



Upper Barataria Basin, Louisiana Draft Feasibility Study with Integrated Environmental Impact Statement



November 29, 2019

EXECUTIVE SUMMARY

The U.S. Army Corps of Engineers (USACE), Mississippi River Valley Division, New Orleans (MVD), Regional Planning and Environment Division South (RPEDS), has prepared this Draft Integrated Feasibility and Environmental Impact Statement (IFR-EIS) for the Upper Barataria Basin, Louisiana study. This report includes input from non-Federal sponsor, Natural Resource Agencies, Federally recognized Indian Tribes, and the public. The Upper Barataria Basin, Louisiana Feasibility Study is a Coastal Storm Risk Management (CSRM) study that evaluates impacts to people, cultural resources and the environment. Going forward in this document, this study will be referred to the Upper Barataria Basin, Louisiana Feasibility Study (UBB).

Study Area – The study area includes communities in the southeast Louisiana parishes of Ascension, Assumption, Jefferson, Lafourche, St. Charles, St. James, and St. John the Baptist (Figure 1-1). The study area is bounded on the north and east by the Mississippi River Levee, on the west by Bayou Lafourche, and on the south it extends slightly past U.S. Highway 90. The study area covers approximately 800 square miles and is characterized by low, flat terrain with wetlands, numerous navigation channels, drainage canals, and natural bayous that drain into Lake Salvador and eventually the Gulf of Mexico. The study area is a diverse ecosystem inhabited by a variety of species of birds, mammals, reptiles, amphibians, as well as fresh, brackish, and saltwater fish.

Problem – The study area is prone to coastal storm damages from tidal surges, storm surges, and rainfall. The headwater flooding from rainfall is intensified by tidal events, resulting in flood damages to industrial, commercial, and agricultural facilities as well as residential structures and critical evacuation routes. Additionally, tidal events can create a backwater effect that does not allow rainfall to drain from within the basin. The study area has been declared a Federal disaster area nine times in the past 30 years due to flood damages from storms.

Planning Objectives – The national objectives to maximize National Economic Development (NED) and is the overarching goal for this study. However, these are general statements that are not specific enough for direct use in plan formulation. The water and related land resource problems and opportunities identified in this study are stated as specific planning objectives to provide focus for the formulation of alternatives. These planning objectives reflect the problems and opportunities in the study area and represent desired positive changes from the future without project condition. Within the study area and over the 50-year period of analysis, the planning objectives are:

- Reduce the risk to human life, health, and safety by reducing flood impacts to structures, evacuation routes, and critical infrastructure
- Reduce the risks of economic impacts due to storm inundation of structures, evacuation routes, and critical infrastructure in the study area.
- Increase community resiliency before, during, and after flooding events

Constraints – A planning constraint is a restriction that limits plan formulation and should be avoided or worked around when possible. Planning constraints for the CSRM study area are:

- The project features cannot increase flood risk to adjacent areas
- Oil and gas infrastructure (Wells) must be avoided
- Impacts to cultural resources must be minimized
- Vessel traffic in and out of the interior basin must not be impeded
- Maintain the hydrological regime through the basin to support targeted habitats
- Do not induce development within a flood plain – Executive Order (EO)-11988
- Minimize the impact to threatened or endangered species existing in the area

Tentatively Selected Plan (TSP)/NED Plan – Per USACE Guidance, the Project Delivery Team (PDT) tentatively selects the alternative that maximizes net benefits as the recommended plan (also called the NED Plan) for this CSR study. In order to determine which alternative is the NED Plan, the costs and benefits for the Final Array of Alternatives were compared. The alternative with the greatest net benefits is the apparent NED Plan, and thus the Tentatively Selected Plan (TSP). The TSP identified from the final array is Alternative 1, Hwy 90 – Segment 1 Extension.

The TSP is a 7.5 foot elevation levee extending out from the Existing St Charles Parish levee continuing south improving the Sunset Levee and include a vehicle crossing at Bayou Gauche. Then the levee system would cross Bayou Des Allemands just south of US Highway 90 with a 270ft barge gate structure. The levee system will then parallel US Highway 90 until high ground near Raceland (Natural Ridge). Hydraulic control structures will be placed to in the section paralleling US Highway 90 to maintain existing water exchanges.

