture/Upland. Habitat types comprising less than 5% of unit are shown only if habitat is particularly rare or important to wildlife.
Status: NH = Not Historically Present; NL = No Longer Present; Lo = Low Numbers; Mo = Moderate Numbers; Hi = High Numbers
Functions of Particular Interest: Ne = Nesting, St = Stopover Habitat; W = Wintering Area; Mu = Multiple Functions
Trends (since 1985) / **Projections** (through 2050): Sy = Steady; D = Decrease; I = Increase; U = Unknown

Mapping Unit	1988 Habitat		Avifauna												Furbearer										Game Mammals										Reptiles			
			Other Marsh/ OW Residents				Other Wood-land Resid.				Other Marsh/ OW Migrants				Other Wood-land Migrants				Nutria				Muskrat				Mink, Otter, and Raccoon				Rabbits				Squirrels				Deer				American Alligator			
	Type	% of Unit	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.
Atchafalaya Basin																																											
Atchafalaya Subdelta	OW	95	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Lo	I	I
	FM	3	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				Mu	Lo	Sy	Sy	Mu	Mo	I	I
	BB	1		NH				NH				NH				NH				NH				NH				NH				NH				NH				Mu	Lo	Sy	Sy
West N. Wax Lake	FM	17	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Hi	Sy	Sy
	FS	16	Mu	Lo	Sy	Sy	Ne	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy
	HF	55		NH			Ne	Hi	Sy	D		NH			Mu	Hi	Sy	D	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy
	AU	11		NH			Ne	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy
East N. Wax Lake Wetlands	FS	35	Mu	Lo	Sy	Sy	Ne	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy
	HF	56		NH			Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy
Wax Lake Wetlands	OW	18	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Mo	I	I
	FM	38	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Mo	I	I
	FS	8	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Hi	I	I
	HF	34		NH			Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	I	I
Wax Lk. Outlet Subdelta	OW	97	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Lo	I	I
	FM	2	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Mo	I	I
	BB	1		NH				NH				NH				NH				NH				NH				NH				NH				NH				Mu	Lo	Sy	Sy
Teche/Vermilion Basin																																											
Cote Blanche Wetlands	OW	10	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Hi	I	I
	FM	54	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Hi	I	I
	FS	15	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	I	I
	HF	17		NH			Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	I	I
East Cote Blanche Bay	OW	100	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH				NH				NH				NH				NH				NH				NH				NH		
West Cote Blanche Bay	OW	100	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH				NH				NH				NH				NH				NH				NH				NH		
Marsh Island	OW	20	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy		NH				NH				NH			Mu	Mo	Sy	I

JA
37-899
871
10/04/2019

Table 7-2. Region 3 wildlife functions, status, trends, and projections.

Habitat Types: OW = Open Water; AB = Aquatic Bed; FM = Fresh Marsh; IM = Intermediate Marsh; BM = Brackish Marsh; SM = Saline Marsh; FS = Fresh Swamp; HF = Hardwood Forest; BB = Barrier Beach; AU = Agriculture/Upland. Habitat types comprising less than 5% of unit are shown only if habitat is particularly rare or important to wildlife.
Status: NH = Not Historically Present; NL = No Longer Present; Lo = Low Numbers; Mo = Moderate Numbers; Hi = High Numbers
Functions of Particular Interest: Ne = Nesting; St = Stopover Habitat; W = Wintering Area; Mu = Multiple Functions
Trends (since 1985) / **Projections** (through 2050): Sy = Steady; D = Decrease; I = Increase; U = Unknown

| Mapping Unit | 1988 Habitat | | Avifauna | | |

Table 7-2. Region 3 wildlife functions, status, trends, and projections.

Habitat Types: OW = Open Water, AB = Aquatic Bed; FM = Fresh Marsh, IM = Intermediate Marsh; BM = Brackish Marsh; SM = Saline Marsh; FS = Fresh Swamp; HF = Hardwood Forest; BB = Barrier Beach; AU = Agriculture/Upland. Habitat types comprising less than 5% of unit are shown only if habitat is particularly rare or important to wildlife.
Status: NH = Not Historically Present; NL = No Longer Present; Lo = Low Numbers; Mo = Moderate Numbers; Hi = High Numbers
Functions of Particular Interest: Ne = Nesting; St = Stopover Habitat; W = Wintering Area; Mu = Multiple Functions
Trends (since 1985) / **Projections** (through 2050): Sy = Steady; D = Decrease; I = Increase; U = Unknown

Mapping Unit	1988 Habitat		Avifauna (cont.)												Furbearers										Game Mammals										Reptiles			
	Type	% of Unit	Other Marsh/ OW Residents				Other Wood-land Resid.				Other Marsh/ OW Migrants				Other Wood-land Migrants				Nutria				Muskrat				Mink, Otter, and Raccoon				Rabbits				Squirrels				Deer				American Alligator			
			Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.
	BM	70	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Mo	Sy	I
	SM	10	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy
Vermilion Bay Marsh	OW	13	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Lo	I	I
	FM	5	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	I	I
	IM	25	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	I	I
	BM	30	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	I	I
	FS	5	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	I	I
	HF	18		NH			Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	I	I
Vermilion Bay	OW	99	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH				NH				NH				NH				NH				NH				NH				NH		
Big Woods	FM	8	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy
	HF	60		NH			Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy
	AU	25	Mu	Lo	Sy	Sy	Ne	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy
Rainey Marsh	OW	12	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Hi	Sy	Sy	Mu	Mo	Sy	Sy		NH				NH				NH			Mu	Hi	I	I
	IM	11	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Mo	Sy	Sy	Mu	Hi	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Hi	I	I
	BM	70	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Mo	Sy	Sy	Mu	Hi	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Hi	I	I

JA 37-899 10/04/2019

Table 7-2. Region 4 wildlife functions, status, trends, and projections.

Habitat Types: OW = Open Water; AB = Aquatic Bed; FM = Fresh Marsh; IM = Intermediate Marsh; BM = Brackish Marsh; SM = Saline Marsh; FS = Fresh Swamp; HF = Hardwood Forest; BB = Barrier Beach; AU = Agriculture/Upland. Habitat types comprising less than 5% of unit are shown only if habitat is particularly rare or important to wildlife.
Status: NH = Not Historically Present; NL = No Longer Present; Lo = Low Numbers; Mo = Moderate Numbers; Hi = High Numbers
Functions of Particular Interest: No = Nesting; St = Stopover Habitat; W = Wintering Area; Mu = Multiple Functions
Trends (since 1985) / **Projections** (through 2050): Sy = Steady, D = Decrease; I = Increase; U = Unknown

| Mapping Unit | 1988 Habitat | | Avifauna | | |

Table 7-2. Region 4 wildlife functions, status, trends, and projections.

Habitat Types: OW = Open Water; AB = Aquatic Bed; FM = Fresh Marsh; IM = Intermediate Marsh; BM = Brackish Marsh; SM = Saline Marsh; FS = Fresh Swamp; HF = Hardwood Forest; BB = Barrier Beach; AU = Agriculture/Upland. Habitat types comprising less than 5% of unit are shown only if habitat is particularly rare or important to wildlife.
Status: NH = Not Historically Present, NL = No Longer Present; Lo = Low Numbers; Mo = Moderate Numbers; Hi = High Numbers
Functions of Particular Interest: Ne = Nesting; St = Stopover Habitat; W = Wintering Area; Mu = Multiple Functions
Trends (since 1985) / **Projections** (through 2050): Sy = Steady; D = Decrease; I = Increase; U = Unknown

| Mapping Unit | 1988 Habitat | | Avifauna | | |

Table 7-2. Region 4 wildlife functions, status, trends, and projections.

Habitat Types: OW = Open Water; AB = Aquatic Bed; FM = Fresh Marsh; IM = Intermediate Marsh; BM = Brackish Marsh; SM = Saline Marsh; FS = Fresh Swamp; HF = Hardwood Forest; BB = Barrier Beach; AU = Agriculture/Upland. Habitat types comprising less than 5% of unit are shown only if habitat is particularly rare or important to wildlife.
Status: NH = Not Historically Present; NL = No Longer Present; Lo = Low Numbers; Mo = Moderate Numbers; Hi = High Numbers
Functions of Particular Interest: Ne = Nesting; St = Stopover Habitat; W = Wintering Area; Mu = Multiple Functions
Trends (since 1985) / **Projections** (through 2050): Sy = Steady; D = Decrease; I = Increase; U = Unknown

Mapping Unit	1988 Habitat		Avifauna												Furbearer												Game												Reptiles		
	Type	% of Unit	Other Marsh/ OW Residents				Other Wood-land Resid.				Other Marsh/ OW Migrants				Other Wood-land Mig.				Nutria				Muskrat				Mink, Otter, and Raccoon				Rabbits				Squirrels				Deer				American Alligator		
			Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend
Mermentau Basin																																										
Amoco	OW	14	Mu	Mo	Sy	Sy		NH				Mu	Mo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Mo	I	I
	FM	80	Mu	Hi	Sy	D		NH				Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Mo	I	I
Big Marsh	OW	11	Mu	Mo	Sy	Sy		NH				Mu	Mo	Sy	D		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Hi	I	I
	FM	57	Mu	Hi	Sy	Sy		NH				Mu	Hi	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Mo	I	I
	IM	25	Mu	Hi	Sy	Sy		NH				Mu	Hi	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Hi	I	I
Big Burn	OW	18	Mu	Mo	Sy	Sy		NH				Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Mo	I	I
	AB	6	Mu	Hi	Sy	Sy		NH				Mu	Hi	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Mo	I	I
	FM	67	Mu	Hi	Sy	D		NH				Mu	Hi	Sy	D		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Mo	I	I
Cameron Prairie	OW	6	Mu	Mo	Sy	Sy		NH				Mu	Mo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Mo	I	Sy
	AB	14	Mu	Hi	Sy	Sy		NH				Mu	Hi	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Mo	I	Sy
	FM	67	Mu	Hi	Sy	D		NH				Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Mo	I	Sy
	AU	11	Mu	Mo	Sy	Sy	Ne	Lo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy		NH			Mu	Lo	Sy	Sy
Grand Chenier Ridge	OW	11	Mu	Mo	Sy	Sy		NH				Mu	Mo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Lo	I	Sy
	FM	23	Mu	Hi	Sy	Sy		NH				Mu	Hi	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	I	Sy
	IM	24	Mu	Hi	Sy	Sy		NH				Mu	Hi	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	I	Sy
	BM	5	Mu	Hi	Sy	Sy		NH				Mu	Hi	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	I	Sy
	HF	8		NH			Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy
	AU	30	Mu	Lo	Sy	Sy	Ne	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy		NH			Mu	Lo	Sy	Sy
Grand Lake	OW	99	Mu	Mo	Sy	Sy		NH				Mu	Mo	Sy	Sy		NH			NH				NH				NH				NH				NH				NH			NH		

JA 37-899 876 10/04/2019

Table 7-2. Region 4 wildlife functions, status, trends, and projections.

Habitat Types: OW = Open Water, AB = Aquatic Bed; FM = Fresh Marsh; IM = Intermediate Marsh; BM = Brackish Marsh; SM = Saline Marsh; FS = Fresh Swamp; HF = Hardwood Forest; BB = Barrier Beach; AU = Agriculture/Upland. Habitat types comprising less than 5% of unit are shown only if habitat is particularly rare or important to wildlife.
Status: NH = Not Historically Present; NL = No Longer Present; Lo = Low Numbers; Mo = Moderate Numbers; Hi = High Numbers
Functions of Particular Interest: Ne = Nesting; St = Stopover Habitat; W = Wintering Area; Mu = Multiple Functions
Trends (since 1985) / **Projections** (through 2050): Sy = Steady; D = Decrease; I = Increase; U = Unknown

| Mapping Unit | 1988 Habitat Type | % of Unit | Avifauna | | |

Table 7-2. Region 4 wildlife functions, status, trends, and projections.

Habitat Types: OW = Open Water; AB = Aquatic Bed; FM = Fresh Marsh; IM = Intermediate Marsh; BM = Brackish Marsh; SM = Saline Marsh; FS = Fresh Swamp; HF = Hardwood Forest; BB = Barrier Beach; AU = Agriculture/Upland. Habitat types comprising less than 5% of unit are shown only if habitat is particularly rare or important to wildlife.
Status: NH = Not Historically Present; NL = No Longer Present, Lo = Low Numbers; Mo = Moderate Numbers; Hi = High Numbers
Functions of Particular Interest: Ne = Nesting; St = Stopover Habitat; W = Wintering Area; Mu = Multiple Functions
Trends (since 1985) / **Projections** (through 2050): Sy = Steady; D = Decrease; I = Increase; U = Unknown

Mapping Unit	1988 Habitat		Avifauna												Furbearer										Game										Reptiles		
	Type	% of Unit	Other Marsh/ OW Residents				Other Wood-land Resid.				Other Marsh/ OW Migrants				Other Wood-land Mig.				Nutria				Muskrat				Mink, Otter, and Raccoon				Rabbits				Squirrels				Deer				American Alligator			
			Func.	Status	Trend	Proj	Func.	Status	Trend	Proj	Func.	Status	Trend	Proj	Func.	Status	Trend	Proj	Func.	Status	Trend	Proj	Func.	Status	Trend	Proj	Func.	Status	Trend	Proj	Func.	Status	Trend	Proj	Func.	Status	Trend	Proj	Func.	Status	Trend	Proj	Func.	Status	Trend	Proj
Grand/White Lake Land Bridge	OW	35	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Mo	I	I
	FM	54	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	D	D		NH			Mu	Lo	D	D	Mu	Mo	I	I
	HF	9		NH			Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	D	D		NH			Mu	Lo	D	D	Mu	Lo	Sy	Sy
Grand Lake East	OW	14	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Mo	I	Sy
	AB	6	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Mo	I	Sy
	FM	64	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	D	D		NH			Mu	Lo	D	D	Mu	Mo	I	Sy
	HF	14		NH			Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy
Hog Bayou	OW	34	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Lo	Sy	Sy
	FM	5	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy
	BM	32	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy
	SM	25	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy
	BB	1		NH				NH				NH				NH				NH				NH				NH				NH				NH				NH				NH		
Lacassine	OW	20	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Hi	I	Sy
	AB	20	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Hi	I	Sy
	FM	55	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Hi	I	Sy
	HF	5		NH			Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy
Little Prairie	OW	6	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Mo	I	Sy
	FM	30	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Mo	I	Sy
	HF	14		NH			Mu	Hi	Sy	D		NH			Mu	Hi	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy
	AU	50	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy

JA
37-899
878
10/04/2019

Table 7-2. Region 4 wildlife functions, status, trends, and projections.

Habitat Types: OW = Open Water, AB = Aquatic Bed, FM = Fresh Marsh; IM = Intermediate Marsh, BM = Brackish Marsh, SM = Saline Marsh; FS = Fresh Swamp; HF = Hardwood Forest, BB = Barrier Beach, AU = Agriculture/Upland. Habitat types comprising less than 5% of unit are shown only if habitat is particularly rare or important to wildlife.
Status: NH = Not Historically Present, NL = No Longer Present; Lo = Low Numbers; Mo = Moderate Numbers, Hi = High Numbers
Functions of Particular Interest: Ne = Nesting; St = Stopover Habitat; W = Wintering Area; Mu = Multiple Functions
Trends (since 1985) / **Projections** (through 2050): Sy = Steady, D = Decrease, I = Increase, U = Unknown

Mapping Unit	1988 Habitat Type	% of Unit	Avifauna: Brown Pelican				Bald Eagle				Seabirds				Wading Birds				Shorebirds				Dabbling Ducks				Diving Ducks				Geese				Raptors				Rails, Coots, and Gallinules			
			Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.
Little Pecan	OW	15		NH				NH			Mu	Mo	Sy	Sy		NH				NH			W	Mo	D	D	W	Mo	Sy	Sy	W	Lo	Sy	Sy		NH			W	Mo	Sy	Sy
	FM	75		NH				NH			Mu	Lo	Sy	Sy	Mu	Hi	I	Sy	Mu	Hi	Sy	Sy	W	Mo	D	D	W	Mo	D	D	W	Lo	Sy	Sy		NH			Mu	Mo	Sy	Sy
	HF	3		NH				NH				NH				NH				NH			Ne	Lo	Sy	Sy		NH				NH				NH				NH		
Locust Island	OW	9		NH				NH			Mu	Mo	Sy	Sy		NH				NH			W	Mo	Sy	Sy	W	Mo	Sy	Sy	W	Lo	Sy	Sy	W	Mo	Sy	Sy	W	Mo	Sy	Sy
	FM	9		NH				NH			Mu	Lo	Sy	Sy	Mu	Hi	Sy	D	Mu	Hi	Sy	D	W	Mo	Sy	Sy	W	Mo	Sy	Sy	W	Lo	Sy	Sy	W	Mo	Sy	Sy	Mu	Mo	Sy	Sy
	IM	31		NH				NH			Mu	Lo	Sy	Sy	Mu	Hi	Sy	D	Mu	Hi	Sy	D	W	Mo	Sy	Sy	W	Mo	Sy	Sy	W	Lo	Sy	Sy	W	Mo	Sy	Sy	Mu	Mo	Sy	Sy
	BM	13		NH				NH			Mu	Lo	Sy	Sy	Mu	Hi	Sy	D	Mu	Hi	Sy	D	W	Mo	Sy	Sy	W	Mo	Sy	Sy	W	Lo	Sy	Sy	W	Mo	Sy	Sy	Mu	Mo	Sy	Sy
	AU	36		NH				NH			Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Hi	Sy	Sy	W	Lo	Sy	Sy	W	Lo	Sy	Sy	W	Lo	Sy	Sy	W	Mo	Sy	Sy	Mu	Lo	Sy	Sy
Lower Mud Lake	OW	11	W	Lo	I	I		NH			Mu	Mo	Sy	Sy		NH				NH			W	Mo	D	D	W	Mo	D	D	W	Lo	D	D		NH			W	Lo	Sy	Sy
	SM	77		NH				NH			Mu	Mo	Sy	D	Mu	Hi	I	Sy	Mu	Hi	Sy	D	W	Lo	D	D	W	Lo	D	D	W	Lo	D	D		NH			Mu	Lo	Sy	Sy
	HF	4		NH				NH				NH				NH				NH				NH				NH				NH				NH				NH		
	BB	2		NH				NH			Mu	Hi	Sy	Sy	St	Lo	Sy	Sy	Mu	Hi	Sy	Sy		NH				NH				NH				NH				NH		
Middle Marsh	OW	7		NH				NH			Mu	Lo	Sy	Sy		NH				NH			W	Hi	Sy	Sy	W	Hi	Sy	Sy	W	Lo	Sy	Sy		NH			W	Mo	Sy	Sy
	FM	10		NH				NH			Mu	Lo	Sy	Sy	Mu	Hi	Sy	D	Mu	Hi	Sy	D	W	Hi	Sy	Sy	W	Hi	Sy	Sy	W	Lo	Sy	Sy	Mu	Lo	Sy	D	Mu	Mo	Sy	Sy
	IM	69		NH				NH			Mu	Lo	Sy	Sy	Mu	Hi	Sy	D	Mu	Hi	Sy	D	W	Hi	Sy	Sy	W	Hi	Sy	Sy	W	Lo	Sy	Sy	Mu	Lo	Sy	D	Mu	Mo	Sy	Sy
	AU	10		NH				NH				Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	W	Mo	Sy	Sy	W	Mo	Sy	Sy	W	Lo	Sy	Sy	Mu	Lo	Sy	D	Mu	Mo	Sy	Sy				
North White Lake	FM	92		NH				NH			Mu	Lo	Sy	Sy	Mu	Hi	I	Sy	Mu	Hi	Sy	Sy	W	Lo	Sy	Sy	W	Lo	Sy	Sy	W	Lo	Sy	Sy	W	Lo	Sy	Sy	W	Lo	Sy	Sy
	HF	6		NH				NH				NH				NH				NH				Mu	Lo	Sy	Sy		NH				NH			Mu	Hi	Sy	D		NH		

JA 37-899 879 10/04/2019

Table 7-2. Region 4 wildlife functions, status, trends, and projections.

Habitat Types: OW = Open Water, AB = Aquatic Bed; FM = Fresh Marsh; IM = Intermediate Marsh; BM = Brackish Marsh; SM = Saline Marsh; FS = Fresh Swamp; HP = Hardwood Forest; BB = Barrier Beach; AU = Agriculture/Upland. Habitat types comprising less than 5% of unit are shown only if habitat is particularly rare or important to wildlife.
Status: NH = Not Historically Present, NL = No Longer Present, Lo = Low Numbers, Mo = Moderate Numbers, Hi = High Numbers
Functions of Particular Interest: Ne = Nesting; St = Stopover Habitat; W = Wintering Area; Mu = Multiple Functions
Trends (since 1985) / **Projections** (through 2050): Sy = Steady; D = Decrease; I = Increase; U = Unknown

Mapping Unit	1988 Habitat		Avifauna												Furbear												Game												Reptiles			
			Other Marsh/ OW Residents				Other Wood-land Resid.				Other Marsh/ OW Migrants				Other Wood-land Mig.				Nutria				Muskrat				Mink, Otter, and Raccoon				Rabbits				Squirrels				Deer				American Alligator			
	Type	% of Unit	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.
Little Pecan	OW	15	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy		NH				NH			Mu	Hi	I	I
	FM	75	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Hi	I	I
	HP	3		NH			Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy
Locust Island	OW	9	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Mo	I	Sy
	FM	9	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Mo	I	Sy
	IM	31	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Mo	I	Sy
	BM	13	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Mo	I	Sy
	AU	36	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy
Lower Mud Lake	OW	11	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Lo	Sy	Sy
	SM	77	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy
	HP	4		NH			Mu	Hi	Sy	D		NH			Mu	Hi	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy
	BB	2		NH				NH				NH				NH				NH				NH				NH				NH				NH				NH				NH		
Middle Marsh	OW	7	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Mo	I	Sy
	FM	10	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Mo	I	Sy
	IM	69	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Mo	I	Sy
	AU	10	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy
North White Lake	FM	92	W	Lo	Sy	Sy	W	Lo	Sy	Sy	W	Lo	Sy	Sy	W	Lo	Sy	Sy	W	Lo	Sy	Sy	W	Lo	Sy	Sy	W	Lo	Sy	Sy		NH				NH			Mu	Lo	Sy	Sy	Mu	Mo	I	Sy
	HP	6		NH			Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	W	Lo	Sy	Sy	W	Lo	Sy	Sy	W	Lo	Sy	Sy	Mu	Lo	Sy	Sy

JA 37-899 880 10/04/2019

Table 7-2. Region 4 wildlife functions, status, trends, and projections.

Habitat Types: OW = Open Water; AB = Aquatic Bed; FM = Fresh Marsh; IM = Intermediate Marsh; BM = Brackish Marsh; SM = Saline Marsh; FS = Fresh Swamp; HF = Hardwood Forest; BB = Barrier Beach; AU = Agriculture/Upland. Habitat types comprising less than 5% of unit are shown only if habitat is particularly rare or important to wildlife.
Status: NH = Not Historically Present; NL = No Longer Present; Lo = Low Numbers; Mo = Moderate Numbers; Hi = High Numbers
Functions of Particular Interest: Ne = Nesting; St = Stopover Habitat; W = Wintering Area; Mu = Multiple Functions
Trends (since 1985) / **Projections** (through 2050): Sy = Steady, D = Decrease; I = Increase; U = Unknown

| Mapping Unit | 1988 Habitat | | Avifauna | | |

Table 7-2. Region 4 wildlife functions, status, trends, and projections.

Habitat Types: OW = Open Water, AB = Aquatic Bed; FM = Fresh Marsh; IM = Intermediate Marsh, BM = Brackish Marsh, SM = Saline Marsh; FS = Fresh Swamp, HF = Hardwood Forest, BB = Barrier Beach, AU = Agriculture/Upland. Habitat types comprising less than 5% of unit are shown only if habitat is particularly rare or important to wildlife.
Status: NH = Not Historically Present, NL = No Longer Present, Lo = Low Numbers; Mo = Moderate Numbers; Hi = High Numbers
Functions of Particular Interest: Ne = Nesting; St = Stopover Habitat; W = Wintering Area; Mu = Multiple Functions
Trends (since 1985) / **Projections** (through 2050): Sy = Steady, D = Decrease, I = Increase; U = Unknown

Mapping Unit	1988 Habitat		Avifauna														Furbeare												Game												Reptiles			
	Type	% of Unit	Other Marsh/ OW Residents				Other Wood-land Resid.				Other Marsh/ OW Migrants				Other Wood-land Mig.				Nutria				Muskrat				Mink, Otter, and Raccoon				Rabbits				Squirrels				Deer				American Alligator			
			Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.
North Grand Lake	OW	20	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy		NH				NH				NH			Mu	Mo	I	Sy
	FM	68	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	W	Lo	Sy	Sy		NH			W	Lo	Sy	Sy	Mu	Mo	I	Sy
	HF	7		NH			Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	W	Lo	Sy	Sy	W	Lo	Sy	Sy	W	Mo	Sy	Sy	Mu	Lo	Sy	Sy
Oak Grove	IM	73	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				Mu	Lo	Sy	Sy	Mu	Mo	I	Sy
	BM	13	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				Mu	Lo	Sy	Sy	Mu	Mo	I	Sy
	AU	8	Mu	Lo	Sy	Sy	Ne	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mo	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy		NH				Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy
Rockefeller	OW	23		NH				NH				NH				NH				NH				NH				NH				NH				NH				NH			Mu	Hi	I	Sy
	FM	15	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Hi	Sy	Sy	Mu	Mo	Sy	D		NH				Mu	Mo	Sy	D	Mu	Hi	I	Sy
	IM	14	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Hi	Sy	Sy	Mu	Mo	Sy	D		NH				Mu	Mo	Sy	D	Mu	Hi	I	Sy
	BM	30	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Hi	Sy	Sy	Mu	Mo	Sy	D		NH				Mu	Mo	Sy	D	Mu	Hi	I	Sy
	SM	15	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Mo	Sy	D		NH				Mu	Mo	Sy	D	Mu	Lo	Sy	Sy
South Pecan Island	OW	26		NH				NH				NH				NH				NH				NH				NH				NH				NH				NH			Mu	Mo	I	Sy
	IM	5	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Hi	Sy	Sy	Mu	Lo	Sy	D		NH				Mu	Lo	Sy	D	Mu	Mo	I	Sy
	BM	61	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Hi	Sy	Sy	Mu	Lo	Sy	D		NH				Mu	Lo	Sy	D	Mu	Mo	I	Sy
South White Lake	OW	7	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	D		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Mo	I	Sy
	FM	70	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				Mu	Lo	Sy	Sy	Mu	Mo	I	Sy
	HF	11	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy
	AU	10	W	Mo	Sy	Sy	W	Mo	Sy	Sy	W	Mo	Sy	Sy	W	Mo	Sy	Sy	W	Mo	Sy	Sy	W	Mo	Sy	Sy	W	Mo	Sy	Sy	W	Mo	Sy	Sy		NH				Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy
White Lake	OW	99	Mo	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH				NH				NH				NH				NH				NH				NH				NH		

JA 37-899 10/04/2019 882

Table 7-2. Region 4 wildlife functions, status, trends, and projections.

Habitat Types: OW = Open Water, AB = Aquatic Bed; FM = Fresh Marsh; IM = Intermediate Marsh, BM = Brackish Marsh; SM = Saline Marsh; FS = Fresh Swamp; HF = Hardwood Forest, BB = Barrier Beach, AU = Agriculture/Upland. Habitat types comprising less than 5% of unit are shown only if habitat is particularly rare or important to wildlife.
Status: NH = Not Historically Present; NL = No Longer Present; Lo = Low Numbers; Mo = Moderate Numbers; Hi = High Numbers
Functions of Particular Interest: Ne = Nesting; St = Stopover Habitat; W = Wintering Area; Mu = Multiple Functions
Trends (since 1985) / **Projections** (through 2050): Sy = Steady, D = Decrease; I = Increase; U = Unknown

Mapping Unit	1988 Habitat Type	% of Unit	Avifauna: Brown Pelican (Func. / Status / Trend / Proj.)	Bald Eagle (Func. / Status / Trend / Proj.)	Seabirds (Func. / Status / Trend / Proj.)	Wading Birds (Func. / Status / Trend / Proj.)	Shorebirds (Func. / Status / Trend / Proj.)	Dabbling Ducks (Func. / Status / Trend / Proj.)	Diving Ducks (Func. / Status / Trend / Proj.)	Geese (Func. / Status / Trend / Proj.)	Raptors (Func. / Status / Trend / Proj.)	Rails, Coots, and Gallinules (Func. / Status / Trend / Proj.)
Calcasieu/Sabine Basin												
Big Lake	OW	24	NH	NH	Mu Mo Sy Sy	NH	NH	W Mo Sy Sy	W Mo Sy Sy	W Lo Sy Sy	NH	W Mo Sy Sy
	FM	14	NH	NH	Mu Lo Sy D	Mu Hi I Sy	Mu Hi Sy D	W Mo Sy Sy	W Mo Sy Sy	W Lo Sy Sy	NH	Mu Mo Sy Sy
	IM	9	NH	NH	Mu Lo Sy D	Mu Hi I Sy	Mu Hi Sy D	W Mo Sy Sy	W Mo Sy Sy	W Lo Sy Sy	NH	Mu Mo Sy Sy
	BM	18	NH	NH	Mu Mo Sy D	Mu Hi I Sy	Mu Hi Sy D	W Mo Sy Sy	W Mo Sy Sy	W Lo Sy Sy	NH	Mu Mo Sy Sy
	HF	10	NH	NH	NH	NH	NH	Ne Lo Sy Sy	NH	NH	NH	NH
	AU	25	NH	NH	St Lo Sy Sy St	Mu Sy Sy	Mu Mo Sy Sy	W Lo Sy Sy	W Lo Sy Sy	W Lo Sy Sy	Mu Mo Sy Sy	NH
Black Bayou	OW	34	W Lo I I	NH	Mu Mo Sy Sy	NH	NH	W Hi I D	W Hi I D	W Mo I D	NH	W Lo Sy D
	IM	23	NH	NH	Mu Lo Sy D	Mu Hi I Sy	Mu Hi Sy D	W Hi I D	W Hi I D	W Mo I D	NH	Mu Lo Sy D
	BM	34	NH	NH	Mu Lo Sy D	Mu Hi I Sy	Mu Hi Sy D	W Hi I D	W Hi I D	W Mo I D	NH	Mu Lo Sy D
	HF	5	NH	NH	NH	NH	NH	NH	NH	NH	NH	NH
Black Lake	OW	68	NH	NH	Mu Mo Sy Sy	NH	NH	W Lo I D	W Lo I D	W Lo I D	W Lo I D	W Lo Sy D
	IM	5	NH	NH	Mu Lo Sy D	Mu Hi I Sy	Mu Hi Sy D	W Lo I D	W Lo I D	W Lo I D	W Lo I D	Mu Lo Sy D
	BM	11	NH	NH	Mu Lo Sy D	Mu Hi I Sy	Mu Hi Sy D	W Lo I D	W Lo I D	W Lo I D	W Lo I D	Mu Lo Sy D
	AU	10	NH	NH	St Lo Sy Sy St	Mu Sy Sy	Mu Mo Sy Sy	NH	NH	NH	NH	NH
Brown Lake	OW	52	NH	NH	Mu Mo Sy Sy	NH	NH	W Hi I D	W Hi I D	W Mo I D	NH	Mu Lo Sy D
	FM	7	NH	NH	Mu Lo Sy D	Mu Hi I Sy	Mu Hi Sy D	W Hi I D	W Hi I D	W Mo I D	NH	Mu Lo Sy D
	IM	5	NH	NH	Mu Lo Sy D	Mu Hi I Sy	Mu Hi Sy D	W Hi I D	W Hi I D	W Mo I D	NH	Mu Lo Sy D
	BM	34	NH	NH	Mu Mo Sy D	Mu Hi I Sy	Mu Hi Sy D	W Hi I D	W Hi I D	W Mo I D	NH	Mu Lo Sy D

JA 37-899 10/04/2019 883

Table 7-2. Region 4 wildlife functions, status, trends, and projections.

Habitat Types: OW = Open Water, AB = Aquatic Bed; FM = Fresh Marsh; IM = Intermediate Marsh; BM = Brackish Marsh; SM = Saline Marsh; FS = Fresh Swamp; HF = Hardwood Forest; BB = Barrier Beach; AU = Agriculture/Upland. Habitat types comprising less than 5% of unit are shown only if habitat is particularly rare or important to wildlife.
Status: NH = Not Historically Present; NL = No Longer Present; Lo = Low Numbers; Mo = Moderate Numbers; Hi = High Numbers
Functions of Particular Interest: Ne = Nesting; St = Stopover Habitat; W = Wintering Area; Mu = Multiple Functions
Trends (since 1985) / **Projections** (through 2050): Sy = Steady; D = Decrease; I = Increase; U = Unknown

Mapping Unit	1988 Habitat		Avifauna												Furbear										Game										Reptiles		
	Type	% of Unit	Other Marsh/ OW Residents			Other Wood-land Resid.			Other Marsh/ OW Migrants			Other Wood-land Mig.			Nutria			Muskrat			Mink, Otter, and Raccoon			Rabbits			Squirrels			Deer			American Alligator		
			Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.
Calcasieu/Sabine Basin																																				
Big Lake	OW	24	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH			Mu	Mo	I	Sy
	FM	14	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Mo	I	Sy
	IM	9	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Mo	I	Sy
	BM	18	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Mo	I	Sy
	HF	10		NH			Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy
	AU	25	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy
Black Bayou	OW	34	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Lo	Sy	Sy
	IM	23	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	D		NH			Mu	Lo	Sy	D	Mu	Mo	I	Sy
	BM	34	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	D		NH			Mu	Lo	Sy	D	Mu	Mo	I	Sy
	HF	5		NH			Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	D		NH			Mu	Lo	Sy	D	Mu	Lo	Sy	Sy
Black Lake	OW	68	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Lo	Sy	Sy
	IM	5	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	D		NH			Mu	Lo	Sy	D	Mu	Lo	Sy	Sy
	BM	11	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	D		NH			Mu	Lo	Sy	D	Mu	Lo	Sy	Sy
	AU	10	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	D		NH			Mu	Mo	Sy	D	Mu	Lo	Sy	Sy
Brown Lake	OW	52	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Lo	Sy	Sy
	FM	7	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	D		NH			Mu	Lo	Sy	D	Mu	Mo	I	Sy
	IM	5	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	D		NH			Mu	Lo	Sy	D	Mu	Mo	I	Sy
	BM	34	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	D		NH			Mu	Lo	Sy	D	Mu	Mo	I	Sy

JA 37-899 884 10/04/2019

Table 7-2. Region 4 wildlife functions, status, trends, and projections.

Habitat Types: OW = Open Water; AB = Aquatic Bed; FM = Fresh Marsh; IM = Intermediate Marsh; BM = Brackish Marsh; SM = Saline Marsh; FS = Fresh Swamp; HF = Hardwood Forest; BB = Barrier Beach; AU = Agriculture/Upland. Habitat types comprising less than 5% of unit are shown only if habitat is particularly rare or important to wildlife.
Status: NH = Not Historically Present; NL = No Longer Present; Lo = Low Numbers; Mo = Moderate Numbers; Hi = High Numbers
Functions of Particular Interest: No = Nesting; St = Stopover Habitat; W = Wintering Area; Mu = Multiple Functions
Trends (since 1985) / **Projections** (through 2050): Sy = Steady; D = Decrease; I = Increase; U = Unknown

| Mapping Unit | 1988 Habitat | | Avifauna | | |

Table 7-2. Region 4 wildlife functions, status, trends, and projections.

Habitat Types: OW = Open Water; AB = Aquatic Bed; FM = Fresh Marsh; IM = Intermediate Marsh; BM = Brackish Marsh; SM = Saline Marsh; FS = Fresh Swamp; HF = Hardwood Forest; BB = Barrier Beach; AU = Agriculture/Upland. Habitat types comprising less than 5% of unit are shown only if habitat is particularly rare or important to wildlife.
Status: NH = Not Historically Present; NL = No Longer Present; Lo = Low Numbers; Mo = Moderate Numbers; Hi = High Numbers
Functions of Particular Interest: Ne = Nesting; St = Stopover Habitat; W = Wintering Area; Mu = Multiple Functions
Trends (since 1985) / **Projections** (through 2050): Sy = Steady, D = Decrease; I = Increase; U = Unknown

Mapping Unit	1988 Habitat		Avifauna												Furbeare										Game										Reptiles		
	Type	% of Unit	Other Marsh/ OW Residents				Other Wood-land Resid.				Other Marsh/ OW Migrants				Other Wood-land Mig.				Nutria				Muskrat				Mink, Otter, and Raccoon				Rabbits				Squirrels				Deer				American Alligator		
			Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.
Cameron	OW	6	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Mo	I	Sy
	FM	19	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Mo	I	Sy
	IM	22	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Mo	I	Sy
	BM	14	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Mo	I	Sy
	SM	6	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy
	HF	1	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy
	BB	1		NH				NH				NH				NH				NH				NH				NH				NH				NH				NH				NH		
Calcasieu Lake	OW	94	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH				NH				NH				NH				NH				NH				NH				NH		
Cameron-Creole Watershed	OW	38	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Lo	I	I	Mu	Mo	I	I	Mu	Mo	I	I		NH				NH				NH			Mu	Mo	I	I
	IM	26	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Lo	I	I	Mu	Mo	I	I	Mu	Mo	I	I	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Mo	I	I
	BM	35	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Lo	I	I	Mu	Mo	I	I	Mu	Mo	I	I	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Mo	I	I
Choupique Island	OW	33	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Lo	Sy	Sy
	FM	29	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	W	Lo	Sy	Sy		NH			W	Lo	Sy	Sy	Mu	Lo	Sy	Sy
	BM	31	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	W	Lo	Sy	Sy		NH			W	Lo	Sy	Sy	Mu	Lo	Sy	Sy
	AU	5		NH			Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	W	Lo	Sy	Sy		NH			W	Lo	Sy	Sy	Mu	Lo	Sy	Sy
Clear Marais	OW	21	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Mo	I	I
	AB	10	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Mo	I	I
	FM	58	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Mo	I	I
	AU	6	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy
Gum Cove	FM	21	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy
	AU	77	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy

JA 37-899 10/04/2019 886

Table 7-2. Region 4 wildlife functions, status, trends, and projections.

Habitat Types: OW = Open Water, AB = Aquatic Bed; FM = Fresh Marsh; IM = Intermediate Marsh; BM = Brackish Marsh, SM = Saline Marsh; FS = Fresh Swamp; HF = Hardwood Forest; BB = Barrier Beach; AU = Agriculture/Upland. Habitat types comprising less than 5% of unit are shown only if habitat is particularly rare or important to wildlife.
Status: NH = Not Historically Present; NL = No Longer Present; Lo = Low Numbers; Mo = Moderate Numbers; Hi = High Numbers
Functions of Particular Interest: Ne = Nesting; St = Stopover Habitat; W = Wintering Area; Mu = Multiple Functions
Trends (since 1985) / **Projections** (through 2050): Sy = Steady; D = Decrease; I = Increase; U = Unknown

Mapping Unit	1988 Habitat Type	% of Unit	Avifauna: Brown Pelican Func.	Status	Trend	Proj.	Bald Eagle Func.	Status	Trend	Proj.	Seabirds Func.	Status	Trend	Proj.	Wading Birds Func.	Status	Trend	Proj.	Shorebirds Func.	Status	Trend	Proj.	Dabbling Ducks Func.	Status	Trend	Proj.	Diving Ducks Func.	Status	Trend	Proj.	Geese Func.	Status	Trend	Proj.	Raptors Func.	Status	Trend	Proj.	Rails, Coots, and Gallinules Func.	Status	Trend	Proj.
Hackberry Ridge	OW	12		NH				NH			Mu	Mo	Sy	Sy		NH				NH			W	Hi	I	D	W	Hi	I	D	W	Mo	I	D		NH				Mu	Lo	Sy	D
	BM	21		NH				NH			Mu	Mo	Sy	Sy	Mu	Hi	I	Sy	Mu	Hi	Sy	Sy	W	Hi	I	D	W	Hi	I	D	W	Mo	I	D		NH				Mu	Lo	Sy	D
	HF	9		NH				NH				NH				NH				NH			Ne	Lo	Sy	Sy		NH				NH			Mu	Mo	Sy	D		NH		
	AU	53		NH				NH				NH			St	Lo	Sy	Sy	Mu	Mo	Sy	Sy	W	Mo	Sy	Sy	W	Mo	Sy	Sy	W	Mo	Sy	Sy	W	Mo	Sy	Sy	W	Lo	Sy	Sy
Hog Island Gully	OW	37		NH				NH			Mu	Mo	Sy	Sy		NH				NH			W	Hi	I	D	W	Hi	I	D	W	Mo	I	D		NH				Mu	Lo	Sy	D
	BM	22		NH				NH			Mu	Mo	Sy	D	Mu	Hi	I	Sy	Mu	Hi	Sy	D	W	Mo	I	D	W	Mo	I	D	W	Mo	I	D		NH				Mu	Lo	Sy	D
	SM	36		NH				NH			Mu	Mo	Sy	D	Mu	Hi	I	Sy	Mu	Hi	Sy	D	W	Lo	Sy	D	W	Lo	Sy	D	W	Lo	Sy	D		NH				Mu	Lo	Sy	D
East Johnson's Bayou	OW	7		NH				NH			Mu	Mo	Sy	Sy		NH				NH			W	Hi	I	D	W	Hi	I	D	W	Mo	I	D		NH				W	Lo	Sy	Sy
	FM	7		NH				NH			Mu	Lo	Sy	D	Mu	Hi	I	Sy	Mu	Hi	Sy	D	W	Hi	I	D	W	Hi	I	D	W	Mo	I	D	Mu	Lo	Sy	D	Mu	Lo	Sy	D
	IM	80		NH				NH			Mu	Lo	Sy	D	Mu	Hi	I	Sy	Mu	Hi	Sy	D	W	Hi	I	D	W	Hi	I	D	W	Mo	I	D	Mu	Lo	Sy	D	Mu	Lo	Sy	D
West Johnson's Bayou	OW	13	W	Lo	I	I		NH			Mu	Hi	Sy	Sy		NH				NH			W	Mo	I	D	W	Mo	I	D	W	Mo	I	D		NH				W	Lo	Sy	Sy
	BM	83		NH				NH			Mu	Mo	Sy	D	Mu	Hi	I	D	Mu	Hi	Sy	D	W	Mo	I	D	W	Mo	I	D	W	Mo	I	D	Mu	Lo	Sy	D	Mu	Lo	Sy	D
Johnson's Bayou Ridge	OW	5	W	Lo	I	I		NH			Mu	Mo	Sy	Sy		NH				NH			W	Mo	I	D	W	Mo	I	D	W	Mo	I	D		NH				W	Lo	Sy	Sy
	BM	31		NH				NH			Mu	Mo	Sy	D	Mu	Hi	I	Sy	Mu	Hi	Sy	D	W	Mo	I	D	W	Mo	I	D	W	Hi	I	D	Mu	Lo	Sy	D	Mu	Lo	Sy	D
	SM	44		NH				NH			Mu	Mo	Sy	D	Mu	Hi	I	Sy	Mu	Hi	Sy	D	W	Mo	I	D	W	Mo	I	D	W	Hi	I	D	Mu	Lo	Sy	D	Mu	Lo	Sy	D
	HF	3		NH				NH				NH				NH				NH			Ne	Lo	Sy	Sy		NH				NH				NH				NH		
	BB	1		NH				NH			Mu	Hi	Sy	Sy	St	Lo	Sy	Sy	Mu	Hi	Sy	Sy		NH				NH				NH				NH				NH		
	AU	16		NH				NH				NH			St	Lo	Sy	Sy	Mu	Mo	Sy	Sy	W	Mo	I	D	W	Mo	I	D	W	Hi	I	D	Mu	Lo	Sy	D	Mu	Lo	Sy	D
Martin Beach-Ship Can. Shore	OW	9	W	Mo	I	I		NH			Mu	Mo	Sy	Sy		NH				NH			W	Mo	I	D	W	Mo	I	D	W	Lo	I	D		NH				W	Lo	Sy	Sy
	IM	33		NH				NH			Mu	Lo	Sy	D	Mu	Hi	Sy	D	Mu	Hi	Sy	D	W	Mo	I	D	W	Mo	I	D	W	Mo	I	D	Mu	Lo	Sy	D	Mu	Lo	Sy	D
	BM	26		NH				NH			Mu	Mo	Sy	D	Mu	Hi	Sy	D	Mu	Hi	Sy	D	W	Mo	I	D	W	Mo	I	D	W	Mo	I	D	Mu	Lo	Sy	D	Mu	Lo	Sy	D
	SM	7		NH				NH			Mu	Mo	Sy	D	Mu	Hi	Sy	D	Mu	Hi	Sy	D	W	Mo	I	D	W	Mo	I	D	W	Mo	I	D	Mu	Lo	Sy	D	Mu	Lo	Sy	D
	BB	1		NH				NH			Mu	Hi	Sy	Sy	St	Lo	Sy	Sy	Mu	Hi	Sy	Sy		NH				NH				NH				NH				NH		
	AU	24		NH				NH				NH			St	Lo	Sy	Sy	Mu	Mo	Sy	Sy	W	Lo	I	D	W	Lo	I	D	W	Mo	I	D	Mu	Lo	Sy	D	Mu	Lo	Sy	D

JA 37-899 887 10/04/2019

Table 7-2. Region 4 wildlife functions, status, trends, and projections.

Habitat Types: OW = Open Water, AB = Aquatic Bed; FM = Fresh Marsh, IM = Intermediate Marsh, BM = Brackish Marsh; SM = Saline Marsh; FS = Fresh Swamp, HF = Hardwood Forest, BB = Barrier Beach; AU = Agriculture/Upland. Habitat types comprising less than 5% of unit are shown only if habitat is particularly rare or important to wildlife.
Status: NH = Not Historically Present, NL = No Longer Present; Lo = Low Numbers; Mo = Moderate Numbers; Hi = High Numbers
Functions of Particular Interest: Ne = Nesting; St = Stopover Habitat; W = Wintering Area; Mu = Multiple Functions
Trends (since 1985) / **Projections** (through 2050): Sy = Steady, D = Decrease, I = Increase, U = Unknown

Mapping Unit	1988 Habitat		Avifauna												Furbearer										Game										Reptiles			
			Other Marsh/ OW Residents				Other Wood-land Resid.				Other Marsh/ OW Migrants				Other Wood-land Mig.				Nutria				Muskrat				Mink, Otter, and Raccoon				Rabbits				Squirrels				Deer				American Alligator			
	Type	% of Unit	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.
Hackberry Ridge	OW	12	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Lo	Sy	Sy
	BM	21	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	D		NH			Mu	Lo	Sy	D	Mu	Lo	Sy	Sy
	HF	9	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH				NH				NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				
	AU	53	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH		
Hog Island Gully	OW	37	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Lo	Sy	Sy
	BM	22	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	D		NH			Mu	Lo	Sy	D	Mu	Lo	Sy	Sy
	SM	56	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	D		NH			Mu	Lo	Sy	D	Mu	Lo	Sy	Sy
East Johnson's Bayou	OW	7	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy		NH				NH				NH			Mu	Hi	I	Sy
	FM	7	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Hi	I	Sy
	IM	80	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Hi	I	Sy
West Johnson's Bayou	OW	13	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy		NH				NH				NH			Mu	Hi	I	Sy
	BM	83	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	D		NH			Mu	Lo	Sy	D	Mu	Hi	I	Sy
Johnson's Bayou Ridge	OW	5	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy		NH				NH				NH			Mu	Lo	Sy	Sy
	BM	31	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	D		NH			Mu	Lo	Sy	D	Mu	Lo	Sy	Sy
	SM	44	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	D		NH			Mu	Lo	Sy	D	Mu	Lo	Sy	Sy
	HF	3		NH			Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy				
	BB	1		NH				NH				NH				NH				NH				NH				NH				NH				NH				NH				NH		
	AU	16	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	D		NH			Mu	Lo	Sy	D	Mu	Lo	Sy	Sy
Martin Beach-Ship Can. Shore	OW	9	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy		NH				NH				NH			Mu	Lo	Sy	Sy
	IM	33	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	D		NH			Mu	Lo	Sy	D	Mu	Lo	Sy	Sy
	BM	26	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	D		NH			Mu	Lo	Sy	D	Mu	Lo	Sy	Sy
	SM	7	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	D		NH			Mu	Lo	Sy	D	Mu	Lo	Sy	Sy
	BB	1		NH				NH				NH				NH				NH				NH				NH				NH				NH				NH				NH		
	AU	24	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Mo	Sy	D		NH			Mu	Mo	Sy	D	Mu	Lo	Sy	Sy

JA
37-899
888
10/04/2019

Table 7-2. Region 4 wildlife functions, status, trends, and projections.

Habitat Types: OW = Open Water, AB = Aquatic Bed; FM = Fresh Marsh; IM = Intermediate Marsh, BM = Brackish Marsh; SM = Saline Marsh; FS = Fresh Swamp; HF = Hardwood Forest, BB = Barrier Beach; AU = Agriculture/Upland. Habitat types comprising less than 5% of unit are shown only if habitat is particularly rare or important to wildlife.
Status: NH = Not Historically Present; NL = No Longer Present; Lo = Low Numbers; Mo = Moderate Numbers, Hi = High Numbers
Functions of Particular Interest: Ne = Nesting, St = Stopover Habitat; W = Wintering Area; Mu = Multiple Functions
Trends (since 1985) / **Projections** (through 2050): Sy = Steady, D = Decrease, I = Increase, U = Unknown

| Mapping Unit | 1988 Habitat | | Avifauna | | |

Table 7-2. Region 4 wildlife functions, status, trends, and projections.

Habitat Types: OW = Open Water; AB = Aquatic Bed; FM = Fresh Marsh; IM = Intermediate Marsh; BM = Brackish Marsh; SM = Saline Marsh; FS = Fresh Swamp; HF = Hardwood Forest, BB = Barrier Beach, AU = Agriculture/Upland. Habitat types comprising less than 5% of unit are shown only if habitat is particularly rare or important to wildlife.
Status: NH = Not Historically Present, NL = No Longer Present; Lo = Low Numbers; Mo = Moderate Numbers; Hi = High Numbers
Functions of Particular Interest: Ne = Nesting; St = Stopover Habitat; W = Wintering Area; Mu = Multiple Functions
Trends (since 1985) / **Projections** (through 2050): Sy = Steady; D = Decrease; I = Increase; U = Unknown

Mapping Unit	1988 Habitat		Avifauna												Furbearers										Game										Reptiles		
			Other Marsh/ OW Residents				Other Wood-land Resid				Other Marsh/ OW Migrants				Other Wood-land Mig.				Nutria				Muskrat				Mink, Otter, and Raccoon				Rabbits				Squirrels				Deer				American Alligator			
	Type	% of Unit	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.
Mud Lake	OW	34	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Mo	I	Sy
	BM	62	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Mo	I	Sy
Perry Ridge	OW	30	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Hi	I	Sy
	FM	30	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Hi	I	Sy
	IM	28	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Hi	I	Sy
	HF	10		NH			Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy
Sabine Pool No. 3	OW	32		NH				NH				NH				NH				NH				NH				NH				NH				NH				NH			Mu	Hi	Sy	Sy
	AB	7	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Hi	Sy	Sy
	FM	61	Mu	Hi	Sy	Sy		NH			Mu	Hi	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Hi	Sy	Sy
Sabine Lake Ridges	OW	5	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Mo	Sy	Sy
	FM	5	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy
	IM	24	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	D		NH			Mu	Lo	Sy	D	Mu	Mo	Sy	Sy
	BM	35	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	D		NH			Mu	Lo	Sy	D	Mu	Mo	Sy	Sy
	SM	11	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	D		NH			Mu	Lo	Sy	D	Mu	Lo	Sy	Sy
	HF	1		NH			Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy
	BB	2		NH				NH				NH				NH				NH				NH				NH				NH				NH				NH				NH		
	AU	17	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy
Second Bayou	OW	13	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy		NH				NH				NH			Mu	Hi	I	I
	IM	72	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	D		NH			Mu	Lo	Sy	D	Mu	Hi	I	I
	BM	14	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	D		NH			Mu	Lo	Sy	D	Mu	Hi	I	I

JA 37-899 890 10/04/2019

Table 7-2. Region 4 wildlife functions, status, trends, and projections.

Habitat Types: OW = Open Water, AB = Aquatic Bed, FM = Fresh Marsh, IM = Intermediate Marsh, BM = Brackish Marsh, SM = Saline Marsh, FS = Fresh Swamp, HF = Hardwood Forest, BB = Barrier Beach, AU = Agriculture/Upland. Habitat types comprising less than 5% of unit are shown only if habitat is particularly rare or important to wildlife.
Status: NH = Not Historically Present, NL = No Longer Present, Lo = Low Numbers, Mo = Moderate Numbers, Hi = High Numbers
Functions of Particular Interest: Ne = Nesting, St = Stopover Habitat, W = Wintering Area, Mu = Multiple Functions
Trends (since 1985) / **Projections** (through 2050): Sy = Steady, D = Decrease, I = Increase, U = Unknown

| Mapping Unit | 1988 Habitat | | Avifauna | | |

Table 7-2. Region 4 wildlife functions, status, trends, and projections.

Habitat Types: OW = Open Water; AB = Aquatic Bed; FM = Fresh Marsh; IM = Intermediate Marsh; BM = Brackish Marsh; SM = Saline Marsh; FS = Fresh Swamp; HF = Hardwood Forest; BB = Barrier Beach; AU = Agriculture/Upland. Habitat types comprising less than 5% of unit are shown only if habitat is particularly rare or important to wildlife.
Status: NH = Not Historically Present; NL = No Longer Present; Lo = Low Numbers; Mo = Moderate Numbers; Hi = High Numbers
Functions of Particular Interest: Ne = Nesting; St = Stopover Habitat; W = Wintering Area; Mu = Multiple Functions
Trends (since 1985) / **Projections** (through 2050): *Sy* = Steady; D = Decrease; I = Increase; U = Unknown

Mapping Unit	1988 Habitat Type	% of Unit	Avifauna: Other Marsh/OW Residents				Avifauna: Other Woodland Resid.				Avifauna: Other Marsh/OW Migrants				Avifauna: Other Woodland Mig.				Furbear: Nutria				Furbear: Muskrat				Furbear: Mink, Otter, and Raccoon				Game: Rabbits				Game: Squirrels				Game: Deer				Reptiles: American Alligator			
			Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.	Func.	Status	Trend	Proj.
Southeast Sabine	OW	9	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy		NH				NH				NH			Mu	Hi	I	Sy
	IM	59	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	D		NH				Mu	Lo	Sy	D	Mu	Hi	I	Sy
	BM	31	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Mo	Sy	Sy	Mu	Lo	Sy	D		NH				Mu	Lo	Sy	D	Mu	Hi	I	Sy
SW Gum Cove	OW	17	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Mo	Sy	Sy
	FM	41	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	D		NH				Mu	Lo	Sy	D	Mu	Mo	Sy	Sy
	IM	24	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	D		NH				Mu	Lo	Sy	D	Mu	Mo	Sy	Sy
	BM	8	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	D		NH				Mu	Lo	Sy	D	Mu	Mo	Sy	Sy
	HF	6		NH			Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	D		NH				Mu	Lo	Sy	D	Mu	Lo	Sy	Sy
	AU	5	W	Mo	Sy	Sy	W	Mo	Sy	Sy	W	Mo	Sy	Sy	W	Mo	Sy	Sy	W	Mo	Sy	Sy	W	Mo	Sy	Sy	W	Mo	Sy	Sy	W	Mo	Sy	Sy		NH				W	Mo	Sy	Sy	Mu	Lo	Sy	Sy
Sweet/Willow Lakes	OW	43	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Lo	Sy	Sy
	AB	6	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Mo	Sy	Sy
	FM	46	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy
West Black Lake	OW	61	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Lo	Sy	Sy
	FM	20	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	D		NH				Mu	Lo	Sy	D	Mu	Lo	Sy	I
	IM	9	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	D		NH				Mu	Lo	Sy	D	Mu	Lo	Sy	I
	AU	6	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Mo	Sy	Sy		NH				Mu	Mo	Sy	Sy	Mu	Lo	Sy	Sy
West Cove	OW	24	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Hi	I	Sy
	AB	7	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Hi	I	Sy
	FM	65	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	D		NH				Mu	Lo	Sy	D	Mu	Hi	I	Sy
Willow Bayou	OW	40	Mu	Mo	Sy	Sy		NH			Mu	Mo	Sy	Sy		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy		NH				NH				NH			Mu	Mo	I	Sy
	IM	8	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	D		NH				Mu	Lo	Sy	D	Mu	Mo	I	Sy
	BM	52	Mu	Hi	Sy	D		NH			Mu	Hi	Sy	D		NH			Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	Sy	Mu	Lo	Sy	D		NH				Mu	Lo	Sy	D	Mu	Mo	I	Sy

JA 37-899 892 10/04/2019

SOUTHWEST COASTAL LOUISIANA
REVISED INTEGRATED DRAFT FEASIBILITY REPORT
AND
ENVIRONMENTAL IMPACT STATEMENT

ANNEX S

Floods and Storms of Record

1. FLOODS AND STORMS OF RECORD

FLOODS AND STORMS OF RECORD

There have been several floods caused by runoff from heavy rainfall. Some of the major events that occurred over the last thirty years, including Hurricanes Lili, Rita, and Ike are discussed below.

Hurricane Audrey (June 25 - 29, 1957) ranks as the 7th deadliest hurricane to strike the United States and was the deadliest natural disaster in the history of southwest Louisiana in modern record-keeping with at least 500 deaths (source: http://www.srh.noaa.gov/lch/?n=audrey; accessed January 7, 2016).

Hurricane Lili (September 23 - October 3, 2002) was originally a Category 4 hurricane and first made landfall near Marsh Island in Iberia Parish with maximum sustained winds of 92 mph. Highest recorded rainfall amount was about 9 inches in some parts of Louisiana. The highest storm surge was over 11 feet in St. Mary Parish (source: https://coast.noaa.gov/hes/docs/postStorm/Lili_%20final.pdf; accessed December 15, 2015).

Hurricane Rita (September 24 - 26, 2005) Hurricane Rita, reaching its peak intensity southeast of the mouth of the Mississippi River as a Category 5, first made landfall just west of Johnson's Bayou and east of Sabine Pass at the Texas-Louisiana border as a Category 3 hurricane Sensors recorded storm-surge water levels over 14 ft above NAVD 88 at Constance Beach (LC11), Creole (LA12), and Grand Chenier (LA11), La., about 20 miles, 48 miles, and 54 miles, respectively, east of Sabine Pass, Texas. In general, storm-surge water levels increased eastward from the Sabine River into southwest Louisiana. The magnitude of the storm surge was greatest near the coast and decreased inland through the approximate latitude of I-10, about 35 miles inland from the coast (source: http://pubs.usgs.gov/circ/1306/pdf/c1306_ch7_i.pdf; accessed December 15, 2015).

Hurricane Gustav (August 25 - September 4, 2008) Gustav made landfall near Cocodrie, Louisiana on September 1, 2008 as a strong category 2 (based on 110 mph sustained winds) and continued to move northwest, spreading hurricane force wind gusts across portions of Southeast and South Central Louisiana (http://www.srh.noaa.gov/lix/?n=gustavsummary; accessed January 26, 2016). Due to the storm making landfall east of the study area, storm surge values were only 4-5 feet across St. Mary, Iberia, and Vermilion parishes (http://www.srh.noaa.gov/images/lch/tropical/HPW1-SUN.pdf; accessed January 26, 2016).

Hurricane Ike (September 1-14, 2008) first made landfall near Galveston, Texas on September 13, 2008 as a Category 2 hurricane with maximum sustained winds of 110 mph (http://www.srh.noaa.gov/hgx/?n=projects_ike08; accessed December 15, 2015). Ike was a large hurricane with tropical-storm-force and hurricane-force winds associated at the time of its landfall extending approximately 275 miles and 120 miles from the storm center, respectively. In Louisiana, estimated wind speeds ranged from 80 mph near the Texas-Louisiana border to 50 mph in Vermilion Parish. Storm surge caused flooding in Cameron, Vermilion, and many parishes to the east, with over 9 foot stillwater levels estimated for Lake Charles (http://www.fema.gov/media-library-data/20130726-1648-20490-1790/757_ch1_final.pdf; accessed December 15, 2015).

SOUTHWEST COASTAL LOUISIANA
FINAL INTEGRATED DRAFT FEASIBILITY REPORT
AND
ENVIRONMENTAL IMPACT STATEMENT

APPENDIX A

ENVIRONMENTAL REPORT

SOUTHWEST COASTAL LOUISIANA
FINAL INTEGRATED DRAFT FEASIBILITY REPORT
AND
ENVIRONMENTAL IMPACT STATEMENT

Environmental Report

Annex A:	**Clean Water Act Section 401 Water Quality Certification** **Clean Water Act Section 404(b)(1) Evaluation**
Annex B:	**Louisiana Coastal Resources Program Consistency Determination**
Annex C:	**Louisiana State Department of Wildlife and Fisheries Scoping Letter**
Annex D:	**National Marine Fisheries Service Scoping, Planning Aid Letter, Comment Letter on Revised Integrated Draft Report & EIS, USACE Comment Response Letter**
Annex E:	**Natural Resources Conservation Service Prime and Unique Farmlands Coordination**
Annex F:	**Section 106 Consultation Letters and Programmatic Agreements**
Annex G:	**U.S. Fish and Wildlife Service Final Coordination Act Report**
Annex H:	**U.S. Fish and Wildlife Service Scoping / Planning Aid Letter**
Annex I:	**Technical, Institutional and Public Significance of Relevant Resources**
Annex J:	**Environmental Compliance Laws**
Annex K:	**Threatened and Endangered Species**
Annex L:	**Adaptive Management and Monitoring Plan**
Annex M:	**Reserved**
Annex N:	**Recreation**
Annex O:	**Environmental Justice**
Annex P:	**Other Social Effects**
Annex Q:	**Best Management Practices and Avoidance Procedures**
Annex R:	**Coast 2050 Wildlife Tables**
Annex S:	**Floods and Storms of Record**
Annex T:	**Wetland Value Assessments**
Annex U:	**Glossary**
Annex V:	**Borrow Maps**
Annex W:	**Hypertemporal Subunit Change Rate and Map**

INTRODUCTION

This Appendix provides information that supplements the information provided in corresponding sections of Chapter 1 of the Main Report (i.e. subsection 1.2.4 Transportation in Appendix A supplements information in subsection 1.2.4 Transportation in Chapter 1).

1.0 Project Setting

1.1 Affected Environment

Study Area

Figure 1-1 displays land class changes within the study area between 1956 and 2000. This information, derived for the present study, was taken from a data set that does not include areas outside the Coastal Zone; hence the large areas categorized as "Out of Analysis".

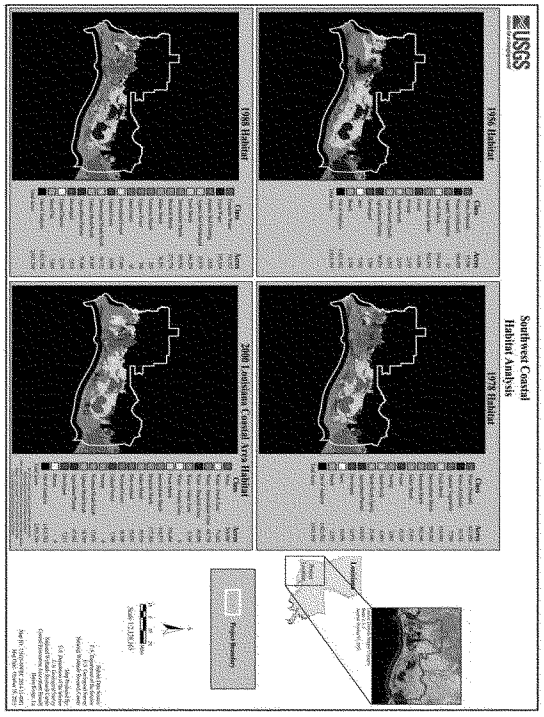


Figure 1-1: Land class (habitat) changes between 1978-2000 (source: USGS 2013).

Geomorphic and Physiographic Setting

The study area occupies a portion of the Pleistocene Prairie Terrace (or Prairie Complex) on the northern edge of Cameron, the northern half of Vermilion, as well as the majority of Calcasieu Parishes, and most of the Marginal Plain (or Chenier Plain) on the far southern portions of Calcasieu, most of Cameron and southern half of Vermilion Parishes. The main physiographic zones of the Chenier Plain include the Gulf Coast Marsh, Gulf Coast Prairies, and Forested Terraced Uplands. The Gulf Coast Marsh is at or near sea level and borders the Gulf of Mexico and most of the large lakes in the area. The Gulf Coast Prairie extends from the central part of Vermilion and Cameron Parishes into the southern part of Calcasieu Parish, while the Forested Uplands, which occur at or near 25-foot elevation, are located in the northern part of Vermilion and Calcasieu Parishes. Louisiana's coastal prairies, once encompassing an estimated 2.5 million acres in the Southwest portion of the state, now are considered critically imperiled with less than 600 acres remaining.

The study area formed over the past 7,000 years by the deltaic processes of the Mississippi River and other streams. Fine-grained sediment transported to the Chenier Plain in the mud stream from the Mississippi River was brought into coastal estuaries and marshes and deposited along the shore to form mudflats (Gagliano and van Beek, 1993). The newly formed land was then colonized by wetland vegetation, which further promoted the land-building process. Wave action and occasional storm events also deposited sand and shells onto the newly built land. As the Mississippi River changed course and active delta-building switched to the eastern Deltaic Plain, or extended to the edge of the continental shelf or beyond (current course), the mud stream ceased to carry sediment to the Chenier Plain and the Gulf shore became subject to erosion. Periods of erosion winnowed out fine-grained materials, leaving the deposits of sand and shell to form the Gulf beaches, examples of such in the area are Holly and Rutherford Beaches. Beach deposits were subsequently shaped by waves and coastal currents to form elevated ridge systems. Once the mud stream returned and land-building continued seaward, these elevated ridges or cheniers (forests atop relict beach ridges) were stranded inland where deciduous vegetative growth (e.g., live oak trees) occurred. Examples of cheniers in the area include Hackberry, Little Chenier, Grand Chenier, Pecan Island and Cheniere au Tigre ridges to name just a few. These ridges and cheniers blocked drainage and saltwater inflows from the Gulf of Mexico, resulting in the development of large freshwater basins on the landward side of the ridges. Chenier ridges run laterally to the modern shoreline and rise above the surrounding marshes by as little as a few inches or as much as 10 ft (Byrne et al. 1959). These ridges can range from 100 to 1,500 ft wide with some ridges extending along the coast for a distance of up to 30 miles. On the seaward side of the cheniers, a zone of brackish to saline marshes developed as a result of tidal influences from the Gulf (adapted from Visser et al. (2000), USACE (2004), and LADNR (2009)).

1.2 Human Environment

1.2. Employment, Business, and Industrial Activity

Table 1-1 displays the percentage breakdown of non-farm employment by industry for each parish in the study area.

Table 1-1: Non-farm employment by industry (2010)

Industry	Calcasieu	Cameron	Vermilion
Forestry, fishing, and related activities	0%	6%	3%
Mining	1%	6%	7%
Utilities	0%	X	0%
Construction	9%	7%	8%
Manufacturing	8%	10%	6%
Wholesale trade	2%	8%	3%
Retail trade	11%	X	13%
Transportation and warehousing	3%	11%	3%
Information	1%	X	1%
Finance and insurance	3%	X	4%
Real estate and rental and leasing	3%	X	4%

Professional, scientific, and technical services	5%	X	3%
Management of companies and enterprises	1%	X	0%
Administrative and waste management services	5%	3%	3%
Educational services	1%	1%	X
Health care and social assistance	12%	3%	X
Arts, entertainment, and recreation	2%	X	1%
Accommodation and food services	10%	X	5%
Other services, except public administration	6%	4%	9%
Federal, civilian	1%	1%	1%
Military	1%	1%	1%
State government	3%	2%	1%
Local government	10%	19%	14%

Source: Bureau of Economic Analysis (BEA)
An "X" denotes that data is not available for an entry.

Approximately 32% of the land area is used for agriculture. The major crops grown in the area are rice, soybeans, sugarcane, and sorghum. Pecans are also a major crop in Cameron Parish. According to the 2007 Census of Agriculture, the total stock of crops in the area is valued at over $62 million, with Vermillion Parish accounting for 80% of the total crop value.

1.2.4 Transportation

Navigation Projects

Navigational channels in the chenier plain influence hydrology, primarily by increasing marine influences (saltwater intrusion, wave energies) into freshwater and other interior marshes (LCA 2004). The following navigation waterways are in the vicinity of the Southwest Coastal Louisiana feasibility study area:

- GIWW
- Sabine-Neches Waterway
- Calcasieu River and Pass
- Mermentau River
- Freshwater Bayou
- Bayou Teche and Vermilion River

Gulf Intracoastal Waterway

The GIWW traces the U.S. coast along the Gulf of Mexico from Apalachee Bay near St. Marks, FL to Brownsville, TX, near the Mexico border. It intersects the Mississippi River and extends eastward for approximately 376 miles and west-southwestward for approximately 690 miles. In the study area, the approximate distances between major crossings are as follows:

- Atchafalaya River to Vermilion River, 64 miles;
- Vermilion River to Mermentau River, 43 miles;
- Mermentau River to Calcasieu River, 37 miles;
- Calcasieu River to Sabine River, 27 miles.

In addition to its main stem, the GIWW (Figure 1-2) includes a major alternative route (64 miles) which connects Morgan City, LA to Port Allen, LA. Project dimensions for the main stem channel and the alternative route are 12 ft deep and 125 ft wide, except for the reach between the Mississippi River and Mobile Bay, which is 150 ft wide. Today, parts of the GIWW are deeper and wider than the original construction dimensions.

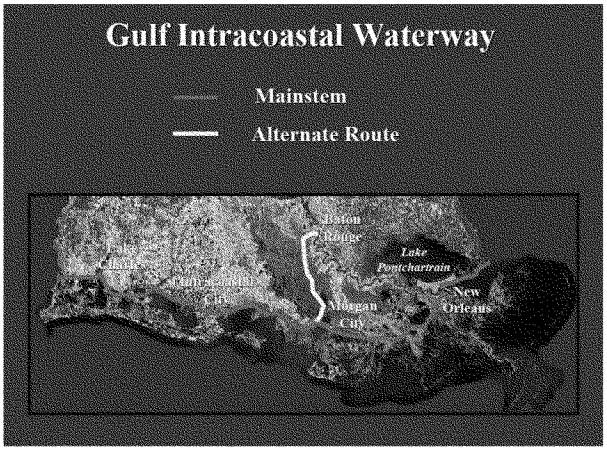


Figure 1-2 Gulf Intracoastal Waterway Mainstem and Alternate Route

The GIWW was first authorized and construction began in the 1920s. The project was authorized by the River and Harbor Act of July 24, 1946, Senate Document 242, 79th Congress, 2nd Session, and prior River and Harbor Acts. The primary purpose of the inland navigation channel is transportation of goods by barge. Numerous side channels and tributaries intersect both the eastern and western main stem channel, providing access to inland areas, coastal harbors, and the Gulf of Mexico. The USACE operates the Leland Bowman Lock located on the GIWW. The lock helps to regulate the flow of water in the Mermentau Basin and keeps salt water out of the fresh water supply that serves the farming communities further north, while allowing barge transportation.

Sabine-Neches Waterway and Sabine Pass Ship Channel

The Sabine-Neches Waterway is an approximately 64-mile federally authorized and maintained waterway located in Jefferson and Orange Counties in southeast Texas and Cameron Parish, Louisiana. The Sabine Pass, Sabine Lake, and Sabine River together form part of the boundary between the states of Texas and Louisiana. The Sabine-Neches main channel dimensions are currently 40 ft deep and 400 ft wide. The existing waterway consists of a jettied entrance channel, 42 ft deep and 500 to 800 ft wide, from the Gulf of Mexico; a channel 40 ft deep and 400 ft wide to Beaumont via the Neches River; and a channel 30 ft deep and 200 ft wide to Orange via the Sabine River.

The Sabine-Neches Project was authorized by the River and Harbor Act of 1962, House Document No. 553, 87th Congress, 2nd Session. The Sabine-Neches Waterway and the Sabine Pass Ship Channel serve the ports of Port Arthur, Beaumont, and Orange, Texas in the movement of commodities, particularly crude petroleum.

The USACE Galveston District is currently investigating navigation improvements on the Sabine-Neches Waterway. A draft report has been circulated for public review which tentatively recommends a channel modification to a depth of 48 ft. The project modification process is described in more detail in the chapter on Existing and Future Without Project Conditions.

Calcasieu River and Pass

The Calcasieu River is a 68-mile, deep-draft navigation channel. The northern boundary of the ship channel is located at Mile 36.0, just south of Interstate 10 in Lake Charles, LA. The southern boundary extends to Mile 32.0 in the Gulf of Mexico. The project was authorized under the River & Harbor Act of July 14, 1960 House Document 436, 86th Congress, 2nd Session (USACE). The purpose of this project is to provide deep-draft access to the Port of Lake Charles, the 12th largest port in the U.S. based on tonnage. The project also provides for a Saltwater Barrier Structure located north of Lake Charles, approximately 3 miles north of the northern boundary of the deep-draft ship channel.

Mermentau River

The Mermentau River navigation channel is a 4.6-mile channel beginning at the point of entry of the Mermentau River into Lower Mud Lake and extends in a southerly direction to the Gulf of Mexico.

The project includes two salinity control structures: the Catfish Point Control Structure located at Mile 24 of the Mermentau River, and the Schooner Bayou Control Structure located in the enlarged White Bay to Vermilion Bay channel, approximately 5 miles southwest of Intracoastal City. The Catfish Point and Schooner Bayou Control Structures reduce saltwater intrusion into the Mermentau Basin, which consists of hundreds of thousands of acres of rice and crawfish farms that are dependent on freshwater.

The project is authorized by the Flood Control Act of August 18, 1941, as modified by the River and Harbor Act of July 24, 1946. The Act provides for enlargement of the lower Mermentau River below Grand Lake to a minimum cross-sectional area of 3,000 sq ft below Mean Low Gulf (MLG) for discharge of flows. It also provides for channel enlargement and realignment of the Inland Waterway from Vermilion Bay to Grand Lake to provide a minimum cross-sectional area of 3,000 sq ft below MLG for discharge of flood flows and interflow between lakes.

This project also provides for the enlargement of the North Prong of Schooner Bayou and Schooner Bayou Cutoff to a channel -6 ft MLG by 60 ft. It also provides for a sector gated control structure at Catfish Point, Mile 24 of the Mermentau River, and Schooner Bayou Lock on Schooner Bayou. The Act further provides for incorporation of the existing projects: "Waterway from White Lake to Pecan Island, LA" and the portion of "Inland Waterway from Franklin, LA to the Mermentau River" west of Vermilion Bay. The waterway from "Inland Waterway from White Lake to Pecan Island, LA" consists of a channel -5 ft MLG by 40 ft.

Freshwater Bayou and Freshwater Bayou Lock

Freshwater Bayou is a 23.1-mile navigation channel that serves as the hydrologic boundary between the Mermentau Basin to the west and the Teche-Vermilion Basin to the east. The canal extends from the northern boundary at Mile 161.2 of the GIWW, at Intracoastal City west of the Harvey Lock, to the 12-ft depth contour in the Gulf of Mexico. A lock is located at the Gulf of Mexico to aid in reducing saltwater intrusion into interior wetlands along the canal. Between 1979 and 1986, approximately 300,000 tons of cargo was transported along Freshwater Bayou Canal, mostly in oil and gas service and supply vessels and commercial fishing boats (USACE, 1989). The project was authorized under the River and Harbor Act of July 14, 1960 (USACE Project Fact Sheet) and constructed between 1965 and 1967. The purpose of this project is to provide deep-draft vessels access between the Gulf of Mexico and Intracoastal City, Abbeville Harbor and Terminal District, and the GIWW.

Bayou Teche and Vermilion River, LA

The Vermilion River is a 131.8-mile navigable channel that flows from the 8-foot contour in Vermilion Bay to the head of navigation at Mile 52 at Lafayette, LA. There is a flood control project from Lafayette to Port Barre, LA, as well as in Bayou Teche from 2 miles below Arnaudville to Port Barre (USACE Project Fact Sheet).

The project was authorized by the Flood Control Act of August 18, 1941 (USACE Project Fact Sheet). The purpose of this project is to provide a shallow-draft navigation channel to Lafayette and improve flood control from Port Barre to the Vermilion River via Bayou Teche, Bayou Fusilier, and the Vermilion River.

Operations and Maintenance Dredging of Navigation Channels

Calcasieu River and Pass, Louisiana, published as House Document Number 436, 86th Congress, resulted in authorization by the River and Harbor Act of July 14, 1960 (Public Law 86-646) of the following measures: a 42- by 800-foot approach channel from the 42-foot depth in the Gulf of Mexico to the jettied channel; a channel between the jetties varying in depth from 42 ft at the seaward end to 40 ft at the shoreline over a bottom width of 400 ft; a 40- by 400-foot channel from the shoreline (mile 0) to the wharves of the Port of Lake Charles (mile 34.1); enlargement of the existing turning basin at mile 29.6 to a depth of 40 ft; a mooring basin at about mile 3 having dimensions of 40 by 350 by 2,000 ft; extension of the existing channel at a depth of 35 ft over a bottom width of 250 ft from the Port of Lake Charles at mile 34.1 to the vicinity of the bridge on U.S. Highway 90 at mile 36.0, with a 35- by 750- by 1,000-foot turning basin at its upper end; and maintenance of the existing 12- by 200-foot channel from the ship channel to Cameron, Louisiana, via the old channel of the Calcasieu River. The project maintenance is focused in 3 primary reaches. The most gulfward reach from mile 0-5 is maintained with agitation dredging. Two Calcasieu Lake reaches, mile 5-17 and mile 17-22 are typically maintained on an alternating year cycle. The typical quantity removed and disposed for each reach is 2.5 million cubic yards.

The Calcasieu River and Pass Dredged Material Management Plan (DMMP) was approved in December 2010. Existing disposal areas for the continued maintenance of the navigation channels cannot accommodate the volume of material, which would be dredged for channel maintenance. Alternative plans addressed in the DMMP include modification of existing disposal areas, development of new disposal areas, and measures to reduce channel maintenance requirements.

Operations and maintenance (O&M) dredging of navigation channels can provide a source of materials for ecosystem restoration projects. For example, the Calcasieu Dredge Material Management Plan estimates that over 6,000 acres could be created over the next 20 years from the Calcasieu River.

In general, O&M dredge material management plans must be "environmentally acceptable;" however, that does not necessarily mean that the material will be used beneficially. The authorized and funded Louisiana Coastal Area (LCA) Beneficial Use of Dredged Material (BUDMAT) Program also could provide a potential source of funding for beneficial use of dredged material throughout the Louisiana coastal area. Of the nine authorized Federal navigation channels that represent the most significant opportunities for additional beneficial use of dredged material in coastal Louisiana, three are located in the Southwest Coastal area: Calcasieu River and Pass, Mermentau River, and Freshwater Bayou. See Table 1-2 for information on dredging quantities and amounts for beneficial use by channel.

Table 1-2: Marsh restoration dredging locations and quantities

Channel / Reach	Average Quantity/ Event (cubic yard)	Average Annual Quantity (cubic yard)	Frequency Of Dredging	Federal Standard (% Used Beneficially)
Freshwater Bayou - Lock to Gulf	1,057,000	352,333	2 to 4 yrs	100
Freshwater Bayou - inland	2,000,000	133,333	every 15 yrs	n/a
Total	3,057,000	485,666		
Mermentau River – bar & inland*	1,264,000	632,000	1 to 3 yrs	100
Total*	1,264,000	632,000		
Calcasieu – Mile 5 to 14	3,615,000	1,446,000	2 to 3 yrs	0
Calcasieu – Mile 14 to 24.5	5,250,000	2,100,000	2 to 3 yrs	0
Calcasieu – Mile 28 to 36	1,334,000	242,545	3 to 8 yrs	0
Calcasieu - bar	7,547,000	7,547,000	annually	10
Total	17,746,000	11,335,545		
Grand Total	22,067,000	12,453,211		

Note: Based on New Orleans District data from years 1996 through 2007. Extracted from BUDMAT Table 2-6. New Orleans District (CEMVN) Primary Navigation Channels

* The Mermentau River project includes dredging of the Mermentau River from Highway 82 out to the Gulf of Mexico (and also includes Schooner Bayou and Catfish Point Control Structures). The USACE typically dredges Mermentau from LA-82 to the Gulf (approx 6 mile reach) every 2 to 4 years. Most recent dredging took place after Gustav/Ike. However, in light of O&M funding being decreased and low use waterways being funded 50% of their average annual funding, USACE may not dredge the Mermentau again anytime soon. Mermentau falls under the classification of a "low use" waterway (communication with Tracy Falk, USACE Operations Manager for Mermentau).

1.4.5 Rare, Unique, and Imperiled Vegetative Communities

The following rare, unique, and imperiled communities, documented by the Louisiana Natural Heritage Program, are important in that they contribute to the diversity and stability of the coastal ecosystem. In the future without action, these rare, unique, and imperiled vegetative communities are expected to continue disappearing. For example, without action, saltwater intrusion and drainage problems would continue, resulting in the conversion of freshwater marsh to intermediate and brackish marsh.

Coastal Live Oak-Hackberry Forest (chenier maritime forest): Also known as chenier maritime forest, this natural community formed on abandoned beach ridges primarily in southwest Louisiana. Composed primarily of fine sandy loams interbedded with sand and shell debris, these ridges range in height from 4 to 5 ft above sea level. Live oak and hackberry are the dominant canopy species. Other common species include red maple, sweet gum, water oak, green ash, and American elm.

Chenier forests have historically been subject to human disturbance. It is the only high ground in the landscape and therefore is used for development, highways, access roads, infrastructures, oil and gas production, and agriculture. In a study conducted by Providence Engineering and funded by the LDNR on the cheniers and natural ridges, approximately 11 percent of the cheniers studied were undeveloped (Cheniers and Natural Ridges Report, 2009). Of the original 100,000 to 500,000 acres in Louisiana, only 2,000 to 10,000 acres remain.

Coastal Dune Grassland: Coastal dune grasslands occur on beach dunes and elevated backshore areas above intertidal beaches. Louisiana's coastal dunes are poorly developed because of the high frequency of overwash

associated with hurricanes and storms, and a limited amount of eolian-transported sand. Vegetative cover ranges from sparse to fairly dense and is dominated by salt spray tolerant grasses. Coastal dune grasslands are estimated to have occupied less than 2,000 acres in pre-settlement times, and 50 to 75 percent was thought to remain prior to the 2005 hurricanes. Some of the most extensive examples of coastal dune grasslands in Louisiana occur in the Chenier Plain.

Coastal Prairie: The Coastal Prairie can be divided into two main types, upland dry to mesic prairies at the northern end of its range, and marsh fringing prairies on "islands" or "ridges" in the marsh at the southern end of its range. The soil conditions and frequent burning from lightning strikes prevented invasion by woody trees and shrubs and maintained the prairie vegetation. Coastal prairie vegetation is extremely diverse and dominated by grasses. Remnant Louisiana coastal prairies, once covering an estimated 2.5 million acres, have been reduced to less than 1 percent of the original extent. Some of the larger prairie remnants are marsh fringing, wet prairies found in Vermilion and Cameron Parishes.

Freshwater Marsh: Freshwater marsh is generally located adjacent to intermediate marsh along the northern extent of the coastal marshes. Salinities are usually less than 2 parts per thousand (ppt) and normally average about 0.5-1 ppt. Freshwater marsh has the greatest plant diversity of any of the marsh types. Although the freshwater marshes, as previously described, compose a large amount of the entire coastal marsh acreage, the Louisiana Natural Heritage Program ranks this community as imperiled because it has undergone the largest reduction in acreage of any of the marsh types over the past 20 years due to saltwater intrusion. Some of the largest contiguous tracts of freshwater marsh in Louisiana occur in Vermilion and Cameron Parishes.

1.4.7 Aquatic and Fisheries Resources

Benthic Resources

Estuarine benthic organisms include: macrobenthic (e.g., molluscs, worms, large crustaceans); microbenthic (e.g., protozoa); and meiobenthic (e.g., microscopic worms and crustaceans) groups (Day et al. 1989). Primary consumer groups of the benthic habitat include: bacteria and fungi, microalgae, meiofauna, and microfauna (Mitsch and Gosselink 2000). A major link in the aquatic food web between plants and predators is formed by the conversion of plant material (formed in primary production) by benthic detritivores and herbivores to animal tissue (Cole 1975). The salt marsh is a major producer of detritus for both the salt marsh system and the adjacent estuary (Mitsch and Gosselink 2000).

Fisheries Resources

The area contains a variety of aquatic habitats, including rivers, bayous, canals, lakes, ponds, shallow open water areas, the Gulf of Mexico, and estuarine marsh and embayments. Salinity and habitat structure (SAV, marsh, tidal creeks, deep water, oyster reefs, and benthic substrate) are the primary drivers that affect the distribution of fish and macrocrustaceans throughout the area with three general types: freshwater resident, estuarine resident, and transient marine species. Freshwater species, some of which may tolerate low salinities, generally live in the freshwater portions of the more interior and northern-most regions of the area. Resident species are generally smaller and do not commonly migrate very far. Marine transient species spend a portion of their life cycle in the estuary, generally spawning offshore or in high-salinity bays, and use coastal marshes as nursery areas (Herke 1971, 1995). Species typically found in freshwater areas include: spotted gar, bowfin, largemouth bass, channel catfish, crappie, and gizzard shad. Estuarine-dependent species typically include red and black drum, spotted seatrout, Gulf menhaden, and southern flounder. Typical marine species include king and Spanish mackerel, and cobia.

1.4.8 Essential Fish Habitat (EFH)

Figures 1-3, 1-4, 1-5 and 1-6 display EFH for coastal migratory pelagics (king mackerel, Spanish mackerel and cobia); shrimp (brown, white and pink shrimp); red drum; and stone crab, respectively within the area (source: http://www.habitat.noaa.gov/protection/efh/newInv/index.html; accessed December 15, 2015).

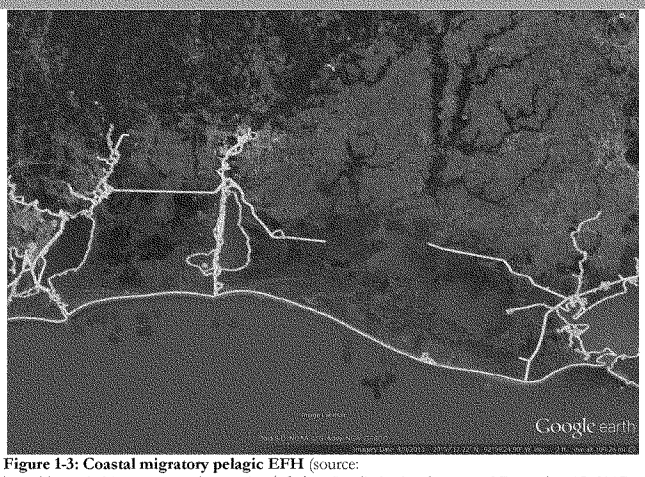


Figure 1-3: Coastal migratory pelagic EFH (source: http://www.habitat.noaa.gov/protection/efh/newInv/index.html; accessed December 15, 2015)

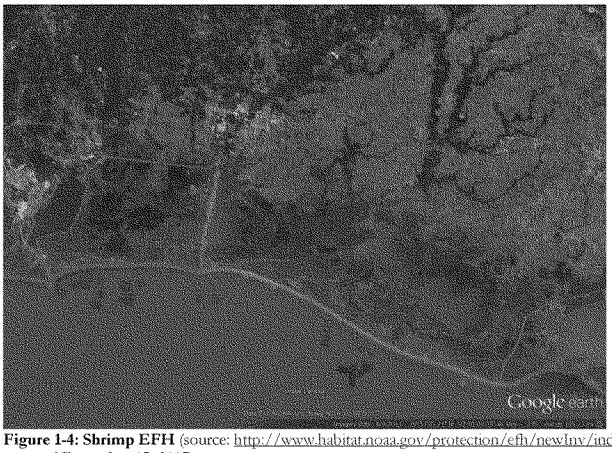


Figure 1-4: Shrimp EFH (source: http://www.habitat.noaa.gov/protection/efh/newInv/index.html; accessed December 15, 2015)

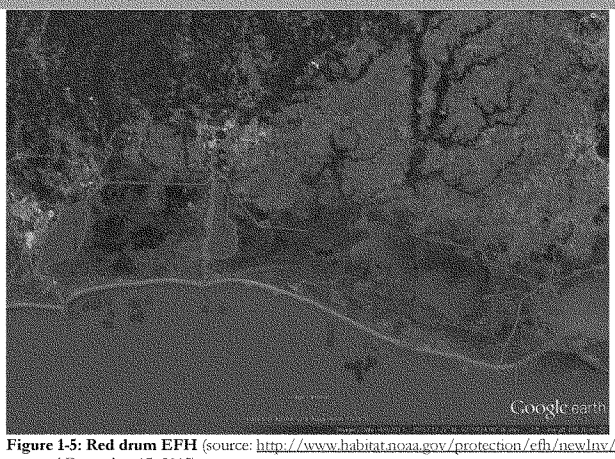


Figure 1-5: Red drum EFH (source: http://www.habitat.noaa.gov/protection/efh/newInv/index.html; accessed December 15, 2015).

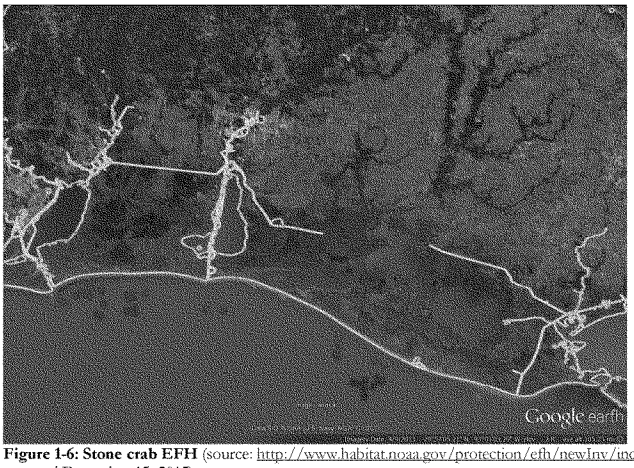


Figure 1-6: Stone crab EFH (source: http://www.habitat.noaa.gov/protection/efh/newInv/index.html; accessed December 15, 2015)

1.4.9 Threatened and Endangered Species

Piping plovers winter in Louisiana but do not nest on Louisiana's coast. Critical wintering habitat encompasses 24,950 acres along 342.5 miles of shoreline, which is most of the coast of Louisiana. Critical habitat is presented in Figure 1-7. Piping plovers arrive from their northern breeding grounds as early as late July and may be present in designated critical wintering habitat for 8 to 10 months of the year.

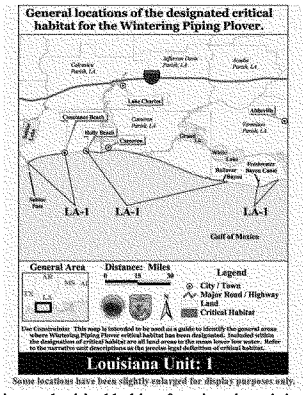


Figure 1-7: Designated critical habitat for wintering piping plover (Source: http://www.fws.gov/plover/finalchmaps/Plover_LA_1.jpg; accessed December 15, 2015)

Loggerhead Critical Habitat (*Sargassum* habitat) exists in the southernmost (offshore) portion of the study area (Figure 1-8). This critical habitat expands the entire length of the project (west to east) with the closest points ranging from approximately four miles to nine miles offshore. For additional detail concerning threatened and endangered species see Annex K.

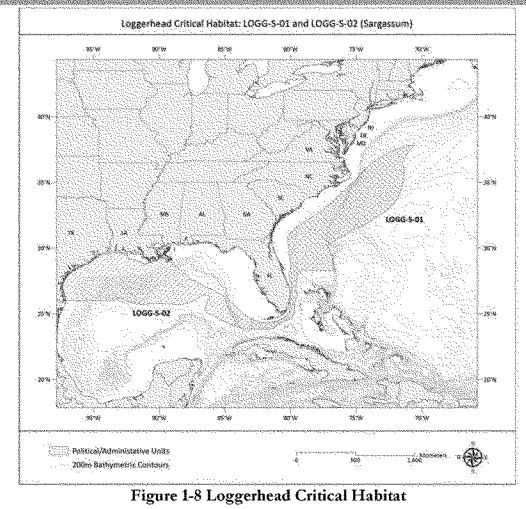


Figure 1-8 Loggerhead Critical Habitat

1.4.11 Aesthetics and Visual Resources

Other major water resources include the Gulf of Mexico, Sabine Lake, Calcasieu Lake, Grand Lake, White Lake and Vermillion Bay as large bodies of water. Within the coastal parishes there is an abundance of varying water bodies both salt and fresh water mixed with marsh, swamp and wetland. Numerous canals, streams and creeks crisscross the native habitat south of I-10 and the more developed areas along that corridor.

There are a variety of eco-regions within the area. Cameron Parish is primarily made up of Texas – Louisiana Coastal Marshes. Vermilion Parish is made up of Northern Humid Gulf Coastal Prairies in the northwest, Lafayette Loess Plains in the northeast, and Texas – Louisiana Coastal Marshes in the south. Calcasieu Parish is made up of Northern Humid Gulf Coastal Prairies in the southern parish of the parish, Flatwoods in the northern portion of the parish, and small pockets of Texas – Louisiana Coastal Marshes along the Calcasieu River corridor (according to the State of Louisiana Eco-Region Map, ref. "Louisiana Speaks").

The Northern Humid Gulf Coast Prairies originally contained tallgrass grasslands with gallery forests along streams paired with gently sloping coastal plain. In modern times, almost all of the coastal prairies have been converted to croplands, pasture, aquaculture or urban land uses. Texas – Louisiana Coastal Marshes is an area characterized by extensive freshwater and saltwater coastal marshes, few bays, and lack of barrier islands. There are many rivers, lakes, bayous, tidal channels, and canals. Chenier plains occupy about three percent of the region and are typically treeless. Lafayette Loess plains originally were home to a variety of plant species that included trees and grasses. In modern times native species have been replaced with crops of rice, soybeans, cotton, sugarcane, sweet potatoes, wheat, and aquaculture. Urban expansion into this eco-region has been substantial. Flatwoods generally occurs on mostly flat to gently sloping sediments. This eco-region was once dominated by longleaf pine flatwoods and savannas, pimple mounds, and small hillocks. While reduction of these characteristics has taken place, these features still dominate the area, especially in the case of the longleaf pine.

Other entities with institutional and public significance include the Sabine National Wildlife Refuge, Cameron Prairie National Wildlife Refuge, and Lacassine National Wildlife Refuge, all of which are located in Cameron Parish, and, finally, Sam Houston Jones State Park, which is located in Calcasieu Parish. These state and federally protected areas offer a refuge for the landscape and wildlife of southeast Louisiana and important recreational opportunities.

INTEGRATED FINAL FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT STATEMENT

APPENDIX B
ENGINEERING

U.S. Army Corps of Engineers
Mississippi Valley Division
New Orleans District
7400 Leake Avenue
New Orleans, Louisiana 70118

April 2016



INTEGRATED FINAL FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT STATEMENT ENGINEERING REPORT

TABLE OF CONTENTS

1.0 PURPOSE 1
1.1 INTRODUCTION 1
1.1.1 General 1
1.1.2 Study Purpose 2
1.1.3 Study Overview 2
1.2 ALTERNATIVES 3
1.2.1 NED Focused Array 3
1.2.2 NER Focused Array 8
2.0 HYDROLOGY AND HYDRAULICS 10
2.1 GENERAL 10
2.2 ADCIRC MODELING 10
2.3 LEVEE DESIGN 10
2.3.1 Methodology 14
2.3.2 Results 25
2.4 FUTURE WITHOUT PROJECT FREQUENCY CURVES 31
2.4.1 Methodology 31
2.4.2 RESULTS AND REFERENCE TABLES 47
2.4.3 Nonstructural Analysis 52
2.5 PUMPING 52
2.6 NER MODELING 52
3.0 SURVEYS 54
3.1 NED AND NER FOCUSED ARRAY OF ALTERNATIVES 54
3.2 DESIGN SURVEYS 54
4.0 GEOTECHNICAL 55
4.1 GEOLOGY 55
4.2 NED GEOTECHNICAL DESIGN 56
4.2.1 Design Assumptions 56
4.2.2 Design Development 56
4.3 NER GEOTECHNICAL ANALYSIS 62
4.3.1 Design Assumptions 62
5.0 DESIGN 63
5.1 NED 63

5.2 NER FEATURES 63
5.2.1 Marsh Restoration/Nourishment 64
5.2.2 Shoreline Protection/Stabilization 73
5.2.3 Chenier Reforestation 74
6.0 STRUCTURAL FEATURES 75
6.1 NED 75
6.1.1 Sector Gate Structures 75
6.1.2 Stop Log Gates 77
6.1.3 Drainage Structures 78
6.2 NER STRUCTURAL FEATURES 79
7.0 RELOCATIONS 80
7.1 NED ALTERNATIVES 80
7.2 NER ALTERNATIVES 80
8.0 OPERATION, MAINTENANCE, REPAIR, REPLACEMENT, AND REHABILITATION (OMRR&R) 81
8.1 NED 81
8.2 NER 81
9.0 COST ESTIMATES 83
9.1 NED COST ESTIMATES PRIOR TO MARCH 2015 83
9.1.1 NED Structural Alternative Estimates 83
9.1.2 NED Nonstructural Alternative Estimates 86
9.1.3 Contingencies 89
9.1.4 Alternative Estimates 89
9.2 NER COST ESTIMATES PRIOR TO MARCH 2015 89
9.2.1 Feature and Alternative Costs 89
9.3 NER AND NED CURRENT ESTIMATES 90
9.3.1 Current OMRR&R Costs 91
10.0 CONSTRUCTION SCHEDULE 91
10.1 NED FOCUSED ARRAY PRIOR TO MARCH 2015 91
10.2 NER FOCUSED ARRAY PRIOR TO MARCH 2015 92
10.2.1 Marsh Restoration 92
10.2.2 Shoreline Protection/Stabilization 93
10.2.3 Hydrologic/Salinity Control Structures ..... **Error! Bookmark not defined.**
10.2.4 Chenier Reforestation 93
10.3 NER AND NED RECOMMENDED PLANS 93
11.0 RISK AND UNCERTAINTY 95
11.1 NED 95
11.2 NER 95
12.0 REFERENCES 97



TABLES

Table 1 - Focused Array of NER Alternatives 8
Table 2 – Features in the NER Alternatives 9
Table 3 - Lake Charles Westbank Sulphur 2025 2% Hydraulic Boundary Conditions 14
Table 4 – Lake Charles Westbank Sulphur 2075 2% Hydraulic Boundary Conditions 15
Table 5 – Lake Charles Westbank Sulphur 2025 1% Hydraulic Boundary Conditions 15
Table 6 – Lake Charles Westbank Sulphur 2075 1% Hydraulic Boundary Conditions 15
Table 7 – Lake Charles Westbank Sulphur 2025 0.5% Hydraulic Boundary Conditions 15
Table 8 – Lake Charles Westbank Sulphur 2075 0.5% Hydraulic Boundary Conditions 16
Table 9 - Abbeville to Delcambre Hwy 330 2025 2% Hydraulic Boundary Conditions 16
Table 10 – Abbeville to Delcambre Hwy 330 2075 2% Hydraulic Boundary Conditions 16
Table 11 - Abbeville to Delcambre Hwy 330 2025 1% Hydraulic Boundary Conditions 16
Table 12 - Abbeville to Delcambre Hwy 330 2075 1% Hydraulic Boundary Conditions 16
Table 13 - Abbeville to Delcambre Hwy 330 2025 0.5% Hydraulic Boundary Conditions 17
Table 14 - Abbeville to Delcambre Hwy 330 2075 0.5% Hydraulic Boundary Conditions 17
Table 15 - Lake Charles Eastbank Sulphur 2025 2% Hydraulic Boundary Conditions 17
Table 16 - Lake Charles Eastbank Sulphur 2075 2% Hydraulic Boundary Conditions 17
Table 17 - Lake Charles Eastbank Sulphur 2025 1% Hydraulic Boundary Conditions 18
Table 18 - Lake Charles Eastbank Sulphur 2075 1% Hydraulic Boundary Conditions 18
Table 19 - Lake Charles Eastbank Sulphur 2025 0.5% Hydraulic Boundary Conditions 18
Table 20 - Lake Charles Eastbank Sulphur 2075 0.5% Hydraulic Boundary Conditions 18
Table 21 - Delcambre Erath 2025 2% Hydraulic Boundary Conditions 19
Table 22 - Delcambre Erath 2075 2% Hydraulic Boundary Conditions 19
Table 23 - Delcambre Erath 2025 1% Hydraulic Boundary Conditions 19
Table 24 - Delcambre Erath 2075 1% Hydraulic Boundary Conditions 19
Table 25 - Delcambre Erath 2025 0.5% Hydraulic Boundary Conditions 19
Table 26 - Delcambre Erath 2075 0.5% Hydraulic Boundary Conditions 20
Table 27 - Lake Charles Westbank Sulphur South 2025 2% Hydraulic Boundary Conditions 20
Table 28 - Lake Charles Westbank Sulphur South 2075 2% Hydraulic Boundary Conditions 20
Table 29 - Lake Charles Westbank Sulphur South 2025 1% Hydraulic Boundary Conditions 20
Table 30 - Lake Charles Westbank Sulphur South 2075 1% Hydraulic Boundary Conditions 21
Table 31 - Lake Charles Westbank Sulphur South 2025 0.5% Hydraulic Boundary Conditions 21
Table 32 - Lake Charles Westbank Sulphur South 2075 0.5% Hydraulic Boundary Conditions 21
Table 33 - Abbeville Ring Levee 2025 2% Hydraulic Boundary Conditions 21
Table 34 - Abbeville Ring Levee 2075 2% Hydraulic Boundary Conditions 22
Table 35 - Abbeville Ring Levee 2025 1% Hydraulic Boundary Conditions 22
Table 36 - Abbeville Ring Levee 2075 1% Hydraulic Boundary Conditions 22
Table 37 - Abbeville Ring Levee 2025 0.5% Hydraulic Boundary Conditions 22

Table 38 - Abbeville Ring Levee 2075 0.5% Hydraulic Boundary Conditions 22
Table 39 - Lake Charles Westbank Sulphur 2% Design Elevation 26
Table 40 - Lake Charles Westbank Sulphur 1% Design Elevation 26
Table 41 - Lake Charles Westbank Sulphur 0.5% Design Elevation 26
Table 42 - Abbeville to Delcambre Hwy 330 2% Design Elevation 27
Table 43 - Abbeville to Delcambre Hwy 330 1% Design Elevation 27
Table 44 - Abbeville to Delcambre Hwy 330 0.5% Design Elevation 27
Table 45 - Lake Charles Eastbank Sulphur 2% Design Elevation 28
Table 46 - Lake Charles Eastbank Sulphur 1% Design Elevation 28
Table 47 - Lake Charles Eastbank Sulphur 0.5% Design Elevation 28
Table 48 - Delcambre Erath 2% Design Elevation 29
Table 49 - Delcambre Erath 1% Design Elevation 29
Table 50 - Delcambre Erath 0.5% Design Elevation 29
Table 51 - Lake Charles Westbank Sulphur South 2% Design Elevation 29
Table 52 - Lake Charles Westbank Sulphur South 1% Design Elevation 30
Table 53 - Lake Charles Westbank Sulphur South 0.5% Design Elevation 30
Table 54 - Abbeville Ring Levee 2% Design Elevation 30
Table 55 - Abbeville Ring Levee 1% Design Elevation 31
Table 56 - Abbeville Ring Levee 0.5% Design Elevation 31
Table 57 - Marsh Storage Areas 36
Table 58 - Adjusted Boundary Conditions 38
Table 59 - FWOP With Marsh Accretion 41
Table 60 - FWOP Without Marsh Accretion 48
Table 61 – Pumping Capacity 52
Table 62 - Required Design Elevations 58
Table 63 - Alternatives 63
Table 64 – Structures 75
Table 65 Estimated Annual OMRR&R 81
Table 66 - NED Structural Cost Estimates 86
Table 67-Cost per Square Foot of Elevating Residential Structures 87
Table 68 - NER Feature Estimates 89
Table 69 – Current NER Feature Estimates 91

FIGURES

Figure 1 - Study Area 2
Figure 2 – Lake Charles Area Alignments 5
Figure 3 - Abbeville and Delcambre Erath Alignments 6
Figure 4 - Abbeville to Delcambre Hwy 330 7
Figure 5– Lake Charles Westbank Sulphur Levee Alignment 11
Figure 6 - Lake Charles Eastbank Alignment 12

Figure 7 - Lake Charles Westbank Sulphur South Alignment 12
Figure 8 - Abbeville Ring Levee Alignment 13
Figure 9 - Abbeville to Delcambre Hwy 330 Levee Alignment 13
Figure 10 - Delcambre Erath Levee Alignment 14
Figure 11 - Van der Meer Overtopping Formula 24
Figure 12 - Definition for Overtopping for Levee 25
Figure 13 - HEC RAS Storage Areas 34
Figure 14 - Land Use Areas Coded Into ADCIRC 35
Figure 15 - Adjusted Storage Areas 37
Figure 16 - Storage Areas 39
Figure 17 - Adjusted Curves 40
Figure 18 - Typical Section 57
Figure 19 - Lift Schedule 61
Figure 20 - Typical 56' Sector Gate 76
Figure 21 - Typical Sector Gate With Sluice Gates 77
Figure 22 - Typical Stop Log Gate 78
Figure 23 - Typical Drainage Structure 79

ANNEX 1 Cost Engineering Annex

INTEGRATED FINAL FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT STATEMENT

FINAL ENGINEERING REPORT

1.0 PURPOSE

Note: This Appendix summarizes the preliminary engineering and design work completed for alternative development, formulation, and design processes that evaluated NED and NER features up to the focused array. This report includes hydrologic and hydraulic engineering analyses, including: levee and channel design, hydrologic/salinity control structure design, shoreline protection/stabilization design, marsh restoration design, and Chenier reforestation design for the NED and NER features. The information contained herein was presented in the 2015 Revised Draft Report that was released for public review in March 2015. Changes to the NED and NER TSPs, and to the method of implementation of the NED Recommended Plan (NED RP) have occurred since that public review. Those changes are not captured in this Appendix. Since the NED Recommended Plan (RP) is nonstructural and 100% voluntary, refinements to the NED TSP that resulted in the identification of the RP are primarily captured in the Economics Appendix D, with changes in the method of implementation being addressed in Appendix L. The NER RP features were also refined and are captured in the Fact Sheet Appendix K. Certified cost updates for both RPs are captured in the Cost Annex to this Appendix. Descriptions of both plans appear in Chapter 4.