This TSP is estimated to produce nearly \$30.3 million in average annual benefits at an average annual cost of nearly \$20.4 million (total project cost of little less than \$514 million not including the cost of armoring for resiliency), for a Benefit to Cost Ratio (BCR) of 1.5 at the current Federal Discount Rate (FDR) of 2.75 percent. When including the cost of armoring, the BCR comes out to 1.4 and 1.2 for High Performance Turf Reinforcement Matting (HPTRM) and concrete armor respectively if the entire alignment and the existing St. Charles Parish Levee were armored for resiliency.

Timeline – This document is available for public review and comment beginning November 29, 2019. The official closing date for receiving comments is January 13, 2020, which is 45 days from the date on which the notice of availability of this DIFR-EIS is published in the Federal Register during this review period. Comments may be mailed to the address listed below or dropped off in person during business hours (Monday through Friday 8am to 5pm local time). Comments may also be emailed to the email address listed below.

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1 Introduction

The USACE-MVD, RPEDS, has prepared this Draft Integrated Feasibility and Environmental Impact Statement (EIS) for the UBB CSRM. This report includes input from non-Federal sponsor, natural resource agencies, Federally recognized Indian Tribes, and the public. The Upper Barataria Basin (UBB), Louisiana Feasibility study is a Coastal Storm Risk Management (CSRM) study that evaluates impacts to people, environment, and cultural resources.

1.1 Study Scope

The UBB Feasibility Study investigates alternatives for CSRM and identified and evaluated a full range of reasonable alternatives including No Action. In accordance with USACE's Planning Guidance Notebook (Engineer Regulation [ER]:1105-2-100), the product of this study is a decision document in the form of an integrated Feasibility Report and National Environmental Policy Act of 1969 (NEPA) document (usually an Environmental Assessment or Environmental Impact Statement).

1.2 Study Authority

The Bipartisan Budget Act of 2018 (Public Law 115-123), Division B, Subdivision 1, Title IV, (BBA 2018) appropriated supplemental funds which included \$135,000,000 in Supplemental Investigations Funds for Long Term Disaster Recovery Investment Plans (LDRIPs) related to the completion, or initiation and completion, of authorized flood and storm damage reduction studies, including shore protection. Feasibility studies that are predominately for flood and storm damage reduction, as well as comprehensive and watershed studies that are predominately for flood and storm damage reduction (even if there are ancillary purposes) are eligible for supplemental funding consideration. In conducting an authorized study, both structural and non-structural measure must be considered. Studies may address long-range measures to reduce exposure to risks from, floods and coastal storms.

In order for a feasibility study to be undertaken using Supplemental Funds, the study must be Federally-authorized. Enclosure 4 dated July 5, 2018 to the MEMORANDUM FOR Deputy Commanding General for Civil and Emergency Operations, SUBJECT: Policy Guidance on Implementation of Supplemental Appropriations of the Bipartisan Budget Act of 2018, dated August 9, 2018, identified the UBB Study as a feasibility study to be funded with Supplemental Investigations funds as part of the LDRIP. The UBB Feasibility Study was Federally-authorized pursuant to a Resolution of the Committee on Transportation and Infrastructure of the United States House of Representatives, 105th Congress, Docket 2554, "Donaldsonville, Louisiana to the Gulf of Mexico," adopted May 6, 1998. That Resolution (at Docket 2554), requested the Secretary of the Army to review the Report of the Chief of Engineers on the Mississippi River and Tributaries, published as House Document 308, 88th Congress, 2nd Session, and other pertinent reports to determine whether modifications of the recommendations in the Chief's Report were advisable, in the interest of flood control, navigation, wetlands conservation and restoration, wildlife habitat, commercial and recreational fishing, salt water intrusion and

fresh water and sediment diversion, and other purposes, in the area between Bayou Lafourch and the Mississippi River System, from Donaldsonville, Louisiana, to the Gulf of Mexico.