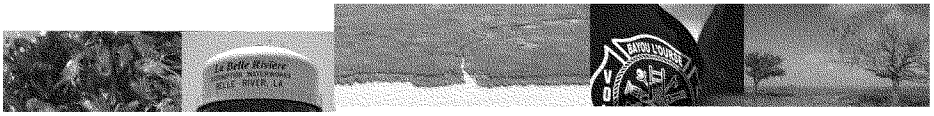
1.1 INTRODUCTION

1.1.1 General

The Southwest Coastal Louisiana Study is located in southwestern Louisiana adjacent to Texas and covers an area of approximately 4,700 square miles. The area includes Cameron, Vermilion and Calcasieu Parishes. The Gulf Intracoastal Waterway (GIWW) bisects the area into north and south regions generally running along the existing state coastal zone boundary. The study area is shown in Figure 1.

Cameron Parish is located in the southwest corner of Louisiana. The southern boundary of the parish is the Gulf of Mexico. Eighty-two percent of Cameron Parish is coastal marshes. The parish is chiefly rural and the largest communities are Cameron and Hackberry. Calcasieu Parish is located due north of Cameron Parish. The town of Lake Charles is the parish seat, which is the largest urban area in the study area. Only a small portion of the parish is located in the coastal zone. Vermilion Parish is located due east of Cameron Parish. The southern boundary of the parish is the Gulf of Mexico. Large expanses of Vermilion Parish are open water (lakes, bays, and streams). Approximately 50 percent of the land is coastal marshes. The parish is chiefly rural and the town of Abbeville is the parish seat as well as the largest urban area in the parish.

The area is characterized by extensive coastal marshland interrupted by forests atop relict Chenier ridges and natural ridges. The main physiographic zones of the Chenier Plain include the Gulf Coast Marsh, Gulf Coast Prairies, and Forested Terraced Uplands. The Gulf Coast Marsh is at or near sea level and borders the Gulf of Mexico and most of the large lakes are in this area. The Gulf Coast Prairie extends from the central part of Vermilion and Cameron Parishes into the southern part of Calcasieu Parish, while the Forested Uplands, which occur at or near 25-foot elevation, are located in the northern part of Vermilion and Calcasieu Parishes. Further details of the project setting can be found in the Main Report.



1.1.2 Study Purpose

The NED purpose of this study is to provide hurricane and storm damage risk reduction to reduce the risk of structure damages. The NER purpose of the study is to significantly restore environmental conditions for the ecosystem of the study area.

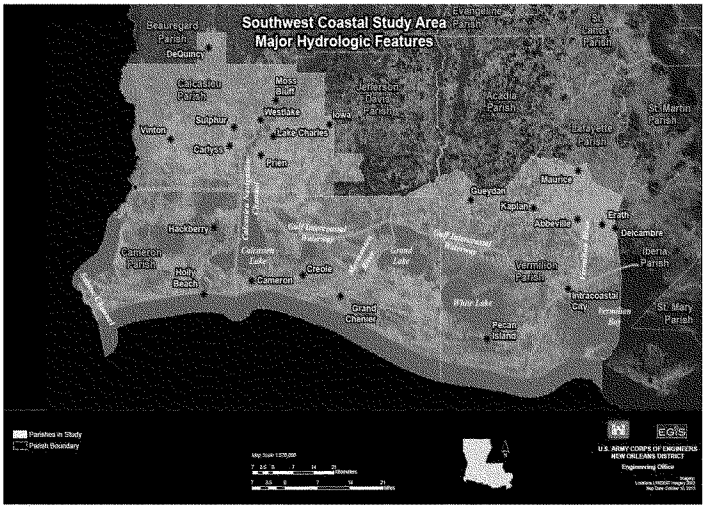


Figure 1 - Study Area

1.1.3 Study Overview

Separate alternatives were developed for the NED and NER objectives and were analyzed independently. An initial array of NED and NER alternatives were evaluated to develop the focused array.

Hurricane storm damage risk reduction measures were developed and screened using preliminary costs and benefits to identify a focused array of NED alternatives. Details of this initial evaluation can be found in the Appendix C to the Main Report. Components of the NED focused array can be found in Section 1.2 below.

NER plan screening was based on monetary and non-monetary evaluations. Preliminary costs and benefits for marsh restoration, shore protection, chenier reforestation and water control were estimated. Screening criteria included planning constraints; support for objectives; measure effectiveness; and below average efficiency. Measures that did not meet the screening criteria were retained only in limited instances in which they supported critical adjacent features. Alternative plans for the focused NER array were created by combining measure types

into comprehensive strategies. Details of this initial evaluation can be found in the Appendix C to the Main Report. All elevations presented in this Report are relative to NAVD 88 (2004.65) unless otherwise stated.

1.2 ALTERNATIVES

1.2.1 NED Focused Array

The focused array of NED alternatives analyzed consists of the eight plans identified below. These include six different levee alignments (three in the area around Lake Charles, LA and three in the area around Abbeville, LA), two nonstructural plans, and a no action plan. Each of the levee alignments was evaluated at three levels of risk reduction 2% (50-year), 1% (100-year) and .5% (200-year) during final array comparisons.

Plan 0: No Action
Plan 1: Lake Charles Eastbank Levee
Plan 2: Lake Charles Westbank/Sulphur Extended Levee
Plan 3: Lake Charles Westbank/Sulphur South Levee
Plan 4: Delcambre/Erath Levee
Plan 5: Abbeville Levee (Abbeville Ring Levee)
Plan 6: Abbeville to Delcambre Levee
Plan 7: Nonstructural Plan (Justified Reaches Plan)
Plan 8: Nonstructural Plan (100 year Floodplain in 2075)

In a coastal environment, coastal storm damage risk can be caused by a combination of hurricane surge, waves, wave overtopping of structures, rainfall flooding including riverine flooding due to rainfall, or other sources. The NED portion of this study only addresses the risk of damage arising from hurricane storm surge and does not address other forms of damage resulting from hurricanes. In the project area for the 0-10-year events, most of the damages are from rainfall events. For the 50-100-year events, most damages are associated with storm surge. Both storm surge and waves are taken into account in proposed levee designs. Risk in the case of the levee designs is defined as the probability that an area will be flooded by storm surge, resulting in undesirable consequences. ER 1105-2-101 requires project performance to be described in terms of annual chance or exceedance probability and long-term risk rather than level of protection. In terms of annual chance or exceedance probability, a 1% Annual Exceedance Probability (AEP) levee is designed to withstand a storm surge that has a 1 in 100 chance of occurring in any given year. Section 2 describes how the required 2%, 1% and .5% levee elevations were developed.

The nonstructural plans were evaluated based on several potential measures. One was elevation of residential structures to the 1% stage under 2075 hydrologic conditions, or by no more than 13 feet (whichever is lower). A second involved acquisition/buyout of residential structures that would require elevation over 13 feet and property owners would receive fair market value for the property acquired. A third measure involved dry flood proofing of non-residential and public structures (excluding industrial buildings and warehouses) for flood depths not greater than three feet above the adjacent ground. A final measure evaluated involved detached flood proofing of industrial buildings and warehouses using barriers or localized storm surge risk reduction measures not exceeding six feet in height.

Designs and costs were developed for each level of risk reduction for each alignment. The levee alignments referred to above as Plans 1-6 are shown in Figure 2 through Figure 4. Further details on these alignments and how they were developed can be found in the Main Report. This Engineering Report does not cover the nonstructural alternatives

in detail. Details of the analysis and selection of the nonstructural plan can be found in the Plan Formulation Appendix and the Economics Appendix.

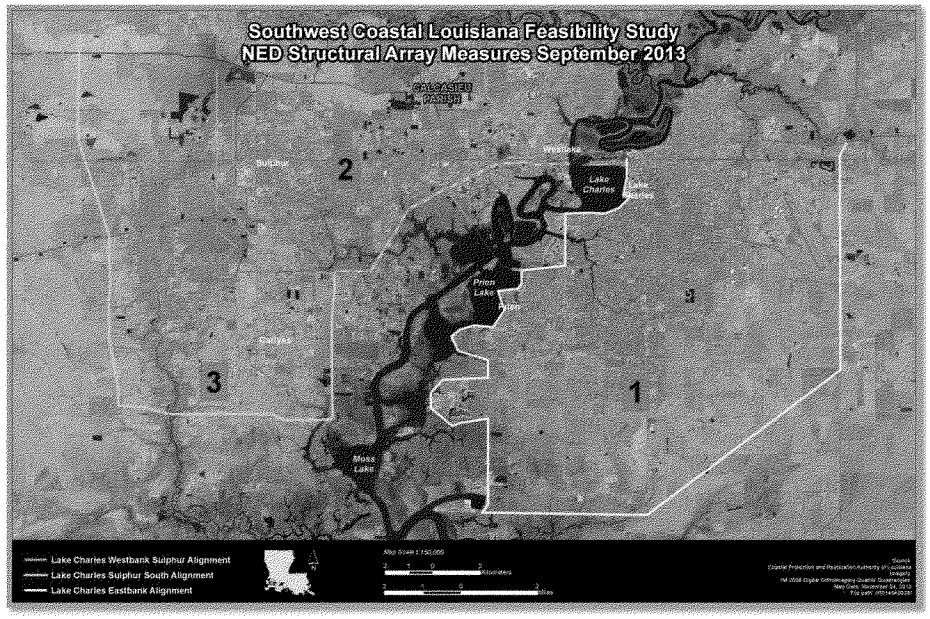


Figure 2 – Lake Charles Area Alignments

JA 37-899 11/27/2019 920

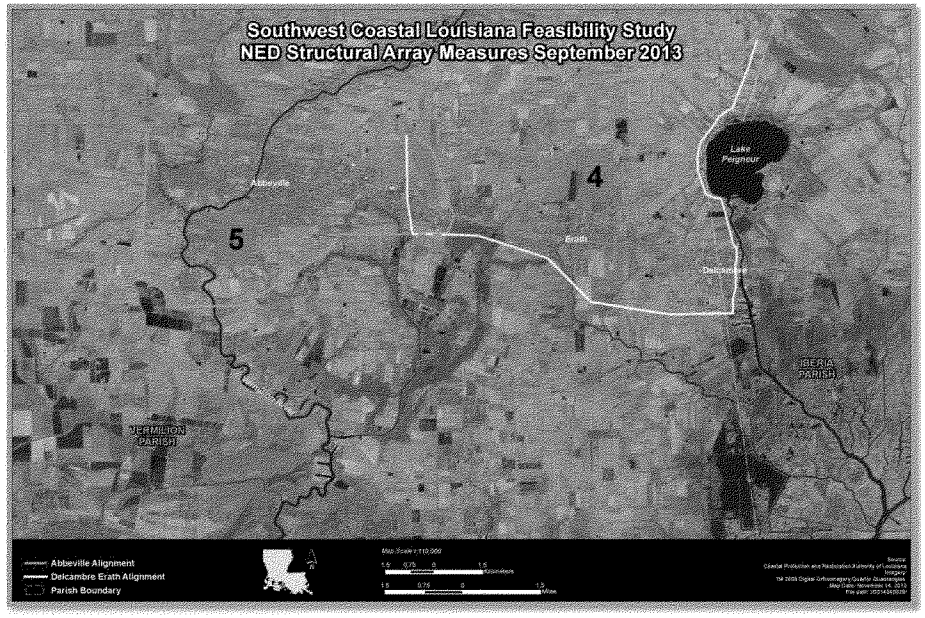


Figure 3 - Abbeville and Delcambre Erath Alignments

JA 37-899 11/27/2019 621

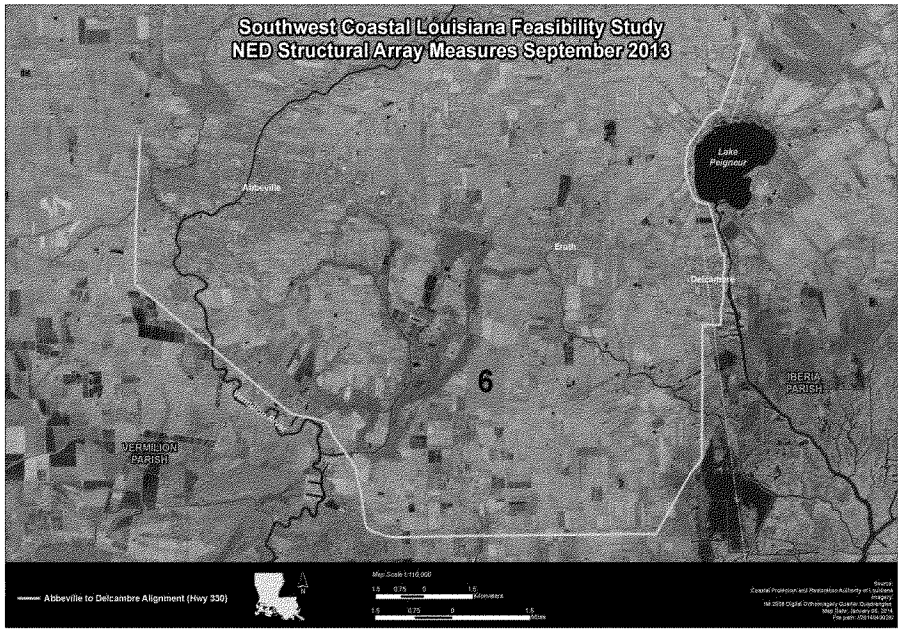


Figure 4 - Abbeville to Delcambre Hwy 330

JA 37-899 11/27/2019 622

1.2.2 NER Focused Array

The focused array of NER alternatives is shown in Table 1.

Table 1 - Focused Array of NER Alternatives

PLAN No	ALTERNATIVE NAME
CMA-1	Comprehensive Large Integrated Restoration w/ Entry Salinity Control
CM-1	Comprehensive Large Integrated Restoration
CA-1	Calcasieu Large Integrated Restoration w/ Entry Salinity Control
C-1	Calcasieu Large Integrated Restoration
M-1	Mermentau Large Integrated Restoration
CMA-2	Comprehensive Moderate Integrated Restoration w/ Entry Salinity Control
CM-2	Comprehensive Moderate Integrated Restoration
CA-2	Calcasieu Moderate Integrated Restoration w/ Entry Salinity Control
C-2	Calcasieu Moderate Integrated Restoration
M-2	Mermentau Moderate Integrated Restoration
CMA-3	Comprehensive Moderate Integrated Restoration w/ Gum Cove & Entry Salinity Control
CM-3	Comprehensive Moderate Integrated Restoration
CA-3	Calcasieu Moderate Integrated Restoration w/ Gum Cove & Entry Salinity Control
C-3	Calcasieu Moderate Integrated Restoration
M-3	Mermentau Moderate Integrated Restoration
CMA-4	Comprehensive Small Integrated Restoration w/ Entry Salinity Control
CM-4	Comprehensive Small Integrated Restoration
CA-4	Calcasieu Small Integrated Restoration w/ Entry Salinity Control
C-4	Calcasieu Small Integrated Restoration
M-4	Mermentau Small Integrated Restoration
CM-5	Comprehensive Interior Perimeter Salinity Control
C-5	Calcasieu Interior Perimeter Salinity Control
M-5	Mermentau Interior Perimeter Salinity Control
CM-6	Comprehensive Marsh & Shoreline
C-6	Calcasieu Marsh & Shoreline
M-6	Mermentau Marsh & Shoreline
A	Entry Salinity Control

Alternatives designated by an "A" differ from those without the "A" designation in that the "A" designated alternatives include the Calcasieu Ship Channel Salinity Control Structure. Alternatives designated as "C" or "M" only include features in the Calcasieu Basin or Mermentau Basin respectively.

Table 1 shows the different features included in each comprehensive NER alternative in the Focused Array. Further details on these measures can be found in Section 5 and 6 of this Report and in the Main Report. Maps showing the location of these features can be found in the Main Report.

Table 2 – Features in the NER Alternatives

Feature Location: Mermentau Basin / Calcasieu Basin		No Action	Strategy 1/1A	Strategy 2/2A	Strategy 3/3A	Strategy 4/4A	Strategy 5	Strategy 6	Strategy 7 (or A)
Measure	Feature		Large Integrated Restoration across Basins	Moderate Integrated Restoration across Basins	Moderate Integrated Restoration + Gum Cove	Small Integrated Restoration	Interior Perimeter Salinity Control	Marsh & Shoreline Focus	Entry Salinity Control
Hydrologic & Salinity Control									
	7#	0	0/X	0/X	0/X	0/X	0	0	X
	13*	0	0	0	0	0	0	0	0
	17a-c*	0	0	0	0	0	0	0	0
	48	0	0	0	0	0	0	0	0
	74a	0	X	X	X	X	X	X	0
	407	0	0	0	X	0	X	0	0
Marsh Restoration									
	3a1	0	0	0	0	X	X	0	0
	3c1	0	X	X	X	X	X	X	0
	3c2	0	X	X	X	0	0	X	0
	3c3	0	X	X	X	0	0	X	0
	3c4	0	X	X	X	0	0	X	0
	3c5	0	X	X	X	0	0	X	0
	47a1	0	X	X	X	X	X	X	0
	47a2	0	X	X	X	X	X	X	0
	47c1	0	X	X	X	X	X	X	0
	47c2	0	X	0	0	0	0	X	0
	124a	0	X	0	0	0	0	X	0
	124b	0	X	0	0	0	0	X	0
	124c	0	X	X	X	X	X	X	0
	124d	0	X	X	X	X	X	X	0
	127c1	0	X	0	0	0	0	X	0
	127c2	0	X	X	X	0	0	X	0
	127c3	0	X	X	X	X	X	X	0
	306a1	0	X	X	X	X	X	X	0
	306a2	0	X	0	0	0	0	X	0
Shoreline Protection/Stabilization									
	5a	0	X	X	X	X	X	X	0
	6b1	0	X	X	X	X	X	X	0
	6b2	0	X	X	X	X	X	X	0
	6b3	0	X	X	X	X	X	X	0
	16b	0	X	0	0	X	X	0	0
	99a	0	X	0	0	0	0	X	0
	113b2	0	X	0	0	0	0	0	0
Chenier Reforestation (both basins)									
	CR	0	X	X	X	X	X	X	0

Feature 7 functions both as a stand-alone Strategy/Alternative and an additive feature. *Following refinement of the benefit assessment as a result of technical comments, these features were found to lack positive outputs and were dropped from all plans. Note: Green cells denote features found in the Calcasieu Basin. Blue cells denote features in the Mermentau Basin. An 'X' in a cell indicates the feature is a component of the strategy while a '0' indicates it is not a component of the strategy.

2.0 HYDROLOGY AND HYDRAULICS

2.1 GENERAL

This section describes the hydrology and hydraulic analysis done for the NED alternatives.

2.2 ADCIRC MODELING

A version of the Southern Louisiana ADCIRC (Advanced CIRCulation) model, coupled with the STWAVE (Steady State spectral WAVE) model was developed for analysis of the Southwest Coastal Louisiana alternatives. The ADCIRC model is a two-dimensional, depth-integrated, barotropic time-dependent long wave, hydrodynamic circulation model that can be used to simulate storm surge response to hurricanes and tropical storms. STWAVE is a steady-state, finite difference, spectral model base on the wave action balance equation. STWAVE is used to model nearshore wind-wave growth and propagation. The modeling system used for this study was established by updating existing models used previously for the Joint Storm Surge (JSS) Analysis in Southern Louisiana for the Louisiana Coastal Protection and Restoration (LACPR) Project, as well as the recent flood insurance rate map modernization study conducted by the FEMA (USACE, 2008a and USACE, 2007). Details of the model development and results can be found in Annex 1 of the Engineering Report.

2.3 LEVEE DESIGN

The NED focused array of alternatives contained six levee alignments. The resulting design deliverables consisted of the 2025 and 2075 levee design elevations for all six alignments for the 2%, 1%, and 0.5% return frequencies. The six levee alignments that were analyzed are shown in Figure 5 through Figure 10. Each levee alignment was divided into segments as shown in Figure 5 through Figure 10 for use in determining the design elevations.

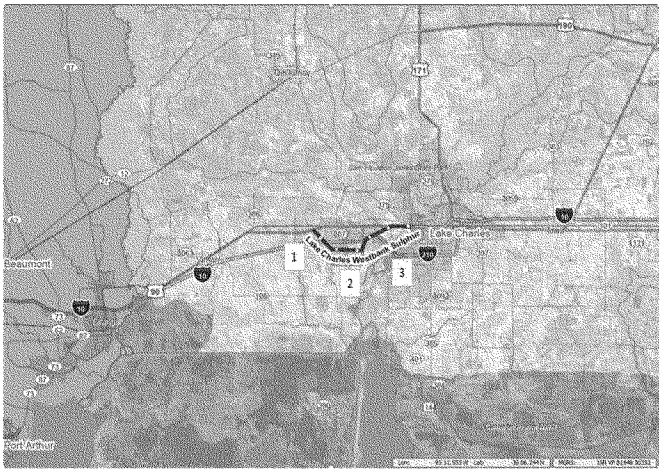


Figure 5– Lake Charles Westbank Sulphur Levee Alignment

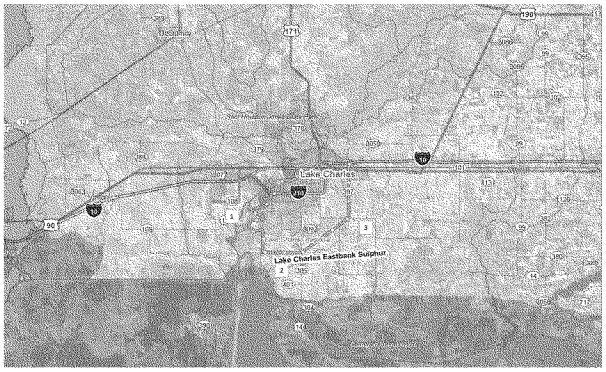


Figure 6 - Lake Charles Eastbank Alignment

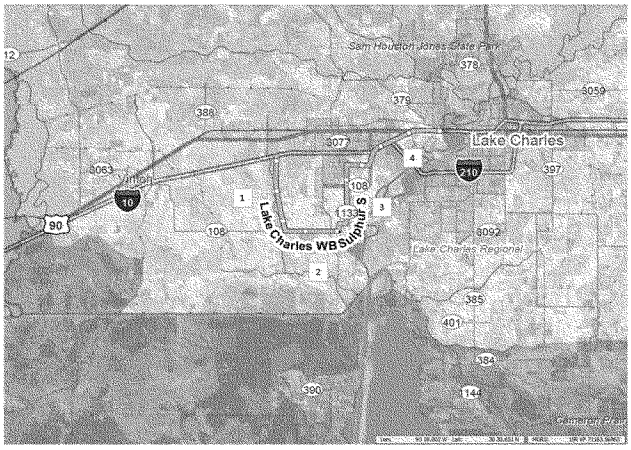


Figure 7 - Lake Charles Westbank Sulphur South Alignment

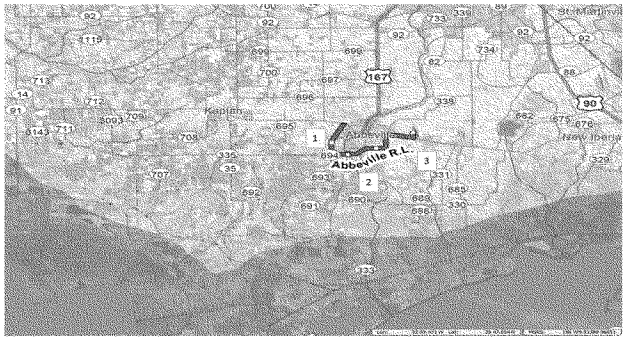


Figure 8 - Abbeville Ring Levee Alignment

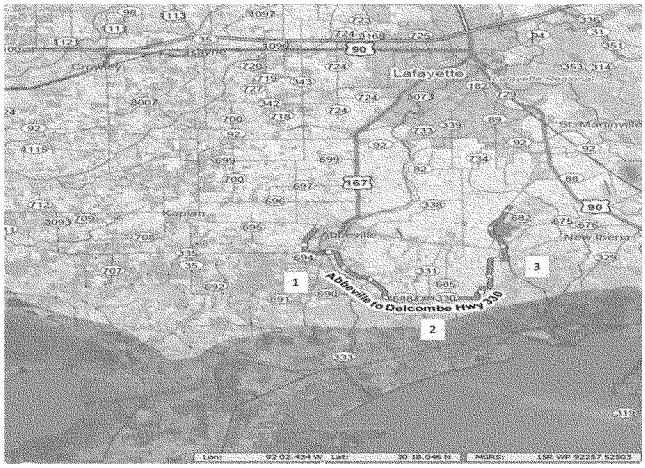


Figure 9 - Abbeville to Delcambre Hwy 330 Levee Alignment

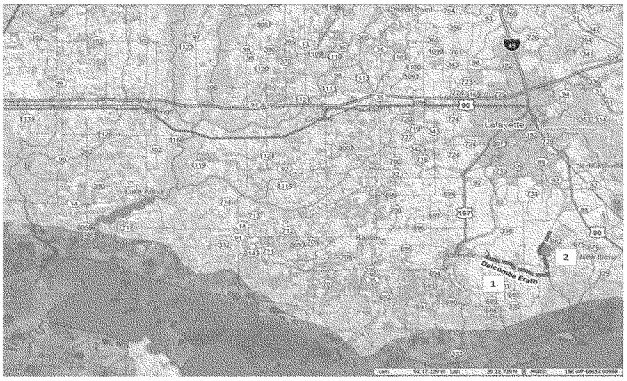


Figure 10 - Delcambre Erath Levee Alignment

2.3.1 Methodology

For the initial preliminary design, limited model information was available. The "without project" hydraulic boundary conditions were obtained from the ADCIRC model simulations for the given project locations. In order to estimate the "with-project" conditions, the "without project" hydraulic boundary conditions (i.e. surface water elevation, wave heights, and wave periods) were used with an adjustment factor of 1 foot for 2025 surface water elevations and 2 feet for 2075 surface water elevations. The increased amount of water elevation was based on observations of the available model results for "without project" and "with project" conditions of other studies, such as the Morganza to the Gulf Post Authorization Change Study and Westshore Lake Pontchartrain Feasibility Study. The increase in water elevations is due to the surge stacking up against the levee. The amount of increase in water elevation is dependent on the location of the levee, the rate of Sea Level Rise and the future condition (2025 or 2075).

The hydraulic boundary conditions for each alignment and return frequency are shown in Table 3 through Table 38.

Table 3 - Lake Charles Westbank Sulphur 2025 2% Hydraulic Boundary Conditions

Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	6.6	1.2	1	0.1	2	0.4
2	5.3	1.2	1	0.1	2	0.4
3	7	1.2	1	0.1	2	0.4

Table 3 - Lake Charles Westbank Sulphur 2025 2% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std

Table 4 – Lake Charles Westbank Sulphur 2075 2% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	10.5	1.2	2	0.2	3	0.6
2	9.3	1.2	2	0.2	3	0.6
3	13.1	1.2	2	0.2	3	0.6

Table 5 – Lake Charles Westbank Sulphur 2025 1% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	9	1.2	2	0.2	3	0.6
2	8.5	1.2	2	0.2	3	0.6
3	11.7	1.2	2	0.2	3	0.6

Table 6 – Lake Charles Westbank Sulphur 2075 1% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	13.2	1.2	3	0.3	4	0.8
2	13.3	1.2	3	0.3	4	0.8
3	15.4	1.2	3	0.3	4	0.8

Table 7 – Lake Charles Westbank Sulphur 2025 0.5% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	11.7	1.2	2.5	0.3	4	0.8
2	11.2	1.2	2.5	0.3	4	0.8
3	12.9	1.2	2.5	0.3	4	0.8

Table 8 – Lake Charles Westbank Sulphur 2075 0.5% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	16.6	1.2	4	0.4	5	1.0
2	17	1.2	4	0.4	5	1.0
3	16.8	1.2	4	0.4	5	1.0

Table 9 - Abbeville to Delcambre Hwy 330 2025 2% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	10.4	1.2	1	0.1	2	0.4
2	11.6	1.2	1	0.1	2	0.4
3	10.7	1.2	1	0.1	2	0.4

Table 10 – Abbeville to Delcambre Hwy 330 2075 2% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	15.2	1.2	2	0.1	3	0.4
2	15	1.2	2	0.1	3	0.4
3	15.3	1.2	2	0.1	3	0.4

Table 11 - Abbeville to Delcambre Hwy 330 2025 1% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	11.6	1.2	2	0.2	3	0.6
2	13.1	1.2	2	0.2	3	0.6
3	12.1	1.2	2	0.2	3	0.6

Table 12 - Abbeville to Delcambre Hwy 330 2075 1% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	16.5	1.2	3	0.3	4	0.8
2	16.5	1.2	3	0.3	4	0.8

Table 12 - Abbeville to Delcambre Hwy 330 2075 1% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
3	16.9	1.2	3	0.3	4	0.8

Table 13 - Abbeville to Delcambre Hwy 330 2025 0.5% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	12.6	1.2	2.5	0.3	4	0.8
2	14.2	1.2	2.5	0.3	4	0.8
3	13.1	1.2	2.5	0.3	4	0.8

Table 14 - Abbeville to Delcambre Hwy 330 2075 0.5% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	17.6	1.2	4	0.4	5	1.0
2	17.6	1.2	4	0.4	5	1.0
3	18	1.2	4	0.4	5	1.0

Table 15 - Lake Charles Eastbank Sulphur 2025 2% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	12.6	1.2	2.5	0.3	4	0.8
2	14.2	1.2	2.5	0.3	4	0.8
3	13.1	1.2	2.5	0.3	4	0.8

Table 16 - Lake Charles Eastbank Sulphur 2075 2% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	13	1.2	2	0.2	3	0.6
2	13.4	1.2	2	0.2	3	0.6
3	13.3	1.2	2	0.2	3	0.6

Table 17 - Lake Charles Eastbank Sulphur 2025 1% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	11.2	1.2	2	0.2	3	0.6
2	11	1.2	2	0.2	3	0.6
3	10.7	1.2	2	0.2	3	0.6

Table 18 - Lake Charles Eastbank Sulphur 2075 1% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	15.5	1.2	3	0.3	4	0.8
2	16.1	1.2	3	0.3	4	0.8
3	15.8	1.2	3	0.3	4	0.8

Table 19 - Lake Charles Eastbank Sulphur 2025 0.5% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	12.5	1.2	2.5	0.3	4	0.8
2	12.2	1.2	2.5	0.3	4	0.8
3	11.9	1.2	2.5	0.3	4	0.8

Table 20 - Lake Charles Eastbank Sulphur 2075 0.5% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	17.1	1.2	4	0.4	5	1.0
2	17.6	1.2	4	0.4	5	1.0
3	17.3	1.2	4	0.4	5	1.0

Table 21 - Delcambre Erath 2025 2% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	10.7	1.2	2	0.2	6	1.2
2	10.6	1.2	2	0.2	6	1.2

Table 22 - Delcambre Erath 2075 2% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	15.4	1.2	3	0.3	6	1.2
2	15.4	1.2	4	0.4	7	1.4

Table 23 - Delcambre Erath 2025 1% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	12.1	1.2	3	0.3	7	1.4
2	12	1.2	3	0.3	7	1.4

Table 24 - Delcambre Erath 2075 1% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	17	1.2	4	0.4	7	1.4
2	17	1.2	5	0.5	7	1.4

Table 25 - Delcambre Erath 2025 0.5% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	13.1	1.2	3	0.3	8	1.6
2	13.1	1.2	4	0.4	8	1.6

Table 26 - Delcambre Erath 2075 0.5% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	18.1	1.2	5	0.5	8	1.6
2	18.2	1.2	5	0.5	8	1.6

Table 27 - Lake Charles Westbank Sulphur South 2025 2% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	8.4	1.2	1	0.1	2	0.4
2	9.3	1.2	1	0.1	2	0.4
3	9.3	1.2	1	0.1	2	0.4
4	10	1.2	1	0.1	2	0.4

Table 28 - Lake Charles Westbank Sulphur South 2075 2% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	13.4	1.2	2	0.2	3	0.6
2	13.3	1.2	2	0.2	3	0.6
3	13	1.2	2	0.2	3	0.6
4	13.1	1.2	2	0.2	3	0.6

Table 29 - Lake Charles Westbank Sulphur South 2025 1% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	11.2	1.2	2	0.2	3	0.6
2	11.2	1.2	2	0.2	3	0.6
3	11.2	1.2	2	0.2	3	0.6
4	11.7	1.2	2	0.2	3	0.6

Table 30 - Lake Charles Westbank Sulphur South 2075 1% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	17.2	1.2	3	0.3	4	0.8
2	16	1.2	3	0.3	4	0.8
3	15.4	1.2	3	0.3	4	0.8
4	15.4	1.2	3	0.3	4	0.8

Table 31 - Lake Charles Westbank Sulphur South 2025 0.5% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	12.6	1.2	2.5	0.3	4	0.8
2	12.5	1.2	2.5	0.3	4	0.8
3	12.5	1.2	2.5	0.3	4	0.8
4	12.9	1.2	2.5	0.3	4	0.8

Table 32 - Lake Charles Westbank Sulphur South 2075 0.5% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	18.8	1.2	4	0.4	5	1.0
2	17.5	1.2	4	0.4	5	1.0
3	17	1.2	4	0.4	5	1.0
4	16.8	1.2	4	0.4	5	1.0

Table 33 - Abbeville Ring Levee 2025 2% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	10.5	1.2	1	0.1	2	0.4
2	10.5	1.2	1	0.1	2	0.4
3	9.7	1.2	1	0.1	2	0.4

Table 34 - Abbeville Ring Levee 2075 2% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	15.4	1.2	2	0.2	3	0.6
2	15.4	1.2	2	0.2	3	0.6
3	14.9	1.2	2	0.2	3	0.6

Table 35 - Abbeville Ring Levee 2025 1% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	11.8	1.2	2	0.2	3	0.6
2	11.8	1.2	2	0.2	3	0.6
3	11.5	1.2	2	0.2	3	0.6

Table 36 - Abbeville Ring Levee 2075 1% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	16.8	1.2	3	0.3	4	0.8
2	16.8	1.2	3	0.3	4	0.8
3	17	1.2	3	0.3	4	0.8

Table 37 - Abbeville Ring Levee 2025 0.5% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	12.8	1.2	2.5	0.3	4	0.8
2	12.8	1.2	2.5	0.3	4	0.8
3	12.8	1.2	2.5	0.3	4	0.8

Table 38 - Abbeville Ring Levee 2075 0.5% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
1	17.8	1.2	4	0.4	5	1.0

Table 38 - Abbeville Ring Levee 2075 0.5% Hydraulic Boundary Conditions						
Segment	Surface Water Elevation (ft)		Significant Wave Height (ft)		Peak Period (s)	
	Mean	Std	Mean	Std	Mean	Std
2	17.8	1.2	4	0.4	5	1.0
3	18.2	1.2	4	0.4	5	1.0

The 2025 and 2075 2%, 1%, and 0.5% hydraulic boundary conditions were then used to compute the 2025 and 2075 2%, 1%, and 0.5% annual exceedence levee design elevations. All levees were designed using a slope of 1 on 3. The design criteria for the levees are as follows:

- For the design still water, wave height and wave period, the maximum allowable average wave overtopping of 0.1 cubic feet per second per foot (cfs/ft) at 90% level of assurance and 0.01 cfs/ft at 50% level of assurance for grass-covered levees;
- No minimum freeboard required.

The application of a Monte Carlo analysis was used to determine the levee design elevation. In the Monte Carlo analysis, the overtopping algorithm is repeated to compute the overtopping rate many times. Based on these outputs, a statistical distribution can be derived from the resulting overtopping rates. The parameters that are included in the Monte Carlo analysis are the 1% surge elevation, wave height and wave period.

To determine the overtopping rate in the Monte Carlo analysis, the probabilistic overtopping formulations from Van der Meer (TAW, 2002) are applied for levees (see Figure 11). Along with the geometric parameters (levee height and slope), hydraulic input parameters for determination of the overtopping rate in Equations 1 and 2 are the water elevation (ζ), the significant wave height (H_s) and the peak wave period (T_p).

Van der Meer overtopping formulations
The overtopping formulation from Van der Meer reads (TAW, 2002):

$$\frac{q}{\sqrt{gH_{m0}^3}} = \frac{0.067}{\sqrt{\tan\alpha}}\gamma_b\xi_{0}\exp\left(-4.75\frac{R_c}{H_{m0}}\frac{1}{\xi_{0}\gamma_b\gamma_f\gamma_\beta\gamma_v}\right)$$

$$with: \quad \max imum: \quad \frac{q}{\sqrt{gH_{m0}^3}} = 0.2\exp\left(-2.6\frac{R_c}{H_{m0}}\frac{1}{\gamma_f\gamma_\beta}\right) \qquad (1)$$

With:
q: average overtopping rate [cfs/ft]
g: gravitational acceleration [ft/s²]
H_{m0}: wave height at toe of the structure [ft]
ξ_0: surf similarity parameter [-]
α: slope [-]
R_c: freeboard [ft]
$\gamma_{..}$: coefficient for presence of berm (b), friction (f), wave incidence (β), vertical wall (v)

The surf similarity parameter $\xi 0$ is defined herein as $\xi_0 = \tan\alpha / \sqrt{s_0}$ with α the angle of slope and s_0 the wave steepness. The wave steepness follows from $s0 = 2\pi H_{m0} / (g\ Tm\text{-}1_0^2)$. The coefficients -4.75 and -2.6 in Equation 1 are the mean values. The standard deviations of these coefficients are equal to 0.5 and 0.35, respectively and these errors are normally distributed (TAW, 2002). The reader is referred to TAW (2002) for definitions of the various coefficients for presence of berm, friction, wave incidence, vertical wall.

Equation 1 is valid for $\xi_0 < 5$ and slopes steeper than 1:8. For values of $\xi_0 > 7$ the following equation is proposed for the overtopping rate:

$$\frac{q}{\sqrt{gH_{m0}^3}} = 10^{-0.92}\exp\left(-\frac{R_c}{\gamma_f\gamma_\beta H_{m0}(0.33+0.022\xi_{0})}\right) \qquad (2)$$

The overtopping rates for the range $5 < \xi_0 < 7$ are obtained by linear interpolation of Equation 1 and 2 using the logarithmic value of the overtopping rates. For slopes between 1:8 and 1:15, the solution should be found by iteration. If the slope is less than 1:15, it should be considered as a berm or a foreshore depending on the length of the section compared to the deep water wavelength. The coefficients -0.92 is the mean value. The standard deviation of this coefficient is equal to 0.24 and the error is normally distributed (TAW, 2002).

Figure 11 - Van der Meer Overtopping Formula

Figure 12 graphically shows the overtopping for a levee situation including the most relevant parameters.

In the design process, we use the best estimate 2%, 1%, and 0.5% values for these parameters from the JPM-OS method (Resio, 2007); uncertainty in these values exists. Resio (2007) has provided a method to derive the standard deviation in the 2%, 1%, and 0.5% surge elevations. Standard deviation values of 10% of the average significant wave height and 20% of the peak period were used (Smith, 2006, pers. comm.). In the absence of data, all uncertainties are assumed to be normally distributed.

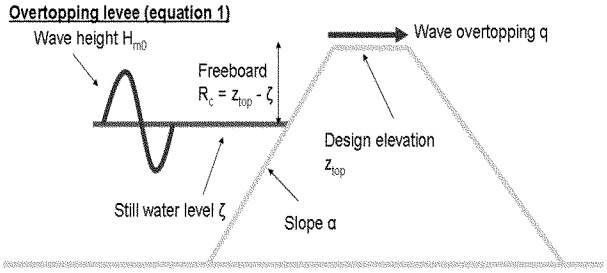


Figure 12 - Definition for Overtopping for Levee

The Monte Carlo Analysis is executed as follows:

1. Draw a random number between 0 and 1 to set the exceedence probability (p).
2. Compute the water elevation from a normal distribution using the mean 1% surge elevation and standard deviation as parameters and with an exceedence probability (p).
3. Draw a random number between 0 and 1 to set the exceedence probability (p).
4. Compute the wave height and wave period from a normal distribution using the mean 1% wave height/wave period and the associated standard deviation and with an exceedence probability (p).
5. Repeat step 3 and 4 for the three overtopping coefficients independently.
6. Compute the overtopping rate for these hydraulic parameters and overtopping coefficients determined in step 2, 4 and 5 using the Van der Meer overtopping formulations for levees or the Franco & Franco equation for floodwalls (see Equations 1 and 2 in the textbox).
7. Repeat the Step 1 through 5 a large number of times. (N)
8. Compute the 50% and 90% confidence limit of the overtopping rate. (i.e. q_{50} and q_{90})

The procedure is implemented in the numerical software package MATLAB because it is a computationally intensive procedure. MATLAB is a high-level technical computing language and interactive environment for algorithm development, data visualization, data analysis, and numeric computation. The computation of the overtopping rate in the present MATLAB routine is limited in the sense that it can only take into account an average slope for the entire cross-section. If a wave berm exists, this effect is included in a berm factor. The following procedure was carried out to determine this berm factor. First, the overtopping rate is computed with PC-Overslag with the best estimates of surge level and waves. Next, the berm factor is calibrated with the Van der Meer overtopping formulations to get exactly same result from PC-Overslag. Then, the berm factor is checked to see if it is in between the recommended range of 0.6 – 1.0. Finally, the calibrated berm factor is applied in the uncertainty analysis (and keep this factor constant) throughout the Monte Carlo analysis in MATLAB. The analysis was completed and the results were then compiled for levees at the 2%, 1% and 0.5% Design Elevation shown in Table 39 through Table 56.

2.3.2 Results

Table 39 - Lake Charles Westbank Sulphur 2% Design Elevation				
Segment	**Type**	**Condition**	**Levee Slope**	**Design Elevation (ft) NAVD88 (2004.65)**
1	Levee	2025	1V:3H	9.0
1	Levee	2075	1V:3H	14.5
2	Levee	2025	1V:3H	8.0
2	Levee	2075	1V:3H	13.5
3	Levee	2025	1V:3H	9.5
3	Levee	2075	1V:3H	17.0

Table 40 - Lake Charles Westbank Sulphur 1% Design Elevation				
Segment	**Type**	**Condition**	**Levee Slope**	**Design Elevation (ft) NAVD88 (2004.65)**
1	Levee	2025	1V:3H	13.0
1	Levee	2075	1V:3H	19.5
2	Levee	2025	1V:3H	12.5
2	Levee	2075	1V:3H	19.5
3	Levee	2025	1V:3H	16.0
3	Levee	2075	1V:3H	22.0

Table 41 - Lake Charles Westbank Sulphur 0.5% Design Elevation				
Segment	**Type**	**Condition**	**Levee Slope**	**Design Elevation (ft) NAVD88 (2004.65)**
1	Levee	2025	1V:3H	17.0
1	Levee	2075	1V:3H	26.0
2	Levee	2025	1V:3H	16.5
2	Levee	2075	1V:3H	26.5
3	Levee	2025	1V:3H	18.5
3	Levee	2075	1V:3H	26.5

Table 42 - Abbeville to Delcambre Hwy 330 2% Design Elevation				
Segment	**Type**	**Condition**	**Levee Slope**	**Design Elevation (ft) NAVD88 (2004.65)**
1	Levee	2025	1V:3H	13.0
1	Levee	2075	1V:3H	19.5
2	Levee	2025	1V:3H	14.0
2	Levee	2075	1V:3H	19.0
3	Levee	2025	1V:3H	13.0
3	Levee	2075	1V:3H	19.5

Table 43 - Abbeville to Delcambre Hwy 330 1% Design Elevation				
Segment	**Type**	**Condition**	**Levee Slope**	**Design Elevation (ft) NAVD88 (2004.65)**
1	Levee	2025	1V:3H	15.5
1	Levee	2075	1V:3H	23.0
2	Levee	2025	1V:3H	17.0
2	Levee	2075	1V:3H	23.0
3	Levee	2025	1V:3H	16.0
3	Levee	2075	1V:3H	23.5

Table 44 - Abbeville to Delcambre Hwy 330 0.5% Design Elevation				
Segment	**Type**	**Condition**	**Levee Slope**	**Design Elevation (ft) NAVD88 (2004.65)**
1	Levee	2025	1V:3H	18.0
1	Levee	2075	1V:3H	27.0
2	Levee	2025	1V:3H	19.5
2	Levee	2075	1V:3H	27.0
3	Levee	2025	1V:3H	18.5
3	Levee	2075	1V:3H	27.5

Table 45 - Lake Charles Eastbank Sulphur 2% Design Elevation				
Segment	**Type**	**Condition**	**Levee Slope**	**Design Elevation (ft) NAVD88 (2004.65)**
1	Levee	2025	1V:3H	12.0
1	Levee	2075	1V:3H	17.0
2	Levee	2025	1V:3H	11.5
2	Levee	2075	1V:3H	17.5
3	Levee	2025	1V:3H	11.5
3	Levee	2075	1V:3H	17.5

Table 46 - Lake Charles Eastbank Sulphur 1% Design Elevation				
Segment	**Type**	**Condition**	**Levee Slope**	**Design Elevation (ft) NAVD88 (2004.65)**
1	Levee	2025	1V:3H	15.0
1	Levee	2075	1V:3H	22.0
2	Levee	2025	1V:3H	15.0
2	Levee	2075	1V:3H	22.5
3	Levee	2025	1V:3H	15.0
3	Levee	2075	1V:3H	22.0

Table 47 - Lake Charles Eastbank Sulphur 0.5% Design Elevation				
Segment	**Type**	**Condition**	**Levee Slope**	**Design Elevation (ft) NAVD88 (2004.65)**
1	Levee	2025	1V:3H	18.0
1	Levee	2075	1V:3H	26.5
2	Levee	2025	1V:3H	17.5
2	Levee	2075	1V:3H	27.0
3	Levee	2025	1V:3H	17.5
3	Levee	2075	1V:3H	27.0

Table 48 - Delcambre Erath 2% Design Elevation				
Segment	**Type**	**Condition**	**Levee Slope**	**Design Elevation (ft) NAVD88 (2004.65)**
1	Levee	2025	1V:3H	15.5
1	Levee	2075	1V:3H	23.0
2	Levee	2025	1V:3H	15.5
2	Levee	2075	1V:3H	26.0

Table 49 - Delcambre Erath 1% Design Elevation				
Segment	**Type**	**Condition**	**Levee Slope**	**Design Elevation (ft) NAVD88 (2004.65)**
1	Levee	2025	1V:3H	19.5
1	Levee	2075	1V:3H	27.5
2	Levee	2025	1V:3H	19.5
2	Levee	2075	1V:3H	30.5

Table 50 - Delcambre Erath 0.5% Design Elevation				
Segment	**Type**	**Condition**	**Levee Slope**	**Design Elevation (ft) NAVD88 (2004.65)**
1	Levee	2025	1V:3H	21.0
1	Levee	2075	1V:3H	32.0
2	Levee	2025	1V:3H	24.0
2	Levee	2075	1V:3H	32.0

Table 51 - Lake Charles Westbank Sulphur South 2% Design Elevation				
Segment	**Type**	**Condition**	**Levee Slope**	**Design Elevation (ft) NAVD88 (2004.65)**
1	Levee	2025	1V:3H	11.0
1	Levee	2075	1V:3H	17.5
2	Levee	2025	1V:3H	11.5
2	Levee	2075	1V:3H	17.5
3	Levee	2025	1V:3H	11.5
3	Levee	2075	1V:3H	17.0
4	Levee	2025	1V:3H	12.5
4	Levee	2075	1V:3H	17.0

Table 52 - Lake Charles Westbank Sulphur South 1% Design Elevation				
Segment	**Type**	**Condition**	**Levee Slope**	**Design Elevation (ft) NAVD88 (2004.65)**
1	Levee	2025	1V:3H	15.0
1	Levee	2075	1V:3H	23.5
2	Levee	2025	1V:3H	15.0
2	Levee	2075	1V:3H	22.5
3	Levee	2025	1V:3H	15.0
3	Levee	2075	1V:3H	22.0
4	Levee	2025	1V:3H	16.0
4	Levee	2075	1V:3H	22.0

Table 53 - Lake Charles Westbank Sulphur South 0.5% Design Elevation				
Segment	**Type**	**Condition**	**Levee Slope**	**Design Elevation (ft) NAVD88 (2004.65)**
1	Levee	2025	1V:3H	18.0
1	Levee	2075	1V:3H	28.5
2	Levee	2025	1V:3H	18.0
2	Levee	2075	1V:3H	27.0
3	Levee	2025	1V:3H	18.0
3	Levee	2075	1V:3H	26.5
4	Levee	2025	1V:3H	18.5
4	Levee	2075	1V:3H	26.5

Table 54 - Abbeville Ring Levee 2% Design Elevation				
Segment	**Type**	**Condition**	**Levee Slope**	**Design Elevation (ft) NAVD88 (2004.65)**
1	Levee	2025	1V:3H	13.0
1	Levee	2075	1V:3H	19.5
2	Levee	2025	1V:3H	13.0
2	Levee	2075	1V:3H	19.5
3	Levee	2025	1V:3H	12.0
3	Levee	2075	1V:3H	19.0

Table 55 - Abbeville Ring Levee 1% Design Elevation				
Segment	**Type**	**Condition**	**Levee Slope**	**Design Elevation (ft) NAVD88 (2004.65)**
1	Levee	2025	1V:3H	16.0
1	Levee	2075	1V:3H	23.0
2	Levee	2025	1V:3H	16.0
2	Levee	2075	1V:3H	23.0
3	Levee	2025	1V:3H	15.5
3	Levee	2075	1V:3H	23.5

Table 56 - Abbeville Ring Levee 0.5% Design Elevation				
Segment	**Type**	**Condition**	**Levee Slope**	**Design Elevation (ft) NAVD88 (2004.65)**
1	Levee	2025	1V:3H	18.5
1	Levee	2075	1V:3H	27.5
2	Levee	2025	1V:3H	18.5
2	Levee	2075	1V:3H	27.5
3	Levee	2025	1V:3H	18.5
3	Levee	2075	1V:3H	28.0

2.4 FUTURE WITHOUT PROJECT FREQUENCY CURVES

2.4.1 Methodology

The project covers the Louisiana parishes of Calcasieu, Cameron, and Vermilion. The HEC-RAS model of the Calcasieu Lock Study Feasibility Study was originally calibrated to the November 5, 2002 rainfall event and verified to the August 28 to September 6, 2001 rainfall event, and Agency Technical Review was performed. Since damages from rainfall runoff is not the objective for this hurricane storm surge damage reduction study, the additional areas that were added for the requirements of this study did not need to be recalibrated and verified again.