Notwithstanding Section 105(a) of the Water Resources Development Act of 1986 (33 U.S.C. 2215(a)), which specifies the cost-sharing requirements generally applicable to feasibility studies, BBA 2018 authorizes the Government to conduct the Study at full Federal expense to the extent that appropriations provided under the Investigations heading of the BBA 2018 are available and used for such purpose. Thereafter, HQUSAE developed and approved a model Feasibility Cost Sharing Agreement (FSCA) as set forth in the MEMORANDUM FOR DISTRIBUTION, SUBJECT: Bipartisan Budget Act of 2018 (BBA 2018) - Model Agreement for New Feasibility Studies dated August 10, 2018, which also provided that the responsibility for review and approval of an (FSCA) agreement that does not deviate from the model is delegated to the MSC Commander and may not be further delegated. Furthermore, Division Counsel's concurrence that the (FSCA) agreement does not deviate from the subject model, and is appropriate for use for the particular study, is required prior to approval. The authority to execute an (FSCA) agreement may be delegated to the District Commander after it is approved by the MSC Commander.

On September 27, 2018, the New Orleans District submitted the (model) FSCA package (with no deviations) for review and approval to the Mississippi Valley Division, together with a request that the signature authority for the FSCA be delegated to the New Orleans District Commander. On September 29, 2018, MVD approved the FSCA and the delegation of signature authority in the MEMORANDUM FOR Commander, New Orleans District, SUBJECT: Request for Review and Approval to Execute the Model Feasibility Cost Share Agreement (FSCA) between the Department of the Army and the Coastal Protection and Restoration Authority Board of Louisiana for the UBB Study. The FSCA for the UBB Study between the Department of the Army and the Coastal Protection and Restoration Authority Board of Louisiana was executed on October 9, 2018.

This Study has been undertaken in accordance with Sections 1001 and 1002 of the Water Resources Reform Development Act of 2014, applicable existing USACE Civil Work regulations, policies and guidance, and has incorporated SMART Planning principles. See MEMORANDUM FOR COMMANDING GENERAL, U.S. ARMY CORPS OF ENGINEERS, SUBJECT: Revised Implementation Guidance for Section 1001 of the Water Resources Reform and Development Act of 2014, Vertical Integration and Acceleration of Studies as amended by Section 1330(b) of the Water Resources Development Act of 2018, dated March 25, 2019.

1.3 Non-Federal Sponsor

The Louisiana Coastal Protection and Restoration Authority Board (CPRAB) of Louisiana is the cost-sharing Non-Federal Sponsor (NFS) of the study. The study is 100 percent Federally funded. The FSCA for this study was executed on October 9, 2018.

1.4 Study Area and Map

The study area includes communities in the southeast Louisiana parishes of Ascension, Assumption, Jefferson, Lafourche, St. Charles, St. James, and St. John the Baptist (Figure 1-1). The study area is bounded on the north and east by the Mississippi River Levee, on the west by Bayou Lafourche, and on the south it extends slightly past U.S. Highway 90. The study area covers approximately 800 square miles and is characterized by low, flat terrain with wetlands, numerous navigation channels, drainage canals, and natural bayous that drain into Lake Salvador and eventually the Gulf of Mexico. The study area is a diverse ecosystem inhabited by a variety of species of birds, mammals, reptiles, amphibians, as well as fresh, brackish, and saltwater fish.

1.5 Prior Reports, Existing Water Projects and Ongoing Programs

The study area is a very large region with many former, current, and planned projects, studies, and programs that are or have been prepared by USACE; other Federal, state, and local agencies; research institutions; and individuals. Previous Federal and non-Federal studies have established a reasonable database for this report. The most relevant studies, reports, and projects conducted in the study area are:

- The Center for Wetland Resources, Louisiana State University, performed studies of the hydrologic and geologic characteristics of coastal Louisiana under a contract with USACE. The studies examined and identified trends in the coastal area resulting from natural processes and human activities, identified significant environmental parameters, determined the fresh water required to implement changes for fish and wildlife enhancement, and developed management and structural approaches to problem solving in the estuarine environment. The findings and recommendations of the studies are included in a series of 18 published reports, the last one published in 1973.
- USACE prepared a report title “Freshwater Diversion to the Barataria and Breton Sound Basins” in April 1983. The report recommends diverting Mississippi River water into Breton Sound Basin near Caernarvon and into Barataria Basin near Davis Pond to enhance habitat conditions and improve fish and wildlife resources. The Caernarvon Freshwater Diversion Structure was completed in January 1991.
- An initial USACE evaluation study entitled “Louisiana Coastal Area, Louisiana, Shore and Barrier Island Erosion,” dated September 1984, reports investigative findings that indicate that Louisiana’s beaches and barrier islands act as buffers for coastal marshes and communities, absorbing much of the wave action from the Gulf of Mexico. However, most of the shoreline is receding. Continued retreat will expose valuable marshes to direct attack from the gulf. Loss of the marshes would have a severe impact on existing coastal development and fish and wildlife resources important to the state and nation.
- USACE conducted a reconnaissance study under the Louisiana Coastal Authority entitled “Mississippi River Delta Study.” The purpose of this study was to determine the feasibility of realigning the lower Mississippi River channel to increase its marsh-