The study area consists of multiple hydrologic storage areas connected to each other at the lowest perimeter point. Each area has a storage area curve that is basically elevation versus volume in acre-feet. The maximum water surface elevation of each storage area for any given event will have all elevations below that maximum inundated, even if for a very short time. The stage frequency results from each storage area are input into HEC-FDA to perform economic analysis.

The existing conditions year for this study is 2013 and the assumed base year is 2025 (base conditions). The Future Without Project (FWOP) conditions would apply 50 years after construction, or in 2075. For this effort only Intermediate Sea Level Rise was analyzed. This was calculated from a spreadsheet created using guidelines of EC1165-2-212, which combines the total settlement for each of the four downstream gages with the standard accumulation of

Intermediate Sea Level Rise for both 2025 and 2075. Refer to Appendix O for more detail on Climate Impact on Performance. There are 45 storage areas from the original model, plus an additional 36 storage areas that were added to the eastern and western sides to the model. This created an additional 5 storage areas from the original model and an additional 4 areas in the newly added areas. There were no new channel cross sections taken for the new areas. However, the results of the newer areas were very similar to the pre-existing areas. The nomenclature of the original model storage areas all begin with "SA-", while the additional areas all begin with "XA-". Any storage area with a suffix behind it (such as "-RL" for Ring Levee) represents an anticipated division of an existing area from a possible alternative. A schematic of the HEC-RAS storage areas can be seen in Figure 13.

Four different downstream boundary conditions were used for base and future conditions. They are the following structures: the Calcasieu Lock West, Catfish Point South, Leland Bowman East, and Schooner Bayou East. For base conditions runs, the steady state average elevation of 0.62 was used as the boundary condition for all four locks. The amounts of Relative Sea Level Rise (RSLR) at the Intermediate Level 1 calculated from the spreadsheet mentioned above and based upon EC1165-2-212, were added to existing conditions for each gage to reflect subsidence and the amount of time after 2013. The HEC-RAS model was used to obtain the maximum water surface elevations in each storage area for the 100% as well as the 50%, 20%, 10%, 4%, 2%, and 1% Annual Exceedance Probability (AEP) rainfall events. An ADCIRC storm surge model was run for the same project using the similar storage areas. The storage areas that were not the same were adjusted for comparison purposes. The HEC RAS model results were plotted with the 1% ADCIRC storm surge elevations in the same storage areas in order to determine the governing source of the maximum water surface elevations at the 1% frequency. In most cases, the 1% surge elevations were much greater than the 1% rainfall elevations. In storage areas further north, away from the Gulf of Mexico and the rivers or bayous, the differences between the two decreases until rainfall governs and surge effects are not observed. This situation occurred in less than 10 percent of all storage areas. Land use areas coded into ADCIRC are shown in Figure 14.

ADCIRC surge elevations were available for the 1% and 0.2% AEP events. In order to estimate ADCIRC water elevations for the more frequent events, values were extrapolated between the 100% AEP HEC-RAS and 1% AEP ADCIRC results. Basically, an assumption was made that the 100% AEP event would be equal in HEC-RAS and ADICRC (if ADCIRC could be run for the 100% AEP event). The next step was to find the difference between the 1% AEP HEC-RAS and 1% AEP ADCIRC results. The closer the storage area is to the Gulf of Mexico, the larger this difference would be and vice versa. The difference for each storage area is then divided up for all higher frequencies and added to the HEC-RAS results. The finished results were plotted for each storage area, and many had to be smoothed out to provide a curve that would be reasonably expected. Since HEC-RAS results are based upon Partial Duration TP-40 rainfall amounts, these elevations may be slightly over estimated at higher frequency events. The adjusted curves can be seen on Figure 17. Since the year 2025 is very close to the year 2013, results for 2025 were linearly interpolated between the 2013 existing year and the 2075 FWOP year. This resulted in water surface elevations for every storage area in 2025 greater than or equal to the results of 2013. Using this methodology, it is expected that water elevations in the coastal zone are underestimated for the more frequent events. For the transition zone, the areas that are not especially dominated by either rain or surge, it is expected that the water elevations are overestimated for the more frequent events. The method used in this analysis yielded results that are within the expected range of water elevations to consider it sound for use as a screening mechanism. This method was used consistently in the analysis of the alternatives and is not expected to give an advantage or disadvantage to any one alternative. A Joint Probability Analysis combining the likelihood of expected storm surge events with rainfall events to estimate the resultant water elevations due to project implementation would be the best method to use, and will be used for the next phase of the project.

Because storm surge effects were not included in HEC-RAS model runs, (boundary conditions were not set to account for higher stages caused by storms) there are some limitations to the developed area elevation results. However, HEC-RAS model runs with elevated Gulf stages increased the drainage times of runoff but did not increase the peak stages in the storage areas due to the unique topography of the study area.

An average rate of 7 mm per year of marsh accretion within the southwest coastal Louisiana area was found on page 9 of the ERDC/EL TN-10-5 dated August 2010. There are four types of marsh: fresh, intermediate, brackish, and saline. Open water is not to be included for any marsh accretion analysis. The complete list of marsh storage areas are shown in Table 57, and were obtained by comparing storage area boundaries with a map of the marsh areas shown below. Total marsh accretion amounts were found by adding 7 mm of accretion per year to the existing conditions water surface elevations at each of the four downstream boundary conditions to arrive at 0.28 feet maximum for all areas in 2025 and 1.42 feet maximum for all areas in 2075. For the four partial marsh areas, these values were reduced to 50% or 20%, based upon visual inspection of plan views. The appropriate amount of accretion was added to all elevations above the initial water elevation (or base flow) for each applicable marsh area in the HEC-RAS geometry file. The theory behind this very simple method is that the volume at the water surface would be moved up by the required amount of accretion. Samples from two marsh areas are shown in Figure 15 for both 2025 and 2075. These areas are highlighted in red in Table 57. Note that one of these areas only has a 50% accretion rate due to the amount of open water.

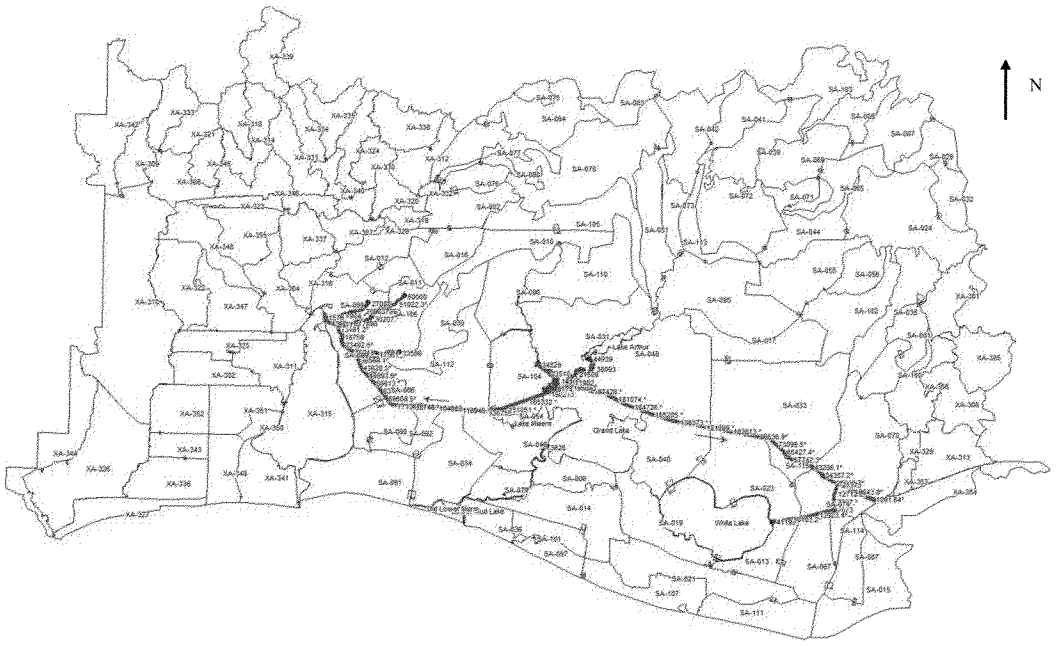


Figure 13 - HEC RAS Storage Areas

JA 37-899 11/27/2019 949

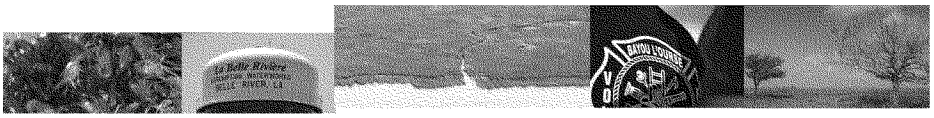


Figure 14 - Land Use Areas Coded Into ADCIRC

JA 37-899 950 11/27/2019

Table 57 - Marsh Storage Areas

Area	Min Elev	Base Flow Elev	Marsh %	2075 total (ft.)
SA-006	-6.00	-0.50	100	1.42
SA-013	-5.00	-3.80	100	1.42
SA-014	-5.00	-1.70	100	1.42
SA-015	-8.00	-2.00	100	1.42
SA-019	-4.00	-2.15	100	1.42
SA-021	-5.00	-1.53	100	1.42
SA-023	-7.00	-2.00	100	1.42
SA-034	-5.00	-1.39	100	1.42
SA-036	-3.00	-1.30	100	1.42
SA-040	-4.00	-2.04	100	1.42
SA-046	-3.00	-1.00	100	1.42
SA-054	-2.00	0.57	100	1.42
SA-067	-4.00	-2.00	100	1.42
SA-074	-6.00	0.60	100	1.42
SA-079	-3.00	-1.00	100	1.42
SA-086	-3.00	1.20	100	1.42
SA-087	-5.00	-5.00	100	1.42
SA-089	-3.00	-1.11	100	1.42
SA-090	-3.00	-0.50	100	1.42
SA-091	-15.00	-1.30	100	1.42
SA-092	-4.00	-0.95	100	1.42
SA-097	-3.00	-1.30	100	1.42
SA-101	-5.00	-1.00	100	1.42
SA-107	-3.00	-1.30	100	1.42
SA-111	-3.00	-1.30	100	1.42
SA-114	-3.00	-1.00	100	1.42
SA-115	-5.00	-2.99	100	1.42
XA-326	-3.00	0.47	100	1.42
XA-327	-3.00	0.00	100	1.42
XA-336	-2.00	1.12	100	1.42
XA-341	-2.00	0.00	100	1.42
XA-343	-2.00	1.67	100	1.42
XA-344	-3.00	0.45	100	1.42
XA-349	-3.00	0.00	100	1.42
XA-354	-3.00	0.00	100	1.42
SA-048	-6.00	-1.99	50	0.71
SA-104	-4.00	-1.77	50	0.71
SA-112	-15.00	0.00	50	0.71
SA-031	-20.00	-2.82	20	0.28



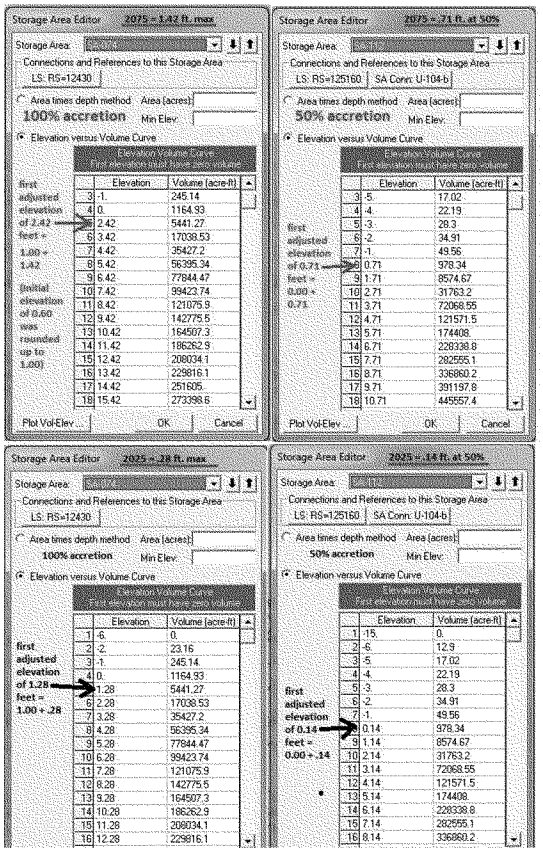


Figure 15 - Adjusted Storage Areas

The full 100% amount of accretion was then subtracted from all four downstream boundary condition elevations that had already been adjusted for Intermediate RSLR. In theory, this would negate the effects of RSLR, but in reality, only the marsh areas saw increased water levels due to higher theoretical land elevations. This caused a very minor backwater effect of less than 0.20 feet in only a few of the upland areas. These adjusted boundary conditions are shown below in Table 58.

Table 58 - Adjusted Boundary Conditions

River	Reach	River Sta	Plan	W.S. Elev (ft)	All are based upon Intermediate RSLR
GIWW	1	62	S75b001	2.04	2075 w/o marsh accretion at Calcasieu Lock West
GIWW	1	62	S25b001	0.84	2025 w/p marsh accretion at Calcasieu Lock West
GIWW	1	62	M75b001	0.62	2075 with marsh accretion at Calcasieu Lock West
GIWW	1	62	M25b001	0.56	2025 with marsh accretion at Calcasieu Lock West
GIWW	7	0	S75b001	2.45	2075 w/o marsh accretion at Leland Bowman East
GIWW	7	0	S25b001	0.92	2025 w/p marsh accretion at Leland Bowman East
GIWW	7	0	M75b001	1.03	2075 with marsh accretion at Leland Bowman East
GIWW	7	0	M25b001	0.64	2025 with marsh accretion at Leland Bowman East
Grand Lake	2 (Mern	134	S75b001	2.62	2075 w/o marsh accretion at Catfish Point South
Grand Lake	2 (Mern	134	S25b001	0.95	2025 w/p marsh accretion at Catfish Point South
Grand Lake	2 (Mern	134	M75b001	1.20	2075 with marsh accretion at Catfish Point South
Grand Lake	2 (Mern	134	M25b001	0.67	2025 with marsh accretion at Catfish Point South
Schooner Bayou	1	1319	S75b001	2.35	2075 w/o marsh accretion at Schooner Bayou East
Schooner Bayou	1	1319	S25b001	0.90	2025 w/p marsh accretion at Schooner Bayou East
Schooner Bayou	1	1319	M75b001	0.93	2075 with marsh accretion at Schooner Bayou East
Schooner Bayou	1	1319	M25b001	0.62	2025 with marsh accretion at Schooner Bayou East

The HEC-RAS model was rerun with the above downstream boundary conditions for 100%-1% AEP rainfall events and the results found were within a range of 1.42 feet maximum to the same runs without marsh accretion. Since the 1% ADCIRC surge elevations were much higher than the 1% HEC-RAS results in most cases, the surge elevations usually governed. The difference between marsh accretion and no accretion at the 100% AEP event for each specific storage area was then linearly interpolated and then added to the 50% through 2% HEC-RAS results from the runs that did not consider marsh accretion. Two areas were chosen to portray this pattern and are shown in Figure 16 and Figure 17. Note that the effect of marsh accretion is much more noticeable in the area on the Gulf itself.

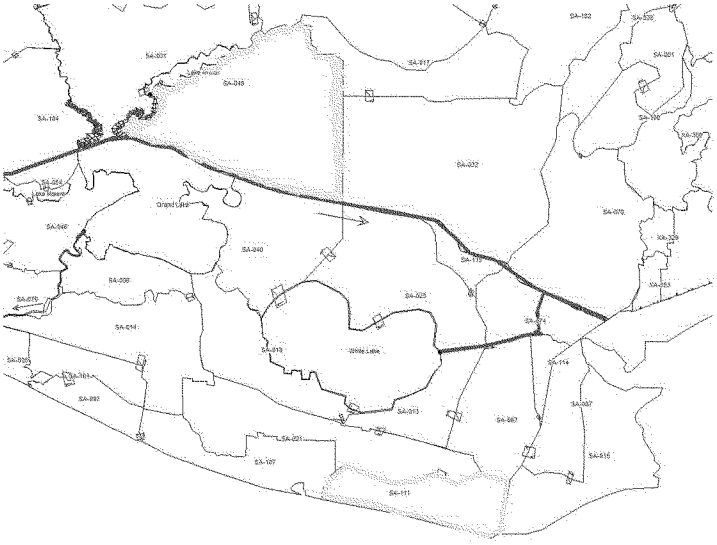


Figure 16 - Storage Areas

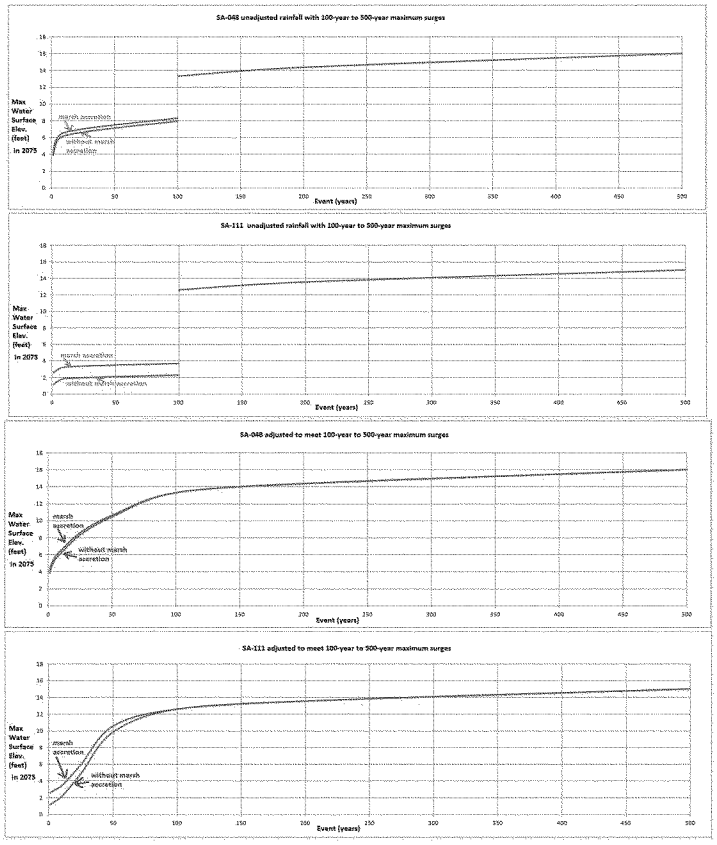


Figure 17 - Adjusted Curves

Table 59 - FWOP With Marsh Accretion

*Values are in feet.

Storage Area	M2025-001	M2025-002	M2025-005	M2025-010	M2025-025	M2025-050	M2025-100	M2025-200	M2025-500
SA-001	5.09	5.52	6.28	6.76	7.61	8.46	9.60	10.36	11.50
SA-006	0.69	0.89	1.27	1.70	3.85	7.74	9.80	10.24	10.90
SA-010	6.44	7.06	8.04	8.71	9.32	9.77	10.20	10.20	10.20
SA-011	8.71	8.86	9.57	10.55	11.28	11.87	12.27	12.34	12.50
SA-012	7.53	8.35	9.69	10.73	11.57	12.17	12.73	12.73	12.73
SA-013	0.93	1.16	1.42	1.91	4.35	8.75	11.10	12.02	13.40
SA-014	0.75	0.97	1.33	1.87	4.61	9.56	12.20	13.32	15.00
SA-015	-1.49	-1.36	-1.10	-0.43	2.95	9.03	12.40	13.40	14.90
SA-016	12.48	13.45	15.06	15.94	16.61	17.09	17.48	17.48	17.48
SA-017	2.46	2.85	3.42	3.90	4.62	5.34	6.30	7.22	8.60
SA-017-RL	2.46	2.85	3.42	3.90	4.62	5.34	6.30	7.22	8.60
SA-019	0.82	1.04	1.32	1.77	4.06	8.18	10.40	11.40	12.90
SA-021	1.01	1.25	1.49	2.00	4.58	9.22	11.70	12.62	14.00
SA-023	0.58	0.73	1.02	1.39	3.27	6.66	8.50	9.02	9.80
SA-030	4.49	4.97	5.51	5.99	6.30	6.70	7.30	8.54	10.40
SA-031	4.08	4.74	5.91	6.82	7.59	8.14	8.65	8.73	8.90
SA-033	2.50	2.90	3.47	3.96	4.84	5.72	6.90	7.74	9.00
SA-033-RL	2.50	2.90	3.47	3.96	4.84	5.72	6.90	7.74	9.00
SA-034	1.40	1.57	1.84	2.40	5.26	10.39	13.10	14.34	16.20
SA-036	0.91	1.17	1.43	1.99	4.77	9.81	12.50	13.54	15.10
SA-038	10.03	10.90	11.95	12.41	12.83	13.09	13.28	13.28	13.28
SA-040	0.58	0.74	1.03	1.32	2.82	5.54	7.00	7.88	9.20
SA-046	1.78	2.17	2.58	2.88	4.43	7.21	8.60	9.92	11.90
SA-048	3.88	4.44	5.44	6.25	6.95	7.44	7.92	8.12	8.60
SA-054	1.38	1.52	1.74	1.98	3.22	5.47	6.60	7.36	8.50
SA-067	0.93	1.16	1.42	1.89	4.26	8.53	10.80	11.80	13.30
SA-070	2.63	3.04	3.68	4.05	5.88	9.17	11.00	11.72	12.80
SA-070-N	2.63	3.04	3.68	4.05	5.88	9.17	11.00	11.72	12.80
SA-070-S	2.63	3.04	3.68	4.05	5.88	9.17	11.00	11.72	12.80
SA-074	1.65	1.81	2.10	2.55	4.79	8.84	11.00	11.60	12.50
SA-079	1.77	2.15	2.56	2.92	4.77	8.10	9.80	11.12	13.10
SA-086	1.69	1.79	1.96	2.27	3.87	6.75	8.30	9.38	11.00
SA-087	-0.05	0.15	0.54	1.04	3.53	8.02	10.50	11.38	12.70
SA-089	0.99	1.19	1.46	1.84	3.81	7.35	9.20	10.16	11.60
SA-090	1.00	1.20	1.47	1.81	3.55	6.68	8.30	9.38	11.00
SA-091	1.35	1.54	1.74	2.22	4.62	8.96	12.80	12.85	14.20
SA-092	1.08	1.28	1.54	1.83	3.32	6.03	7.40	8.32	9.70
SA-096	2.22	2.40	2.76	3.08	4.24	5.77	6.90	7.78	9.10
SA-097	0.91	1.16	1.45	1.98	4.63	9.44	12.00	13.28	15.20
SA-099	7.52	8.34	9.68	10.71	11.55	12.14	12.71	12.71	12.71
SA-099-RL	7.52	8.34	9.68	10.71	11.55	12.14	12.71	12.71	12.71
SA-100	2.63	3.04	3.68	4.20	5.82	7.98	9.60	10.36	11.50
SA-101	0.78	1.01	1.35	1.90	4.72	9.79	12.50	13.58	15.20
SA-104	2.17	2.33	2.65	2.98	4.10	5.61	6.70	7.46	8.60
SA-106	4.46	4.93	5.48	5.96	6.99	8.02	9.40	10.36	11.80

Storage Area	M2075-001	M2075-002	M2075-005	M2075-010	M2075-025	M2075-050	M2075-100	M2075-200	M2075-500
SA-001	5.09	5.52	6.28	6.76	8.78	10.80	13.50	14.42	15.80
SA-006	1.82	2.01	2.35	2.77	5.04	9.14	10.90	11.78	13.10
SA-010	6.52	7.14	8.12	8.78	9.38	9.81	10.20	10.20	10.20
SA-011	8.71	8.86	9.58	10.56	11.29	12.05	13.20	14.29	16.00
SA-012	7.53	8.34	9.68	10.71	11.57	12.16	13.20	14.29	16.00
SA-013	2.04	2.26	2.48	2.99	5.69	10.58	12.80	13.72	15.10
SA-014	1.88	2.09	2.41	2.94	5.71	10.73	13.00	14.04	15.60
SA-015	-1.46	-1.33	-1.07	-0.36	3.21	9.65	13.20	14.12	15.50
SA-016	12.48	13.45	15.07	15.94	16.61	17.09	17.48	17.48	17.48
SA-017	2.46	2.85	3.42	3.90	6.48	9.06	12.50	14.18	16.70
SA-017-RL	2.46	2.85	3.42	3.90	6.48	9.06	12.50	14.18	16.70
SA-019	1.56	1.77	2.03	2.50	4.89	9.23	11.30	12.14	13.40
SA-021	2.12	2.34	2.55	3.06	5.74	10.59	12.80	13.68	15.00
SA-023	0.97	1.12	1.40	1.91	4.47	9.10	11.50	12.46	13.90
SA-030	4.49	4.91	5.45	5.90	7.69	9.48	11.90	13.66	16.30
SA-031	4.40	5.06	6.22	7.12	9.11	11.06	13.60	14.65	16.30
SA-033	2.50	2.90	3.46	3.95	6.39	8.83	12.10	13.14	14.70
SA-033-RL	2.50	2.90	3.46	3.95	6.39	8.83	12.10	13.14	14.70
SA-034	2.33	2.49	2.74	3.31	6.32	11.76	14.30	15.42	17.10
SA-036	2.04	2.29	2.51	3.07	6.02	11.35	13.80	14.96	16.70
SA-038	10.03	10.90	11.95	12.41	12.83	13.09	13.28	13.28	13.28
SA-040	0.98	1.14	1.42	1.93	4.52	9.19	11.60	12.80	14.60
SA-046	2.58	2.96	3.34	3.77	6.02	10.08	11.90	12.86	14.30
SA-048	4.20	4.75	5.74	6.53	8.60	10.64	13.30	14.35	16.00
SA-054	2.39	2.52	2.71	3.16	5.58	9.95	11.90	12.86	14.30
SA-067	2.05	2.27	2.49	2.98	5.54	10.20	12.30	13.06	14.20
SA-070	2.63	3.04	3.68	4.16	6.54	10.82	13.20	14.32	16.00
SA-070-N	2.63	3.04	3.68	4.16	6.54	10.82	13.20	14.32	16.00
SA-070-S	2.63	3.04	3.68	4.16	6.54	10.82	13.20	14.32	16.00
SA-074	2.71	2.85	3.11	3.58	6.03	10.49	12.50	13.38	14.70
SA-079	2.57	2.94	3.32	3.76	6.06	10.23	12.10	13.10	14.60
SA-086	2.12	2.20	2.37	2.88	5.51	10.26	12.70	13.94	15.80
SA-087	0.33	0.53	0.90	1.48	4.39	9.64	12.40	13.08	14.10
SA-089	2.04	2.23	2.46	2.98	5.72	10.66	12.90	14.22	16.20
SA-090	2.05	2.24	2.47	2.98	5.66	10.51	12.70	13.86	15.60
SA-091	2.26	2.44	2.61	3.13	5.88	10.85	13.10	14.22	15.90
SA-092	2.10	2.29	2.51	3.01	5.66	10.45	12.60	13.72	15.40
SA-096	2.68	2.85	3.20	3.72	6.37	11.14	13.60	14.92	16.90
SA-097	2.04	2.28	2.53	3.08	5.94	11.13	13.50	14.58	16.20
SA-099	7.52	8.34	9.67	10.70	11.54	12.49	13.90	15.07	16.90
SA-099-RL	7.52	8.34	9.67	10.70	11.54	12.49	13.90	15.07	16.90
SA-100	2.63	3.04	3.68	4.17	6.63	11.05	13.50	14.42	15.80
SA-101	1.91	2.13	2.43	2.97	5.79	10.88	13.20	14.40	16.20
SA-104	2.65	2.81	3.11	3.60	6.61	10.60	12.90	13.94	15.50
SA-106	4.47	4.90	5.44	5.90	8.10	10.32	13.30	14.46	16.20

Storage Area	M2025-001	M2025-002	M2025-005	M2025-010	M2025-025	M2025-050	M2025-100	M2025-200	M2025-500
SA-107	1.23	1.41	1.71	2.22	4.79	9.43	11.90	12.82	14.20
SA-111	1.43	1.58	1.87	2.35	4.78	9.17	11.50	12.54	14.10
SA-112	2.19	2.37	2.71	3.02	4.56	6.60	8.10	9.10	10.60
SA-114	0.93	1.16	1.41	1.87	4.16	8.30	10.50	11.26	12.40
SA-115	0.58	0.73	1.02	1.46	3.72	7.79	10.00	10.52	11.30
XA-302	1.42	1.62	2.00	2.31	3.83	6.58	8.10	9.54	11.70
XA-304	4.22	4.75	5.72	6.49	7.54	8.60	10.00	11.08	12.70
XA-304-RL	4.22	4.75	5.72	6.49	7.54	8.60	10.00	11.08	12.70
XA-305	4.72	5.27	6.12	6.73	8.01	9.72	11.00	11.96	13.40
XA-306	4.77	5.31	6.16	6.77	8.04	9.31	11.00	11.96	13.40
XA-307	5.85	6.53	7.73	8.67	9.47	10.05	10.61	11.21	12.60
XA-310	3.02	3.27	3.64	3.92	5.37	7.98	9.40	10.36	11.80
XA-311	1.52	1.75	2.12	2.47	4.22	7.36	9.10	10.34	12.20
XA-313	1.28	1.46	1.83	2.34	4.91	9.57	12.10	12.86	14.00
XA-315	1.87	2.13	2.57	2.90	4.53	7.48	9.10	10.06	11.50
XA-316	2.24	2.56	3.11	3.47	5.24	8.44	10.20	11.16	12.60
XA-316-RL	2.24	2.56	3.11	3.47	5.24	8.44	10.20	11.16	12.60
XA-319	5.58	6.09	6.97	7.69	8.33	8.83	9.30	10.20	12.30
XA-320	5.76	6.33	7.34	8.16	8.86	9.36	9.86	10.73	12.10
XA-322	2.24	2.48	2.97	3.28	4.82	6.86	8.40	9.76	11.80
XA-324	10.61	11.94	14.12	15.70	17.02	17.89	18.71	18.71	18.71
XA-325	1.73	1.98	2.35	2.69	4.41	7.49	9.20	10.24	11.80
XA-326	2.05	2.21	2.48	2.80	4.44	7.40	9.00	10.20	12.00
XA-327	1.90	2.10	2.38	2.92	5.63	10.52	13.20	14.60	16.70
XA-329	1.27	1.42	1.77	2.28	4.84	9.46	12.00	12.64	13.60
XA-331	10.14	11.36	13.30	14.76	15.95	16.75	17.54	17.54	17.54
XA-336	1.98	2.17	2.40	2.94	5.65	10.53	13.20	14.60	16.70
XA-337	3.48	4.04	5.02	5.76	7.10	8.43	10.20	11.16	12.60
XA-340	9.97	11.18	13.06	14.38	15.44	16.18	16.90	16.90	16.90
XA-341	1.60	1.82	2.22	2.76	5.49	10.40	13.10	14.42	16.40
XA-343	2.16	2.26	2.45	2.77	4.37	7.25	8.80	10.04	11.90
XA-344	2.33	2.51	2.79	3.11	4.70	7.56	9.10	10.58	12.80
XA-346	13.38	14.94	17.09	18.41	19.45	20.14	20.81	20.81	20.81
XA-347	2.24	2.47	2.95	3.26	4.83	7.64	9.20	10.24	11.80
XA-347-RL	2.24	2.47	2.95	3.26	4.83	7.64	9.20	10.24	11.80
XA-348	5.23	5.90	7.09	7.94	8.66	9.20	10.00	11.08	12.70
XA-348-RL	5.23	5.90	7.09	7.94	8.66	9.20	10.00	11.08	12.70
XA-349	1.42	1.61	2.03	2.43	4.49	8.19	10.20	10.88	11.90
XA-350	1.59	1.81	2.23	2.66	4.80	8.67	10.80	11.08	11.50
XA-351	1.60	1.83	2.22	2.54	4.10	6.94	8.50	9.70	11.50
XA-352	2.48	2.63	2.93	3.22	4.70	7.36	8.80	10.04	11.90
XA-353	1.23	1.41	1.76	2.24	4.69	9.09	11.50	12.02	12.80
XA-354	1.33	1.52	1.90	2.39	4.83	9.21	11.60	12.36	13.50
XA-355	8.39	8.68	9.19	9.56	9.94	10.18	10.44	10.44	10.44
XA-356	5.10	5.63	6.49	7.13	8.20	9.27	10.70	11.50	12.70

Storage Area	M2075-001	M2075-002	M2075-005	M2075-010	M2075-025	M2075-050	M2075-100	M2075-200	M2075-500
SA-107	2.36	2.53	2.79	3.29	5.92	10.67	12.80	13.88	15.50
SA-111	2.57	2.71	2.96	3.44	5.98	10.57	12.60	13.56	15.00
SA-112	2.66	2.83	3.16	3.63	6.04	10.39	12.60	13.80	15.60
SA-114	2.04	2.26	2.48	2.97	5.54	10.20	12.30	13.10	14.30
SA-115	0.97	1.12	1.40	1.93	4.59	9.40	11.90	13.02	14.70
XA-302	1.45	1.65	2.03	2.62	5.53	10.79	13.70	15.10	17.20
XA-304	4.24	4.77	5.74	6.51	8.97	11.43	14.70	15.94	17.80
XA-304-RL	4.24	4.77	5.74	6.51	8.97	11.43	14.70	15.94	17.80
XA-305	4.72	5.27	6.12	6.57	9.30	12.93	15.20	16.16	17.60
XA-306	4.77	5.31	6.16	6.77	9.30	11.83	15.20	16.16	17.60
XA-307	5.89	6.57	7.77	8.71	9.82	10.93	12.40	13.41	15.00
XA-310	3.36	3.61	3.96	4.46	7.01	11.60	14.00	15.92	18.80
XA-311	1.57	1.80	2.17	2.73	5.61	10.76	13.60	15.04	17.20
XA-313	1.69	1.86	2.22	2.82	5.88	11.42	14.30	15.10	16.30
XA-315	2.02	2.28	2.71	3.20	5.69	10.18	12.60	14.16	16.50
XA-316	2.38	2.70	3.24	3.77	6.46	11.28	13.90	15.10	16.90
XA-316-RL	2.38	2.70	3.24	3.77	6.46	11.28	13.90	15.10	16.90
XA-319	5.60	6.11	6.99	7.71	9.12	10.53	12.40	13.41	15.00
XA-320	5.78	6.35	7.36	8.18	9.45	10.72	12.40	13.41	15.00
XA-322	2.24	2.48	2.97	3.51	6.19	11.02	13.70	15.74	18.80
XA-324	10.61	11.94	14.12	15.70	17.02	17.89	18.71	18.71	18.71
XA-325	1.74	1.99	2.36	2.93	5.77	10.87	13.70	15.10	17.20
XA-326	2.67	2.82	3.07	3.52	5.78	9.88	11.90	13.58	16.10
XA-327	2.45	2.64	2.90	3.47	6.37	11.62	14.30	15.46	17.20
XA-329	1.65	1.80	2.13	2.71	5.67	11.00	13.80	14.92	16.60
XA-331	10.15	11.37	13.31	14.77	15.96	16.76	17.54	17.54	17.54
XA-336	2.62	2.80	3.01	3.57	6.47	11.68	14.30	15.58	17.50
XA-337	3.50	4.06	5.04	5.78	8.01	10.24	13.20	14.32	16.00
XA-340	9.98	11.19	13.07	14.39	15.45	16.19	16.90	16.90	16.90
XA-341	1.78	2.00	2.39	2.98	5.95	11.31	14.20	15.44	17.30
XA-343	2.69	2.78	2.96	3.42	5.76	10.00	12.10	13.38	15.30
XA-344	2.85	3.02	3.29	3.80	6.41	11.12	13.50	15.42	18.30
XA-346	13.38	14.94	17.09	18.41	19.45	20.14	20.81	20.81	20.81
XA-347	2.24	2.47	2.95	3.49	6.18	11.01	13.70	15.10	17.20
XA-347-RL	2.24	2.47	2.95	3.49	6.18	11.01	13.70	15.10	17.20
XA-348	5.23	5.90	7.09	7.94	9.97	12.00	14.70	15.94	17.80
XA-348-RL	5.23	5.90	7.09	7.94	9.97	12.00	14.70	15.94	17.80
XA-349	2.15	2.33	2.73	3.20	5.64	10.05	12.20	13.44	15.30
XA-350	1.72	1.94	2.35	2.84	5.32	9.79	12.20	13.36	15.10
XA-351	1.69	1.92	2.31	2.80	5.28	9.76	12.20	13.36	15.10
XA-352	2.71	2.86	3.15	3.60	5.89	10.02	12.20	13.36	15.10
XA-353	1.57	1.75	2.08	2.67	5.63	10.99	13.80	14.88	16.50
XA-354	1.91	2.09	2.46	3.03	5.99	11.30	14.00	14.72	15.80
XA-355	8.39	8.68	9.19	9.56	9.94	10.18	10.44	10.44	10.44
XA-356	5.10	5.63	6.49	7.13	9.34	11.55	14.50	15.02	15.80

Storage Area	2013-001	2013-002	2013-005	2013-010	2013-025	2013-050	2013-100	2013-200	2013-500
SA-001	5.09	5.53	6.34	6.89	7.46	8.00	8.90	9.83	10.80
SA-006	0.42	0.68	1.24	1.71	2.75	4.33	7.40	8.33	9.30
SA-010	6.43	7.05	8.03	8.70	9.31	9.76	10.21	10.58	10.96
SA-011	8.71	8.86	9.57	10.55	11.28	11.87	12.27	12.73	13.13
SA-012	7.53	8.35	9.69	10.73	11.57	12.17	12.73	13.20	13.62
SA-013	0.67	1.00	1.53	2.17	3.69	6.04	10.60	11.78	13.00
SA-014	0.48	0.79	1.46	2.16	3.85	6.48	11.60	12.87	14.20
SA-015	-1.49	-1.24	-0.63	0.17	2.13	5.20	11.20	12.77	14.40
SA-016	12.48	13.45	15.06	15.94	16.61	17.09	17.48	17.85	18.18
SA-017	2.46	2.85	3.42	3.90	4.25	4.49	5.10	6.30	7.40
SA-017-RL	2.46	2.85	3.42	3.90	4.25	4.49	5.10	6.30	7.40
SA-019	0.62	0.91	1.45	2.06	3.45	5.60	9.80	11.56	13.40
SA-021	0.75	1.08	1.61	2.29	3.89	6.38	11.20	12.47	13.80
SA-023	0.46	0.68	1.18	1.73	2.96	4.84	8.50	9.28	10.10
SA-030	4.49	4.97	5.51	5.99	6.30	6.54	6.79	7.97	9.20
SA-031	4.01	4.67	5.84	6.76	7.54	8.10	8.65	9.11	9.55
SA-033	2.50	2.91	3.52	4.08	4.61	5.19	6.10	8.31	10.60
SA-033-RL	2.50	2.91	3.52	4.08	4.61	5.19	6.10	8.31	10.60
SA-034	1.01	1.28	1.88	2.63	4.40	7.11	12.40	13.92	15.50
SA-036	0.64	1.01	1.60	2.34	4.12	6.93	12.40	13.92	15.50
SA-038	10.03	10.90	11.95	12.41	12.83	13.09	13.28	13.45	13.63
SA-040	0.47	0.67	1.10	1.53	2.41	3.71	6.20	7.13	8.10
SA-046	1.36	1.80	2.37	2.94	3.95	5.37	8.00	9.08	10.20
SA-048	3.79	4.36	5.36	6.18	6.89	7.39	7.92	8.36	8.79
SA-054	1.06	1.24	1.58	1.97	2.72	3.80	5.80	6.63	7.50
SA-067	0.67	0.99	1.51	2.12	3.54	5.74	10.00	10.98	12.00
SA-070	2.63	3.09	3.88	4.65	5.86	7.46	10.30	11.87	13.50
SA-070-N	2.63	3.09	3.88	4.65	5.86	7.46	10.30	11.87	13.50
SA-070-S	2.63	3.09	3.88	4.65	5.86	7.46	10.30	11.87	13.50
SA-074	1.42	1.65	2.18	2.77	4.05	6.04	9.90	11.17	12.50
SA-079	1.35	1.80	2.42	3.07	4.34	6.19	9.70	11.02	12.40
SA-086	1.58	1.73	2.05	2.45	3.32	4.64	7.20	8.57	10.00
SA-087	-0.09	0.20	0.85	1.62	3.18	5.50	10.00	12.16	14.40
SA-089	0.65	0.91	1.36	1.86	2.90	4.49	7.50	9.50	11.10
SA-090	0.66	0.91	1.33	1.77	2.69	4.04	6.60	7.80	8.90
SA-091	0.88	1.18	1.72	2.45	4.25	7.07	12.60	14.32	16.10
SA-092	0.72	0.96	1.38	1.83	2.74	4.08	6.60	7.80	8.90
SA-096	2.13	2.32	2.68	3.01	3.29	3.51	3.75	5.83	8.00
SA-097	0.64	0.99	1.59	2.31	4.02	6.69	11.90	13.27	14.70
SA-099	7.52	8.34	9.67	10.71	11.55	12.14	12.71	13.17	13.59
SA-099-RL	7.52	8.34	9.67	10.71	11.55	12.14	12.71	13.17	13.59
SA-100	2.63	3.08	3.83	4.53	5.52	6.77	8.90	10.42	12.00
SA-101	0.51	0.83	1.49	2.21	3.94	6.64	11.90	13.37	14.90
SA-104	2.10	2.28	2.67	3.11	3.73	4.48	5.80	7.00	7.60
SA-106	4.47	4.94	5.49	5.97	6.29	6.52	6.78	7.97	9.20

Storage Area	2013-001	2013-002	2013-005	2013-010	2013-025	2013-050	2013-100	2013-200	2013-500
SA-107	0.96	1.23	1.81	2.53	4.12	6.49	11.10	12.20	14.10
SA-111	1.15	1.39	1.96	2.67	4.22	6.58	11.20	12.43	13.70
SA-112	2.11	2.32	2.75	3.22	3.96	4.94	6.70	7.78	8.90
SA-114	0.67	0.99	1.50	2.11	3.53	5.74	10.00	11.00	12.00
SA-115	0.46	0.69	1.24	1.86	3.29	5.53	9.90	11.17	12.50
XA-302	1.41	1.65	2.17	2.62	3.52	4.79	7.20	8.87	10.60
XA-304	4.22	4.75	5.72	6.49	7.19	7.66	9.10	10.47	11.90
XA-304-RL	4.22	4.75	5.72	6.49	7.19	7.66	9.10	10.47	11.90
XA-305	4.72	5.29	6.21	6.94	7.80	8.74	10.30	11.48	12.70
XA-306	4.77	5.33	6.25	6.98	7.83	8.76	10.30	11.48	12.70
XA-307	5.84	6.52	7.72	8.66	9.46	10.04	10.61	11.10	11.53
XA-310	1.93	2.30	3.00	3.57	4.40	5.51	7.50	8.90	10.90
XA-311	1.51	1.79	2.33	2.88	3.95	5.49	8.40	10.00	11.50
XA-313	1.17	1.44	2.07	2.82	4.32	6.67	11.20	12.30	13.40
XA-315	1.83	2.14	2.72	3.33	4.39	5.84	8.50	10.00	10.90
XA-316	2.20	2.57	3.26	3.98	5.13	6.65	9.40	10.90	11.90
XA-316-RL	2.20	2.57	3.26	3.98	5.13	6.65	9.40	10.90	11.90
XA-319	5.58	6.09	6.97	7.69	8.33	8.83	9.30	9.70	10.12
XA-320	5.75	6.32	7.33	8.15	8.85	9.35	9.86	10.29	10.70
XA-322	2.24	2.52	3.14	3.67	4.63	5.96	8.40	9.72	11.10
XA-324	10.61	11.94	14.12	15.70	17.02	17.89	18.71	19.38	20.01
XA-325	1.73	2.03	2.55	3.13	4.18	5.64	8.40	9.72	11.10
XA-326	1.66	1.95	2.43	2.93	3.88	5.31	8.00	10.01	12.10
XA-327	1.50	1.83	2.51	3.25	4.96	7.61	12.80	14.50	16.20
XA-329	1.22	1.46	2.08	2.83	4.37	6.76	11.40	12.40	13.50
XA-331	10.14	11.36	13.30	14.76	15.95	16.76	17.54	18.18	18.76
XA-336	1.70	2.02	2.61	3.32	5.01	7.65	12.80	14.47	16.20
XA-337	3.47	4.04	5.08	5.92	6.89	7.91	9.40	10.90	11.90
XA-340	9.97	11.18	13.06	14.38	15.44	16.18	16.91	17.51	18.08
XA-341	1.54	1.86	2.54	3.31	5.01	7.62	12.60	14.50	16.00
XA-343	2.02	2.17	2.51	2.95	3.89	5.31	8.00	9.57	11.20
XA-344	1.72	2.04	2.58	3.14	4.18	5.67	8.50	10.50	12.40
XA-346	13.38	14.94	17.09	18.41	19.45	20.14	20.81	21.37	21.90
XA-347	2.24	2.51	3.13	3.67	4.62	5.96	8.40	9.72	11.10
XA-347-RL	2.24	2.51	3.13	3.67	4.62	5.96	8.40	9.72	11.10
XA-348	5.22	5.89	7.08	7.93	8.65	9.15	9.63	10.47	11.90
XA-348-RL	5.22	5.89	7.08	7.93	8.65	9.15	9.63	10.47	11.90
XA-349	1.33	1.59	2.24	2.85	4.20	6.25	10.20	11.57	13.00
XA-350	1.55	1.84	2.47	3.11	4.46	6.46	10.20	11.57	13.00
XA-351	1.57	1.85	2.37	2.91	3.87	5.22	7.70	9.12	10.60
XA-352	2.39	2.59	3.02	3.47	4.31	5.57	8.00	9.57	11.20
XA-353	1.13	1.40	2.00	2.73	4.24	6.54	11.00	11.90	13.00
XA-354	1.19	1.47	2.10	2.81	4.26	6.49	10.80	11.70	12.90
XA-355	8.39	8.68	9.19	9.56	9.94	10.18	10.44	11.16	11.90
XA-356	5.10	5.65	6.55	7.29	8.05	8.83	10.00	10.98	12.00

2.4.2 RESULTS AND REFERENCE TABLES

The original FWOP stage frequency results without marsh accretion are shown in Table 60 for comparison purposes. Note that for the year 2013 shown in

Table 59, the results are the same for both marsh accretion and without marsh accretion, since accretion would not have yet begun at the start of the analysis. Area SA-316 is the only area that has proposed hurricane risk reduction measures and is affected by marsh accretion. This area is on the west side of the Calcasieu River with its northeast portion including Prien Lake. The net increases are 0.18 feet at the 100% AEP event, and 0.25 feet at the 1% event. However, the 1% surge elevation of 13.90 feet far outweighs the 4.86 foot marsh accretion elevation. XA-307 is the only other area showing marginal increase from marsh accretion, which is 0.05 feet at the 100% AEP event. The two big areas in Lake Charles, SA-012 and SA-099, actually show a very slight decrease (-0.02 to -0.03 feet) at the 100% AEP event due to marsh accretion. All other areas with proposed hurricane risk reduction projects show less than 0.02 feet being the effect of marsh accretion. These areas are SA-070, XA-304, XA-347, and XA-348. As expected, the areas that are most affected by marsh accretion are the open marsh areas adjacent to bodies of water. The maximum water surface elevations, within the selected storage areas, for the 2025 (2%, 1% and 0.5%) and 2075 (2%, 1%, and 0.5%) AEP events can be plotted in GIS. The GIS mapping will show the details and extent of flooding, including flooding of streets.