building capacity. The general study finding was that there are no economically justified alternatives for making realignments to the Mississippi River.

- An initial evaluation report, “Louisiana Coastal Area, Louisiana, Water Supply,” prepared in September 1984, investigated the advisability of improvements or modification of existing improvements, in the interest of water supply, in the coastal area of Louisiana. The report recommends that five of the six problem areas identified be further investigated in the cost-shared feasibility phase of the study.
- USACE prepared a reconnaissance report on hurricane protection in March 1988. “The Louisiana Coastal Area Hurricane Protection Reconnaissance Report” details the feasibility of providing hurricane protection for coastal Louisiana between the Pearl River on the east and the Sabine River on the west. For this report, concentration was placed on the Barataria Basin portion of the Louisiana Coastal Area. The report recommends proceeding to the feasibility phase to investigate a hurricane protection alternative for the Luling area of St. Charles Parish on the west bank of the Mississippi River.
- A USACE report entitled “New Orleans-Baton Rouge Metropolitan Area, Louisiana,” was completed in 1981. The report contains a comprehensive plan for development and conservation of water and related land resources in a 21-parish area.
- The U.S. Fish and Wildlife Service (USFWS) produced a report entitled “Mississippi Deltaic Plain Region Ecological Characterization.” Published in 1980, the report supplies information about the biological, social, and physical parameters in the Mississippi Deltaic Plain region of Louisiana.
- A report sponsored by USFWS, “An Ecological Characterization Study of the Chenier Plain Coastal Ecosystem of Louisiana and Texas,” was published in 1979. This report contains information on the biological, social, and physical parameters in the Chenier Plain of Louisiana and Texas.
- “Bayou Chevreuil and Grand Bayou, Louisiana, Continuing Authorities Program Section 205 Preliminary Evaluation” was conducted by USACE in March 1993. During this evaluation, nonstructural means of flood protection for structures within the Bayou Chevreuil and Grand Bayou drainage basins were analyzed. Nonstructural flood control measures include temporary closures to impacted structures, ring levees, structure raising, and structure relocation. The preliminary evaluation recommended additional Federal studies on nonstructural flood control measures in the study area.
- The most recent documented study of the area is the “Donaldsonville to the Gulf of Mexico Feasibility Study.” This Final Letter Report was released June of 2012 with a negative finding. The Coastal Protection and Restoration Authority Board has an existing study within the study area. The structural plan is currently being pursued by the St. Charles Levee District. It incorporates a levee along U.S. Highway 90 between the West Bank and Larose, of which, St. Charles has constructed one segment.

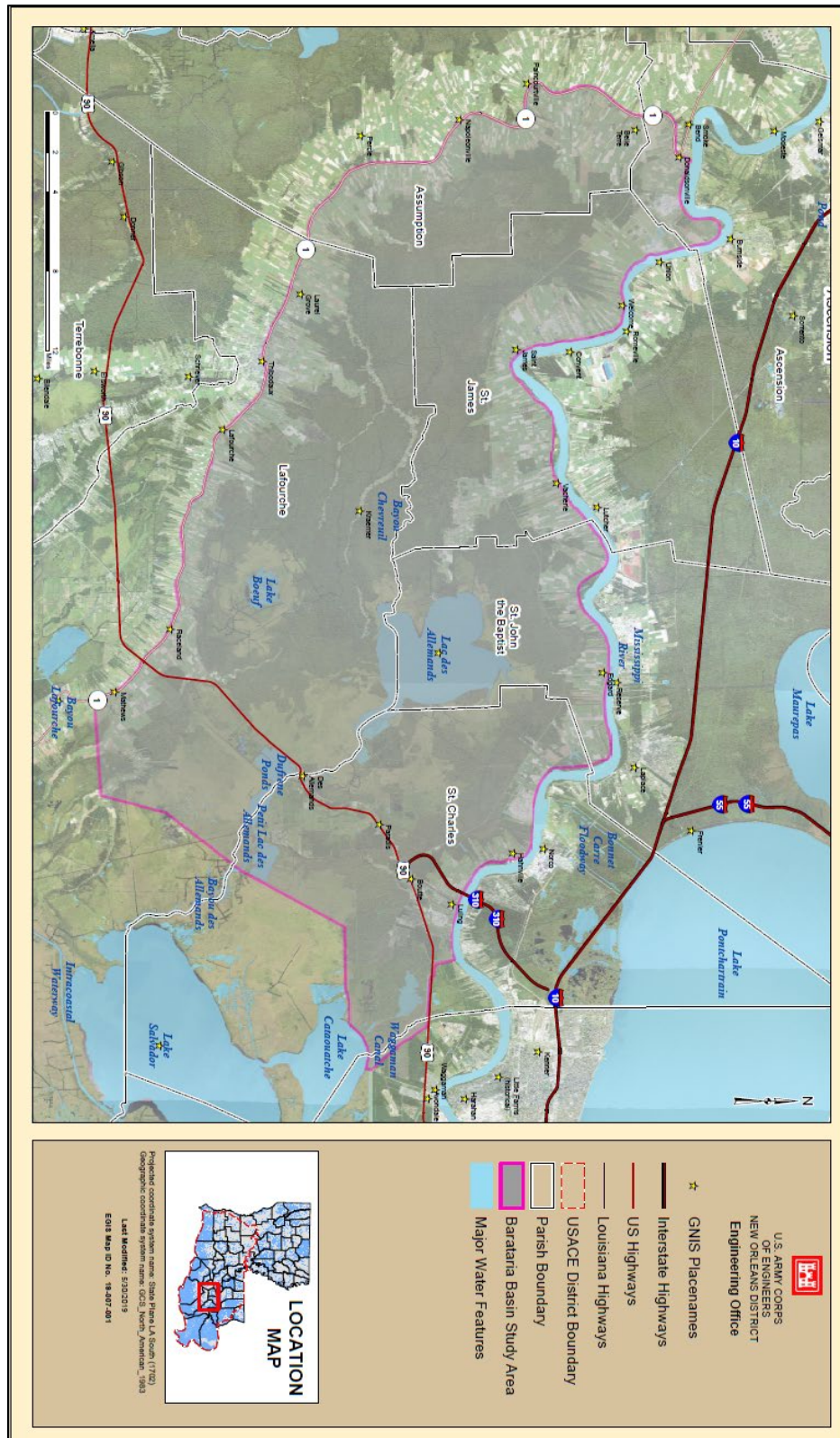


Figure 1-1: Upper Barataria Basin Feasibility Study Area

2 Problems and Opportunities (Purpose and Need)

2.1 Specific Problems and Opportunities

The primary problem identified in the study area is the risk of flood damage from tidal surges, storm surges, and rainfall.

Flood Risk - The headwater flooding from rainfall is intensified by tidal events, resulting in flood damages to industrial, commercial, and agricultural facilities as well as residential structures and critical evacuation routes. Tidal events can create a backwater effect that does not allow rainfall to drain from the basin. The study area has been declared a Federal disaster area nine times in the past 30 years due to flood damages from storms. A coastal storm damage risk management project in the study area will reduce the risk of flooding for residential and commercial structures, major transportation routes, and many other commercially and culturally significant places and activities vital to the economy of the region and nation.

Sea Level Rise - Sea level rise (SLR) and subsidence are expected to increase in the future, causing more frequent storm surge inundation and flood events.

Ecosystem - Saltwater intrusion associated with frequent storm surge will also impact the diverse, ecologically important fresh water habitat within the study area. Aquaculture, commercial fishing, crawfish farming, fishing, hunting, and tourism industries will also be significantly impacted by frequent storm surge events. Coastal flooding also subjects the habitat to changes in water salinity. The economic impacts affect fishers, processors, suppliers, grocers, and restaurants at the regional and national level.