Table 60 - FWOP Without Marsh Accretion

Storage Area	2025-001	2025-002	2025-005	2025-010	2025-025	2025-050	2025-100	2025-200	2025-500
SA-001	5.09	5.61	6.43	7.03	7.83	8.68	9.60	10.36	11.50
SA-006	0.42	0.84	1.50	2.08	3.33	5.12	9.80	10.24	10.90
SA-010	6.43	7.05	8.03	8.70	9.31	9.67	10.20	10.20	10.20
SA-011	8.71	8.86	9.57	10.55	11.28	11.68	12.27	12.34	12.50
SA-012	7.53	8.35	9.69	10.73	11.57	12.04	12.73	12.73	12.73
SA-013	0.68	1.18	1.85	2.60	4.30	6.79	11.10	12.02	13.40
SA-014	0.47	0.98	1.76	2.57	4.43	7.16	12.20	13.32	15.00
SA-015	-1.49	-1.00	-0.21	0.72	2.88	6.07	12.40	13.40	14.90
SA-016	12.48	13.45	15.06	15.94	16.61	16.96	17.48	17.48	17.48
SA-017	2.46	2.97	3.63	4.21	4.90	5.59	6.30	7.22	8.60
SA-017-RL	2.46	2.97	3.63	4.21	4.90	5.59	6.30	7.22	8.60
SA-019	0.62	1.07	1.71	2.41	3.95	6.21	10.40	11.40	12.90
SA-021	0.75	1.26	1.92	2.71	4.47	7.06	11.70	12.62	14.00
SA-023	0.47	0.86	1.48	2.14	3.57	5.62	8.50	9.02	9.80
SA-030	4.50	5.05	5.63	6.16	6.69	6.94	7.30	8.54	10.40
SA-031	4.01	4.73	5.86	6.79	7.80	8.14	8.65	8.73	8.90
SA-033	2.50	3.02	3.70	4.34	5.15	6.09	6.90	7.74	9.00
SA-033-RL	2.50	3.02	3.70	4.34	5.15	6.09	6.90	7.74	9.00
SA-034	1.01	1.49	2.24	3.10	5.05	7.88	13.10	14.34	16.20
SA-036	0.64	1.20	1.93	2.79	4.74	7.65	12.50	13.54	15.10
SA-038	10.03	10.90	11.95	12.41	12.83	13.01	13.28	13.28	13.28
SA-040	0.47	0.86	1.42	1.99	3.14	4.73	7.00	7.88	9.20
SA-046	1.36	1.92	2.59	3.26	4.49	6.15	8.60	9.92	11.90
SA-048	3.80	4.45	5.43	6.28	7.23	7.50	7.92	8.12	8.60
SA-054	1.06	1.42	1.91	2.44	3.47	4.88	6.60	7.36	8.50
SA-067	0.68	1.16	1.81	2.53	4.13	6.47	10.80	11.80	13.30
SA-070	2.63	3.21	4.05	4.88	6.27	8.08	11.00	11.72	12.80
SA-070-N	2.63	3.21	4.05	4.88	6.27	8.08	11.00	11.72	12.80
SA-070-S	2.63	3.21	4.05	4.88	6.27	8.08	11.00	11.72	12.80
SA-074	1.42	1.83	2.48	3.17	4.64	6.78	11.00	11.60	12.50
SA-079	1.35	1.93	2.64	3.37	4.82	6.84	9.80	11.12	13.10
SA-086	1.58	1.92	2.40	2.94	4.09	5.70	8.30	9.38	11.00
SA-087	-0.09	0.39	1.16	2.03	3.78	6.26	10.50	11.38	12.70
SA-089	0.65	1.10	1.71	2.35	3.68	5.56	9.20	10.16	11.60
SA-090	0.66	1.10	1.68	2.27	3.49	5.17	8.30	9.38	11.00
SA-091	0.88	1.36	2.04	2.87	4.80	7.67	13.10	13.71	14.20
SA-092	0.72	1.15	1.72	2.32	3.52	5.19	7.40	8.32	9.70
SA-096	2.14	2.51	3.03	3.52	4.21	5.32	6.90	7.78	9.10
SA-097	0.64	1.18	1.91	2.75	4.63	7.41	12.00	13.28	15.20
SA-099	7.52	8.34	9.67	10.71	11.65	12.08	12.71	12.71	12.71
SA-099-RL	7.52	8.34	9.67	10.71	11.65	12.08	12.71	12.71	12.71
SA-100	2.63	3.21	4.02	4.80	6.03	7.57	9.60	10.36	11.50
SA-101	0.50	1.02	1.80	2.63	4.52	7.32	12.50	13.58	15.20

Storage Area	2025-001	2025-002	2025-005	2025-010	2025-025	2025-050	2025-100	2025-200	2025-500
SA-107	0.96	1.41	2.11	2.93	4.67	7.16	11.90	12.82	14.20
SA-111	1.15	1.57	2.26	3.05	4.75	7.21	11.50	12.54	14.10
SA-112	2.11	2.49	3.04	3.63	4.64	5.95	8.10	9.10	10.60
SA-114	0.68	1.16	1.80	2.52	4.12	6.47	10.50	11.26	12.40
SA-115	0.47	0.88	1.55	2.27	3.87	6.23	10.00	10.52	11.30
XA-302	1.41	1.85	2.51	3.12	4.33	5.96	8.10	9.54	11.70
XA-304	4.22	4.85	5.84	6.66	7.64	8.54	10.00	11.08	12.70
XA-304-RL	4.22	4.85	5.84	6.66	7.64	8.54	10.00	11.08	12.70
XA-305	4.72	5.39	6.33	7.12	8.23	9.51	11.00	11.96	13.40
XA-306	4.77	5.43	6.37	7.16	8.26	9.53	11.00	11.96	13.40
XA-307	5.84	6.52	7.72	8.66	9.56	9.98	10.61	11.21	12.60
XA-310	2.94	2.65	3.43	4.11	5.21	6.66	9.40	10.36	11.80
XA-311	1.51	1.98	2.65	3.33	4.67	6.51	9.10	10.34	12.20
XA-313	1.17	1.65	2.42	3.28	5.00	7.54	12.10	12.86	14.00
XA-315	1.83	2.29	2.97	3.68	4.96	6.65	9.10	10.06	11.50
XA-316	2.20	2.73	3.52	4.33	5.71	7.52	10.20	11.16	12.60
XA-316-RL	2.20	2.73	3.52	4.33	5.71	7.52	10.20	11.16	12.60
XA-319	5.58	6.09	6.97	7.69	8.43	8.78	9.30	10.20	12.30
XA-320	5.75	6.32	7.33	8.15	8.95	9.31	9.86	10.53	12.10
XA-322	2.24	2.69	3.42	4.07	5.30	6.94	8.40	9.76	11.80
XA-324	10.61	11.94	14.12	15.70	17.02	17.70	18.71	18.71	18.71
XA-325	1.73	2.21	2.86	3.57	4.89	6.65	9.20	10.24	11.80
XA-326	1.96	2.15	2.73	3.33	4.49	6.13	9.00	10.20	12.00
XA-327	1.81	2.08	2.87	3.71	5.58	8.32	13.20	14.60	16.70
XA-329	1.22	1.66	2.41	3.26	5.00	7.54	12.00	12.64	13.60
XA-331	10.14	11.36	13.30	14.76	15.95	16.59	17.54	17.54	17.54
XA-336	1.86	2.24	2.96	3.77	5.62	8.36	13.20	14.60	16.70
XA-337	3.46	4.12	5.15	6.01	7.18	8.48	10.20	11.16	12.60
XA-340	9.97	11.18	13.06	14.38	15.44	16.02	16.90	16.90	16.90
XA-341	1.54	2.05	2.85	3.72	5.58	8.30	13.10	14.42	16.40
XA-343	2.02	2.34	2.82	3.37	4.52	6.16	8.80	10.04	11.90
XA-344	2.20	2.30	2.96	3.63	4.91	6.67	9.10	10.58	12.80
XA-346	13.38	14.94	17.09	18.41	19.45	19.99	20.81	20.81	20.81
XA-347	2.24	2.69	3.41	4.07	5.29	6.94	9.20	10.24	11.80
XA-347-RL	2.24	2.69	3.41	4.07	5.29	6.94	9.20	10.24	11.80
XA-348	5.22	5.95	7.09	7.96	8.91	9.35	10.00	11.08	12.70
XA-348-RL	5.22	5.95	7.09	7.96	8.91	9.35	10.00	11.08	12.70
XA-349	1.33	1.76	2.49	3.20	4.71	6.90	10.20	10.88	11.90
XA-350	1.55	2.00	2.71	3.44	4.94	7.08	10.80	11.08	11.50
XA-351	1.57	2.01	2.64	3.28	4.47	6.08	8.50	9.70	11.50
XA-352	2.39	2.75	3.29	3.84	4.91	6.41	8.80	10.04	11.90
XA-353	1.13	1.60	2.33	3.17	4.89	7.36	11.50	12.02	12.80
XA-354	1.19	1.67	2.43	3.25	4.93	7.35	11.60	12.36	13.50
XA-355	8.39	8.68	9.19	9.56	9.94	10.14	10.44	10.44	10.44
XA-356	5.10	5.73	6.64	7.42	8.40	9.49	10.70	11.50	12.70

Storage Area	2075-001	2075-002	2075-005	2075-010	2075-025	2075-050	2075-100	2075-200	2075-500
SA-001	5.09	5.93	6.77	7.61	9.30	11.40	13.50	14.42	15.80
SA-006	0.42	1.47	2.52	3.56	5.66	8.28	10.90	11.78	13.10
SA-010	6.43	7.05	8.03	8.70	9.31	9.76	10.20	10.20	10.20
SA-011	8.71	8.86	9.58	10.56	11.29	11.88	13.20	14.29	16.00
SA-012	7.56	8.37	9.71	10.74	11.59	12.18	13.20	14.29	16.00
SA-013	0.70	1.91	3.12	4.33	6.75	9.78	12.80	13.72	15.10
SA-014	0.47	1.72	2.98	4.23	6.74	9.87	13.00	14.04	15.60
SA-015	-1.49	-0.02	1.45	2.92	5.86	9.53	13.20	14.12	15.50
SA-016	12.48	13.45	15.07	15.94	16.61	17.09	17.48	17.48	17.48
SA-017	2.46	3.46	4.47	5.47	7.48	9.99	12.50	14.18	16.70
SA-017-RL	2.46	3.46	4.47	5.47	7.48	9.99	12.50	14.18	16.70
SA-019	0.63	1.70	2.76	3.83	5.97	8.63	11.30	12.14	13.40
SA-021	0.77	1.97	3.18	4.38	6.79	9.79	12.80	13.68	15.00
SA-023	0.49	1.59	2.69	3.79	6.00	8.75	11.50	12.46	13.90
SA-030	4.64	5.37	6.09	6.82	8.27	10.09	11.90	13.66	16.30
SA-031	4.03	4.99	5.94	6.90	8.82	11.21	13.60	14.65	16.30
SA-033	2.51	3.47	4.43	5.39	7.31	9.70	12.10	13.14	14.70
SA-033-RL	2.51	3.47	4.43	5.39	7.31	9.70	12.10	13.14	14.70
SA-034	1.01	2.34	3.67	5.00	7.66	10.98	14.30	15.42	17.10
SA-036	0.64	1.96	3.27	4.59	7.22	10.51	13.80	14.96	16.70
SA-038	10.03	10.90	11.95	12.41	12.83	13.09	13.28	13.28	13.28
SA-040	0.49	1.60	2.71	3.82	6.05	8.82	11.60	12.80	14.60
SA-046	1.37	2.42	3.48	4.53	6.64	9.27	11.90	12.86	14.30
SA-048	3.84	4.79	5.73	6.68	8.57	10.94	13.30	14.35	16.00
SA-054	1.06	2.14	3.23	4.31	6.48	9.19	11.90	12.86	14.30
SA-067	0.70	1.86	3.02	4.18	6.50	9.40	12.30	13.06	14.20
SA-070	2.63	3.69	4.74	5.80	7.92	10.56	13.20	14.32	16.00
SA-070-N	2.63	3.69	4.74	5.80	7.92	10.56	13.20	14.32	16.00
SA-070-S	2.63	3.69	4.74	5.80	7.92	10.56	13.20	14.32	16.00
SA-074	1.45	2.56	3.66	4.77	6.98	9.74	12.50	13.38	14.70
SA-079	1.36	2.43	3.51	4.58	6.73	9.42	12.10	13.10	14.60
SA-086	1.59	2.70	3.81	4.92	7.15	9.92	12.70	13.94	15.80
SA-087	-0.09	1.16	2.41	3.66	6.16	9.28	12.40	13.08	14.10
SA-089	0.66	1.88	3.11	4.33	6.78	9.84	12.90	14.22	16.20
SA-090	0.66	1.86	3.07	4.27	6.68	9.69	12.70	13.86	15.60
SA-091	0.88	2.10	3.32	4.55	6.99	10.05	13.10	14.22	15.90
SA-092	0.72	1.91	3.10	4.28	6.66	9.63	12.60	13.72	15.40
SA-096	2.14	3.29	4.43	5.58	7.87	10.74	13.60	14.92	16.90
SA-097	0.64	1.93	3.21	4.50	7.07	10.29	13.50	14.58	16.20
SA-099	7.54	8.36	9.69	10.72	12.06	12.95	13.90	15.07	16.90
SA-099-RL	7.54	8.36	9.69	10.72	12.06	12.95	13.90	15.07	16.90
SA-100	2.63	3.72	4.80	5.89	8.07	10.78	13.50	14.42	15.80
SA-101	0.50	1.77	3.04	4.31	6.85	10.03	13.20	14.40	16.20
SA-104	2.10	3.18	4.26	5.34	7.50	10.20	12.90	13.94	15.50
SA-106	4.61	5.48	6.35	7.22	8.96	11.13	13.30	14.46	16.20

Storage Area	2075-001	2075-002	2075-005	2075-010	2075-025	2075-050	2075-100	2075-200	2075-500
SA-107	0.96	2.14	3.33	4.51	6.88	9.84	12.80	13.88	15.50
SA-111	1.15	2.30	3.44	4.59	6.88	9.74	12.60	13.56	15.00
SA-112	2.11	3.16	4.21	5.26	7.36	9.98	12.60	13.80	15.60
SA-114	0.70	1.86	3.02	4.18	6.50	9.40	12.30	13.10	14.30
SA-115	0.49	1.63	2.77	3.91	6.20	9.05	11.90	13.02	14.70
XA-302	1.41	2.64	3.87	5.10	7.56	10.63	13.70	15.10	17.20
XA-304	4.22	5.27	6.32	7.36	9.46	12.08	14.70	15.94	17.80
XA-304-RL	4.22	5.27	6.32	7.36	9.46	12.08	14.70	15.94	17.80
XA-305	4.72	5.77	6.82	7.86	9.96	12.58	15.20	16.16	17.60
XA-306	4.77	5.81	6.86	7.90	9.99	12.59	15.20	16.16	17.60
XA-307	5.84	6.52	7.72	8.66	9.96	11.34	12.40	13.41	15.00
XA-310	2.94	4.05	5.15	6.26	8.47	11.24	14.00	15.92	18.80
XA-311	1.51	2.72	3.93	5.14	7.56	10.58	13.60	15.04	17.20
XA-313	1.17	2.48	3.80	5.11	7.74	11.02	14.30	15.10	16.30
XA-315	1.83	2.91	3.98	5.06	7.22	9.91	12.60	14.16	16.50
XA-316	2.20	3.37	4.54	5.71	8.05	10.98	13.90	15.10	16.90
XA-316-RL	2.20	3.37	4.54	5.71	8.05	10.98	13.90	15.10	16.90
XA-319	5.58	6.09	6.97	7.69	8.83	10.33	12.40	13.41	15.00
XA-320	5.75	6.32	7.33	8.15	9.35	10.85	12.40	13.41	15.00
XA-322	2.24	3.39	4.53	5.68	7.97	10.84	13.70	15.74	18.80
XA-324	10.61	11.94	14.12	15.70	17.02	17.89	18.71	18.71	18.71
XA-325	1.73	2.93	4.12	5.32	7.72	10.71	13.70	15.10	17.20
XA-326	1.96	2.95	3.95	4.94	6.93	9.42	11.90	13.58	16.10
XA-327	1.81	3.06	4.31	5.56	8.06	11.18	14.30	15.46	17.20
XA-329	1.22	2.48	3.74	4.99	7.51	10.66	13.80	14.92	16.60
XA-331	10.14	11.36	13.30	14.76	15.95	16.75	17.54	17.54	17.54
XA-336	1.86	3.10	4.35	5.59	8.08	11.19	14.30	15.58	17.50
XA-337	3.46	4.43	5.41	6.38	8.33	10.77	13.20	14.32	16.00
XA-340	9.97	11.18	13.06	14.38	15.44	16.18	16.90	16.90	16.90
XA-341	1.54	2.81	4.07	5.34	7.87	11.04	14.20	15.44	17.30
XA-343	2.02	3.03	4.04	5.04	7.06	9.58	12.10	13.38	15.30
XA-344	2.20	3.33	4.46	5.59	7.85	10.68	13.50	15.42	18.30
XA-346	13.38	14.94	17.09	18.41	19.45	20.14	20.81	20.81	20.81
XA-347	2.24	3.39	4.53	5.68	7.97	10.84	13.70	15.10	17.20
XA-347-RL	2.24	3.39	4.53	5.68	7.97	10.84	13.70	15.10	17.20
XA-348	5.22	6.17	7.12	8.06	9.96	12.33	14.70	15.94	17.80
XA-348-RL	5.22	6.17	7.12	8.06	9.96	12.33	14.70	15.94	17.80
XA-349	1.33	2.42	3.50	4.59	6.77	9.48	12.20	13.44	15.30
XA-350	1.55	2.62	3.68	4.75	6.88	9.54	12.20	13.36	15.10
XA-351	1.57	2.63	3.70	4.76	6.89	9.54	12.20	13.36	15.10
XA-352	2.39	3.37	4.35	5.33	7.30	9.75	12.20	13.36	15.10
XA-353	1.13	2.40	3.66	4.93	7.47	10.63	13.80	14.88	16.50
XA-354	1.19	2.47	3.75	5.03	7.60	10.80	14.00	14.72	15.80
XA-355	8.39	8.68	9.19	9.56	9.94	10.18	10.44	10.44	10.44
XA-356	5.10	6.04	6.98	7.92	9.80	12.15	14.50	15.02	15.80

2.4.3 Nonstructural Analysis

Stage probability relationships were provided for existing, 2025 and 2075 without-project conditions. The 2025 and 2075 without project stages were used to determine existing damages and to identify the structures that fall below the 2025 and 2075 stages and would require raising or flood proofing. The 2075 stages were used to determine the amount of raising that would need to be done for those structures to be raised. The Economics Appendix (Appendix D) details the process used to analyze damages and benefits for the nonstructural alternatives.

2.5 PUMPING

Estimates for pumping capacity required for each alternative were based on analysis done for the Louisiana Coastal Protection and Restoration (LACPR) Final Technical Report dated 2009 which analyzed levee alternatives in the same general locations. Table 61 shows the pumping capacity used to estimate cost for each NED alternative.

Table 61 – Pumping Capacity

Alternative	Pumping Capacity
Abbeville Ring Levee	1,000 cfs
Abbeville to Delcambre Hwy 330	3,000 cfs
Delcambre Erath	1,000 cfs
Lake Charles East Bank	3,000 cfs
Lake Charles West Bank Sulphur	1,000 cfs
Lake Charles West Bank Sulphur South	3,000 cfs

2.6 NER MODELING

The effects of the hydrologic and salinity control features of the NER alternatives were assessed using the State of Louisiana Master Plan models and MIKE FLOOD hydrodynamic model. For the focused array of alternatives, the 2012 State Master Plan modeling effort was used with input from the Eco-hydrology module to estimate land and water changes. The alternatives were run under the Intermediate RSLR scenario to predict salinity, water levels, and flows at a 500 m resolution every five years. The results of this modeling effort were input into the Vegetation and Wetland Morphology modules of the State Master Plan modeling system to predict wetland loss and other trends over time. The State Master Plan model included accretion and subsidence projections.

The Wetland Morphology model produced spatial patterns of landscape composition (land and water area), fragmentation (percent edge), soil vertical accretion rates, soil surface elevation, and SOC storage and sequestration for the period of 2010-2060. These outputs are provided for each 5-year interval during the period of study. The temporal changes could be resolved daily, weekly, or monthly, while the spatial resolution ranged from less than 1 km2 to nearly 6,000 km2 per compartment. After the first 25 simulation years, the stage, salinity, and sediment outputs from the Eco-hydrology model were used as input into the Wetland Morphology model. Subsequently, the Wetland Morphology land use and elevation output were used as input to the Eco-hydrology models as a feedback step. The Vegetation model was used to predict species shifts associated with changing salinities. Outputs were calculated at 500 m resolution at 25-year intervals.

The study team also simulated the effects of the H&S measures using the finer-resolution MIKE FLOOD hydrodynamic model, which utilizes a 500x500 meter grid. The results of the MIKE FLOOD model simulations were used to support decisions on screening of hydraulic and salinity control features and to refine the features and their operating plans. Information on the State Master Plan models can be found in the State of Louisiana Master Plan Report (2012). Information on the MIKE FLOOD modeling can be found in Meselhe et al. (2013a).

3.0 SURVEYS

3.1 NED AND NER FOCUSED ARRAY OF ALTERNATIVES

No new surveys were taken for the analysis of the NED and NER focused array of alternatives. Existing statewide LIDAR data was used for this analysis.

3.2 DESIGN SURVEYS

Site specific surveys will be taken for the detailed design of both the NED and NER features might be ultimately recommended. These surveys will be done for future implementation documents during PED. Surveys for the detailed design of any NED and the NER recommendations will be performed in accordance with the New Orleans District Minimum Survey Standards and the respective survey plans will be approved by the District Datum Coordinator.

4.0 GEOTECHNICAL

4.1 GEOLOGY

The study area is contained within the Pleistocene-aged Prairie Terraces in the northern portion and the Holocene-aged Chenier plain in the southern portion. The Prairie Terraces are characterized by nearly level plains having low relief which are dissected by rivers and streams that flow toward the Gulf of Mexico. The Prairie Terraces are characterized by deltaic and lagoonal deposits laid down during the Farmdalian and Sangamon interglacial periods when sea level was higher than present and sediment was transported south by rivers and streams. These deposits are generally characterized by medium to very stiff silty clays with layers of silt and sand. Based on limited boring data, these deposits are estimated to be over 100 feet thick. Recent alluvial material (sand, silt, and clay) fills the valleys of large rivers and streams.

The Chenier Plain is located south of the Pleistocene terraces and extends from Sabine Pass, Texas eastward to Southwest Point, Louisiana. Chenier plain development is the result of the interplay of four coastal plain rivers, cycles of Mississippi River delta development, and marine processes. Dominant physiographic features in the Chenier Plain are the sandy/shelly cheniers, broad expanses of marsh, rivers, large inland lakes, and the Pleistocene uplands forming the northern boundary of the Chenier Plain. Elevations on the cheniers generally range from approximately +5 to +10 feet.

The Chenier Plain formed in the southwest portion of the coast, away from active deltaic growth. When the Mississippi River was in a more westward position, fine silt and clays were transported by westward flowing nearshore currents and deposited as mudflats along the existing shoreline. When Mississippi River deposition ceased or declined as the River shifted eastward, these mudflats were reworked by marine processes concentrating the coarser grained sediments and shell material into shore-parallel ridges called "cheniers." Introduction of new sediments by the next westward shift of the Mississippi River resulted in isolation of these ridges by accretion of mudflats gulfward of the ridges. Numerous cycles of deposition and erosion are responsible for creating the alternating ridges separated by marshlands characteristic of the Chenier Plain (Gould and McFarlan, 1959; Byrne et al, 1959; Hoyt, 1969). Therefore, most cheniers represent relict shoreline positions. Currently, a portion of Atchafalaya River sediments reaching the coast are being carried westward and deposited as progradational mudflats along the eastern Chenier Plain, representing a new episode of Chenier plain development.

The surface and subsurface of the Chenier Plain is generally characterized by a vertical sequence of marsh, estuarine and marine clays and silts, and Pleistocene deposits. Marsh deposits up to 10 feet thick are comprised mainly of very soft to soft organic clays with peat. Soft to medium estuarine and marine clays and silts located below the marsh deposits are up to 30 feet thick. Pleistocene deposits are at the surface in the vicinity of the Gulf Intracoastal Waterway and slope gulfward to approximately -30 feet in elevation at the coast. Pleistocene deposits are generally characterized by very stiff silty clay, silt, and sand. The Chenier ridges are generally composed of shell and sand material up to 15 feet thick.

The Chicot aquifer underlies most of southwestern Louisiana and extends from central southwestern Louisiana to the Gulf of Mexico and from Sabine Lake to St. Mary Parish. The Chicot aquifer is up to 800 feet thick at its most northern extent and extends to an unknown depth beneath the Gulf of Mexico.

4.2 NED GEOTECHNICAL DESIGN

4.2.1 Design Assumptions

The preliminary analyses performed for this Feasibility Study relied on existing data; no soil borings were taken and no testing was conducted. Soil unit weights and shear strengths of the strata were assigned based upon geological information and geotechnical engineering experience in the region with various projects in the vicinity. Based on this pre-existing data, the determination was made that soil conditions in the study area generally consist of Pleistocene clay at or very close to the ground surface. An assumption was also made that about 10% of the study area has soil conditions where Pleistocene is found beneath a weak layer of soil. This weak layer of soil was assumed to be 20 feet deep.

The average natural ground elevation for all six levee alignments in the focused array was estimated to be at elevation 9.5'. This was based on a comparison of the LIDAR survey data for all of the alignments. Elevation 9.5 feet is an average of a large sample of the survey points. A further assumption was made that an estimated 10% of the alignment area has Pleistocene deeper than at the natural ground surface. It was assumed that in the areas where Pleistocene is at the surface, the only settlement that would be expected would be the shrinkage settlement plus ½ of a foot, with shrinkage settlement assumed to be approximately 10% of the amount of fill needed.

Where necessary, geotextile would be used to minimize the footprint. Geotextile may not be needed in areas where Pleistocene is near the ground surface, but would be needed where the proposed alignments cross existing and abandoned channels, or where Pleistocene is below weak soils.

4.2.2 Design Development

4.2.2.1 Method

Two very basic analyses were done with a simple subsurface soils profile. The first analysis assumed that Pleistocene is at the ground surface and the second assumed that a 20' very weak layer of clay exists between the ground surface and the Pleistocene layer. A typical design section is shown in Figure 18. This section pertains to the Abbeville to Delcambre Hwy 330 levee alignment. A very basic Settle 3D analysis was performed to get a better estimate of what kind of settlement could be expected with Pleistocene at the ground surface and with Pleistocene 20' below the ground surface.

4.2.2.2 Conclusions

Areas with Pleistocene at the ground surface would require a lift to the construction grade elevation listed in Table 62. Areas with Pleistocene below a twenty foot layer of weak soils would require a four foot overbuild (see Table 62). A typical lift schedule for areas with weak soil layers over Pleistocene is shown in Figure 19.

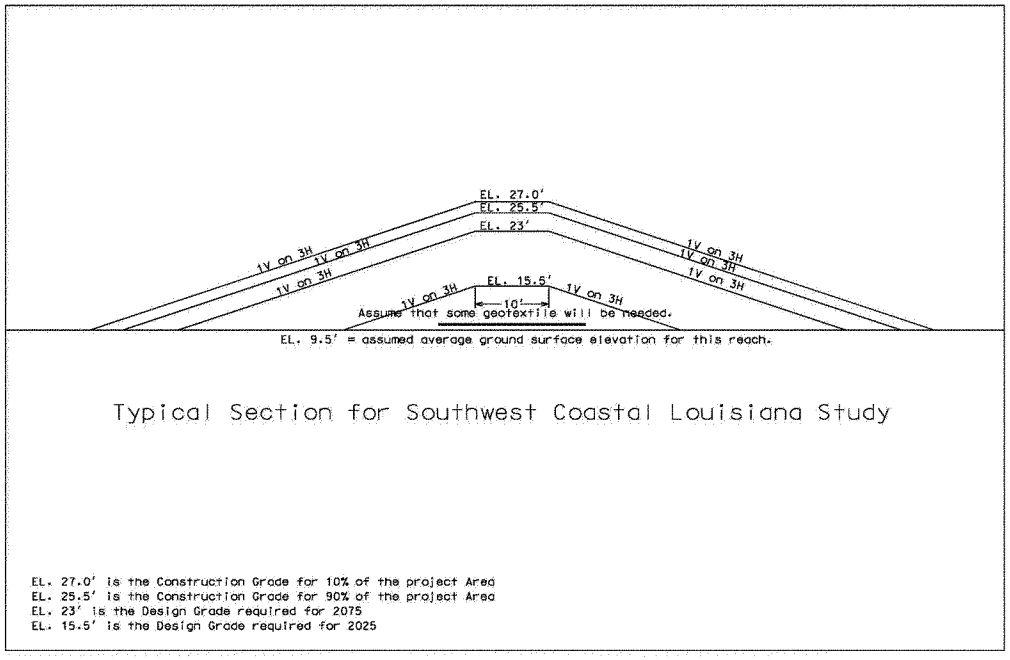


Figure 18 - Typical Section

JA 37-899 11/27/2019 672

Table 62 - Required Design Elevations

LAKE CHARLES									Amount of shrinkage based on difference between Average natural ground elevation and 2075 Shrinkage is assumed to be 10 % of the amount of fill			Construction Grade Elevation (ft) for 90% of the project area			Construction Grade Elevation (ft) for 10% of the project area		
	2025			2075													
	2%	1%	0.50%	2%	1%	0.50%			2%	1%	0.50%	2%	1%	0.50%	2%	1%	0.50%
Lake Charles Westbank Sulphur Levee							LIDAR Data Elevations					Lake Charles Westbank Sulphur Levee					
Reach 1	9	13	17	14.5	19.5	26	Maximum	19.6	0.18	0.68	1.33	15.0	21.0	28.0	18.5	23.5	30.0
Reach 2	8	12.5	16.5	13.5	19.5	26.5	Minimum	2.8	0.08	0.68	1.38	14.0	21.0	28.5	17.5	23.5	30.5
Reach 3	9.5	16	18.5	17	22	26.5	Average	12.7	0.43	0.93	1.38	18.0	23.5	28.5	21.0	26.0	30.5
							Mode	12.4									
							Median	12.4									
Lake Charles Westbank Sulphur South Levee							LIDAR Data Elevations					Lake Charles Westbank Sulphur South Levee					
	2%	1%	0.50%	2%	1%	0.50%	Maximum	29.7	2%	1%	0.50%	2%	1%	0.50%	2%	1%	0.50%
Reach 1	11	15	18	17.5	23.5	28.5	Minimum	-0.4	0.71	1.31	1.81	19.0	25.5	31.0	21.5	27.5	32.5
Reach 2	11.5	15	18	17.5	22.5	27	Average	10.4	0.71	1.21	1.66	19.0	24.5	29.5	21.5	26.5	31.0
Reach 3	11.5	15	18	17	22	26.5	Mode	9.1	0.66	1.16	1.61	18.5	24.0	29.0	21.0	26.0	30.5
Reach 4	12.5	16	18.5	17	22	26.5	Median	9.9	0.66	1.16	1.61	18.5	24.0	29.0	21.0	26.0	30.5
Lake Charles Eastbank							LIDAR Data Elevations					Lake Charles Eastbank					
	2%	1%	0.50%	2%	1%	0.50%	Maximum	18.3	2%	1%	0.50%	2%	1%	0.50%	2%	1%	0.50%
Reach 1	12	15	18	17	22	26.5	Minimum	-0.4	0.73	1.23	1.68	18.5	24.0	29.0	21.0	26.0	30.5
Reach 2	11.5	15	17.5	17.5	22.5	27	Average	9.7	0.78	1.28	1.73	19.0	24.5	29.5	21.5	26.5	31.0
Reach 3	11.5	15	17.5	17.5	22	27	Mode	13	0.78	1.23	1.73	19.0	24.0	29.5	21.5	26.0	31.0

JA 37-899 973 11/27/2019

Table 62 - Required Design Elevations

							Median	9.8										
ABBEVILLE									Amount of shrinkage based on difference between average			Construction Grade Elevation (ft) for 90% of project area			Construction Grade Elevation (ft) for 10% of project area		
Abbeville to Delcambre Hwy 330							LIDAR Data Elevations		x			Abbeville to Delcambre Hwy 330					
	2%	1%	0.50%	2%	1%	0.50%	Maximum	18.7	2%	1%	0.50%	2%	1%	0.50%	2%	1%	0.50%
Reach 1	13	15.5	18	19.5	23	27	Minimum	1.5	1.26	1.61	2.01	21.5	25.5	29.5	23.5	27.0	31.0
Reach 2	14	17	19.5	19	23	27	Average	6.9	1.21	1.61	2.01	21.0	25.5	29.5	23.0	27.0	31.0
Reach 3	13	16	18.5	19.5	23.5	27.5	Mode	6.8	1.26	1.66	2.06	21.5	26.0	30.5	23.5	27.5	31.5
							Median	6.3									
Abbeville Ring Levee							LIDAR Data Elevations					Abbeville Ring Levee					
	2%	1%	0.50%	2%	1%	0.50%	Maximum	15.5	2%	1%	0.50%	2%	1%	0.50%	2%	1%	0.50%
Reach 1	13	16	18.5	19.5	23	27.5	Minimum	1.26	0.92	1.27	1.72	21.0	25.0	30.0	23.5	27.0	31.5
Reach 2	13	16	18.5	19.5	23	27.5	Average	10.3	0.92	1.27	1.72	21.0	25.0	30.0	23.5	27.0	31.5
Reach 3	12	15.5	18.5	19	23.5	28	Mode	12.7	0.87	1.32	1.77	20.5	25.5	30.5	23.0	27.5	32.0
							Median	10.3									
Delcambre Erath Levee							LIDAR Data Elevations					Delcambre Erath Levee					
	2%	1%	0.50%	2%	1%	0.50%	Maximum	17.3	2%	1%	0.50%	2%	1%	0.50%	2%	1%	0.50%
Reach 1	15.5	19.5	21	23	27.5	32	Minimum	0	1.47	1.92	2.37	25.0	30.0	35.0	27.0	31.5	36.0
Reach 2	15.5	19.5	24	26	30.5	32	Average	8.3	1.77	2.22	2.37	28.5	33.5	35.0	30.0	34.5	36.0
Maximum	15.5	19.5	24	26	30.5	32	Mode	8									
Minimum	8	12.5	16.5	13.5	19.5	26	Median	8									
Average	12.1	15.7	18.6	18.4	23.0	27.6	Average of all Average values	9.7									

JA 37-899 974 11/27/2019

Table 62 - Required Design Elevations						
Mode	11.5	15	18.5	17	22	26.5
Median	12	15.5	18.25	17.5	22.75	27

JA 37-899 11/27/2019 975

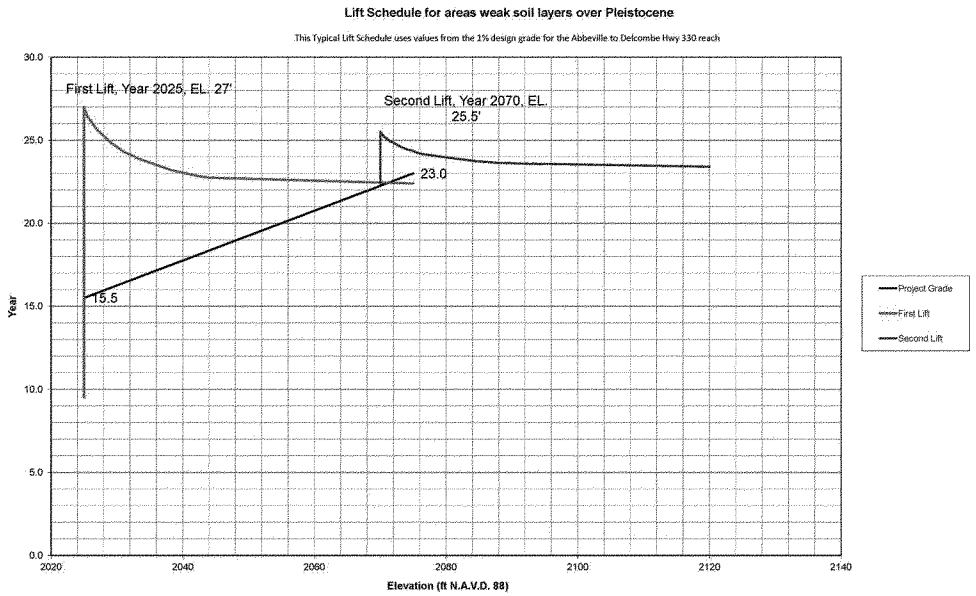


Figure 19 - Lift Schedule

JA 37-899 976 11/27/2019

4.3 NER GEOTECHNICAL ANALYSIS

4.3.1 Design Assumptions

The preliminary analyses performed for this Feasibility Study relied on existing data; no soil borings were taken and no testing was conducted. Volumes adjustments due to settlement were based on broad assumptions using values typically included in the Coastal Wetlands Planning Protection and Restoration Act (CWPPRA) planning process and through the development of regional settlement curves using historical data.

5.0 PRELIMINARY DESIGN

5.1 NED

The information presented below was developed early on in the study process for alternatives that may not have been carried forward. It is presented in this appendix as background information and to document the details that went into the evaluation of different features to assess their viability, constructability, and design parameters.

Table 63 - Alternatives

Alternatives	Length (Linear Feet)
Abbeville Ring Levee	53,267
Delcambre Erath	68,593
Abbeville to Delcambre	142,205
Lake Charles East Bank	177,573
Lake Charles West Bank Sulphur	72,073
Lake Charles West Bank Sulphur South	140,833

The above alternatives were analyzed utilizing the one basic geotextile reinforced Typical Section depicted in Figure 18. First lift fill for year 2025 quantity computations were derived using In-Roads software and the existing LIDAR survey data on file. Various construction grades for 90% of the study area and 10% of the study area were provided and analyzed accordingly. (See Table 62) Based on Geotech team input, settlement and shrinkage factors were added to the net values to determine the final computations provided in the report. All alternatives included second lift levee enlargement assuming two feet of settlement and a one foot overbuild to obtain the year 2075 elevation quantity computations.

It was assumed that construction of selected levee reaches would be made in two lifts to the design elevations and dimensions provided in the final construction document. Material used for embankment would be levee grade material meeting the USACE Hurricane Storm Damage Risk Reduction System (HSDRRS) guidelines. All levee grade material would be moisture controlled and compacted as per the specific ASTM standards. Compaction techniques and efforts vary but typically include combinations of rollers, scrapers, dozers and dump trucks to achieve the required 90% maximum dry density compaction. The embankment operation would include borrow pit management, clearing and grubbing of the levee footprint, placement of embankment material, and turfing of all disturbed areas.

Borrow material for the levees would be obtained locally. The average haul distance between the borrow source and the construction site is assumed to be 25 miles one way trip. Borrow pit geometry is typically 1V on 3H side and end slopes with an excavated bottom elevation of -20.0 NAVD88 (2004.65). Borrow pits are generally sized assuming in place borrow to in place levee embankment ratio of 2:1 applied after stripping the top 3'-5' of unsuitable material for levee construction.

5.2 NER FEATURES

Design details for the marsh restoration/nourishment features, the shoreline protection/stabilization features; and Chenier reforestation features included for the NER focused array are described in this section. There are

updates to features that have occurred since this appendix was developed and features were screened from further consideration and based on feasibility level design details. This new information can be found in Appendix K, which contains the descriptions, material quantities, benefits, and maps for the Recommended Plan (RP) features only.

5.2.1 Marsh Restoration/Nourishment

5.2.1.1 General

Final information on all of the NER features in the RP can be found in Chapter 4 of the Main Report and Appendix K (NER Fact Sheets). Not all features below are in the RP.

5.2.1.1.1 Marsh Restoration/Nourishment Acreage

Total acres of land restored or nourished by these measures was determined from shapefiles developed for each feature. USGS established land/water ratios for each feature. Marsh restoration involves the placement of dredged material in shallow open water areas and extensively broken marsh. Marsh nourishment refers to the placement of a thin layer of dredged material into broken marsh. Renourishment refers to the maintenance required to keep the feature at the desired elevation and can be either restoration, nourishment or a combination of both.

5.2.1.1.2 Fill Volumes

The total estimated volume of marsh fill material required to construct the individual measure using one initial lift is based on the target marsh elevation at target year zero (TY0). Target year zero is defined as the year construction is completed and benefits begin to accrue. Assumptions for bottom elevations for areas were derived using information from recently constructed projects near the project areas, from depth information obtained during the CWPPRA planning process, and from information from nearby Coastwide Reference Monitoring System (CRMS) stations. Marsh restoration fill area bottom elevations are average elevations and are not meant to represent the deepest part of the open water restoration areas. These assumptions are represented in the cost estimates. Volume adjustments due to settlement were based on broad assumptions using values typically included in the CWPPRA planning process and through the development of regional settlement curves. Target marsh elevations were estimated using information from recently constructed projects near the project areas and from information from nearby CRMS stations.

5.2.1.1.3 Cut Volume

Total dredging quantity required for the individual feature used the estimated volume of marsh fill material required multiplied by a cut-to-fill ratio of 1.3. This volume is the gross cubic yards required and is the amount assumed to be dredged to achieve the required marsh fill. This amount is referred to as gross cubic yards in this Engineering Report. Elsewhere in the report it is referred to as cubic yards (1.3 million cubic yards as opposed to 1.3M gross cubic yards). These numbers both refer to the amount of material to be dredged and are the same number.

5.2.1.1.4 Borrow Source

Areas identified for potential borrow sources include nearby lakes, rivers and the Gulf of Mexico. Several of the marsh restoration features have been evaluated using beneficial use of dredged material from the Calcasieu Ship Channel. Each feature has been evaluated individually and considered to develop a schedule of material usage based on current maintenance dredging cycles. Such evaluations will be performed considering the features carried forward. Calcasieu Lake was not considered as a borrow source as it is designated as public oyster seed grounds.

5.2.1.1.5 Earthen Containment Dikes

Earthen containment dikes will be constructed using in-situ material from the interior of each marsh restoration/nourishment feature area. Borrow area for the containment dike will be refilled during hydraulic

dredging. Typical section of the containment dike includes a crest width of 5 feet, side slopes of 4(H):1(V), and a crown elevation with 1 foot of freeboard above the initial slurry elevation. Containment dikes are assumed to be maintained during construction. Bottom elevation of the earthen containment dikes was assumed to coincide with the assumed bottom elevation of the respective marsh restoration and marsh nourishment areas.

5.2.1.2 Feature 3c1 Beneficial Use of Dredged Material from Calcasieu Ship Channel

Feature 3c1 is a marsh restoration and nourishment feature located adjacent to the eastern rim of Calcasieu Lake and is situated within the Cameron-Creole Watershed area. The feature will consist of converting approximately 1,347 acres of open water to marsh habitat, along with the nourishment of approximately 450 acres of adjacent wetlands, through maintenance dredging of material to be borrowed from the Calcasieu Ship Channel. Approximately 10.2 million gross cubic yards of borrow will be required for this marsh restoration and nourishment feature. The material will be transported directly to the site via pipeline.

The dredged material will be placed to achieve a post-construction marsh target elevation of +1.4' NAVD88 (2004.65). During construction, effluent from dewatering will be discharged into adjacent wetlands via spill box weirs. Approximately 92,500' of earthen containment dikes will be constructed from in-situ material located within the marsh restoration/nourishment area. The borrow area used for construction of the earthen containment dike will be refilled during the placement of dredged material. One foot (1') of freeboard will be maintained at all times during dredge discharge operations. The earthen containment dikes will be constructed to an approximate 5' crown width and slopes no steeper than 4H:1V.

One renourishment cycle at TY30 is estimated to include 787 acres of marsh restoration along with 1,317 acres of marsh nourishment. Approximately 5.6 million cubic yards of borrow from the Calcasieu Ship Channel will be required for this renourishment cycle.

5.2.1.3 Feature 3c2 Beneficial Use of Dredged Material from Calcasieu Ship Channel

Feature 3c2 is a marsh restoration feature located adjacent to the eastern rim of Calcasieu Lake and is situated within the Cameron-Creole Watershed area.

The feature will consist of converting approximately 1,131 acres of open water to marsh habitat through dedicated dredging of material to be borrowed from the Calcasieu Ship Channel. Approximately 6.3 million gross cubic yards of borrow will be required for this marsh restoration feature. The material will be transported directly to the restoration site via pipeline.

The dredged material will be placed to achieve a post-construction marsh target elevation of +1.4' NAVD88 (2004.65). During construction, effluent from dewatering will be discharged into adjacent wetlands via spill box weirs. Approximately 60,500' of earthen containment dikes will be constructed from in-situ material located within the marsh restoration/nourishment area. The borrow area used for construction of the earthen containment dike will be refilled during the placement of dredged material. One foot (1') of freeboard will be maintained at all times during dredge discharge operations. The earthen containment dikes will be constructed to an approximate 5' crown width and slopes no steeper than 4H:1V.

One renourishment cycle at TY30 is estimated to include 205 acres of marsh restoration along with 869 acres of marsh nourishment. Approximately 2.2 million cubic yards of borrow from the Calcasieu Ship Channel will be required for this renourishment cycle.

5.2.1.4 Feature 3c3 Beneficial Use of Dredged Material from Calcasieu Ship Channel

Feature 3c3 is a marsh restoration feature located adjacent to the eastern rim of Calcasieu Lake and is situated within the Cameron-Creole Watershed area. The feature will consist of converting approximately 1,293 acres of open water to marsh habitat through maintenance dredging of material from the Calcasieu Ship Channel. Approximately 7.0 million gross cubic yards of borrow will be required for this marsh restoration feature. The material will be transported directly to the restoration site via pipeline.

The dredged material will be placed to achieve a post-construction marsh target elevation of +1.4' NAVD88 (2004.65). During construction, effluent from dewatering will be discharged into adjacent wetlands via spill box weirs. Approximately 46,000' of earthen containment dikes will be constructed from in-situ material located within the marsh restoration/nourishment area. The borrow area used for construction of the earthen containment dike will be refilled during the placement of dredged material. One foot (1') of freeboard will be maintained at all times during dredge discharge operations. The earthen containment dikes will be constructed to an approximate 5' crown width and slopes no steeper than 4H:1V. One renourishment cycle at TY30 is estimated to include 240 acres of marsh restoration along with 998 acres of marsh nourishment. Approximately 2.5 million cubic yards of borrow from the Calcasieu Ship Channel will be required for this renourishment cycle.

5.2.1.5 Feature 3c4 Beneficial Use of Dredged Material from Calcasieu Ship Channel

Feature 3c4 is a marsh restoration feature located adjacent to the southeastern rim of Calcasieu Lake and is situated within the Cameron-Creole Watershed area. The feature will consist of converting approximately 1,018 acres of open water to marsh habitat through maintenance dredging of material from the Calcasieu Ship Channel or approximately 2 miles offshore within state waterbottoms. Approximately 5.5 million gross cubic yards of borrow will be required for this marsh restoration feature. The material will be transported directly to the restoration site via pipeline.

The dredged material will be placed to achieve a post-construction marsh target elevation of +1.4' NAVD88 (2004.65). During construction, effluent from dewatering will be discharged into adjacent wetlands via spill box weirs. Approximately 37,000' of earthen containment dikes will be constructed from in-situ material located within the marsh restoration/nourishment area. The borrow area used for construction of the earthen containment dike will be refilled during the placement of dredged material. One foot (1') of freeboard will be maintained at all times during dredge discharge operations. The earthen containment dikes will be constructed to an approximate 5' crown width and slopes no steeper than 4H:1V. One renourishment cycle at TY30 is estimated to include 174 acres of marsh restoration along with 793 acres of marsh nourishment. Approximately 2.2 million cubic yards of borrow from the Calcasieu Ship Channel or approximately 2 miles offshore within state waterbottoms will be required for this renourishment cycle.

5.2.1.6 Feature 3c5 Beneficial Use of Dredged Material from Calcasieu Ship Channel

Feature 3c5 is a marsh restoration feature located adjacent to the southeastern rim of Calcasieu Lake and is situated within the Cameron-Creole Watershed area. The feature will consist of converting approximately 3,328 acres of open water to marsh habitat through maintenance dredging of material from the Calcasieu Ship Channel or to be borrowed from approximately 2 to 3 miles offshore within state waterbottoms. Approximately 17.8 million gross cubic yards of borrow will be required for this marsh restoration feature. The material will be transported directly to the restoration site via pipeline.

The dredged material will be placed to achieve a post-construction marsh target elevation of +1.4' NAVD88 (2004.65). During construction, effluent from dewatering will be discharged into adjacent wetlands via spill box weirs. Approximately 71,300' of earthen containment dikes will be constructed from in-situ material located

within the marsh restoration/nourishment area. The borrow area used for construction of the earthen containment dike will be refilled during the placement of dredged material. One foot (1') of freeboard will be maintained at all times during dredge discharge operations. The earthen containment dikes will be constructed to an approximate 5' crown width and slopes no steeper than 4H:1V. One renourishment cycle at TY30 is estimated to include 586 acres of marsh restoration along with 5,576 acres of marsh nourishment. Approximately 6.3 million cubic yards of borrow from approximately 2 to 3 miles offshore within state waterbottoms will be required for this renourishment cycle.

5.2.1.7 Feature 3a1 Beneficial Use of Dredged Material from Calcasieu Ship Channel

Feature 3a1 is a marsh restoration feature located adjacent to the southern shoreline of the GIWW west of the Calcasieu Ship Channel near Black Lake. The feature will consist of converting approximately 599 acres of open water to marsh habitat through dredging of maintenance material from the Calcasieu Ship Channel. Approximately 5.3 million gross cubic yards of borrow will be required for this marsh restoration feature. The material will be transported directly to the restoration site via pipeline.

The dredged material will be placed to achieve a post-construction marsh target elevation of +1.4' NAVD88 (2004.65). During construction, effluent from dewatering will be discharged into adjacent wetlands via spill box weirs. Approximately 44,700' of earthen containment dikes will be constructed from in-situ material located within the marsh restoration/nourishment area. The borrow area used for construction of the earthen containment dike will be refilled during the placement of dredged material. One foot (1') of freeboard will be maintained at all times during dredge discharge operations. The earthen containment dikes will be constructed to an approximate 5' crown width and slopes no steeper than 4H:1V. One renourishment cycle at TY30 is estimated to include 62 acres of marsh restoration along with 507 acres of marsh nourishment. Approximately 1.0 million cubic yards of borrow from the Calcasieu Ship Channel will be required for this renourishment cycle.