This study is specific to CSRM and formulation focuses on minimizing damages due to coastal storms.

Opportunities to address the identified problems for this CSRM study area include:

- Decrease the risk to human life due to flooding
- Reduce flood risk and damages to residential, commercial, historic, cultural, and critical assets and infrastructure
- Limit economic damages and improve economic resiliency of the local economy and communities
- Increase the resiliency and reliability of critical infrastructure (airports, industrial, and power facilities).
- Convert flood zones to help minimize insurance expenses
- Increase community awareness about flooding risks
- Reduce recovery time from high water events that make evacuation routes and other critical roadways impassable
- Sustain the unique heritage of coastal Louisiana by minimizing impacts from coastal storm events

2.2 Purpose and Need

Per the authority referenced in Section 1, the UBB study's purpose is to address the flooding problems discussed in Section 2.1.

Without the project, the UBB Study area would continue to experience damages from storm events. These impacts would be exacerbated due to heavy rainfall coupled with increases in relative sea level change.

2.3 Planning Objectives

The NED Plan is the alternative plan that reasonably maximizes net economic benefits consistent with protecting the nation's environment. NED will be calculated explicitly including uncertainties in the key variables specified in the risk register. The national objective to maximize NED is the overarching goal for this study. However, these are general statements that are not specific enough for direct use in plan formulation. The water and related land resource problems and opportunities identified in this study are stated as specific planning objectives to provide focus for the formulation of alternatives. These planning objectives reflect the problems and opportunities in the study area and represent desired positive changes from the future without project condition. Within the study area and over the 50-year period of analysis, the planning objectives are:

- Reduce the risk to human life, health, and safety by reducing flood impacts to structures, evacuation routes, and critical infrastructure
- Reduce the risk of economic impacts due to storm inundation in the study area; structures, evacuation routes, and critical infrastructure.
- Increase community resiliency before, during, and after flooding events

2.4 Planning Constraints

A planning constraint is a restriction that limits plan formulation and should be avoided or worked around when possible. Planning constraints for the CSRM study area are:

- The project features cannot increase flood risk to adjacent areas
- Oil and gas infrastructure (wells) must be avoided
- Impacts to cultural resources must be minimized
- Vessel traffic in and out of the interior basin must not be impeded
- Maintain the hydrological regime through the basin to support targeted habitats
- Do not induce development within a flood plain – EO-11988
- Minimize the impact to threatened or endangered species existing in the area

2.5 Public Scoping Section

NEPA coordination with the non-Federal sponsor (NFS), stakeholders, Federal and state agencies (United States Fish and Wildlife Services (USFWS) and the National Marine Fisheries Service (NMFS)) and Federally-recognized Tribes was performed prior to the Notice of Intent (NOI) and afterwards through public meetings, social media, and the USACE New Orleans District (CEMVN) website. Per Water Resources Reform and

Development Act (WRRDA) 2014 general scoping meetings were hosted by USACE within 90 days of the start of the study. A public website page with the study information and request for feedback was established in December of 2018. A scoping report is included in the Environmental Appendix C, which has copies of all written feedback received.

The collaborative stakeholders associated with this USACE study are the Lafourche Basin Levee District, the St. Charles Levee District, and Coastal Protection and Restoration Authority (CPRA). Resource agencies associated with this study include the USFWS and NMFS. Additionally, in partial fulfillment of USACE's responsibilities under Executive Order (EO) 13175, early NEPA coordination was initiated with the following Tribes: Alabama-Coushatta Tribe of Texas (ACTT), Chickasaw Nation, Chitimacha Tribe of Louisiana (CTL), Choctaw Nation of Oklahoma (CNO), Coushatta Tribe of Louisiana (CT), Jena Band of Choctaw Indians (JBCI), Mississippi Band of Choctaw Indians (MBCI), Muscogee (Creek) Nation (MCN), Seminole Nation of Oklahoma (SNO), Seminole Tribe of Florida (STF), and Tunica-Biloxi Tribe of Louisiana (TBTL) on December 4, 2018.

Additionally, a general scoping meeting was conducted on January 10, 2019, at CEMVN with Facebook Live Streaming, which requested feedback as well. Feedback from the public scoping meeting did not result in formulation of additional measures but gave suggestions to where flooding was being experienced in the study area.