5.2.1.8 Feature 47a1 Marsh Restoration Using Dredged Material South of Highway 82

Feature 47a1 is a marsh restoration and nourishment feature located adjacent to the south side of Highway 82 approximately 4.5 miles west of Grand Chenier. The feature will consist of converting approximately 88 acres of open water to marsh habitat, along with the nourishment of approximately 933 acres of adjacent wetlands, through dedicated dredging of material to be borrowed from approximately 3 miles offshore within state waterbottoms. Approximately 3.0 million gross cubic yards of borrow will be required for this marsh restoration and nourishment feature. The material will be transported directly to the restoration site via pipeline.

The dredged material will be placed to achieve a post-construction marsh target elevation of +1.5' NAVD88 (2004.65). During construction, effluent from dewatering will be discharged into adjacent wetlands via spill box weirs. Approximately 68,300' of earthen containment dikes will be constructed from in-situ material located within the marsh restoration/nourishment area. The borrow area used for construction of the earthen containment dike will be refilled during the placement of dredged material. One foot (1') of freeboard will be maintained at all times during dredge discharge operations. The earthen containment dikes will be constructed to an approximate 5' crown width and slopes no steeper than 4H:1V. One renourishment cycle at TY30 is estimated to include 70 acres of marsh restoration along with 900 acres of marsh nourishment. Approximately 1.5 million cubic yards of borrow from approximately 3 miles offshore within state waterbottoms will be required for this renourishment cycle.

5.2.1.9 Feature 47a2 Marsh Restoration Using Dredged Material South of Highway 82

Feature 47a2 is a marsh restoration and nourishment feature located on the south side of Highway 82 approximately 4.5 miles west of Grand Chenier. Feature 47a2 is located immediately south of Feature 47a1.

The feature will consist of converting approximately 1297 acres of open water to marsh habitat, along with the nourishment of approximately 126 acres of adjacent wetlands, through dedicated dredging of material to be borrowed from approximately 3 miles offshore within state waterbottoms. Approximately 8.8 million gross cubic yards of borrow will be required for this marsh restoration and nourishment feature. The material will be transported directly to the restoration site via pipeline.

The dredged material will be placed to achieve a post-construction marsh target elevation of +1.5' NAVD88 (2004.65). During construction, effluent from dewatering will be discharged into adjacent wetlands via spill box weirs. Approximately 41,000' of earthen containment dikes will be constructed from in-situ material located within the marsh restoration/nourishment area. The borrow area used for construction of the earthen containment dike will be refilled during the placement of dredged material. One foot (1') of freeboard will be maintained at all times during dredge discharge operations. The earthen containment dikes will be constructed to an approximate 5' crown width and slopes no steeper than 4H:1V. One renourishment cycle at TY30 is estimated to include 125 acres of marsh restoration along with 1,227 acres of marsh nourishment. Approximately 1.5 million cubic yards of borrow from approximately 3 miles offshore within state waterbottoms will be required for this renourishment cycle.

5.2.1.10 Feature 47c1 Marsh Restoration Using Dredged Material South of Highway 82

Feature 47c1 is a marsh restoration and nourishment feature located on the south side of Highway 82 approximately 4.5 miles west of Grand Chenier. The feature will consist of converting approximately 1,304 acres of open water to marsh habitat, along with the nourishment of approximately 4 acres of adjacent wetlands, through dedicated dredging of material to be borrowed from approximately 3 miles offshore within state waterbottoms. Approximately 8.6 million gross cubic yards of borrow will be required for this marsh restoration and nourishment feature. The material will be transported directly to the restoration site via pipeline.

The dredged material will be placed to achieve a post-construction marsh target elevation of +1.5' NAVD88 (2004.65). During construction, effluent from dewatering will be discharged into adjacent wetlands via spill box weirs. Approximately 35,200' of earthen containment dikes will be constructed from in-situ material located within the marsh restoration/nourishment area. The borrow area used for construction of the earthen containment dike will be refilled during the placement of dredged material. One foot (1') of freeboard will be maintained at all times during dredge discharge operations. The earthen containment dikes will be constructed to an approximate 5' crown width and slopes no steeper than 4H:1V.

One renourishment cycle at TY30 is estimated to include 55 acres of marsh restoration along with 1,188 acres of marsh nourishment. Approximately 1.8 million cubic yards of borrow from approximately 3 miles offshore within state waterbottoms will be required for this renourishment cycle.

5.2.1.11 Feature 47c2 Marsh Restoration Using Dredged Material South of Highway 82

Feature 47c2 is a marsh restoration feature located on the south side of Highway 82 approximately 4.5 miles west of Grand Chenier. Feature 47c2 is located immediately south of Feature 47a2. The feature will consist of converting approximately 445 acres of open water to marsh habitat through dedicated dredging of material to be borrowed from approximately 3 miles offshore within state waterbottoms. Approximately 2.9 million gross cubic yards of borrow will be required for this marsh restoration and nourishment feature. The material will be transported directly to the restoration site via pipeline.

The dredged material will be placed to achieve a post-construction marsh target elevation of +1.5' NAVD88 (2004.65). During construction, effluent from dewatering will be discharged into adjacent wetlands via spill box weirs. Approximately 23,000' of earthen containment dikes will be constructed from in-situ material located

within the marsh restoration/nourishment area. The borrow area used for construction of the earthen containment dike will be refilled during the placement of dredged material. One foot (1') of freeboard will be maintained at all times during dredge discharge operations. The earthen containment dikes will be constructed to an approximate 5' crown width and slopes no steeper than 4H:1V. One renourishment cycle at TY30 is estimated to include 24 acres of marsh restoration along with 399 acres of marsh nourishment. Approximately 650,000 cubic yards of borrow from approximately 3 miles offshore within state waterbottoms will be required for this renourishment cycle.

5.2.1.12 Feature 124a Marsh Restoration at Mud Lake

Feature 124a is a marsh restoration and nourishment feature located north of Mud Lake and west of West Cove. The feature will consist of converting approximately 886 acres of open water to marsh habitat, along with the nourishment of approximately 217 acres of adjacent wetlands, through dedicated dredging of material to be borrowed from the Calcasieu Ship Channel. Approximately 5.5 million gross cubic yards of borrow will be required for this marsh restoration and nourishment feature. The material will be transported directly to the restoration site via pipeline.

The dredged material will be placed to achieve a post-construction marsh target elevation of +1.4' NAVD88 (2004.65). During construction, effluent from dewatering will be discharged into adjacent wetlands via spill box weirs. Approximately 77,300' of earthen containment dikes will be constructed from in-situ material located within the marsh restoration/nourishment area. The borrow area used for construction of the earthen containment dike will be refilled during the placement of dredged material. One foot (1') of freeboard will be maintained at all times during dredge discharge operations. The earthen containment dikes will be constructed to an approximate 5' crown width and slopes no steeper than 4H:1V. One renourishment cycle at TY30 is estimated to include 146 acres of marsh restoration along with 902 acres of marsh nourishment. Approximately 1.9 million cubic yards of borrow from West Cove or the Calcasieu Ship Channel will be required for this renourishment cycle.

5.2.1.13 Feature 124b Marsh Restoration at Mud Lake

Feature 124b is a marsh restoration and nourishment feature located adjacent to Mud Lake west of the Calcasieu Ship Channel. The feature will consist of converting approximately 271 acres of open water to marsh habitat, along with the nourishment of approximately 71 acres of adjacent wetlands, through dedicated dredging of material to be borrowed from the Calcasieu Ship Channel. Approximately 1.6 million gross cubic yards of borrow will be required for this marsh restoration and nourishment feature. The material will be transported directly to the restoration site via pipeline.

The dredged material will be placed to achieve a post-construction marsh target elevation of +1.5' NAVD88 (2004.65). During construction, effluent from dewatering will be discharged into adjacent wetlands via spill box weirs. Approximately 48,500' of earthen containment dikes will be constructed from in-situ material located within the marsh restoration/nourishment area. The borrow area used for construction of the earthen containment dike will be refilled during the placement of dredged material. One foot (1') of freeboard will be maintained at all times during dredge discharge operations. The earthen containment dikes will be constructed to an approximate 5' crown width and slopes no steeper than 4H:1V.

One renourishment cycle at TY30 is estimated to include 60 acres of marsh restoration along with 265 acres of marsh nourishment. Approximately 660,000 cubic yards of borrow from Mud Lake will be required for this renourishment cycle.

5.2.1.14 Feature 124c Marsh Creation at Mud Lake

Feature 124c is a marsh restoration and nourishment feature located adjacent and north of Highway 82 and east of Mud Lake. The feature will consist of converting approximately 1,908 acres of open water to marsh habitat, along with the nourishment of approximately 734 acres of adjacent wetlands, through dedicated dredging of material to be borrowed from approximately 3 miles offshore within state waterbottoms. Approximately 11.1 million gross cubic yards of borrow will be required for this marsh restoration and nourishment feature. The material will be transported directly to the restoration site via pipeline.

The dredged material will be placed to achieve a post-construction marsh target elevation of +1.5' NAVD88 (2004.65). During construction, effluent from dewatering will be discharged into adjacent wetlands via spill box weirs. Approximately 52,600' of earthen containment dikes will be constructed from in-situ material located within the marsh restoration/nourishment area. The borrow area used for construction of the earthen containment dike will be refilled during the placement of dredged material. One foot (1') of freeboard will be maintained at all times during dredge discharge operations. The earthen containment dikes will be constructed to an approximate 5' crown width and slopes no steeper than 4H:1V.

One renourishment cycle at TY30 is estimated to include 352 acres of marsh restoration along with 2,158 acres of marsh nourishment. Approximately 4.7 million cubic yards of borrow from approximately 3 miles offshore within state waterbottoms will be required for this renourishment cycle.

5.2.1.15 Feature 124d Marsh Restoration at Mud Lake

Feature 124d is a marsh restoration and nourishment feature located west of the Calcasieu Ship Channel and adjacent to the southern rim of West Cove. The feature will consist of converting approximately 159 acres of open water to marsh habitat, along with the nourishment of approximately 448 acres of adjacent wetlands, through maintenance dredging of material to be borrowed from the Calcasieu Ship Channel or dedicated dredging from West Cove. Approximately 1.4 million gross cubic yards of borrow will be required for this marsh restoration and nourishment feature. The material will be transported directly to the restoration site via pipeline.

The dredged material will be placed to achieve a post-construction marsh target elevation of +1.5' NAVD88 (2004.65). During construction, effluent from dewatering will be discharged into adjacent wetlands via spill box weirs. Approximately 32,500' of earthen containment dikes will be constructed from in-situ material located within the marsh restoration/nourishment area. The borrow area used for construction of the earthen containment dike will be refilled during the placement of dredged material. One foot (1') of freeboard will be maintained at all times during dredge discharge operations. The earthen containment dikes will be constructed to an approximate 5' crown width and slopes no steeper than 4H:1V. One renourishment cycle at TY30 is estimated to include 103 acres of marsh restoration along with 474 acres of marsh nourishment. Approximately 1.2 million cubic yards of borrow from the Calcasieu Ship Channel or West Cove will be required for this renourishment cycle.

5.2.1.16 Feature 127c1 Marsh Restoration at Pecan Island

Measure 127c1 is a marsh restoration and nourishment feature located west of the Freshwater Bayou Canal and approximately 5 miles north of the Freshwater Bayou locks. The feature will consist of converting approximately 1,088 acres of open water to marsh habitat, along with the nourishment of approximately 89 acres of adjacent wetlands, through dedicated dredging of material to be borrowed from approximately 3 miles offshore within state waterbottoms. Approximately 9.3 million gross cubic yards of borrow will be required for this marsh restoration and nourishment feature. The material will be transported directly to the restoration site via pipeline.

The dredged material will be placed to achieve a post-construction marsh target elevation of +1.4' NAVD88 (2004.65). During construction, effluent from dewatering will be discharged into adjacent wetlands via spill box weirs. Approximately 36,100' of earthen containment dikes will be constructed from in-situ material located within the marsh restoration/nourishment area. The borrow area used for construction of the earthen containment dike will be refilled during the placement of dredged material. One foot (1') of freeboard will be maintained at all times during dredge discharge operations. The earthen containment dikes will be constructed to an approximate 5' crown width and slopes no steeper than 4H:1V. One renourishment cycle at TY30 is estimated to include 94 acres of marsh restoration along with 1,024 acres of marsh nourishment. Approximately 1.8 million cubic yards of borrow from approximately 3 miles offshore within state waterbottoms will be required for this renourishment cycle.

5.2.1.17 Feature 127c2 Marsh Restoration at Pecan Island

Feature 127c2 is a marsh restoration and nourishment feature located west of the Freshwater Bayou Canal and approximately 5 miles north of the Freshwater Bayou locks. The feature will consist of converting approximately 1,309 acres of open water to marsh habitat, along with the nourishment of approximately 14 acres of adjacent wetlands, through dedicated dredging of material to be borrowed from approximately 3 miles offshore within state waterbottoms. Approximately 11.1 million gross cubic yards of borrow will be required for this marsh restoration and nourishment feature. The material will be transported directly to the restoration site via pipeline.

The dredged material will be placed to achieve a post-construction marsh target elevation of +1.4' NAVD88 (2004.65). During construction, effluent from dewatering will be discharged into adjacent wetlands via spill box weirs. Approximately 39,900' of earthen containment dikes will be constructed from in-situ material located within the marsh restoration/nourishment area. The borrow area used for construction of the earthen containment dike will be refilled during the placement of dredged material. One foot (1') of freeboard will be maintained at all times during dredge discharge operations. The earthen containment dikes will be constructed to an approximate 5' crown width and slopes no steeper than 4H:1V.

One renourishment cycle at TY30 is estimated to include 79 acres of marsh restoration along with 1,178 acres of marsh nourishment. Approximately 1.9 million cubic yards of borrow from approximately 3 miles offshore within state waterbottoms will be required for this renourishment cycle.

5.2.1.18 Feature 127c3 Marsh Restoration at Pecan Island

Feature 127c3 is a marsh restoration and nourishment feature located west of the Freshwater Bayou Canal and approximately 5 miles north of the Freshwater Bayou locks. The feature will consist of converting approximately 832 acres of open water to marsh habitat, along with the nourishment of approximately 62 acres of adjacent wetlands, through dedicated dredging of material to be borrowed from approximately 3 miles offshore within state waterbottoms. Approximately 7.3 million gross cubic yards of borrow will be required for this marsh restoration and nourishment feature. The material will be transported directly to the restoration site via pipeline.

The dredged material will be placed to achieve a post-construction marsh target elevation of +1.4' NAVD88 (2004.65). During construction, effluent from dewatering will be discharged into adjacent wetlands via spill box weirs. Approximately 46,000' of earthen containment dikes will be constructed from in-situ material located within the marsh restoration/nourishment area. The borrow area used for construction of the earthen containment dike will be refilled during the placement of dredged material. One foot (1') of freeboard will be maintained at all times during dredge discharge operations. The earthen containment dikes will be constructed to an approximate 5' crown width and slopes no steeper than 4H:1V. One renourishment cycle at TY30 is

estimated to include 45 acres of marsh restoration along with 425 acres of marsh nourishment. Approximately 781,000 cubic yards of borrow from Freshwater Bayou will be required for this renourishment cycle.

5.2.1.19 Feature 306a1 Rainey Marsh Restoration – Southwest Portion (Christian Marsh)
Feature 306a1 is a marsh restoration and nourishment feature located east of the Freshwater Bayou Canal and approximately 5 miles north of the Freshwater Bayou locks. The feature will consist of converting approximately 627 acres of open water to marsh habitat, along with the nourishment of approximately 1,269 acres of adjacent wetlands, through dedicated dredging of material to be borrowed from approximately 3 miles offshore within state waterbottoms. Approximately 8.1 million gross cubic yards of borrow will be required for this marsh restoration and nourishment feature. The material will be transported directly to the restoration site via pipeline.

The dredged material will be placed to achieve a post-construction marsh target elevation of +1.4' NAVD88 (2004.65). During construction, effluent from dewatering will be discharged into adjacent wetlands via spill box weirs. Approximately 108,000' of earthen containment dikes will be constructed from in-situ material located within the marsh restoration/nourishment area. The borrow area used for construction of the earthen containment dike will be refilled during the placement of dredged material. One foot (1') of freeboard will be maintained at all times during dredge discharge operations. The earthen containment dikes will be constructed to an approximate 5' crown width and slopes no steeper than 4H:1V.

One renourishment cycle at TY30 is estimated to include 317 acres of marsh restoration along with 1,484 acres of marsh nourishment. Approximately 3.5 million cubic yards of borrow from approximately 3 miles offshore within state waterbottoms will be required for this renourishment cycle.

5.2.1.20 Feature 306a2 Rainey Marsh Restoration – Southwest Portion (Christian Marsh)
Feature 306a2 is a marsh restoration and nourishment feature located east of the Freshwater Bayou Canal, approximately 9 miles north of the Freshwater Bayou locks, and west of the McIlhenny Canal. The feature will consist of converting approximately 1,400 acres of open water to marsh habitat, along with the nourishment of approximately 1,105 acres of adjacent wetlands, through dedicated dredging of material to be borrowed from approximately 1 mile nearshore in Vermilion Bay or 3 miles offshore within state waterbottoms. Approximately 13.4 million gross cubic yards of borrow will be required for this marsh restoration and nourishment feature. The material will be transported directly to the restoration site via pipeline.

The dredged material will be placed to achieve a post-construction marsh target elevation of +1.4' NAVD88 (2004.65). During construction, effluent from dewatering will be discharged into adjacent wetlands via spill box weirs. Approximately 48,900' of earthen containment dikes will be constructed from in-situ material located within the marsh restoration/nourishment area. The borrow area used for construction of the earthen containment dike will be refilled during the placement of dredged material. One foot (1') of freeboard will be maintained at all times during dredge discharge operations. The earthen containment dikes will be constructed to an approximate 5' crown width and slopes no steeper than 4H:1V. One renourishment cycle at TY30 is estimated to include 456 acres of marsh restoration along with 1,924 acres of marsh nourishment. Approximately 4.8 million cubic yards of borrow from approximately 1 mile nearshore in Vermilion Bay or 3 miles offshore within state waterbottoms will be required for this renourishment cycle.

5.2.2 Shoreline Protection/Stabilization

5.2.2.1 General

Shoreline protection measures consist of breakwaters, shoreline revetment and nearshore dikes. The terms restoration, stabilization and fortification all refer to methods of shoreline protection. No reestablishment of eroded shoreline is included in these features. The total estimated volume of rock required to construct the shoreline protection features generally assumed an open water contour elevation of -1.0 foot NAVD88 (2004.65), with varying crest elevations and included additional volume to account for the initial and long term consolidation settlement. Assumptions for bottom elevations and crest elevations for project areas were derived using information from recently constructed projects near the project areas and/or information obtained during the CWPPRA planning process. A 250-lb class rock was assumed for the breakwaters. No preliminary hydraulic analysis was performed to provide criteria such as stone size, crown width and height. No actual field data has been collected for this preliminary quantity and cost estimating effort. Surveys will be performed on features carried forward into the next implementation phase. Additionally, no geotechnical information was collected during this phase of the study.

5.2.2.2 Features 6b1, 6b2, and 6b3 Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou

These three feature reaches, 6b1 (approx. 11.1 miles), 6b2 (approx. 8.1 miles) and 6b3 (approx. 7.2 miles); consist of the construction of a reef breakwater with a lightweight aggregate (LWA) core. The encapsulated LWA core decreases the bearing pressure and allows greater crest elevation and increased wave attenuation. The design of this feature incorporates the design and construction of a portion of a CWPPRA demonstration project (ME-18) along the Rockefeller Refuge shoreline. The breakwater will be located along the approximate -4 foot contour approximately 150 ft offshore. The feature includes geotextile fabric overlying geogrid, 1 foot of bedding stone with 3.75 feet of LWA core to be initially covered by approximately 4 feet of armor stone. The structure will have a crest width of 18 ft with 2(H):1(V) side slopes. Flotation dredging is anticipated for access to the site for construction equipment and material barges. Flotation excavation along the alignment will be limited to an 80-foot bottom width channel not to exceed elevation -7.0' NAVD88 (2004.65). One maintenance lift at Target Year (TY) 25 consisting of approximately 10% of the original armor stone quantity is included.

5.2.2.3 Features 16bNE, 16bSE, and 16bW Fortify Spoil Banks of GIWW & Freshwater Bayou Bank

These three feature reaches, 16bNE (approx. 3.1 miles), 16bSE (approx. 9.1 miles) and 16bW (approx. 3.2 miles), consist of the construction of rock revetment shoreline protection along critical areas of the Freshwater Bayou navigation canal. Armoring of the shoreline is intended to prevent the shoreline from breaching so that salt water does not negatively impact the surrounding freshwater marshes and lakes in the Mermentau Basin. Implementation of similar shoreline protection projects along Freshwater Bayou has halted the shoreline erosion along those reaches. The proposed rock revetment feature will be located at the approximate -1.0 foot contour. Crown elevation will be 4.0' NAVD88 (2004.65) with a 4' crown width and 3(H):1(V) side slopes. The rock dike will be underlain with geotextile fabric to minimize settlement. Limited flotation dredging is anticipated for access to the site for construction equipment and material barges. Flotation excavation along the alignment will be limited to an 80-foot bottom width channel not to exceed elevation -7.0' NAVD88 (2004.65). A maintenance lift at TY15 consisting of approximately 15% of the initial rock quantity is included. A second maintenance at TY25 consisting of approximately 10% of the initial rock quantity is also included.

5.2.2.4 Feature 113b2 Stabilize Shoreline of Vermilion, East & West Cote Blanche Bays: SW Section

This feature consists of the construction of approximately 8.0 miles of a nearshore rock dike at the approximate -1.0 foot contour for the purpose of reducing shoreline erosion and protection of the adjacent marsh. The dike will be constructed to a crown elevation of 4.0' NAVD88 (2004.65) with a 4' crown width and 3(H):1(V) side slopes. The rock dike will be underlain with geotextile fabric to minimize settlement. Flotation dredging is anticipated for access to the site for construction equipment and material barges. Flotation excavation along the alignment will be limited to an 80-foot bottom width channel not to exceed elevation -7.0' NAVD88 (2004.65). The rock dike will be accommodated with gaps to allow continued fish and wildlife access into the interior marshes. A maintenance lift at TY15 consisting of approximately 15% of the initial rock quantity is included. A second maintenance at TY25 consisting of approximately 10% of the initial rock quantity is also included.

5.2.2.5 Feature 99a Gulf Shoreline Restoration: Freshwater Bayou to South Point/Marsh Island

This feature consists of the construction of approximately 1.75 miles of rock breakwaters and is a continuation of existing breakwaters. The breakwaters will be constructed at the approximate -1.2 foot contour to a crown elevation of 4.5' NAVD88 (2004.65) with a crown width of 5.0 feet and 3(H):1(V) side slopes. The rock breakwaters will be underlain with geotextile fabric to minimize settlement. Breakwater segments will be approximately 280 feet in length with 175 gapping between breakwaters. Flotation dredging is anticipated for access to the site for construction equipment and material barges. Flotation excavation along the alignment will be limited to an 80-foot bottom width channel not to exceed elevation -7.0' NAVD88 (2004.65). A maintenance lift at TY15 consisting of approximately 15% of the initial rock quantity is included. A second maintenance at TY25 consisting of approximately 10% of the initial rock quantity is also included.

5.2.2.6 Feature 5a Holly Beach Shoreline Stabilization – Breakwaters

This feature consists of the construction of approximately 8.7 miles of rock breakwaters and is a continuation of existing breakwaters. The breakwaters will be constructed at the approximate -1.0 foot contour to a crown elevation of 3.5' NAVD88 (2004.65) with a crown width of 4.0 feet and 3(H):1(V) side slopes. The rock breakwaters will be underlain with geotextile fabric to minimize settlement. Breakwater segments will be approximately 280 feet in length with 175 gapping between breakwaters. Flotation dredging is anticipated for access to the site for construction equipment and material barges. Flotation excavation along the alignment will be limited to an 80-foot bottom width channel not to exceed elevation -7.0' NAVD88 (2004.65). A maintenance lift at TY15 consisting of approximately 15% of the initial rock quantity is included. A second maintenance at TY25 consisting of approximately 10% of the initial rock quantity is also included.

5.2.3 Chenier Reforestation

Chenier reforestation consists of replanting of 435 seedlings per acre at 10' x 10' spacing, in 22 Chenier locations on 1,400 acres in Cameron and Vermilion parishes. Areas eligible for Chenier reforestation consist of areas greater than five feet in elevation and with low shoreline erosion rates, provided the existing canopy coverage is less than 50% unless nearby development would prevent achieving study objectives. This feature also includes the removal of certain invasive species.

6.0 STRUCTURAL FEATURES

6.1 NED

Potential structures were identified using the proposed alternative levee alignments and existing mapping. An attempt was made to identify the major structures that would be required. Three basic types of structures were used for cost estimating purposes: sector gates, stop log gates, and drainage culverts. Sector gate structures would consist of a 56' wide sector gate with or without sluice gates. Structures with sluice gates would have a total width of 600 feet. Stop log gates would be 20' or 30' wide. Drainage culvert structures would consist of 2 – 6'x6' culverts. Structures would be constructed to the 2075 design elevations. Basic quantities were taken from designs developed for the Morganza to the Gulf of Mexico, Louisiana Post Authorization Change Report and adjusted as required to meet the requirements for each alternative. The number and type of structures for each alternative levee alignment are listed in Table 64.

Table 64 – Structures

Alternative	**Structure Description**
Abbeville Ring Levee	Sector Gate with Sluice Gates
	Stop Log Gates (2) – 20' width
	Drainage structure
Abbeville to Delcambre – Hwy 330	Sector Gate with Sluice Gates
	Stop Log Gates (4) – 2-20' wide and 2-30' wide
	Drainage Structures (2)
Delcambre Erath	Stop Log Gate – 30' wide
	Drainage Structure
Lake Charles East Bank	Sector Gate
	Stop Log Gate – 20' wide
	Drainage Structure (2)
Lake Charles West Bank Sulphur	Stop Log Gates
	Drainage Structure – 30' wide
Lake Charles West Bank Sulphur South	Stop Log Gates (2) – 30' wide
	Drainage Structure (3)

6.1.1 Sector Gate Structures

Sector gated structures would provide coastal storm damage risk reduction (closure) during storm events while allowing normal navigation at many of the waterways intersecting the storm damage risk reduction alignment. Typical sector gates with and without sluice gates are shown in Figure 20 and Figure 21. These structures were sized based on the apparent width of the existing waterway. The sill elevation at each location was selected based on the prevailing bottom elevation at the site. Standard sector gate widths of 56 feet were used. Each sector gate structure would be a pile founded, reinforced concrete structure at the required sill elevation and width to maintain navigation in the waterway. The structure would have emergency and/or maintenance stop logs and separate control houses on each

wall. A timber guidewall with a protective cellular dolphin at the end would be provided on both sides of each approach channel to the structure.

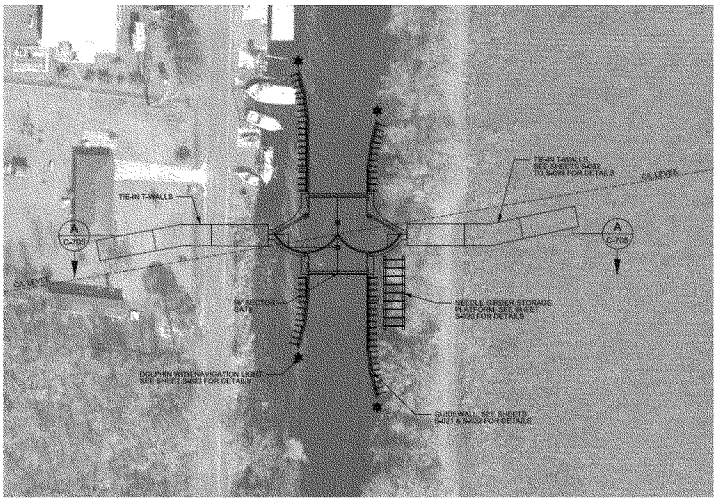


Figure 20 - Typical 56' Sector Gate

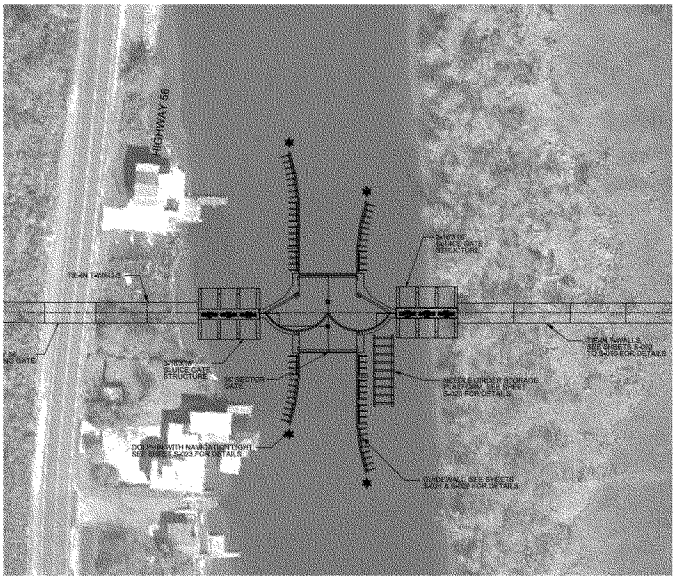


Figure 21 - Typical Sector Gate With Sluice Gates

6.1.2 Stop Log Gates

For smaller waterways which intersect the storm surge risk reduction, stop log gates provide coastal storm surge risk reduction (closure) while taking up a smaller footprint than a sector gate. A typical stop log gate is shown in Figure 22. Gate operation however, is of longer duration than a sector gate, requiring earlier closure of the structure prior to an event. The stop log gates were sized based on the apparent width of the existing waterway. Two stop log gate sizes were used, 20' and 30'. The sill elevation at each location was selected based on the prevailing bottom elevation at the site. Each gate structure would be a pile founded, reinforced concrete structure. The structure would be 42 feet long and will have a usable navigation width of 20 or 30 feet. The total width of the structure would be 70 feet.

Slots in the middle of the structure walls provide for gate placement. The gates consist of horizontal plate girders which carry loads to the adjacent concrete walls. Loads would be transferred from the bulkheads to the concrete walls through reaction plates. Two vertical braced frames would be placed under the lifting points to provide vertical support under lifting and storage conditions. Rollers would be placed on the ends of the gate to assist in placing them in the slots. The main walls of the structure adjacent to the navigation channel would

be 5 feet wide. Timber guide walls and end dolphins would be provided on both sides of each approach channel. When not employed, gates would be stored on-site on a platform. Access to the platform would be via the crane platform.

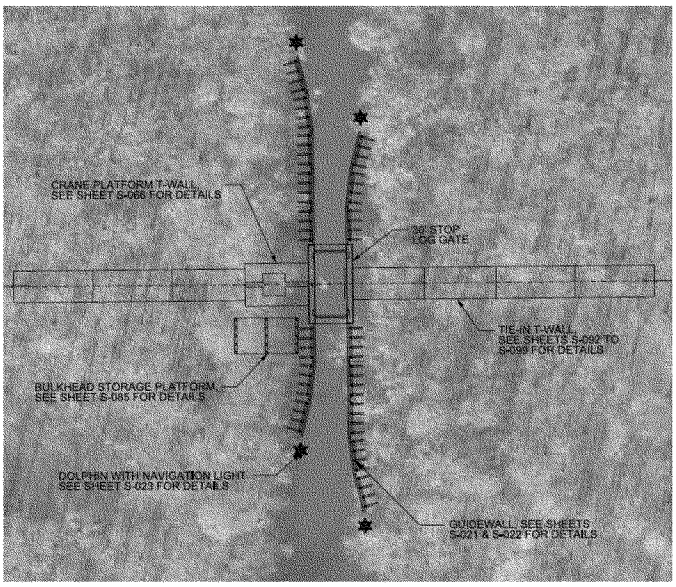


Figure 22 - Typical Stop Log Gate

6.1.3 Drainage Structures

Drainage structures with sluice gates would provide drainage through the storm surge risk reduction at various locations within the planning area. A typical drainage structure is shown in Figure 23. Each structure would consist of a pile founded, reinforced concrete structure with trash screens, operating platforms, and provisions for dewatering. The sluice gate structures would connect into the existing storm surge risk reduction on each side of the structure with a T-wall. The sluice gates would have the capability to be operated manually or will be mechanically actuated with portable motors.

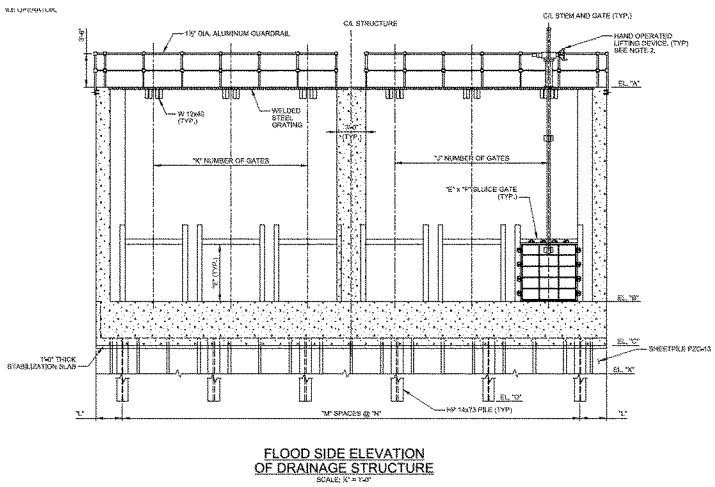


Figure 23 - Typical Drainage Structure

6.2 NER STRUCTURAL FEATURES

Design assumptions and cost estimates for hydrologic and salinity control features included in the focused NER array for this study were taken from the 2012 Louisiana Comprehensive Master Plan for a Sustainable Coast.

7.0 RELOCATIONS

7.1 NED ALTERNATIVES

Relocations were not specifically identified for developing costs for the NED alternatives. For the purpose of developing parametric cost estimates of relocations costs were accounted for by taking 2% of the construction costs. As a cross check of this assumption the relocations for the recently completed Morganza to the Gulf PAC Study accounted for approximately 4% of the project cost.

7.2 NER ALTERNATIVES

No relocations were specifically identified in the State Master Plan for the NER features. Since the NER features generally involve only surface level construction, and avoidance of any significant infrastructure would be the preferred construction approach, no relocations are anticipated. As a result no costs for relocations were included in the NER feature estimates.

8.0 OPERATION, MAINTENANCE, REPAIR, REPLACEMENT, AND REHABILITATION (OMRR&R)

8.1 NED

OMRR&R estimates were developed for the structures, levees and pump stations for each NED levee alternative in the focused array. The estimates used were initially developed for use in the LACPR Final Technical Report completed in 2009. Estimates for structures include annual operation and maintenance cost as well as periodic refurbishment. OMRR&R estimates for levees assume $10,000 per mile per year for maintenance which includes grass cutting. The average annual OMRR&R cost is shown in Table 65.

There are de minimus OMRR&R requirements anticipated for the Government and the Non-Federal Sponsor for the Nonstructural measures considered in this study. The Non-Federal Sponsor (NFS), as a part of its obligations for the NED feature, is required to prepare a Floodplain Management Plan in coordination with the U.S. Army Corps of Engineers (USACE) to maintain the integrity of the project; to issue annual notifications to the public regarding the risk reduction measures that have been implemented; to comply with the requirements of Section 402 of the Water Resources Development Act of 1986, as amended; to conduct regular periodic inspections of the properties upon which the nonstructural measures have been implemented in order to assure continuing compliance that the terms of the non-structural agreements executed by the owners and others; and to prevent obstructions or encroachments on the project, including prescribing and enforcing regulations to prevent any such obstructions or encroachments that might reduce the level of risk reduction provided by the NED project or that hinder or interfere with the operation and maintenance of the project and the project's proper function. Primary responsibility and cost for the OMRR&R of the non-structural measures rests with the owner of the property.

Table 65 Estimated Annual OMRR&R

Alternative	Estimated Annual OMRR&R
Abbeville Ring Levee	$276,000
Delcambre Erath	$240,000
Abbeville to Delcambre	$566,000
Lake Charles East Bank	$604,000
Lake Charles West Bank Sulphur	$205,000
Lake Charles West Bank Sulphur South	$444,000

8.2 NER

Marsh creation OMRR&R consists of a 30-yr marsh renourishment cycle. The acres of renourishment needed were based on land loss estimates. Shoreline protection OMRR&R estimates for features with breakwaters were based on performing two additional maintenance lifts at year 15 and year 25. Year 15 lift assumes 15% of the initial rock tonnage would be needed and year 25 lift assumes another 10% of the initial rock tonnage would be needed. Features with lightweight aggregate cores assumed one maintenance event at year 25 and 10% of the initial armor stone tonnage would be needed. The assumptions are based on predicted settlement based on experience with previous projects in the study area. The hydraulic and salinity structure features assumed one maintenance event at year 15. The OMRR&R costs for the structure were taken from costs developed for the State Master Plan. OMRR&R assumptions are for

individual measures are included in the measure descriptions in Section 5. OMRR&R cost for individual features is shown in Table 68.

9.0 COST ESTIMATES

9.1 NED COST ESTIMATES PRIOR TO MARCH 2015

The cost estimates for the NED alternatives were prepared based on readily available New Orleans District data and quantities provided by the PDT. The cost estimate was developed in the TRACES MII cost estimating software and used the standard approaches for a feasibility estimate structure regarding labor, equipment, materials, crews, unit prices, quotes, sub- and prime contractor markups. All features were estimated based on standard construction methods which are common to the New Orleans District and South Louisiana. The estimates assumed access was available to proposed areas unless otherwise stated. This philosophy was taken wherever practical. It was supplemented with estimating information from other sources where necessary such as quotes, historical bid data, A-E estimates, and previously approved similar studies (Morganza to the Gulf of Mexico, Louisiana Post Authorization Change Report). The intent was to provide or convey a "fair and reasonable" estimate that which depicts the local market conditions. The estimates assume a typical application of tiered subcontractors. Given the unknown economic status during project time, demands from non-governmental civil works projects were not considered to dampen the competition and increase prices.

9.1.1 NED Structural Alternative Estimates

Estimate Structure: The estimate is structured to reflect the projects performed. The estimates are subdivided by USACE feature codes and by local "reach" name.

Bid competition: It is assumed that there will not be an economically saturated market and that bidding competition will be present.

Contract Acquisition Strategy: It is assumed that the contract acquisition strategy will be similar to past projects with some negotiated contracts, focus and preference of small business/8(a), and large, unrestricted design/bid/build contracts. There is no declared contract acquisition plan/types at this time, so typical MVN goals have been included.

Labor Shortages: It is assumed there will be a normal labor market.

Labor Rates: Local labor market wages are above the local Davis-Bacon Wage Determination and actual rates have been used. This is based upon local information and payroll data received from the New Orleans District Construction Representatives and estimators with experiences in past years.

Materials: Cost quotes are used on major construction items when available. Recent quotes may include borrow material, concrete, steel and concrete piling, rock, gravel and sand, and deep soil mixing. Assumptions include:

a. materials will be purchased as part of the construction contract. The estimate does not anticipate government furnished materials. Prices include delivery of materials.

b. Concrete - will be purchased from commercial batch plants.

c. Borrow Material and Haul - Borrow material is considered the highest risk in the contracts, given the large quantities required, uncertainties of sources and materials near the many contract locations. Specific borrow sources have not been established so a conservative estimated haul distance was used when using off-site material. Borrow



pits currently in use are within this distance. Given the small quantities of materials required for the construction of localized storm surge risk reduction features for each structure, it is likely that a small quantities determination will be made, such that contractor-furnished borrow sources will be used.

The borrow quantity calculations followed the MVN Geotechnical guidance:

Hauled Levee: 10 BCY (bank cubic yards) of borrow material = 12 LCY (loose cubic yards) hauled = 8 ECY (embankment cubic yards) compacted.

An assumed average one-way haul distance of 25 miles was used unless a committed borrow source has been confirmed available. This decision is based upon discussions with the New Orleans District cost engineers and Project Delivery Team (PDT).

Haul speeds are estimated using 40 mph speed average given the long distances and rural areas.

d. Rock and stone - The Louisiana area has no rock sources. Historically, rock is barged from northern sources on the Mississippi River. This decision is based upon local knowledge, experience and supported with cost quotes.

Equipment: Rates used are based from the latest USACE EP-1110-1-8, Region III. Adjustments are made for fuel, filters, oil and grease (FOG) prices and facility capital cost of money (FCCM). Use of owned verses rental rates was considered based on small business, large business, and local equipment availability.

a. Trucking: The estimate assumed independent self-employed trucking subcontractors due to the large numbers of trucks required.

b. Dozers: dozers of the D-5/D-6 variety were chosen based on historical knowledge. Heavier equipment gets mired in the mud and soft soils.

c. Severe Rates: Severe equipment rates were used where appropriate.

Fuel: Fuels (gasoline, on and off-road diesel) were based on local market averages for on-road and off-road. The Team found that fuels fluctuate irrationally; thus, used an average.

Crews: Major crew and productivity rates were developed and studied by senior USACE estimators familiar with the type of work. All of the work is typical to the New Orleans District. The crews and productivities were checked by local MVN estimators, discussions with contractors and comparisons with historical cost data. Major crews include haul, earthwork, piling, concrete, and deep soil mixing.

Unit Prices: The unit prices found within the various project estimates will fluctuate within a range between similar construction units such as floodwall concrete, earthwork, and piling. Variances are a result of differing haul distances (trucked or barged), small or large business markups, subcontracted items, designs and estimates by others.

Relocation Cost: Relocation costs are defined as the relocation of public roads, bridges, railroads, and utilities required for project purposes. Due to the limited time available for investigation, an allowance of 2.0% of construction cost was used.

Mobilization: Contractor mobilization and demobilization are based on the assumption that many of the contractors will be coming from within a 500 mile radius. Based on historical studies, Pre-Katrina detailed Government estimates for mobilization averaged 4.9 to 5% of the construction costs. The estimate utilizes the approx. 5% value at each contract. The 5% value matches well with the 5% value prescribed by Walla Walla District, which has studied historical rates.

Field Office Overhead: The estimate used a field office overhead rate of 12% for the prime contractor at budget level development. Based on historical studies and experience, Walla Walla District has recommended typical rates ranging from 9% to 12% for large civil works projects. The 12% rate considers the possibility of maintenance and management of work camps and kitchens. The applied rates were previously discussed on similar projects among numerous USACE District cost engineers including Walla Walla, Vicksburg, Norfolk, Huntington, St. Paul, and New Orleans.

Overhead assumptions include: Superintendent, office manager, pickups, periodic travel, costs, communications, temporary offices (contractor and government), office furniture, office supplies, computers and software, as-built drawings and minor designs, tool trailers, staging setup, utility service, toilets, safety equipment, security and fencing, small hand and power tools, project signs, traffic control, surveys, temp fuel tank station, generators, compressors, lighting, and minor miscellaneous.

Home Office Overhead: Estimate percentages range based upon consideration of 8(a), small business and unrestricted prime contractors. The rates are based upon estimating and negotiating experience, and consultation with local construction representatives. Different percents are used when considering the contract acquisition strategy regarding small business 8(a), competitive small business and large business, high to low respectively. The applied rates were previously discussed on similar projects among numerous USACE District cost engineers including Walla Walla, Vicksburg, Norfolk, Huntington, St. Paul, and New Orleans.

Taxes: Local taxes will be applied, using an average between the parishes that contain the work. Reference the LA parish tax rate website: http://www.laota.com/pta.htm

Bond: Bond is assumed 1% applied against the prime contractor, assuming large contracts. No differentiation was made between large and small businesses.

E&D and S&A: USACE Costs to manage design (PED) and construction (S&A) are based on New Orleans District Programmatic Cost Estimate guidance:

a. Planning, Engineering & Design (PED): The PED cost includes such costs as project management, engineering, planning, designs, investigations, studies, reviews, value engineering and engineering during construction (EDC). Historically New Orleans District has used an approximate 12% rate for E&D/EDC, applied against the estimated construction costs. Other USACE civil works districts such as St. Paul, Memphis and St. Louis have reported values ranging from 10-15%. A rate of 12% for E&D/EDC was applied.

b. Supervision & Administration (S&A): Historically, New Orleans District used a range from 5% to 15% depending on project size and type applied against the estimated construction costs. Other USACE civil works districts

such as St. Paul, Memphis and St. Louis report values ranging from 7.5-10%. Consideration includes that a portion of the S&A effort could be performed by contractors. An S&A rate of 8% was applied.

Table 66 - NED Structural Cost Estimates

Alignment	Level of Risk Reduction	Estimated Cost
Abbeville Ring Levee	2%	$286,043,668
	1%	$344,105,662
	.5%	$447,742,511
Delcambre Erath	2%	$359,417,088
	1%	$470,793,469
	.5%	$589,491,453
Abbeville Delcambre	2%	$726,253,790
	1%	$885,237,639
	.5%	$1,117,889,012
East Bank Lake Charles	2%	$815,634,955
	1%	$1,015,364,226
	.5%	$1,260,363,306
West Bank Lake Charles Sulphur	2%	$142,812,830
	1%	$199,252,279
	.5%	$327,052,735
West Bank Lake Charles Sulphur South	2%	$456,320,325
	1%	$629,124,749
	.5%	$883,942,322

The Total Costs shown in Table 66 are developed as follows:

1. Construction costs were developed in the Mii estimate (levees, sector/stoplog gates, ECS).
2. Construction costs were then entered into the Excel spreadsheet "Cost By Year 2 Oct 13.xlsx" on the "TOTAL Costs" tab.
3. Contingency, E&D, EDC, S&A, Real Estate, Pump Stations, and Relocations are added in on "Cost By Year 2 Oct 13.xlsx", "TOTAL Costs" tab for a Total Cost per Reach and Level of Risk Reduction as shown in Table 66 of Engineering Report.
4. The Excel spreadsheet "Cost By Year 2 Oct 13.xlsx" also includes a tab for each Reach which takes the "TOTAL Costs" and determines yearly costs for Economic analysis.

9.1.2 NED Nonstructural Alternative Estimates

9.1.2.1 General

The cost per square foot for raising a structure was based on data obtained during interviews with representatives of three major metropolitan New Orleans area firms that specialize in the structure elevation. Composite costs were derived for residential structures by type: slab and pier foundation, one story and two story configuration, and for mobile homes. Table 67-Cost per Square Foot of Elevating Residential Structures displays the costs for each of the five residential categories analyzed. The cost per square foot to raise an eligible residential structure to the target height was multiplied by the footprint square footage of each structure to compute the costs to elevate the structure. Full estimates for the Nonstructural alternatives are fully developed as an output of the HEC-FDA economic analysis model. The description of this model, and the manner in which the per-square foot unit costs, are applied can be found in the Appendix D – Economics.

The nonstructural cost estimate was checked employing the TRACES Mii cost estimating software. Elevation contractors were contacted to verify cost estimating assumptions. This information, along with known construction data was fed into the TRACES Mii cost estimating software to validate the unit costs for structure elevation.

Estimate Philosophy: The estimate development used the standard approaches for a feasibility estimate structure regarding labor, equipment, materials, crews, unit prices, quotes, sub- and prime contractor markups. This philosophy was taken wherever practical within the time constraints. It was supplemented with estimating information from other sources where necessary such as quotes, bid data, and A-E estimates. The intent was to provide or convey a "fair and reasonable" estimate that which depicts the local market conditions.

Table 67-Cost per Square Foot of Elevating Residential Structures
(2012 Price Level In Dollars)

	1STY-SLAB			2STY-SLAB			1STY-PIER			2STY-PIER			MOBHOM		
Ft. Raised	Min	Most Likely	Max	Min	Most Likely	Max	Min	Most Likely	Max	Min	Most Likely	Max	Min	Most Likely	Max
1	62	70	77	70	77	85	54	62	69	61	68	76	30	34	38
2	62	70	77	70	77	85	54	62	69	61	68	76	30	34	38
3	64	71	79	71	79	86	57	64	72	63	71	78	30	34	38
4	66	74	81	76	84	91	57	64	72	63	71	78	30	34	38
5	66	74	81	76	84	91	57	64	72	63	71	78	38	42	45
6	68	75	83	78	85	93	58	66	73	65	72	80	38	42	45
7	68	75	83	78	85	93	58	66	73	65	72	80	38	42	45
8	70	78	85	80	88	96	60	67	75	66	74	81	38	42	45
9	70	78	85	80	88	96	60	67	75	66	74	81	38	42	45
10	70	78	85	80	88	96	60	67	75	66	74	81	38	42	45
11	70	78	85	80	88	96	60	67	75	66	74	81	38	42	45
12	70	78	85	80	88	96	60	67	75	66	74	81	38	42	45
13	73	80	88	85	93	101	61	69	76	68	75	83	38	42	45

The estimates assume a typical application of tiering subcontractors. Given the long time over which this project/program is to be constructed and the unknown economic status during that time, demands from non-governmental civil works projects were not considered to dampen the competition and increase prices.

Estimate Structure: The estimate is structured to reflect the projects performed. The estimates are subdivided by USACE feature codes.

Bid competition: It is assumed that there will not be an economically saturated market and bidding competition will be present.

Contract Acquisition Strategy: The Government will procure contracts that will allow a contractor to perform work on multiple structures through a series of one or more task orders and who will be responsible for all work associated with the nonstructural measure from approval of the construction plans for each structure to final inspection

Labor Shortages: It is assumed there will be a normal labor market.

Labor Rates: Local labor market wages are above the local Davis-Bacon Wage Determination and actual rates have been used. This is based upon local information and payroll data received from the New Orleans District Construction Representatives and estimators with experiences in past years.

Materials: Cost quotes are used on major construction items when available, although quantities per site are small relatively speaking. Recent quotes may include borrow material, concrete, steel and concrete piling, rock, gravel and sand. Assumptions include:

a. materials will be purchased as part of the construction contract. The estimate does not anticipate government furnished materials. Prices include delivery of materials.

b. Concrete - will be purchased from commercial batch plants.

c. Borrow Material and Haul - Specific borrow sources have not been established so a conservative estimated haul distance was used when using off-site material. All borrow material is assumed contractor furnished.

An assumed average one-way haul distance of 20 miles was used unless a committed borrow source has been confirmed available.

Equipment: Minimal equipment is required for this work. Rates used are based from the latest USACE EP-1110-1-8, Region III.

Crews: Major crew and productivity rates were reviewed by senior USACE estimators familiar with the type of work. All of the work is typical to the New Orleans District. The crews and productivities were checked by local MVN estimators, discussions with contractors and comparisons with historical cost data.

Most crew work hours are assumed to be 8 hrs 5 days/wk which is typical to the area.

Relocation Cost: Relocation costs are defined as the relocation of public roads, bridges, railroads, and utilities required for project purposes. These costs are not applicable.

Mobilization: Contractor mobilization and demobilization are based on the assumption that most of the contractors will be coming from within the Gulf Coast/Southern region.

Field Office Overhead: Included in contractor quotes for turnkey operations. The contracts are anticipated to be relatively small, simple operations, so "Field" overhead will be small.

Home Office Overhead: Included in contractor quotes for turnkey operations. The contracts are anticipated to be relatively small, simple operations by small, local established companies, so "Home" overhead will be minimal.

Taxes: Local taxes will be applied, using an average between the parishes that contain the work. Reference the LA parish tax rate website: http://www.laota.com/pta.htm

E&D and S&A: USACE Costs to manage design (PED) and construction (S&A) are based on New Orleans District Programmatic Cost Estimate guidance:

9.1.2.2 Escalation

The unit costs were originally developed in 2012 by local vendor quote or A/E report and have been escalated to 2014. The indexed costs have been validated by comparison to one of the same local vendors in Apr 2014 and the indexed costs are at or above the 2014 quote. Escalation used in the Mii and TPCS is based upon the US Army Corps of Engineers Engineering Manual (EM) 1110-2-1304 Civil Works Construction Cost Index System (CWCCIS) revised 30 Mar 2014.

9.1.3 Contingencies

Contingencies were not developed using the USACE Cost and Schedule Risk Analysis (CSRA) process. Contingencies were based upon similar projects, such as Morganza to the Gulf PAC, that were developed using the CSRA process. A contingency of 30% was used for levee and control structure items and 25% for pumping stations.

9.1.4 Alternative Estimates

The estimates for the levee alternatives included in the focused array of alternatives are shown in Table 66. These numbers included Real Estate, E&D, S&A, relocations and contingencies. Estimates for the Nonstructural alternatives contain the same components but are fully estimated as an output of the HEC-FDA economic analysis model. The description of this model, and the manner in which the-per square foot unit costs, are applied can be found in the Appendix D – Economics. The preliminary estimated costs do not include mitigation, monitoring and adaptive management.

9.2 NER COST ESTIMATES PRIOR TO MARCH 2015

9.2.1 Feature and Alternative Costs

The cost estimates for the measures, combined to make up the focused array of NER alternatives, were prepared in an expedited manner based on readily available data and quantities. The estimated costs were derived upon an analysis of each line item evaluating quantity and cost were based on in-house knowledge and experience in estimating and constructing similar projects. Cost Estimates were developed using historical data and a recent version of the CWPPRA cost estimating spreadsheet that has been used for many years for restoration projects. In addition to relying upon recent bid tabulations, the spreadsheet developed by Texas A&M Center for Dredging Studies was utilized to estimate unit rates for hydraulic dredging. All features were estimated based on standard construction methods all of which are common to South Louisiana. The estimates assumed access was available to proposed areas unless otherwise stated. Each element was developed independently and assumed equipment availability is not an issue. Operation and maintenance events were estimated and also included in the cost estimates. OMRR&R requirements were discussed in the description of the design of individual features. A 25% contingency was added to the measure estimates. E&D, S&A, and real estate were not included in the costs for individual measures. The first cost and OMRR&R estimates for the measures included in the NER focused array of alternatives are shown in Chapter 4 of the main report.

Table 68 - NER Individual Feature Estimates

Measure	First Cost	OMRR&R
CALCASIEU		
7 – Salinity Control Structure in the Calcasieu Ship Channel	$315,778,000	$63,160,000
17 – Salinity Control Structures Alkali Ditch, Crab Gully and Black Lake Bayou	$32,866,000	$2,660,000
48 – Salinity Control Structure at Sabine Pass	$21,769,000	$10,520,000
74a – Cameron: Spillway Structures at East Calcasieu Lake	$4,328,000	$830,000
407 – GIWW at Gum Cove Ridge Structure	$240,480,000	$48,100,000
3c1 – Beneficial use of Dredged Material from the Calcasieu Ship Channel	$117,802,030	$67,941,441
3c2 – Beneficial use of Dredged Material from the Calcasieu Ship Channel	$77,070,598	$32,433,230
3c3 – Beneficial use of Dredged Material from the Calcasieu Ship Channel	$83,947,114	$35,137,836
3c4 – Beneficial use of Dredged Material from the Calcasieu Ship Channel	$50,121,614	$21,147,761
3c5 – Beneficial use of Dredged Material from the Calcasieu Ship Channel	$146,057,904	$54,639,970
3a1 – Beneficial use of Dredged Material from the Calcasieu Ship Channel	$66,576,486	$17,835,142
124a – Marsh Restoration at Mud Lake	$54,178,577	$15,098,977
124b – Marsh Restoration at Mud Lake	$21,794,722	$4,716,678
124c – Marsh Restoration at Mud Lake	$65,163,555	$29,566,130

Measure	First Cost	OMRR&R
124d – Marsh Restoration at Mud Lake	$13,826,622	$10,360,810
5a – Holly Beach Shoreline Stabilization	$43,644,018	$17,251,455
510a – Blue Buck Ridge Restoration	$91,062	
510b – Hackberry Ridge Restoration	$25,721	
510d – Front Ridge Restoration	$79,994	
604 – Sabine Oyster Reef*	0	
MERMENTAU		
13 – Structure on Little Pecan Bayou	$4,005,000	$790,000
47a1 – Marsh Restoration South of Highway 82	$32,698,038	$19,346,537
47a2 – Marsh Restoration South of Highway 82	$73,725,657	$22,719,765
47c1 – Marsh Restoration South of Highway 82	$70,993,097	$19,113,914
47c2 – Marsh Restoration South of Highway 82	$29,083,323	$10,897,564
127c1 – Marsh Restoration at East Pecan Island	$105,383,774	$28,038,625
127c2 – Marsh Restoration at East Pecan Island	$123,443,158	$27,417,711
127c3 – Marsh Restoration at East Pecan Island	$84,352,747	$9,097,015
306a1 – Rainey Marsh Restoration	$97,159,850	$45,851,023
306a2 – Rainey Marsh Restoration	$168,410,323	$64,215,103
6b1 – Shoreline Restoration: Calcasieu River to Freshwater Bayou	$104,780,685	$16,139,775
6b2 – Shoreline Restoration: Calcasieu River to Freshwater Bayou	$76,571,740	$11,976,464
6b3 – Shoreline Restoration: Calcasieu River to Freshwater Bayou	$68,096,051	$10,704,819
16b – Fortify Spoil Banks at GIWW and Freshwater Bayou	$67,773,307	$26,125,453
99a – Gulf Shoreline Restoration: Freshwater Bayou to South Point/Marsh Island	$12,198,599	$3,401,744
113b2 – Shoreline Stabilization of Vermilion	$35,104,143	$13,385,533
509c – Bill Ridge Restoration	$5,409	
416 – Grand Chenier Ridge	$44,114	

- There is no cost associated with measure 604, the Sabine Oyster Reef, as it consists of prevention of harvesting of oysters on existing reefs.

These costs for the measures contained in each NER alternative in the focused array were combined to develop total costs for each alternative analyzed. Total costs for alternatives and details about the analysis can be found in the Main Report.

The Total Costs shown in Chapter 4 of the Main Report are developed as follows:

1. Measures for NER alternatives are listed in Table 2 of this report. Each Measure has an alpha-numeric identifier which can be used to trace cost development in estimate files.
2. Marsh and Shoreline construction costs plus contingency are developed in Excel files from the State of LA. Each file has the corresponding alpha-numeric "Measure" identifier in the file name.
3. Hydrology and Salinity Control Structure costs are developed in "2012 MP Costs for SW Coastal HandS Control Measures.pdf".
4. Total construction cost plus contingency per Measure is shown in Table 67 of Engineering Report. These costs per Measure would then be used to determine the various NER alternatives based on Table 2.
5. Construction costs plus other account features (PED, Real Estate, Adaptive Management, Construction Management) are added in Table 69 to develop a Total First cost.

9.3 NER AND NED CURRENT ESTIMATES

For the current information on cost, refer to the "Cost Engineering Annex 1".

9.3.1 Current OMRR&R Costs

OMRR&R for the NED Plan will be minimal. The Non-Federal Sponsor (NFS), as a part of its obligations for the NED feature, is required to prepare a Floodplain Management Plan in coordination with the U.S. Army Corps of Engineers (USACE) to maintain the integrity of the project; to issue annual notifications to the public regarding the risk reduction measures that have been implemented; to comply with the requirements of Section 402 of the Water Resources Development Act of 1986, as amended; to conduct regular periodic inspections of the properties upon which the nonstructural measures have been implemented in order to assure continuing compliance that the terms of the non-structural agreements executed by the owners and others; and to prevent obstructions or encroachments on the project, including prescribing and enforcing regulations to prevent any such obstructions or encroachments that might reduce the level of risk reduction provided by the NED project or that hinder or interfere with the operation and maintenance of the project and the project's proper function. Primary responsibility and cost for the OMRR&R of the non-structural measures rests with the owner of the property.

The current OMRR&R estimates for the restoration measures included in the NER RP are as follows. The first costs include 39% contingency, and the OMRR&R costs include 35% contingency.

Table 69 –NER Recommended Plan Feature Estimates

Measure	First Cost	Total OMRR&R
CALCASIEU		
3a1 – Beneficial use of Dredged Material from the Calcasieu Ship Channel	$66,593,748	$17,759,470
3c1 – Beneficial use of Dredged Material from the Calcasieu Ship Channel (adjacent to a CWPPRA project and to be constructed by USFWS)	$168,194,346	$70,984,253
124c – Marsh Restoration at Mud Lake (adjacent to a CWPPRA project)	$112,219,520	$24,680,885
124d – Marsh Restoration at Mud Lake (to be constructed by USFWS)	$28,882,160	$17,636,205
5a – Holly Beach Shoreline Stabilization	$144,044,021	$28,033,962
MERMENTAU		
47a1 – Marsh Restoration South of Highway 82	$105,234,982	$21,239,680
47a2 – Marsh Restoration South of Highway 82	$97,348,440	$17,585,890
47c1 – Marsh Restoration South of Highway 82	$95,372,834	$14,981,607
127c3 – Marsh Restoration at East Pecan Island	$61,662,041	$15,683,451
306a1 – Rainey Marsh Restoration	$75,885,692	$37,551,555
6b1 – Shoreline Restoration: Calcasieu River to Freshwater Bayou	$198,480,921	$15,839,345
6b2 – Shoreline Restoration: Calcasieu River to Freshwater Bayou	$145,876,561	$11,343,672
6b3 – Shoreline Restoration: Calcasieu River to Freshwater Bayou	$115,270,890	$9,041,421
16b – Fortify Spoil Banks at GIWW and Freshwater Bayou	$36,018,600	$9,661,872
Reforestation	$2,434,344	N/A

10.0 CONSTRUCTION SCHEDULE

10.1 NED FOCUSED ARRAY PRIOR TO MARCH 2015

For all alternatives in the Recommended Plan it was assumed that Engineering and Design (E&D) and Real Estate acquisition would start in 2017 and construction would begin in 2019. Structures that have been identified as preliminarily eligible as part of the NED RP are located across the 4,700 mile, three-parish study area. In order to effectively implement the NED RP, clusters of eligible structures that represent the highest risk for hurricane storm surge damages (i.e. those with a FFE below the 10-year stage) would be identified and prioritized for construction. Individual structures would be addressed based on a ranking of risk from highest to lowest within the cluster. The ranking of individual structures would be revisited as elevation work is completed, as additional funding is distributed, and as new clusters are identified. Addressing groups of structures within a small geographic area would be more cost-

effective, efficient, and would also allow for a more strategic methodology for applying nonstructural measures to at-risk structures. Additional work on this process would occur during the design phase of the Project.

Any structure scheduling or prioritization will be subject to the availability of Federal funds. The locations for scheduling or prioritizing the implementation of nonstructural work will be determined during PED but will be fully assessed for implementing the nonstructural plan in an efficient and cost-effective manner. Some of the methods for scheduling or prioritizing nonstructural work that will be considered as part of the prioritization process; however, additional methods of scheduling or prioritizing such work will also be considered for the priority locations to implement the nonstructural plan.

10.2 NER CONSTRUCTION AND MAINTENANCE

NER RP features were categorized into three tiers whereby Tier I features would be constructed before Tier II, and Tier II features constructed before Tier III. Tier I features may be constructed simultaneously because they would not affect the construction of any nearby Tier I RP feature. Shoreline protection features would be constructed prior to marsh restoration features in an effort to better protect the more storm-vulnerable marsh restoration features. This approach contributes to the sustainability of the marsh restoration features. Tier II RP features were so categorized because they utilize the same borrow or staging area, and/or construction of these features would potentially interfere with construction of a Tier I RP feature. Tier II RP features would be constructed contemporaneously as the construction of any one of these features would not affect any other feature within this grouping. Tier III RP features were so categorized because they would utilize the same borrow or staging area, and/or interfered with construction of a Tier II feature, and/or interfered with an existing mitigation project. Tier III features would be constructed contemporaneously if they would not affect construction of the other features within this grouping. In categorizing features, it was assumed that all construction funds would be available, multiple construction contracts could be let at one time, and there is an adequate supply of all materials to facilitate construction. More detailed design and analysis would be undertaken during the PED phase.

Tier I Projects:

- Holly Beach Shoreline Stabilization – Breakwaters (5a)
- Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou (6b1)
- Fortify Spoil Banks of the GIWW and Freshwater Bayou (16bSE)
- Fortify Spoil Banks of the GIWW and Freshwater Bayou (16bNE)
- Fortify Spoil Banks of the GIWW and Freshwater Bayou (16bW)
- Marsh Restoration at Mud Lake (124d)[1]
- Marsh Restoration at Pecan Island (127c3)
- Chenier Ridges: Grand Chenier Ridge (416)[2]
- Restore Bill Ridge (509c)[2]
- Chenier Ridges: Cheniere au Tigre (509d)[2]
- Restore Blue Buck Ridge (510a)[2]
- Restore Hackberry Ridge (510b)[2]
- Restore Front Ridge (510d)[2]

Tier II Projects:

- Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou (6b2)
- Marsh Restoration at Mud Lake (124c)

- Rainey Marsh Restoration Southwest Portion (Christian Marsh) (306a1)

Tier III Projects:
- Beneficial Use of Dredged Material from the Calcasieu Ship Channel (3a1)
- Beneficial Use of Dredged Material from the Calcasieu Ship Channel (3c1)[1]
- Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou (6b3)
- Marsh Restoration Using Dredged Material South of Highway 82 (47a1)
- Marsh Restoration Using Dredged Material South of Highway 82 (47a2)
- Marsh Restoration Using Dredged Material South of Highway 82 (47c1)

Recommended for Further Study:
- Calcasieu Ship Channel Salinity Control Structure
- Cameron-Creole Spillway Structure

[1]- *USFWS should seek authorization and appropriation for these projects. Since the USACE will have no control over how USFWS approaches this recommendation, the tiered construction phases represent the idealized sequencing of implementation.*

[2]- *Individual features that comprise the chenier reforestation measure*

10.2.1 Marsh Restoration

The construction period for marsh restoration measures was assumed to range from 1 to 4 years. Construction was assumed to start in 2022. There would be one renourishment event that would last from .5 to 1.5 years and would start generally in Year 30 post-construction of the individual feature. Details on the marsh restoration construction and maintenance events can be found in Chapter 2, Table 2-17.

10.2.2 Shoreline Protection/Stabilization

Construction of shoreline protection features ranged from 1 to 3 years beginning in 2022. Maintenance events would be one year in duration and would occur in Years 15 and 25, though not all shoreline features require two maintenance cycles. Details on the shoreline construction and maintenance events can be found in Chapter 2, Table 2-17.

10.2.3 Chenier Reforestation

Chenier reforestation would begin in 2022 and would extend from one to two years. Details on the chenier reforestation feature can be found in Chapter 2, Table 2-17.

10.3 FINAL NER AND NED RECOMMENDED PLANS

For the NER RP, individual feature schedules were not fully developed because, due to the funding constraints assumed, all schedules (program and individual projects) are totally funding driven. Project Management is assuming approximately $50M/year for both features (NER and NED) of the Southwest Coastal Louisiana Study (SWC). Budget justification sheets in Annex 1 of this Appendix have the feasibility study completion and a Chief's report occurring in 2016, a gap period in 2017, PED initiation in 2018, and construction start in mid to late 2019. Based on an October 1, 2019 construction start and approximate $25-$50M annual funding for the NER features, we will use a **50 year NER program schedule** based on the base construction cost of $2,491 million (Mii total excluding Acct 06 AM&M $62,807,000). After completion of the NED plan, more funds could be directed to the NER and shorten the project implementation duration. Fact sheets describing

each of the restoration features along with typical drawings for marsh restoration and shoreline protection/stabilization, can be found in Appendix K.

For the NED RP, individual feature schedules were not fully developed because, due to the funding constraints assumed, all schedules (program and individual projects) are totally funding driven. Project Management is assuming approximately $50M/year for both features (NER and NED) of the Southwest Coastal Louisiana Study (SWC). Budget justification sheets have the feasibility study completion and a Chief's report occurring in 2016, a gap period 2017, PED initiation in 2018, and construction start in mid to late 2019. Based on an October 1, 2019 construction start and approximate $25-$50M annual funding for the NED features, we will use a **25 year NED program schedule** based on the base construction cost of $906 million. This schedule allows for almost 100% participation which is unlikely.

For the latest construction schedule, refer to the "Cost Engineering Annex".

11.0 RISK AND UNCERTAINTY

11.1 NED

Because of the nature of the analysis performed there are several areas of risk and uncertainty involved in the development of the NED alternative plan feature cost. Some of these are listed below.

1. There are inherent risks and uncertainties in the use of any model. In addition the required levee elevations were developed based on the use of the without project ADCIRC runs. Benefit estimates were also based on the without project ADCIRC stage data.
2. The ADCIRC and HEC-RAS models were run independently and although the combined effects were accounted for in the stage-frequency analysis the method used may result in under prediction of the additive effects of surge and rainfall flooding.
3. There are uncertainties in the development of RSLR rate estimates. Actual RSLR may be higher or lower than the rates used in modeling and damage and benefits analysis.
4. Induced flooding: Since no with-project ADCIRC data was available no estimates of induced flooding were developed.
5. Foundation Design: No site specific boring data was available for this effort. Existing data in the vicinity was used to develop levee designs. One levee design was done for use in all alternatives. As most of the study area has uniformly good soil foundation conditions this is not considered a high risk.
6. Structures: An effort was made to identify the major structures that would be required but it is possible that more structures would be needed.
7. Mitigation requirements not required.
8. A conservative estimate was assumed for Real Estate Requirements for all levee alternatives.
9. Real Estate costs for borrow have not been developed.
10. Relocations were added as 2% of the construction costs.
11. Pumping requirements were developed based on work done for the LACPR project. Pumping requirements used were considered minimal amounts. Actual requirements may be different. Additional drainage work may be needed to get the water to the pumping stations.
12. Levee alignments were developed using existing mapping. These preliminary alignments were used to develop cost estimates. Alignments may need to be shifted to avoid existing structures or for other reasons.
13. Quantities developed assume levee for the entirety of each alignment. There is a possibility that some reaches of floodwall may be needed in more developed areas such as Lake Charles.
14. Several contractor-furnished borrow sites have been identified in the study area. In addition, borrow is assumed to be available within a 25 mile radius. Borrow may be available at a closer distance.
15. No costs for road gates/ramps were included in the estimate.
16. Risk and uncertainty for features of the nonstructural plan is discussed in the Economics Appendix.
17. For the Cost and Schedule Risk Analysis (CSRA), refer to the "Cost Engineering Annex".

11.2 NER

Because of the nature of the analysis performed there are several areas of risk and uncertainty involved in the development of the NER alternative cost and benefits. Some of these are listed below.

1. No site specific surveys were taken and marsh fill quantities and shoreline protection quantities were based on estimates of depth using existing data.

2. No site specific borings were taken and settlement of shoreline protection and marsh restoration/nourishment measures was estimated based on available data.
3. Site specific borrow areas have been identified but testing of the borrow areas for suitability and availability of borrow material have not been done. It was assumed that suitable material would be available within the distance used for cost estimating. See Appendix K for proposed borrow sites for marsh restoration features.
4. It was assumed that pipeline access would be available for marsh restoration/nourishment features.
5. Uncertainties in the State Master Plan and MIKE Flood modeling done to evaluate the effects of the restoration features.
6. For the Cost and Schedule Risk Analysis (CSRA), refer to the "Cost Engineering Annex".

12.0 REFERENCES

TAW, 2002. Wave Run-up and Overtopping at Dikes, Technical Report. Technical Advisory Committee on Flood Defence, The Netherlands. Delft, 2002.

USACE, 2009. US Army Corps of Engineers, Louisiana Coastal Protection and Restoration Final Technical Report and Comment Addendum, August 2009.

USACE, 2014. Draft Calcasieu Lock Feasibility Study with Integrated Environmental Impact Statement, September 2013.

Coastal Protection and Restoration Authority of Louisiana, 2012. Louisiana's Comprehensive Master Plan for a Sustainable Coast, May 2012.

Meselhe, E. A., Michot, B., Chen, T., 2013a. Improvement, Utilization, and Assessment of Chenier Plain models for the Southwest Coastal Louisiana Feasibility Study: Extension of the Chenier Plain Circulation Model. Prepared for: Coastal Protection and Restoration Authority, Louisiana. Center for Louisiana Inland Water Studies, University of Louisiana at Lafayette. January 2013

USACE, 2012. Hurricane and Storm Damage Risk Reduction System Design Guidelines, June 2012.

SOUTHWEST COASTAL LOUISIANA

FEASIBILITY STUDY

December 2015

Version: October 27, 2015

COST ENGINEERING ANNEX

Table of Contents

Cost Estimate 3
Section 1. Cost Estimate development 3
Section 2. Estimate Structure: 3
Section 3. Quantity Development 5
Section 4. Bid competition: 6
Section 5. Contract Acquisition Strategy: 6
Section 6. Labor Shortages: 6
Section 7. Labor Rates: 6
Section 8. Materials: 6
Section 9. Equipment: 6
Section 10. Crews: 7
Section 11. Relocation Cost: 7
Section 12. Mobilization: 7
Section 13. Field Office Overhead: 7
Section 14. Home Office Overhead: 8
Section 15. Taxes: 8
Section 16. E&D and S&A: 8
Section 17. Contingencies: 9
Section 18. Escalation: 9
Section 19. HTRW: 9
Total Project Cost Summary (TPCS) 10
MII Cost Estimates 14
Project Construction Schedule 35
Cost and Schedule Risk Analysis (CSRA) 37
Section 1. NER: 38
Section 2. NED: 40

Cost Estimate

Section 1. Cost Estimate development

a) The project cost consists of a National Ecosystem Restoration NER (dredging/marsh creation, rock, and planting) feature and a National Economic Development NED (non-structural – structure raising and floodproofing) feature. The project cost estimates for the NER and NED features were developed in CEDEP and MCACES MII cost estimating software and used the standard approaches for a feasibility estimate structure regarding labor, equipment, materials, crews, unit prices, quotes, sub- and prime contractor markups. This philosophy was taken wherever practical within the time constraints. The project partner is the local sponsor (LS), State of Louisiana CPRA. Some of the cost estimates were prepared by the LS and/or its A/E, ARCADIS U.S. Inc. due to work in-kind arrangements and due to limited USACE funds and time following 3x3x3x3 study guidance. Some costs were developed or supplemented with estimating information from other sources such as quotes, bid data, and A-E estimates. The dredging costs developed by CPRA used their in-house, proprietary dredge estimating program and correlation with their annual coastal restoration/marsh creation/shoreline protection program contracts. Based on previous MVN experience with results, CPRA outputs are consistent with USACE MVN in-house production and overall costs. The costs provided by the LS are directly applicable to the features of work either by direct estimate or reference to recent bid work for adjacent similar features. The intent was to provide or convey "fair and reasonable" estimates that depict the local market conditions. The estimates assume a typical application of subcontractors. Given the long time over which this project/program is to be constructed and the unknown economic status during that time, demands from non-governmental civil works projects were not considered to dampen the competition and increase prices.

Section 2. Estimate Structure:

a) The NER estimate is structured to reflect the projects performed and has been subdivided by USACE feature codes.

b) The NED estimate is structured to develop the unit costs in Mii representing the standard type non-structural work being performed. The Mii unit cost for the average structure of each type were then applied to the voluminous quantities of structures to be raised or floodproofed in an Excel summary spreadsheet that is transferred to the TPCS.

   All work activities and corresponding levels of effort are based upon conversations with Davies Shoring, LLC and Orleans Shoring on 23 June 2015 and 24 June 2015, respectively.

   Residential Elevation Projects were group according to the following categories:

Mobile Home, Low Lift - This includes manufactured homes raised a minimum of 2'-6" and a maximum of 6'-0" above the lowest adjacent grade. For the purpose of this estimate these are assumed to be 576 sq.ft. single-wide sectional trailers.

Mobile Home, High Lift - This includes manufactured homes raised a minimum of 6'-6" and a maximum of 13'-0" above the lowest adjacent grade. For the purpose of this estimate these are assumed to be 576 sq.ft. single-wide sectional trailers.

Pier-supported Frame House, Low Lift - This includes wood frame houses built on a pier and beam foundation raised a minimum of 2'-6" and a maximum of 6'-0" above the lowest adjacent grade. For the purpose of this estimate single story are assumed to be 1,479 sq.ft. and two-story homes are assumed to be 1,327.5 sq.ft.; footprint square footage.

Pier-supported Frame House, High Lift - This includes wood frame houses built on a pier and beam foundation raised a minimum of 6'-6" and a maximum of 13-0" above the lowest adjacent grade. For the purpose of this estimate single story are assumed to be 1,479 sq.ft. and two-story homes are assumed to be 1,327.5 sq.ft.; footprint square footage.

Slab-supported Frame House, Low Lift - This includes wood frame houses built on a concrete slab raised a minimum of 2'-6" and a maximum of 6-0" above the lowest adjacent grade. For the purpose of this estimate single story are assumed to be 2,031 sq.ft. and two-story homes are assumed to be 1,787.5 sq.ft.; footprint square footage.

Slab-supported Frame House, High Lift - This includes wood frame houses built on a concrete slab raised a minimum of 6'-6" and a maximum of 13-0" above the lowest adjacent grade. For the purpose of this estimate single story are assumed to be 2,031 sq.ft. and two-story homes are assumed to be 1,787.5 sq.ft.; footprint square footage.

The work process for Mobile Homes and Pier-supported frame houses is as follows:

1. Complete program application.
2. Government prepares Guide Plans and Specifications, and Estimate.
3. Home owner selects contractor and enters into direct agreement.
3. Contractor obtains all necessary permits and Mobilize to site.
4. Residents temporarily relocate.
5. Disconnect utilities.
6. Place Jacks and Cribbing.
7. Insert Steels.
8. Elevate Structure.
9. Install Piers.
10. Set Structure on Piers.
11. Anchor Structure.
12. For High Lifts, pour grade beams between piers and slab-on-grade.
13. Reconnect Utilities.

14. For Low Lifts, install Perimeter Enclosure.
15. Install elevated landings and stairs.
16. Demobilization and Closeout.

The work process for Slab-supported houses is as follows:

1. Complete program application.
2. Government prepares Guide Plans and Specifications, and Estimate.
3. Home owner selects contractor and enters into direct agreement.
3. Contractor obtains all necessary permits and Mobilize to site.
4. Residents temporarily relocate.
5. Disconnect utilities.
6. Excavate at perimeter and tunnels under slab on 8' centers.
7. Place Jacks and Cribbing.
8. Push segmented piles to refusal.
8. Elevate Structure.
9. Install Piers.
11. Anchor Structure.
12. For lower lifts, demo existing driveway and install new driveway adjusted to garage floor elevation.
13. For High Lifts, pour grade beams between piers and slab-on-grade.
14. Reconnect Utilities.
15. For Low Lifts, install Perimeter Enclosure.
16. Install elevated landings and stairs.
17. Demobilization and Closeout.

Section 3. Quantity Development

a) NER - Designs are based on similar work in the area and incorporate lessons learned and include allowances for settlement and losses. Marsh creation site designs and quantities are conservatively based on similar projects in each area. Rock structures are continuations of existing structures and quantities are based on the existing designs.

b) NED - Field teams visually inspected each structure that was identified on a map based on x,y coordinates assigned to structures appearing on aerial photos. The team estimated the number of square feet for the total structure, along with other characteristics, such as one or two-story, slab or pier foundations, etc. An "average structure" was calculated for each type (one or two-story, slab or pier foundations, mobile homes) and this "average structure" was used to develop the structure elevation costs for each type in Mii. Similar averages were used for non-residential structures for floodproofing and warehouses for berms.

Section 4. Bid competition:

a) NER and NED: It is assumed that there will not be an economically saturated market and that bidding competition will be present.

Section 5. Contract Acquisition Strategy:

a) NER: It is assumed that the contract acquisition strategy will be similar to past projects of this type which are predominately large, unrestricted design/bid/build contracts. There is no declared contract acquisition plan/types at this time.

b) NED: There is no declared contract acquisition plan/type at this time and it is anticipated that the Federal Government will not issue individual contracts directly. Any contracts would be directly between property owners and contractors. The base estimate assumes open and competitive bidding which is the traditionally employed contract procurement method for this type activity.

Section 6. Labor Shortages:

a) It is assumed there will be a normal labor market.

Section 7. Labor Rates:

a) Local labor market wages are above the local Davis-Bacon Wage Determination and actual rates have been used. This is based upon local information and payroll data received from the New Orleans District Construction Representatives and estimators with experiences in past years.

Section 8. Materials:

a) Cost quotes are used on major construction items when available, although quantities per site are small relatively speaking. Recent quotes may include concrete, steel and concrete piling, rock, gravel and sand. Assumptions include:
   i) Materials will be purchased as part of the construction contract. The estimate does not anticipate government furnished materials. Prices include delivery of materials.
   ii) Concrete - will be purchased from commercial batch plants.
   iii) Borrow Material and Haul - Specific borrow sources have not been identified so a conservative estimated haul distance was used where required. All borrow material is assumed contractor furnished due to the small quantities.

Section 9. Equipment:

a) Equipment rates used are primarily based from the latest USACE EP-1110-1-8, Region III.

b) For specialty equipment required, industry practice was assumed and followed in the cost estimates. Examples: NER - rental quotes were used for marsh excavators in Mii. NED - structure jacking system quotes from Jahns Structure Jacking Systems Inc. were entered in USACE CheckRate spreadsheet to develop an hourly equipment rate for use in Mii.

Section 10. Crews:

a) NER: Major crew and productivity rates were developed and studied by senior USACE estimators or specialists familiar with the type of work. Dredging and rock work is typical to the New Orleans District. The crews and productivities were checked by local MVN estimators, discussions with contractors and comparisons with historical cost data. Most crew work hours are assumed to be 10 hrs 6 days/wk which is typical to the area. Marine based bucket excavation and dredging operations are assumed to work 2-12 hours shifts 7 days / week.

b) NED: Major crew and productivity rates were developed and studied by ARCADIS engineers in conjunction with local professionals familiar with the type of work. All of the work is typical to the Louisiana area. The crews and productivities were checked by local MVN senior cost engineers, discussions with contractors, and comparisons with historical cost data. Crew work hours are assumed to be 8 hrs 5 days/wk which is typical to the area and type of work.

Section 11. Relocation Cost:

a) Not applicable.

Section 12. Mobilization:

a) Contractor mobilization and demobilization are based on the assumption that most of the contractors will be coming from within the Gulf Coast/Southern region. Typical equipment is required for the NER dredging and rock work. Minimal equipment is required for the NED non-structural work.

Section 13. Field Office Overhead:

a) NER: Included in Mii / CEDEP cost estimates.

b) NED: Included in Mii cost estimates.

Section 14. Home Office Overhead:

a) NER: Included in Mii cost estimates.

b) NED: Included in Mii cost estimates.

Section 15. Taxes:

a) Local taxes will be applied, using an average between the parishes that contain the work. Reference the LA parish tax rate website: http://www.laota.com/pta.htm

Section 16. E&D and S&A:

a) USACE costs to manage design (PED) and construction (S&A) are based on New Orleans District Programmatic Cost Estimate guidance:

i) NER:
(1) Planning, Engineering & Design (PED): The PED cost includes such costs as project management, engineering, planning, designs, investigations, studies, reviews, value engineering, contracting, and engineering during construction (EDC). Historically New Orleans District has used a 12% rate for the E&D portion plus small amounts for other tasks, applied against the estimated construction costs.

(2) Supervision & Administration (S&A): Historically, New Orleans District used a range from 5% to 15% depending on project size and type applied against the estimated construction costs. A 10% rate was used for the S&A portion.

ii) NED:
(1) Planning, Engineering & Design (PED): Itemized line item costs are included in the direct costs for specific implementation/administrative steps (Gov't and contractor) of each of the projects (non-Real Estate portion – Real Estate related costs covered under Acct 01). Additional PED costs have been included in the 30 Acct PED for more overall programmatic efforts such as Project Management, Planning & Environmental Compliance, Contracting, Planning during Construction, and Project Operations.

(2) Supervision & Administration (S&A): Itemized line item costs are included in the direct costs for specific implementation/administrative steps for the Government administration of each of the projects (non-Real Estate portion – Real Estate related costs covered under Acct 01). Additional more general S&A costs have been included in the 31 Acct S&A for more overall programmatic

Construction Management efforts. It is anticipated that construction actions will be directly between building owner and the contractor they select.

Section 17. Contingencies:

a) Contingencies were developed using the USACE Cost and Schedule Risk Analysis (CSRA) process and the Crystal Ball software that evaluates schedule and cost related risks. A separate CSRA was developed for the NED and NER plans. See summaries in Cost Schedule Risk Analysis (CSRA) section.

Section 18. Escalation:

a) Escalation used in the Mii and TPCS is based upon the latest US Army Corps of Engineers Engineering Manual (EM) 1110-2-1304 Civil Works Construction Cost Index System (CWCCIS).

Section 19. HTRW:

a) The estimates include no costs for any potential Hazardous, Toxic, and Radioactive Waste (HTRW). HTRW issues are not expected and project features could be revised to avoid. HTRW will be avoided at all costs.

Total Project Cost Summary (TPCS)

****** TOTAL PROJECT COST SUMMARY ******

Printed:10/27/2015
Page 1 of 3

PROJECT: Southwest Coastal (SWC) Feasibility Study - NER + NED
PROJECT NO: P2 135700
LOCATION: Southwest Louisiana

DISTRICT: New Orleans District **PREPARED:** 10/23/2015
POC: CHIEF, COST ENGINEERING, Thomas D. Murphy, P.E.

This Estimate reflects the scope and schedule in report: Southwest Coastal (SWC) Feasibility Study - NER + NED

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
						Program Year (Budget EC):				2016					
						Effective Price Level Date:				1 OCT 15					
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Spent Thru: 10/1/2015 ($K)	TOTAL FIRST COST ($K)	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	B	C	D	E	F	G	H	I	J		K	L	M	N	O
06	FISH & WILDLIFE FACILITIES	$62,807	$23,239	37.0%	$86,046	0.0%	$62,807	$23,239	$86,046	$0	$86,046	76.0%	$110,556	$40,906	$151,461
09	CHANNELS & CANALS	$26,637	$9,856	37.0%	$36,493	0.0%	$26,637	$9,856	$36,493	$0	$36,493	76.0%	$46,887	$17,348	$64,235
11	LEVEES & FLOODWALLS	$586,543	$202,357	34.5%	$788,900	0.0%	$586,543	$202,357	$788,900	$0	$788,900	37.4%	$806,003	$278,071	$1,084,074
15	FLOODWAY CONTROL & DIVERSION STRU	$630,422	$233,256	37.0%	$863,678	0.0%	$630,422	$233,256	$863,678	$0	$863,678	76.0%	$1,109,696	$410,587	$1,520,283
16	BANK STABILIZATION	$560,182	$207,267	37.0%	$767,449	0.0%	$560,182	$207,267	$767,449	$0	$767,449	76.0%	$986,057	$364,841	$1,350,898
19	BUILDINGS, GROUNDS & UTILITIES	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	CONSTRUCTION ESTIMATE TOTALS:	$1,866,591	$675,975		$2,542,566	0.0%	$1,866,591	$675,975	$2,542,566	$0	$2,542,566	64.0%	$3,059,198	$1,111,753	$4,170,951
01	LANDS AND DAMAGES	$58,321	$14,581	25.0%	$72,902	0.0%	$58,321	$14,581	$72,902	$0	$72,902	43.2%	$83,518	$20,881	$104,399
30	PLANNING, ENGINEERING & DESIGN	$336,535	$123,785	36.8%	$460,320	0.0%	$336,535	$123,785	$460,320	$0	$460,320	252.6%	$1,185,791	$437,295	$1,623,086
31	CONSTRUCTION MANAGEMENT	$184,537	$67,985	36.8%	$252,522	0.0%	$184,537	$67,985	$252,522	$0	$252,522	256.5%	$657,601	$242,733	$900,334
	PROJECT COST TOTALS:	$2,445,984	$882,326	36.1%	$3,328,310		$2,445,984	$882,326	$3,328,310	$0	**$3,328,310**	104.3%	$4,986,108	$1,812,662	$6,798,770

_____ **CHIEF, COST ENGINEERING, Thomas D. Murphy, P.E.**

_____ **PROJECT MANAGER, Darrel Broussard**

_____ **CHIEF, REAL ESTATE, Linda Labure**

_____ **CHIEF, PLANNING, Troy Constance**

_____ **Acting CHIEF, ENGINEERING, John Bivona, P.E.**

_____ **CHIEF, OPERATIONS, Mike Park**

_____ **CHIEF, CONSTRUCTION, Stuart Waits, P.E.**

_____ **CHIEF, CONTRACTING, Tim Black**

_____ **CHIEF, PM-PB, xxxx**

_____ **CHIEF, DPM, Mark Wingate**

ESTIMATED FEDERAL COST: **65%** **$4,419,200**
ESTIMATED NON-FEDERAL COST: **35%** **$2,379,569**

ESTIMATED TOTAL PROJECT COST: **$6,798,770**

Filename: TPCS SWC NER + NED 102315 MCX CHECK.xlsx
TPCS

****** TOTAL PROJECT COST SUMMARY ******

****** CONTRACT COST SUMMARY ******

PROJECT: Southwest Coastal (SWC) Feasibility Study - NER + NED
LOCATION: Southwest Louisiana
This Estimate reflects the scope and schedule in report; Southwest Coastal (SWC) Feasibility Study - NER + NED

DISTRICT: New Orleans District PREPARED: 10/23/2015
POC: CHIEF, COST ENGINEERING, Thomas D. Murphy, P.E.

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 28-Sep-15 Effective Price Level: 1-Oct-15				Program Year (Budget EC): 2016 Effective Price Level Date: 1 OCT 15								
				RISK BASED										
WBS NUMBER A	Civil Works Feature & Sub-Feature Description B	COST ($K) C	CNTG ($K) D	CNTG (%) E	TOTAL ($K) F	ESC (%) G	COST ($K) H	CNTG ($K) I	TOTAL ($K) J	Mid-Point Date P	INFLATED (%) L	COST ($K) M	CNTG ($K) N	FULL ($K) O
	NER plan													
06	FISH & WILDLIFE FACILITIES	$62,807	$23,239	37.0%	$86,046	0.0%	$62,807	$23,239	$86,046	2044Q4	76.0%	$110,556	$40,906	$151,461
09	CHANNELS & CANALS	$26,637	$9,856	37.0%	$36,493	0.0%	$26,637	$9,856	$36,493	2044Q4	76.0%	$46,887	$17,348	$64,235
11	LEVEES & FLOODWALLS		$0		$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
15	FLOODWAY CONTROL & DIVERSION STRU	$630,422	$233,256	37.0%	$863,678	0.0%	$630,422	$233,256	$863,678	2044Q4	76.0%	$1,109,698	$410,587	$1,520,283
16	BANK STABILIZATION	$560,182	$207,267	37.0%	$767,449	0.0%	$560,182	$207,267	$767,449	2044Q4	76.0%	$986,057	$364,841	$1,350,898
19	BUILDINGS, GROUNDS & UTILITIES		$0		$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONSTRUCTION ESTIMATE TOTALS:	$1,280,048	$473,618	37.0%	**$1,753,666**		$1,280,048	$473,618	$1,753,666			$2,253,195	$833,682	$3,086,877
01	LANDS AND DAMAGES	$8,745	$2,187	25.0%	$10,932	0.0%	$8,745	$2,187	$10,932	2044Q4	76.0%	$15,393	$3,850	$19,243
30	PLANNING, ENGINEERING & DESIGN													
2.0%	Project Management	$25,601	$9,472	37.0%	$35,073	0.0%	$25,601	$9,472	$35,073	2044Q4	267.1%	$93,991	$34,777	$128,768
2.0%	Planning & Environmental Compliance	$25,601	$9,472	37.0%	$35,073	0.0%	$25,601	$9,472	$35,073	2044Q4	267.1%	$93,991	$34,777	$128,768
12.0%	Engineering & Design	$153,606	$56,834	37.0%	$210,440	0.0%	$153,606	$56,834	$210,440	2044Q4	267.1%	$563,946	$208,660	$772,606
1.0%	Reviews, ATRs, IEPRs, VE	$12,800	$4,736	37.0%	$17,536	0.0%	$12,800	$4,736	$17,536	2044Q4	267.1%	$46,994	$17,388	$64,381
1.0%	Life Cycle Updates (cost, schedule, risks)	$12,800	$4,736	37.0%	$17,536	0.0%	$12,800	$4,736	$17,536	2044Q4	267.1%	$46,994	$17,388	$64,381
1.0%	Contracting & Reprographics	$12,800	$4,736	37.0%	$17,536	0.0%	$12,800	$4,736	$17,536	2044Q4	267.1%	$46,994	$17,388	$64,381
2.0%	Engineering During Construction	$25,601	$9,472	37.0%	$35,073	0.0%	$25,601	$9,472	$35,073	2044Q4	267.1%	$93,991	$34,777	$128,768
2.0%	Planning During Construction	$25,601	$9,472	37.0%	$35,073	0.0%	$25,601	$9,472	$35,073	2044Q4	267.1%	$93,991	$34,777	$128,768
1.0%	Project Operations	$12,800	$4,736	37.0%	$17,536	0.0%	$12,800	$4,736	$17,536	2044Q4	267.1%	$46,994	$17,388	$64,381
31	CONSTRUCTION MANAGEMENT													
10.0%	Construction Management	$128,005	$47,362	37.0%	$175,367	0.0%	$128,005	$47,362	$175,367	2044Q4	267.1%	$469,955	$173,883	$643,838
1.0%	Project Operation:	$12,800	$4,736	37.0%	$17,536	0.0%	$12,800	$4,736	$17,536	2044Q4	267.1%	$46,994	$17,388	$64,381
2.5%	Project Management	$32,001	$11,840	37.0%	$43,841	0.0%	$32,001	$11,840	$43,841	2044Q4	267.1%	$117,488	$43,470	$160,958
	CONTRACT COST TOTALS:	$1,768,809	$653,411		$2,422,220		$1,768,809	$653,411	$2,422,220			$4,030,909	$1,489,590	$5,520,499

Filename: TPCS SWC NER + NED 102315 MCX CHECK.xlsx
TPCS

****** TOTAL PROJECT COST SUMMARY ******

****** CONTRACT COST SUMMARY ******

PROJECT: Southwest Coastal (SWC) Feasibility Study - NER + NED
LOCATION: Southwest Louisiana
This Estimate reflects the scope and schedule in report; Southwest Coastal (SWC) Feasibility Study - NER + NED

DISTRICT: New Orleans District
POC: CHIEF, COST ENGINEERING, Thomas D. Murphy, P.E.

PREPARED: 10/23/2015

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 28-Sep-15 Effective Price Level: 1-Oct-15				Program Year (Budget EC): 2016 Effective Price Level Date: 1 OCT 15								
WBS NUMBER A	Civil Works Feature & Sub-Feature Description B	COST ($K) C	CNTG ($K) D	CNTG (%) E	TOTAL ($K) F	ESC (%) G	COST ($K) H	CNTG ($K) I	TOTAL ($K) J	Mid-Point Date P	INFLATED (%) L	COST ($K) M	CNTG ($K) N	FULL ($K) O
	NED Plan													
05	LOCKS	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
06	FISH & WILDLIFE FACILITIES	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
11	LEVEES & FLOODWALLS	$586,543	$202,357	34.5%	$788,900	0.0%	$586,543	$202,357	$788,900	2032Q2	37.4%	$806,003	$278,071	$1,084,074
08	ROADS, RAILROADS & BRIDGES	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
09	CHANNELS & CANALS	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
10	BREAKWATER & SEAWALLS	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
							$0							
	CONSTRUCTION ESTIMATE TOTALS:	$586,543	$202,357	34.5%	**$788,900**		$586,543	$202,357	$788,900			$806,003	$278,071	$1,084,074
01	LANDS AND DAMAGES	$49,576	$12,394	25.0%	$61,970	0.0%	$49,576	$12,394	$61,970	2032Q2	37.4%	$68,125	$17,031	$85,156
30	PLANNING, ENGINEERING & DESIGN													
1.0%	Project Management	$5,865	$2,023	34.5%	$7,888	0.0%	$5,865	$2,023	$7,888	2032Q2	97.5%	$11,581	$3,996	$15,577
1.0%	Planning & Environmental Compliance	$5,865	$2,023	34.5%	$7,888	0.0%	$5,865	$2,023	$7,888	2032Q2	97.5%	$11,581	$3,996	$15,577
	Engineering & Design	$0	$0	34.5%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Reviews, ATRs, IEPRs, VE	$0	$0	34.5%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Life Cycle Updates (cost, schedule, risks)	$0	$0	34.5%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
1.0%	Contracting & Reprographics	$5,865	$2,023	34.5%	$7,888	0.0%	$5,865	$2,023	$7,888	2032Q2	97.5%	$11,581	$3,996	$15,577
	Engineering During Construction	$0	$0	34.5%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
1.0%	Planning During Construction	$5,865	$2,023	34.5%	$7,888	0.0%	$5,865	$2,023	$7,888	2032Q2	97.5%	$11,581	$3,996	$15,577
1.0%	Project Operations	$5,865	$2,023	34.5%	$7,888	0.0%	$5,865	$2,023	$7,888	2032Q2	97.5%	$11,581	$3,996	$15,577
31	CONSTRUCTION MANAGEMENT													
2.0%	Construction Management	$11,731	$4,047	34.5%	$15,778	0.0%	$11,731	$4,047	$15,778	2032Q2	97.5%	$23,165	$7,992	$31,156
	Project Operation:	$0	$0	34.5%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Project Management	$0	$0	34.5%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONTRACT COST TOTALS:	$677,175	$228,916		$906,091		$677,175	$228,916	$906,091			$955,199	$323,072	$1,278,271

Filename: TPCS SWC NER + NED 102315 MCX CHECK.xlsx
TPCS

JA
37-899
1025
11/27/2019

MII Cost Estimates

Southwest Coastal Feasibility Study NER rev Sept 2015

Estimated by	MVN New Orleans District and LA CPRA
Designed by	USACE, MVN and La CPRA
Prepared by	John Petitbon
Preparation Date	9/28/2015
Effective Date of Pricing	6/19/2015
Estimated Construction Time	Days

This report is not copyrighted, but the information contained herein is For Official Use Only.

JA 1027
37-899
11/27/2019

Date	Author	Note
6/29/2015	JP	Southwest Coastal (SWC) Feasibility StudyThe people, economy, environment, and cultural heritage of coastal areas in Southwest Louisiana are at risk from damages caused by hurricane and storm surge flooding. Southwest coastal Louisiana's topography, and low elevation, proximity to the Gulf of Mexico, subsiding lands, and rising seas, are all contributing factors which cause coastal flooding, shoreline erosion, saltwater intrusion, and loss of wetland and Chenier habitats which are conditions that are expected to continue to worsen.Through separate authorizations, Congress authorized the investigation of alternatives to: (1) provide hurricane protection and storm damage reduction, and (2) significantly restore environmental conditions. Planning measures for ecosystem restoration (the NER component) concentrated exclusively on locations within the coastal zone.The SWC study area encompasses over 4,700 square miles of varying terrain in the Calcasieu, Cameron, and Vermilion Parishes. The major physiographic divisions are the Gulf Coast Prairies and the Gulf Coast Marsh. The major hydrologic basins in the Study Area are the Mermentau River, the Calcasieu-Sabine Lakes, and the Teche/Vermilion Basin.The NER TSP is "Small Integrated Restoration" based on the NER Plan CM-4 and consists of the following ecosystem restoration features: 9 marsh restoration features; 35 chenier reforestation features; 5 shoreline protection features. The NER TSP is a comprehensive ecosystem restoration plan that addresses land loss and ecosystem degradation with the goal of minimizing land loss. The NER TSP contains features to restore wetlands; restore and protect designated critical habitat (for threatened piping plover and red knot); enhance plant productivity; and reinforce and protect critical landscape features. The Calcasieu Ship Channel Salinity Barrier Navigation Study is recommended as an additional long-range study and not included in the cost estimate.Estimate Philosophy: The estimate development used the standard approaches for a feasibility estimate structure regarding labor, equipment, materials, crews, unit prices, quotes, sub- and prime contractor markups. This philosophy was taken wherever practical within the time constraints. The project partner is the LS, State of Louisiana CPRA. Some of the cost estimates were prepared by the LS due to work in-kind arrangements and due to limited USACE funds and time following 3x3x3x3 study guidance. Some costs were developed or supplemented with estimating information from other sources such as quotes, bid data, and A-E estimates. The dredging costs developed by CPRA used their in-house, proprietary dredge estimating program and correlation with their vast annual coastal restoration/marsh creation/shoreline protection program contracts. Based on previous MVN experience with results, CPRA outputs are consistent with MVN in-house production and overall costs. The costs provided by the LS are directly applicable to the features of work either by direct estimate or reference to recent bid work for adjacent similar features. The intent was to provide or convey a "fair and reasonable" estimate that which depicts the local market conditions. The estimates assume a typical application of tiering subcontractors. Given the long time over which this project/program is to be constructed and the unknown economic status during that time, demands from non-governmental civil works projects were not considered to dampen the competition and increase prices.Estimate Structure: The estimate is structured to reflect the projects performed. The estimates are subdivided by USACE feature codes and by local "reach" name.Bid competition: It is assumed that there will not be an economically saturated market and bidding competition will be present.Contract Acquisition Strategy: It is assumed that the contract acquisition strategy will be similar to past projects of this type which are predominately large, unrestricted design/bid/build contracts. There is no declared contract acquisition plan/types at this time.Labor Shortages: It is assumed there will be a normal labor market.Labor Rates: Local labor market wages are above the local Davis-Bacon Wage Determination and actual rates have been used. This is based upon local information and payroll data received from the New Orleans District Construction Representatives and estimators with experiences in past years.Materials: Cost quotes are used on major construction items when available. Recent quotes may include rock and other aggregates. Assumptions include:a. materials will be purchased as part of the construction contract. The estimate does not anticipate government furnished materials. Prices include delivery of materials.b. Rock and stone - The New Orleans delta area has no rock sources. Historically, rock is barged from northern sources on the Mississippi River. This decision is based upon local knowledge, experience and supported with cost quotes.Equipment: Rates used are based from the latest USACE EP-1110-1-8, Region III. Adjustments are made for current fuel, local factors, and facility capital cost of money (FCCM). Use of owned verses rental rates was considered based on typical contractor usage and local equipment availability. Only a few select pieces of marine \ marsh equipment are considered rental. Full FCCM/Cost of Money rate is latest available; Mii program takes EP recommended discount, no other adjustments have been made to the FCCM.Fuel: Fuels (gasoline, on and off-road diesel) were based on local market averages for on-road and off-road for the Gulf Coast area. The Team found that fuels fluctuate irrationally; thus, conservatively used an above average rate.Crews: Major crew and productivity rates were developed and studied by senior USACE estimators familiar with the type of work. All of the work is typical to the New Orleans District. The crews and productivities were checked by local MVN estimators, discussions with contractors and comparisons with historical cost data. Major crews include hydraulic dredging, bucket dredging, dike construction, marine rock placement, and planting.Most crew work hours are assumed to be 10 hrs 6 days/wk which is typical to the area. Marine based bucket excavation and dredging operations are assumed to work 2-12 hours shifts 7 days / week.Unit Prices: The unit prices found within various project estimates are based on historical data from recent bid tabulations for similar work.Relocation Cost: Relocation costs are defined as the relocation of public roads, bridges, railroads, and utilities required for project purposes. In cases where potential significant impacts were known, costs were included within the cost estimate. There are no relocations on this project.Mobilization: Contractor mobilization and demobilization are based on the assumption that most of the contractors will be coming from within the Gulf Coast/Southern region.Mob/demob costs are based on historical studies of detailed Government estimate mob/demobs.Field Office Overhead: detailed in Mii / CEDEP.Home Office Overhead: Estimate percentages range based upon consideration of 8(a), small business and unrestricted prime contractors and the type of work they perform. The rates are based upon estimating and negotiating experience, and consultation with local construction representatives.Taxes: Local taxes will be applied, using an average between the parishes that contain the work. Reference the LA parish tax rate website: http://www.laota.com/pta.htmBond: Bond is assumed in the 1%-2% range applied against the prime contractor, assuming large contracts. No differentiation was made between large and small businesses.E&D

JA 37-899 1028 11/27/2019

Date	Author	Note
6/29/2015	JP	and S&A: USACE Costs to manage design (PED) and construction (S&A) are based on New Orleans District Programmatic and generally accepted cost estimate guidance:a. Planning, Engineering & Design (PED): The PED cost includes such costs as project management, engineering, planning, designs, investigations, studies, reviews, value engineering, contracting, and engineering during construction (EDC). Historically New Orleans District has used a 12% rate for the E&D portion plus small amounts for other tasks, applied against the estimated construction costs. Other USACE civil works districts such as St. Paul, Memphis and St. Louis have reported values ranging from 10-15%.b. Supervision & Administration (S&A): Historically, New Orleans District used a range from 5% to 15% depending on project size and type applied against the estimated construction costs. A 10% rate was used for the S&A portion. Other USACE civil works districts such as St. Paul, Memphis and St. Louis report values ranging from 7.5-10%. Consideration includes that a portion of the S&A effort could be performed by contractors.Contingencies: Contingencies were developed using the USACE Cost and Schedule Risk Analysis (CSRA) process and the Crystal Ball software that evaluates schedule and cost related risks.Escalation: Escalation used in the TPCS is based upon the latest US Army Corps of Engineers Engineering Manual (EM) 1110-2-1304 Civil Works Construction Cost Index System (CWCCIS).HTRW: The estimate includes no costs for any potential Hazardous, Toxic, and Radioactive Waste (HTRW) concerns. Phase 1 HTRW investigations were not completed due to funding and time constraints. HTRW issues are not expected and project features could be revised to avoid.
6/29/2015	JP	06-29-2015Revised to base on $50M/year funding stream for SWC (NER and NED) - assume approx. $25M/year for NER. Revise number of Mob/Demobs.
7/1/2015	JP	Cameron Parish sales tax - 4%Calcasieu Parish sales tax - 9.25%Vermilion Parish sales tax - 7.75%
7/7/2015	JP	Added Adaptive Management for Record keeping to Acct 06
10/1/2015	JP	Added additional notes documenting costs per ATR comments.slight revision to qtys for 124c and 3c1 per CPRA area adjustments for overlapping existing mitigation sites.updated 06 Acct -new cost provided by Environmental Br.

JA
37-899
1029
11/27/2019

Print Date Tue 27 October 2015 | U.S. Army Corps of Engineers | Time 15:16:07
Eff. Date 6/19/2015 | Project SWCNER15: Southwest Coastal Feasibility Study NER rev Sept 2015
SWC Project - NER rev Sept 2015 | bid schedule summary Page 1

Description	Quantity	UOM	ContractCost	Contingency	Escalation	ProjectCost
bid schedule summary			**1,280,047,097.52**	**0.00**	**0.00**	**1,280,047,097.52**
			62,807,000.00			*62,807,000.00*
06 Fish and Wildlife Facilities	**1.0000**	**EA**	**62,807,000.00**	**0.00**	**0.00**	**62,807,000.00**
			62,807,000.00			*62,807,000.00*
00 Fish and Wildlife Facilities	**1.0000**	**EA**	**62,807,000.00**	**0.00**	**0.00**	**62,807,000.00**
01 Adaptive Management	**1.0000**	**LS**	**62,807,000.00**	**0.00**	**0.00**	**62,807,000.00**
			26,636,899.00			*26,636,899.00*
09 Channels and Canals	**1.0000**	**EA**	**26,636,899.00**	**0.00**	**0.00**	**26,636,899.00**
			26,636,899.00			*26,636,899.00*
09 01 CHANNELS	**1.0000**	**EA**	**26,636,899.00**	**0.00**	**0.00**	**26,636,899.00**
			5,597,496.00			*5,597,496.00*
09 01 01 16bW Fortify Spoil Banks of GIWW and Freshwater Bayou	**1.0000**	**EA**	**5,597,496.00**	**0.00**	**0.00**	**5,597,496.00**
			5,841,827.00			*5,841,827.00*
09 01 02 16bNE Fortify Spoil Banks of GIWW and Freshwater Bayou	**1.0000**	**EA**	**5,841,827.00**	**0.00**	**0.00**	**5,841,827.00**
			15,197,576.00			*15,197,576.00*
09 01 03 16bSE Fortify Spoil Banks of GIWW and Freshwater Bayou	**1.0000**	**EA**	**15,197,576.00**	**0.00**	**0.00**	**15,197,576.00**
			630,421,649.52			*630,421,649.52*
15 Ecosystem Restoration	**1.0000**	**EA**	**630,421,649.52**	**0.00**	**0.00**	**630,421,649.52**
			628,670,323.00			*628,670,323.00*
15 00 Marsh Creation / Restoration	**1.0000**	**EA**	**628,670,323.00**	**0.00**	**0.00**	**628,670,323.00**
			17,396,127.80			*17,396,127.80*
15 00 01 124d Dedicated Dredging - Calcasieu Ship Channel	**1.0000**	**EA**	**17,396,127.80**	**0.00**	**0.00**	**17,396,127.80**
			58,664,050.14			*58,664,050.14*
15 00 01 124c Marsh Creation at Mud Lake	**1.0000**	**EA**	**58,664,050.14**	**0.00**	**0.00**	**58,664,050.14**
			91,995,556.45			*91,995,556.45*
15 00 01 47a1 Marsh Restoration South of Hwy 82	**1.0000**	**EA**	**91,995,556.45**	**0.00**	**0.00**	**91,995,556.45**
			84,505,519.69			*84,505,519.69*
15 00 01 47a2 Marsh Restoration South of Hwy 82	**1.0000**	**EA**	**84,505,519.69**	**0.00**	**0.00**	**84,505,519.69**
			83,516,901.25			*83,516,901.25*
15 00 01 47c1 Marsh Restoration South of Hwy 82	**1.0000**	**EA**	**83,516,901.25**	**0.00**	**0.00**	**83,516,901.25**
			45,257,472.54			*45,257,472.54*
15 00 01 127c3 Marsh Restoration at Pecan Island	**1.0000**	**EA**	**45,257,472.54**	**0.00**	**0.00**	**45,257,472.54**
			63,808,602.17			*63,808,602.17*
15 00 01 306a1 Rainey Marsh Restoration - Southwest Portion	**1.0000**	**EA**	**63,808,602.17**	**0.00**	**0.00**	**63,808,602.17**
			43,768,469.91			*43,768,469.91*
15 00 01 3a1 Beneficial Use of Dredge Material from Calcasieu Ship Channel	**1.0000**	**EA**	**43,768,469.91**	**0.00**	**0.00**	**43,768,469.91**

Labor ID: NOL2015 EQ ID: EP14R03 Currency in US dollars TRACES MII Version 4.2

Description	Quantity	UOM	ContractCost	Contingency	Escalation	ProjectCost
			139,757,623.05			*139,757,623.05*
15 00 01 3c1 Beneficial Use of Dredge Material from Calcasieu Ship Channel	**1.0000**	**EA**	**139,757,623.05**	**0.00**	**0.00**	**139,757,623.05**
			1,751,326.53			*1,751,326.53*
15 01 Chenier Reforestation	**1.0000**	**EA**	**1,751,326.53**	**0.00**	**0.00**	**1,751,326.53**
			10.00			*10.00*
15 01 01 01 fencing	**150,000.0000**	**LF**	**1,500,000.00**	**0.00**	**0.00**	**1,500,000.00**
			177.75			*177.75*
15 01 01 510a Blue Buck Ridge Restoration	**524.4000**	**ACR**	**93,212.10**	**0.00**	**0.00**	**93,212.10**
			177.75			*177.75*
15 01 02 510b Hackberry Ridge Restoration	**148.5000**	**ACR**	**26,395.88**	**0.00**	**0.00**	**26,395.88**
			177.75			*177.75*
15 01 03 510d Front Ridge Restoration	**458.7000**	**ACR**	**81,533.93**	**0.00**	**0.00**	**81,533.93**
			182.75			*182.75*
15 01 04 509c Bill Ridge Restoration	**21.4000**	**ACR**	**3,910.85**	**0.00**	**0.00**	**3,910.85**
			182.75			*182.75*
15 01 05 509d Cheniere Au Tigre Ridge Restoration	**8.2000**	**ACR**	**1,498.55**	**0.00**	**0.00**	**1,498.55**
			177.75			*177.75*
15 01 06 416 Grand Chenier Ridge Restoration	**251.9000**	**ACR**	**44,775.23**	**0.00**	**0.00**	**44,775.23**
			560,181,549.00			*560,181,549.00*
16 Bank Stabilization	**1.0000**	**EA**	**560,181,549.00**	**0.00**	**0.00**	**560,181,549.00**
			560,181,549.00			*560,181,549.00*
16 00 Bank Stabilization	**1.0000**	**EA**	**560,181,549.00**	**0.00**	**0.00**	**560,181,549.00**
			203,414,240.00			*203,414,240.00*
16 00 01 6b1 Gulf Shoreline Restoration - Calcasieu River to FWB	**1.0000**	**EA**	**203,414,240.00**	**0.00**	**0.00**	**203,414,240.00**
			149,488,714.00			*149,488,714.00*
16 00 01 6b2 Gulf Shoreline Restoration - Calcasieu River to FWB	**1.0000**	**EA**	**149,488,714.00**	**0.00**	**0.00**	**149,488,714.00**
			118,359,774.00			*118,359,774.00*
16 00 01 6b3 Gulf Shoreline Restoration - Calcasieu River to FWB	**1.0000**	**EA**	**118,359,774.00**	**0.00**	**0.00**	**118,359,774.00**
			88,918,821.00			*88,918,821.00*
16 00 01 5a Holly Beach Shoreline Stabilization	**1.0000**	**EA**	**88,918,821.00**	**0.00**	**0.00**	**88,918,821.00**

JA 37-899 1031 11/27/2019

Description	Page
Project Notes	ii
bid schedule summary	1
06 Fish and Wildlife Facilities	1
00 Fish and Wildlife Facilities	1
01 Adaptive Management	1
09 Channels and Canals	1
09 01 CHANNELS	1
09 01 01 16bW Fortify Spoil Banks of GIWW and Freshwater Bayou	1
09 01 02 16bNE Fortify Spoil Banks of GIWW and Freshwater Bayou	1
09 01 03 16bSE Fortify Spoil Banks of GIWW and Freshwater Bayou	1
15 Ecosystem Restoration	1
15 00 Marsh Creation / Restoration	1
15 00 01 124d Dedicated Dredging - Calcasieu Ship Channel	1
15 00 01 124c Marsh Creation at Mud Lake	1
15 00 01 47a1 Marsh Restoration South of Hwy 82	1
15 00 01 47a2 Marsh Restoration South of Hwy 82	1
15 00 01 47c1 Marsh Restoration South of Hwy 82	1
15 00 01 127c3 Marsh Restoration at Pecan Island	1
15 00 01 306a1 Rainey Marsh Restoration - Southwest Portion	1
15 00 01 3a1 Beneficial Use of Dredge Material from Calcasieu Ship Channel	1
15 00 01 3c1 Beneficial Use of Dredge Material from Calcasieu Ship Channel	2
15 01 Chenier Reforestation	2
15 01 01 01 fencing	2
15 01 01 510a Blue Buck Ridge Restoration	2
15 01 02 510b Hackberry Ridge Restoration	2
15 01 03 510d Front Ridge Restoration	2
15 01 04 509c Bill Ridge Restoration	2
15 01 05 509d Cheniere Au Tigre Ridge Restoration	2
15 01 06 416 Grand Chenier Ridge Restoration	2
16 Bank Stabilization	2
16 00 Bank Stabilization	2
16 00 01 6b1 Gulf Shoreline Restoration - Calcasieu River to FWB	2
16 00 01 6b2 Gulf Shoreline Restoration - Calcasieu River to FWB	2
16 00 01 6b3 Gulf Shoreline Restoration - Calcasieu River to FWB	2
16 00 01 5a Holly Beach Shoreline Stabilization	2

JA 37-899 1032 11/27/2019

SWC - Southwest Coastal Louisiana Feasibility Study - NED Plan

9/22/2015

Floodproofing Measures

Category	Number of Structures	Extended Direct Costs	Temporary Housing (3)	Implementation Admin (4)	Total
Mobile Homes	204	$16,803,597	$0	$2,965,140	$19,768,737
1 STY Pier	907	$92,008,055	$0	$13,183,245	$105,191,300
2 STY Pier	45	$4,602,799	$0	$654,075	$5,256,874
1 STY Slab	1966	$270,518,656	$0	$28,575,810	$299,094,466
2 STY Slab	317	$39,161,442	$0	$4,607,595	$43,769,037
Commercial	336	$17,789,563		$5,965,680	$23,755,243
Warehouses	157	$86,920,157		$2,787,535	$89,707,692
Subtotal	3,932	$527,804,269.00	$0.00	$58,739,080.00	**$586,543,349.00**

DO NOT Include in Construction Cost

Acquisition Measures (2)

Category	Number of Structures	Structure & URA	Admin	Total
Mobile Homes	6			$0.00
1 STY Pier	7			$0.00
2 STY Pier	0			$0.00
1 STY Slab	5			$0.00
2 STY Slab	5			$0.00
Commercial	6			$0.00
Warehouses	0			$0.00
Subtotal	29	$0.00	$0.00	$0.00

TOTAL

1) Costs DO NOT include contingency
2) Acquisition Measures NOT included in construction costs - a RE cost
3) Temporary Housing NOT Authorized for Floodproofing measures.
4) Implementation Admin for Floodproofing - Non-RE portion only

Southwest Coastal Louisiana NED Non-Structural Flood Risk Management - rev1
This cost estimate develops the program unit costs for different Floodproofing measures. Unit costs transferred to an Excel summary sheet for TOTAL cost to include on TPCS.

Estimated by	ARCADIS U.S., Inc.
Designed by	
Prepared by	David Fulks, PE
Preparation Date	9/22/2015
Effective Date of Pricing	7/15/2015
Estimated Construction Time	45 Days

This report is not copyrighted, but the information contained herein is For Official Use Only.

JA 37-899 1034 11/27/2019

Date	Author	Note
7/17/2015	D. Fulks	All work activities and corresponding levels of effort are based upon conversations with Davies Shoring, LLC and Orleans Shoring on 23 June 2015 and 24 June 2015, respectively.
7/17/2015	D. Fulks	Residential Elevation Projects were group according to the following categories:Mobile Home, Low Lift - This includes manufactured homes raised a minimum of 2'-6" and a maximum of 6'-0" above the lowest adjacent grade. For the purpose of this estimate these are assumed to be 576 sq.ft. single-wide sectional trailers.Mobile Home, High Lift - This includes manufactured homes raised a minimum of 6'-6" and a maximum of 13'-0" above the lowest adjacent grade. For the purpose of this estimate these are assumed to be 576 sq.ft. single-wide sectional trailers.Pier-supported Frame House, Low Lift - This includes wood frame houses built on a pier and beam foundation raised a minimum of 2'-6" and a maximum of 6'-0" above the lowest adjacent grade. For the purpose of this estimate single story are assumed to be 1,479 sq.ft. and two-story homes are assumed to be 1,327.5 sq.ft.; footprint square footage.Pier-supported Frame House, High Lift - This includes wood frame houses built on a pier and beam foundation raised a minimum of 6'-6" and a maximum of 13-0" above the lowest adjacent grade. For the purpose of this estimate single story are assumed to be 1,479 sq.ft. and two-story homes are assumed to be 1,327.5 sq.ft.; footprint square footage.Slab-supported Frame House, Low Lift - This includes wood frame houses built on a concrete slab raised a minimum of 2'-6" and a maximum of 6-0" above the lowest adjacent grade. For the purpose of this estimate single story are assumed to be 2,031 sq.ft. and two-story homes are assumed to be 1,787.5 sq.ft.; footprint square footage.Slab-supported Frame House, High Lift - This includes wood frame houses built on a concrete slab raised a minimum of 6'-6" and a maximum of 13-0" above the lowest adjacent grade. For the purpose of this estimate single story are assumed to be 2,031 sq.ft. and two-story homes are assumed to be 1,787.5 sq.ft.; footprint square footage.
7/17/2015	D. Fulks	The work process for Mobile Homes and Pier-supported frame houses is as follows:1. Complete program application.2. Government prepares Guide Plans and Specifications, and Estimate.3. Home owner selects contractor and enters into direct agreement.3. Contractor obtains all necessary permits and Mobilize to site.4. Residents temporarily relocate.5. Disconnect utilities.6. Place Jacks and Cribbing.7. Insert Steels.8. Elevate Structure.9. Install Piers.10. Set Structure on Piers.11. Anchor Structure.12. For High Lifts, pour grade beams between piers and slab-on-grade.13. Reconnect Utilities.14. For Low Lifts, install Perimeter Enclosure.15. Install elevated landings and stairs.16. Demobilization and Closeout.
7/17/2015	D. Fulks	The work process for Slab-supported houses is as follows:1. Complete program application.2. Government prepares Guide Plans and Specifications, and Estimate.3. Home owner selects contractor and enters into direct agreement.3. Contractor obtains all necessary permits and Mobilize to site.4. Residents temporarily relocate.5. Disconnect utilities.6. Excavate at perimeter and tunnels under slab on 8' centers.7. Place Jacks and Cribbing.8. Push segmented piles to refusal.8. Elevate Structure.9. Install Piers.11. Anchor Structure.12. For lower lifts, demo existing driveway and install new driveway adjusted to garage floor elevation.13. For High Lifts, pour grade beams between piers and slab-on-grade.14. Reconnect Utilities.15. For Low Lifts, install Perimeter Enclosure.16. Install elevated landings and stairs.17. Demobilization and Closeout.
7/17/2015	D. Fulks	The following process generally describes how the Huntington District implemented its floodproofing program. The process is team based and streamlined to reduce cost. No attempt is made here to describe every facet of the process but rather to provide an overview from which to develop administrative cost for a typical structure.The team consisted of a planner who was generally the team leader (similar to a project manager) and was involved with most every aspect of the process, an architect/engineer who was responsible for the preparation of the floodproofing design, a cost engineer who developed the government estimate, a real estate attorney who verified ownership and prepared floodproofing agreements and conducted closings and a construction inspection. Others who had a minimal part in the process were real estate staff and inspectors for HTRW analysis of the structure.Applications for participation are received from the homeowner (HO) and ownership is verified. The team leaders schedules a site visit with the HO to gather info to develop the design and cost estimate as well as explain the process, responsibilities of all parties, the criteria and policies. The team leader, designer and cost engineer usually participated in the site visits. Based on field visit, the designer prepared the Guide Plans & Specifications (GP&S) which consisted of a general Scope of Work (usually one or two pages, a set of standard specifications, and specific details applicable to the specific structures. The details are pulled from a standard full set of previously developed. Details included would be those needed to guide the contractor in the specific criteria for that particular structure. While this is being done the structure would have been inspected to determine if there was the presence of any HTRW. Any corrective action for HTRW would be included in the scope of work.The GP&S would be delivered to the HO and the HO would be instructed to obtain a minimum of one construction proposal based on the GP&S. In the meantime the cost engineer would be developing the government estimate. An offer would eventually be made to the HO and a request for a floodproofing agreement would be made. Once the HO and Government executed the floodproofing agreement, the HO would be given notice to proceed. Although the HO is responsible for their contractor's performance, the construction inspector would inspect certain critical aspects of the construction. Following completion of construction and approval of the HO and construction inspector, a closing would be conducted and the floodproofing agreement and restrictions on the property would be recorded in the local court house.Again this is a very brief description of the process. The hours needed by discipline, for an average structure is shown below. Note that the hours shown are based on an average structure and that multiple structures would be inspected during a site visit and the construction inspector would be inspecting multiple structures on any given day of inspection.Team leader (planner/PM) - 40 hoursDesigner (architect/engineer) - 36 hours (res) / 64 hours (com)Estimator (Cost engineer) - 26 hoursConstruction inspector - 24 hoursRE attorney - 24 hours (in

JA 37-899 1035 11/27/2019

Date	Author	Note
7/17/2015	D. Fulks	RE cost)RE support staff - 24 hours (in RE cost)Other support staff - 24 hours
10/8/2015	JP	09/22/15 Revised fuel and CMR to be consistent with NER estimate.

JA 37-899 1036 11/27/2019

Description	Quantity	UOM	ContractCost	Contingency	Escalation	ProjectCost
bid schedule summary			**7,612,863.28**	**0.00**	**0.00**	**7,612,863.28**
			6,678,218.85			*6,678,218.85*
1 Residential Structures	**1.0000**	**EA**	**6,678,218.85**	**0.00**	**0.00**	**6,678,218.85**
			18,583.76			*18,583.76*
11 Implementation Costs	**1.0000**	**EA**	**18,583.76**	**0.00**	**0.00**	**18,583.76**
Government Administration - Implementation (Non-RE activities)	**1.0000**	**LS**	**14,533.76**	**0.00**	**0.00**	**14,533.76**
Homeowner Subsistence	**1.0000**	**LS**	**4,050.00**	**0.00**	**0.00**	**4,050.00**
			75,201.98			*75,201.98*
12 Mobile Homes	**12.0000**	**EA**	**902,423.71**	**0.00**	**0.00**	**902,423.71**
			52,557.50			*52,557.50*
Low Lift (1.50'-2.49')	**1.0000**	**EA**	**52,557.50**	**0.00**	**0.00**	**52,557.50**
			91.25			*91.25*
Single-Wide	**576.0000**	**SF**	**52,557.50**	**0.00**	**0.00**	**52,557.50**
			55,290.84			*55,290.84*
Low Lift (2.50'-3.49')	**1.0000**	**EA**	**55,290.84**	**0.00**	**0.00**	**55,290.84**
			95.99			*95.99*
Single-Wide	**576.0000**	**SF**	**55,290.84**	**0.00**	**0.00**	**55,290.84**
			58,664.57			*58,664.57*
Low Lift (3.50'-4.49')	**1.0000**	**EA**	**58,664.57**	**0.00**	**0.00**	**58,664.57**
			101.85			*101.85*
Single-Wide	**576.0000**	**SF**	**58,664.57**	**0.00**	**0.00**	**58,664.57**
			61,397.91			*61,397.91*
Low Lift (4.50'-5.49')	**1.0000**	**EA**	**61,397.91**	**0.00**	**0.00**	**61,397.91**
			106.59			*106.59*
Single-Wide	**576.0000**	**SF**	**61,397.91**	**0.00**	**0.00**	**61,397.91**
			64,340.37			*64,340.37*
Low Lift (5.50'-6.49')	**1.0000**	**EA**	**64,340.37**	**0.00**	**0.00**	**64,340.37**
			111.70			*111.70*
Single-Wide	**576.0000**	**SF**	**64,340.37**	**0.00**	**0.00**	**64,340.37**
			73,660.15			*73,660.15*
High Lift (6.50'-7.49')	**1.0000**	**EA**	**73,660.15**	**0.00**	**0.00**	**73,660.15**
			127.88			*127.88*
Single-Wide	**576.0000**	**SF**	**73,660.15**	**0.00**	**0.00**	**73,660.15**
			79,387.22			*79,387.22*
High Lift (7.50'-8.49')	**1.0000**	**EA**	**79,387.22**	**0.00**	**0.00**	**79,387.22**

JA 37-899 1037 11/27/2019

Description	Quantity	UOM	ContractCost	Contingency	Escalation	ProjectCost
			137.83			*137.83*
Single-Wide	**576.0000**	**SF**	**79,387.22**	**0.00**	**0.00**	**79,387.22**
			83,024.76			*83,024.76*
High Lift (8.50'-9.49')	**1.0000**	**EA**	**83,024.76**	**0.00**	**0.00**	**83,024.76**
			144.14			*144.14*
Single-Wide	**576.0000**	**SF**	**83,024.76**	**0.00**	**0.00**	**83,024.76**
			87,599.96			*87,599.96*
High Lift (9.50'-10.49')	**1.0000**	**EA**	**87,599.96**	**0.00**	**0.00**	**87,599.96**
			152.08			*152.08*
Single-Wide	**576.0000**	**SF**	**87,599.96**	**0.00**	**0.00**	**87,599.96**
			91,237.50			*91,237.50*
High Lift (10.50'-11.49')	**1.0000**	**EA**	**91,237.50**	**0.00**	**0.00**	**91,237.50**
			158.40			*158.40*
Single-Wide	**576.0000**	**SF**	**91,237.50**	**0.00**	**0.00**	**91,237.50**
			95,812.70			*95,812.70*
High Lift (11.50'-12.49')	**1.0000**	**EA**	**95,812.70**	**0.00**	**0.00**	**95,812.70**
			166.34			*166.34*
Single-Wide	**576.0000**	**SF**	**95,812.70**	**0.00**	**0.00**	**95,812.70**
			99,450.24			*99,450.24*
High Lift (12.50'-13.49')	**1.0000**	**EA**	**99,450.24**	**0.00**	**0.00**	**99,450.24**
			172.66			*172.66*
Single-Wide	**576.0000**	**SF**	**99,450.24**	**0.00**	**0.00**	**99,450.24**
			2,312,567.47			*2,312,567.47*
13 Pier-supported Frame Houses	**1.0000**	**EA**	**2,312,567.47**	**0.00**	**0.00**	**2,312,567.47**
			120,976.41			*120,976.41*
Low Lift (1.50'-2.49')	**1.0000**	**EA**	**120,976.41**	**0.00**	**0.00**	**120,976.41**
			41.06			*41.06*
Single-Story	**1,479.0000**	**SF**	**60,724.76**	**0.00**	**0.00**	**60,724.76**
			45.39			*45.39*
Two-Story	**1,327.5000**	**SF**	**60,251.64**	**0.00**	**0.00**	**60,251.64**
			128,373.11			*128,373.11*
Low Lift (2.50'-3.49')	**1.0000**	**EA**	**128,373.11**	**0.00**	**0.00**	**128,373.11**
			43.53			*43.53*
Single-Story	**1,479.0000**	**SF**	**64,387.18**	**0.00**	**0.00**	**64,387.18**
			48.20			*48.20*
Two-Story	**1,327.5000**	**SF**	**63,985.94**	**0.00**	**0.00**	**63,985.94**

JA 37-899 1038 11/27/2019

Description	Quantity	UOM	ContractCost	Contingency	Escalation	ProjectCost
			138,475.15			*138,475.15*
Low Lift (3.50'-4.49')	**1.0000**	**EA**	**138,475.15**	**0.00**	**0.00**	**138,475.15**
			46.88			*46.88*
Single-Story	**1,479.0000**	**SF**	**69,330.38**	**0.00**	**0.00**	**69,330.38**
			52.09			*52.09*
Two-Story	**1,327.5000**	**SF**	**69,144.77**	**0.00**	**0.00**	**69,144.77**
			145,871.86			*145,871.86*
Low Lift (4.50'-5.49')	**1.0000**	**EA**	**145,871.86**	**0.00**	**0.00**	**145,871.86**
			49.35			*49.35*
Single-Story	**1,479.0000**	**SF**	**72,992.79**	**0.00**	**0.00**	**72,992.79**
			54.90			*54.90*
Two-Story	**1,327.5000**	**SF**	**72,879.06**	**0.00**	**0.00**	**72,879.06**
			154,033.18			*154,033.18*
Low Lift (5.50'-6.49')	**1.0000**	**EA**	**154,033.18**	**0.00**	**0.00**	**154,033.18**
			52.11			*52.11*
Single-Story	**1,479.0000**	**SF**	**77,073.45**	**0.00**	**0.00**	**77,073.45**
			57.97			*57.97*
Two-Story	**1,327.5000**	**SF**	**76,959.72**	**0.00**	**0.00**	**76,959.72**
			195,565.96			*195,565.96*
High Lift (6.50'-7.49')	**1.0000**	**EA**	**195,565.96**	**0.00**	**0.00**	**195,565.96**
			66.37			*66.37*
Single-Story	**1,479.0000**	**SF**	**98,156.71**	**0.00**	**0.00**	**98,156.71**
			73.38			*73.38*
Two-Story	**1,327.5000**	**SF**	**97,409.25**	**0.00**	**0.00**	**97,409.25**
			209,478.97			*209,478.97*
High Lift (7.50'-8.49')	**1.0000**	**EA**	**209,478.97**	**0.00**	**0.00**	**209,478.97**
			70.93			*70.93*
Single-Story	**1,479.0000**	**SF**	**104,901.43**	**0.00**	**0.00**	**104,901.43**
			78.78			*78.78*
Two-Story	**1,327.5000**	**SF**	**104,577.54**	**0.00**	**0.00**	**104,577.54**
			219,358.96			*219,358.96*
High Lift (8.50'-9.49')	**1.0000**	**EA**	**219,358.96**	**0.00**	**0.00**	**219,358.96**
			74.22			*74.22*
Single-Story	**1,479.0000**	**SF**	**109,770.83**	**0.00**	**0.00**	**109,770.83**
			82.55			*82.55*
Two-Story	**1,327.5000**	**SF**	**109,588.13**	**0.00**	**0.00**	**109,588.13**

JA 37-899 1039 11/27/2019

Description	Quantity	UOM	ContractCost	Contingency	Escalation	ProjectCost
			233,271.97			*233,271.97*
High Lift (9.50'-10.49')	**1.0000**	**EA**	**233,271.97**	**0.00**	**0.00**	**233,271.97**
			78.78			*78.78*
Single-Story	**1,479.0000**	**SF**	**116,515.55**	**0.00**	**0.00**	**116,515.55**
			87.95			*87.95*
Two-Story	**1,327.5000**	**SF**	**116,756.43**	**0.00**	**0.00**	**116,756.43**
			243,151.96			*243,151.96*
High Lift (10.50'-11.49')	**1.0000**	**EA**	**243,151.96**	**0.00**	**0.00**	**243,151.96**
			82.07			*82.07*
Single-Story	**1,479.0000**	**SF**	**121,384.95**	**0.00**	**0.00**	**121,384.95**
			91.73			*91.73*
Two-Story	**1,327.5000**	**SF**	**121,767.02**	**0.00**	**0.00**	**121,767.02**
			257,064.98			*257,064.98*
High Lift (11.50'-12.49')	**1.0000**	**EA**	**257,064.98**	**0.00**	**0.00**	**257,064.98**
			86.63			*86.63*
Single-Story	**1,479.0000**	**SF**	**128,129.66**	**0.00**	**0.00**	**128,129.66**
			97.13			*97.13*
Two-Story	**1,327.5000**	**SF**	**128,935.31**	**0.00**	**0.00**	**128,935.31**
			266,944.97			*266,944.97*
High Lift (12.50'-13.49')	**1.0000**	**EA**	**266,944.97**	**0.00**	**0.00**	**266,944.97**
			89.92			*89.92*
Single-Story	**1,479.0000**	**SF**	**132,999.07**	**0.00**	**0.00**	**132,999.07**
			100.90			*100.90*
Two-Story	**1,327.5000**	**SF**	**133,945.90**	**0.00**	**0.00**	**133,945.90**
			3,444,643.91			*3,444,643.91*
14 Slab-supported Frame Houses	**1.0000**	**EA**	**3,444,643.91**	**0.00**	**0.00**	**3,444,643.91**
			207,225.63			*207,225.63*
Low Lift (1.50'-2.49')	**1.0000**	**EA**	**207,225.63**	**0.00**	**0.00**	**207,225.63**
			53.54			*53.54*
Single-Story	**2,031.0000**	**SF**	**108,739.55**	**0.00**	**0.00**	**108,739.55**
			55.10			*55.10*
Two-Story	**1,787.5000**	**SF**	**98,486.07**	**0.00**	**0.00**	**98,486.07**
			217,113.78			*217,113.78*
Low Lift (2.50'-3.49')	**1.0000**	**EA**	**217,113.78**	**0.00**	**0.00**	**217,113.78**
			56.07			*56.07*
Single-Story	**2,031.0000**	**SF**	**113,872.11**	**0.00**	**0.00**	**113,872.11**

JA 37-899 1040 11/27/2019

Description	Quantity	UOM	ContractCost	Contingency	Escalation	ProjectCost
			57.76			*57.76*
Two-Story	**1,787.5000**	**SF**	**103,241.67**	**0.00**	**0.00**	**103,241.67**
			229,250.54			*229,250.54*
Low Lift (3.50'-4.49')	**1.0000**	**EA**	**229,250.54**	**0.00**	**0.00**	**229,250.54**
			59.17			*59.17*
Single-Story	**2,031.0000**	**SF**	**120,173.11**	**0.00**	**0.00**	**120,173.11**
			61.02			*61.02*
Two-Story	**1,787.5000**	**SF**	**109,077.43**	**0.00**	**0.00**	**109,077.43**
			239,138.70			*239,138.70*
Low Lift (4.50'-5.49')	**1.0000**	**EA**	**239,138.70**	**0.00**	**0.00**	**239,138.70**
			61.70			*61.70*
Single-Story	**2,031.0000**	**SF**	**125,305.67**	**0.00**	**0.00**	**125,305.67**
			63.68			*63.68*
Two-Story	**1,787.5000**	**SF**	**113,833.03**	**0.00**	**0.00**	**113,833.03**
			251,275.46			*251,275.46*
Low Lift (5.50'-6.49')	**1.0000**	**EA**	**251,275.46**	**0.00**	**0.00**	**251,275.46**
			64.80			*64.80*
Single-Story	**2,031.0000**	**SF**	**131,606.67**	**0.00**	**0.00**	**131,606.67**
			66.95			*66.95*
Two-Story	**1,787.5000**	**SF**	**119,668.79**	**0.00**	**0.00**	**119,668.79**
			286,656.39			*286,656.39*
High Lift (6.50'-7.49')	**1.0000**	**EA**	**286,656.39**	**0.00**	**0.00**	**286,656.39**
			74.40			*74.40*
Single-Story	**2,031.0000**	**SF**	**151,109.67**	**0.00**	**0.00**	**151,109.67**
			75.83			*75.83*
Two-Story	**1,787.5000**	**SF**	**135,546.72**	**0.00**	**0.00**	**135,546.72**
			301,377.69			*301,377.69*
High Lift (7.50'-8.49')	**1.0000**	**EA**	**301,377.69**	**0.00**	**0.00**	**301,377.69**
			78.19			*78.19*
Single-Story	**2,031.0000**	**SF**	**158,803.87**	**0.00**	**0.00**	**158,803.87**
			79.76			*79.76*
Two-Story	**1,787.5000**	**SF**	**142,573.82**	**0.00**	**0.00**	**142,573.82**
			314,420.97			*314,420.97*
High Lift (8.50'-9.49')	**1.0000**	**EA**	**314,420.97**	**0.00**	**0.00**	**314,420.97**
			81.52			*81.52*
Single-Story	**2,031.0000**	**SF**	**165,565.83**	**0.00**	**0.00**	**165,565.83**

JA 37-899 1041 11/27/2019

Description	Quantity	UOM	ContractCost	Contingency	Escalation	ProjectCost
			83.28			*83.28*
Two-Story	**1,787.5000**	**SF**	**148,855.14**	**0.00**	**0.00**	**148,855.14**
			329,142.26			*329,142.26*
High Lift (9.50'-10.49')	**1.0000**	**EA**	**329,142.26**	**0.00**	**0.00**	**329,142.26**
			85.31			*85.31*
Single-Story	**2,031.0000**	**SF**	**173,260.02**	**0.00**	**0.00**	**173,260.02**
			87.21			*87.21*
Two-Story	**1,787.5000**	**SF**	**155,882.24**	**0.00**	**0.00**	**155,882.24**
			342,185.54			*342,185.54*
High Lift (10.50'-11.49')	**1.0000**	**EA**	**342,185.54**	**0.00**	**0.00**	**342,185.54**
			88.64			*88.64*
Single-Story	**2,031.0000**	**SF**	**180,021.99**	**0.00**	**0.00**	**180,021.99**
			90.72			*90.72*
Two-Story	**1,787.5000**	**SF**	**162,163.55**	**0.00**	**0.00**	**162,163.55**
			356,906.83			*356,906.83*
High Lift (11.50'-12.49')	**1.0000**	**EA**	**356,906.83**	**0.00**	**0.00**	**356,906.83**
			92.43			*92.43*
Single-Story	**2,031.0000**	**SF**	**187,716.18**	**0.00**	**0.00**	**187,716.18**
			94.65			*94.65*
Two-Story	**1,787.5000**	**SF**	**169,190.65**	**0.00**	**0.00**	**169,190.65**
			369,950.11			*369,950.11*
High Lift (12.50'-13.49')	**1.0000**	**EA**	**369,950.11**	**0.00**	**0.00**	**369,950.11**
			95.75			*95.75*
Single-Story	**2,031.0000**	**SF**	**194,478.14**	**0.00**	**0.00**	**194,478.14**
			98.17			*98.17*
Two-Story	**1,787.5000**	**SF**	**175,471.97**	**0.00**	**0.00**	**175,471.97**
			381,012.86			*381,012.86*
2 Commercial Structures	**1.0000**	**EA**	**381,012.86**	**0.00**	**0.00**	**381,012.86**
			17,754.88			*17,754.88*
21 Implementation Costs	**1.0000**	**EA**	**17,754.88**	**0.00**	**0.00**	**17,754.88**
Government Administration - Implementation (Non-RE activities)	**1.0000**	**LS**	**17,754.88**	**0.00**	**0.00**	**17,754.88**
			7.40			*7.40*
EAT Eatery	**5,972.0000**	**EA**	**44,208.69**	**0.00**	**0.00**	**44,208.69**
			7.04			*7.04*
GROC Grocery	**6,362.0000**	**SF**	**44,814.95**	**0.00**	**0.00**	**44,814.95**

JA 37-899 1042 11/27/2019

Description	Quantity	UOM	ContractCost	Contingency	Escalation	ProjectCost
			2.19			*2.19*
MULT Multi-occupany	**38,321.0000**	**EA**	**83,791.35**	**0.00**	**0.00**	**83,791.35**
			7.20			*7.20*
PROF Professional	**6,190.0000**	**SF**	**44,547.57**	**0.00**	**0.00**	**44,547.57**
			5.94			*5.94*
PUBL Public	**7,970.0000**	**EA**	**47,314.61**	**0.00**	**0.00**	**47,314.61**
			7.61			*7.61*
REPA Repair	**5,772.0000**	**SF**	**43,897.78**	**0.00**	**0.00**	**43,897.78**
			4.79			*4.79*
RETA Retail	**11,407.5000**	**EA**	**54,683.02**	**0.00**	**0.00**	**54,683.02**
			553,631.57			*553,631.57*
3 Warehouses	**1.0000**	**EA**	**553,631.57**	**0.00**	**0.00**	**553,631.57**
			376,525.10			*376,525.10*
BERM Berms	**1.0000**	**EA**	**376,525.10**	**0.00**	**0.00**	**376,525.10**
			177,106.47			*177,106.47*
GATE Flood Gates	**1.0000**	**EA**	**177,106.47**	**0.00**	**0.00**	**177,106.47**

JA 37-899 1043 11/27/2019

Description	Page
Project Notes	vii
bid schedule summary	1
1 Residential Structures	1
11 Implementation Costs	1
Government Administration - Implementation (Non-RE activities)	1
Homeowner Subsistence	1
12 Mobile Homes	1
Low Lift (1.50'-2.49')	1
Single-Wide	1
Low Lift (2.50'-3.49')	1
Single-Wide	1
Low Lift (3.50'-4.49')	1
Single-Wide	1
Low Lift (4.50'-5.49')	1
Single-Wide	1
Low Lift (5.50'-6.49')	1
Single-Wide	1
High Lift (6.50'-7.49')	1
Single-Wide	1
High Lift (7.50'-8.49')	1
Single-Wide	2
High Lift (8.50'-9.49')	2
Single-Wide	2
High Lift (9.50'-10.49')	2
Single-Wide	2
High Lift (10.50'-11.49')	2
Single-Wide	2
High Lift (11.50'-12.49')	2
Single-Wide	2
High Lift (12.50'-13.49')	2
Single-Wide	2
13 Pier-supported Frame Houses	2
Low Lift (1.50'-2.49')	2
Single-Story	2
Two-Story	2
Low Lift (2.50'-3.49')	2
Single-Story	2
Two-Story	2
Low Lift (3.50'-4.49')	3
Single-Story	3
Two-Story	3
Low Lift (4.50'-5.49')	3
Single-Story	3
Two-Story	3

JA 37-899 1044 11/27/2019

Description	Page
Low Lift (5.50'-6.49')	3
Single-Story	3
Two-Story	3
High Lift (6.50'-7.49')	3
Single-Story	3
Two-Story	3
High Lift (7.50'-8.49')	3
Single-Story	3
Two-Story	3
High Lift (8.50'-9.49')	3
Single-Story	3
Two-Story	3
High Lift (9.50'-10.49')	4
Single-Story	4
Two-Story	4
High Lift (10.50'-11.49')	4
Single-Story	4
Two-Story	4
High Lift (11.50'-12.49')	4
Single-Story	4
Two-Story	4
High Lift (12.50'-13.49')	4
Single-Story	4
Two-Story	4
14 Slab-supported Frame Houses	4
Low Lift (1.50'-2.49')	4
Single-Story	4
Two-Story	4
Low Lift (2.50'-3.49')	4
Single-Story	4
Two-Story	5
Low Lift (3.50'-4.49')	5
Single-Story	5
Two-Story	5
Low Lift (4.50'-5.49')	5
Single-Story	5
Two-Story	5
Low Lift (5.50'-6.49')	5
Single-Story	5
Two-Story	5
High Lift (6.50'-7.49')	5
Single-Story	5
Two-Story	5
High Lift (7.50'-8.49')	5

JA 37-899 1045 11/27/2019

Description	Page
Single-Story	5
Two-Story	5
High Lift (8.50'-9.49')	5
Single-Story	5
Two-Story	6
High Lift (9.50'-10.49')	6
Single-Story	6
Two-Story	6
High Lift (10.50'-11.49')	6
Single-Story	6
Two-Story	6
High Lift (11.50'-12.49')	6
Single-Story	6
Two-Story	6
High Lift (12.50'-13.49')	6
Single-Story	6
Two-Story	6
2 Commercial Structures	6
21 Implementation Costs	6
Government Administration - Implementation (Non-RE activities)	6
EAT Eatery	6
GROC Grocery	6
MULT Multi-occupany	7
PROF Professional	7
PUBL Public	7
REPA Repair	7
RETA Retail	7
3 Warehouses	7
BERM Berms	7
GATE Flood Gates	7

JA 37-899 1046 11/27/2019

Project Construction Schedule

NER plan:

Individual feature schedules were not fully developed because due to the funding constraints assumed, all schedules (program and individual projects) are totally funding driven.

PM is assuming approximately $50M/year for both features (NER and NED) of the Southwest Coastal Louisiana Study (SWC).

Budget justification sheets have the feasibility study completion and a Chief's report in 2016, gap period 2017, PED initiate 2018, construction start in mid to late 2019.

Based on an October 1, 2019 construction start and approximate $25-$50M annual funding for the NER features, we will use a **50 year NER program schedule** based on the base construction cost of $1,218 million (Mii total excluding Acct 06 AM&M $62,807,000). After completion of the NED plan, more funds could be directed to the NER and shorten the program duration.

NED plan:

Individual feature schedules were not fully developed because due to the funding constraints assumed, all schedules (program and individual projects) are totally funding driven.

PM is assuming approximately $50M/year for both features (NER and NED) of the Southwest Coastal Louisiana Study (SWC).

Budget justification sheets have the feasibility study completion and a Chief's report in 2016, gap period 2017, PED initiate 2018, construction start in mid to late 2019.

Based on an October 1, 2019 construction start and approximate $25-$50M annual funding for the NED features, we will use a **25 year NED program schedule** based on the base construction cost of $587 million. This schedule allows for almost 100% participation which is not probable.

Cost and Schedule Risk Analysis (CSRA)

In an effort to identify the applicable cost and schedule risks inherent with execution of the Recommended Alternative, a Cost and Schedule Risk Analysis was prepared for both the NER and NED features as per ER 1110-2-1302. These were implemented in an effort to determine a contingency cost required for cost estimating and based on the risk items associated with the project. The results of these analyses are determined by qualifying and quantifying all potential cost risks and running a Monte Carlo simulation to produce the frequency spectrum and probability range for the applied risk costs. The cost contingency is obtained from the 80-percent contingency as determined by this analysis.

Section 1. NER:

The initial Risk Register considered 34 risk items. A total of 11 potential moderate and high risk items were chosen for modeling purposes for the Cost Risk Analysis and 1 risk items for the Schedule Risk Analysis. Assumptions were made for each risk item before running the Monte Carlo simulation. The result of the simulation for the Cost and Schedule Risk Analysis gave a 37% (rounded) contingency at the 80-percent confidence level.

The contingency cost for this project was utilized for a Micro Computer Aided Cost Estimating System (MCACES) estimation of the costs associated with the Southwest Coastal Ecosystem Restoration Plan. The potential cost risks developed during this analysis also serve as an indicator of how to avoid unforeseen escalation of project costs throughout project implementation and therefore, may be used as a valuable tool in all future aspect of the project study.

The major contributors to the resulting total project cost contingency for the Cost Estimate were:

- (TL-1) Design Development – risk of designs not being fully developed due to lack of site specific data and designs
- (CA-1) Acquisition Strategy – risk of cost increases due to lack of or changes in the acquisition strategy.
- (PR-4) Fuel Cost – risk that fuel costs could escalate.

The major contributor to the resulting total project schedule contingency for the project schedule was:

- (PR-1) Funding Availability – risk of delays in schedule due to a lack of funding during the project.

The corresponding Total Cost including contingency (cost & schedule) for the Cost Risk Analysis is presented on Table 1.

Table 1. Cost Contingency Analysis Table

Confidence Level	Value	Contingency
Most Likely Cost Estimate	$ 1,760,065,000	0.00%
5%	$ 2,182,480,600	24.00%
50%	$ 2,323,285,800	32.00%
80%	$ 2,411,289,050	37.00%
95%	$ 2,481,691,650	41.00%

The corresponding Total Schedule including contingency for the Project Schedule is presented on Table 2.

Table 2. Schedule Contingency Analysis Table

Confidence Level	Value	Contingency
Most Likely Cost Estimate	600.0 Months	0.00%
5%	612.0 Months	2.00%
50%	690.0 Months	15.00%
80%	768.0 Months	28.00%
95%	834.0 Months	39.00%

The rounded contingency percentage for **Project Cost and Schedule (37.0%)** were transferred to the TPCS for final calculation of total contingency and cost. Lands and Damages cost and contingency are not included in the above. (NOTE: The rounding of the contingencies causes the totals on the TPCS to be slightly higher than and not add up to exactly the costs above.)

Section 2. NED:

The initial Risk Register considered 13 risk items. From the initial risk items, a total of 9 potential moderate and high risk items were chosen for modeling purposes for the Cost Risk Analysis and 3 risk items for the Schedule Risk Analysis. Assumptions were made for each risk item before running the Monte Carlo simulation. The result of the simulation for the Cost and Schedule Risk Analysis gave a 34.5% (rounded) contingency at the 80-percent confidence level.

The contingency cost for this project was utilized for a Micro Computer Aided Cost Estimating System (MCACES) estimation of the costs associated with the Southwest Coastal NED Non-Structural Plan. The potential cost risks developed during this analysis also serve as an indicator of how to avoid unforeseen escalation of project costs throughout project implementation and therefore, may be used as a valuable tool in all future aspect of the project study.

The major contributors to the resulting total project cost contingency for the Cost Estimate were:

- (PR-2) Participation Rate 10yr to 25yr – risk (positive) of having only a 65% participation rate instead of the 100% assumed in cost.
- (CON-1) Availability of Floodproofing Contractors – risk of inflated prices due to large budgets and limited pool of contractors.
- (CA-1) Contract Acquisition – risk that contract acquisition methods chosen could cause increased levels of subcontracting and/or limit pool of contractors.

The major contributors to the resulting total project schedule contingency for the project schedule were:

- (PR-3) Intermittent Funding – risk of delays in schedule due to a lack of funding during the project.
- (CA-1) Contract Acquisition – risk of limited competition due to contract type delaying the schedule.
- (PPM-1) PED and S&A - risk of Federal Gov't having to set up a full system to engineer, design, and administer program to the lowest levels.

The corresponding Total Cost including contingency (cost & schedule) for the Cost Risk Analysis is presented on table 3.

Table 3. Cost Contingency Analysis Table

Confidence Level	Value	Contingency
Most Likely Cost Estimate	$627,602,000	0.00%
5%	$633,627,818	0.96%
50%	$765,261,114	21.93%
80%	$843,781,100	34.45%
95%	$918,422,524	46.34%

The corresponding Total Schedule including contingency for the Project Schedule is presented on Table 4.

Table 4. Schedule Contingency Analysis Table

Confidence Level	Value	Contingency
Most Likely Cost Estimate	300.0 Months	0.00%
5%	317.2 Months	5.74%
50%	360.1 Months	20.02%
80%	399.2 Months	33.08%
95%	433.3 Months	44.43%

The rounded contingency percentage for **Project Cost and Schedule (34.5%)** were transferred to the TPCS for final calculation of total contingency and cost. Lands and Damages cost and contingency are not included in the above. (NOTE: The rounding of the contingencies causes the totals on the TPCS to be slightly higher than and not add up to exactly the costs above.)

For more detailed information on the CSRA, see the complete CSRA Risk Report.

FOR CONTINUATION OF HOUSE DOCUMENT 116-69

SOUTHWEST COASTAL LOUISIANA INTEGRATED FINAL FEASIBILITY REPORT AND ENVIRONMENT IMPACT STATEMENT

SEE PART 2