In accordance with NEPA, a NOI to prepare an EIS was published in the Federal Register (Volume 84, No. 63) on April 2, 2019. The scoping period ends on April 2, 2021. Three public scoping meetings were conducted within the study area on May 1 at the Thibodaux Library and on May 2 at the St. Charles Parish Emergency Operations Center in Hahnville, with Facebook Live Streaming. Comments were accepted via written correspondence and emails. Approximately 40 non-USACE people attended the meetings in person and the Facebook Live Streaming had nearly 600 views. People that attended were concerned about flooding due to combined rainfall and a coastal storm effects. Feedback from the public scoping meeting resulted in alterations to the alternatives and an alternative to prevent rainfall damages within the basin. All public comments can be found within the Public Scoping Report contained within Appendix C.

Additionally, a meeting was conducted on October 22, 2019 with collaborative stakeholders and the NFS to present the final array of alternatives and the screening rationale of the alternatives that were screened. This resulted in TSP validation from the stakeholders.

3 Inventory and Forecast Conditions

3.1 Historic and Existing Conditions (Affected Environment)

The environmental settings section describes the climate, geology, and historic and existing conditions for significant environmental resources including: soils; salinity regimes, water quality; vegetation resources; wildlife resources (including birds, mammals, amphibians, and reptiles); fisheries; EFH; plankton; water bottoms and benthic resources; threatened and endangered species; historic and cultural resources; socioeconomic and human resources (population; infrastructure; employment and income; commercial fisheries; aesthetics (visual resources); recreation; and air quality. In addition, noise and hazardous, toxic, and radioactive waste (HTRW) are also considered. A resource is considered important if it is recognized by statutory authorities including laws, regulations, Executive Orders (EO), policies, rules, or guidance; if it is recognized as important by some segment of the general public; or if it is determined to be important based on technical or scientific criteria.

3.1.1 Study Area

The study area is located within the Barataria Basin, an irregularly shaped area located in south-central Louisiana. It is bounded on the north and east by the Mississippi River, on the south by the Gulf of Mexico, and on the west by Bayou Lafourche. The basin itself encompasses approximately 1,565,000 acres and contains approximately 152,120 acres of swamp, 173,320 acres of fresh marsh, 59,490 acres of intermediate marsh, 102,720 acres of brackish marsh, and 133,600 acres of saline marsh. The study area covers 800 square miles within the basin and covers multiple parishes in Louisiana including, Assumption, Ascension, St. James, Lafourche, St. John the Baptist, St. Charles, Jefferson, Plaquemines, and Orleans. It is also divided into nine subbasins: Fastlands, Des Allemands, Salvador, Central Marsh, Grande Cheniere, L'Ours, North Bay, Bay, and Empire.

The UBB area is a region dominated by extensive coastal wetlands created by deltaic processes of the Mississippi River. Because of its deltaic history, the study area is characterized by a number of former distributary channels extending into the basin from either Bayou Lafourche or from the Mississippi River. Because the highest land elevations occur on the banks of those former distributary channels, developed areas are generally located there. The remainder of the upper basin consists of coastal forested wetlands, marshes and associated water bodies. The Barataria Basin exhibits a northwest-southeast salinity gradient with fresh or low-salinity conditions toward the northwest, and more saline conditions nearer the Gulf. Given that the study area is located within the upper basin, the study area is characterized by freshwater conditions, with low- salinity brackish water occurring infrequently in the more tidally influenced southern portion of the study area.

Forested and herbaceous wetlands within the study area are suffering from increased inundation due to the combined effects of subsidence, sea level rise, and loss of Mississippi River suspended sediment inputs. As a result, study area cypress-tupelo swamps are no longer sustainable. Bottomland hardwoods at higher elevations are

converting to cypress-tupelo swamp or marsh. Upper basin marshes have remained healthy and are expected to remain relatively healthy provided that area salinities do not increase and middle and lower basin marshes remain intact. Through the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA), the Corps, and other Federal and state agencies have jointly developed strategies to protect and restore Louisiana's coastal wetlands, including those within the UBB.

Local Protection Measures

The Barataria Basin includes local levee systems which are maintained by local communities. These systems have inconsistent levels of storm surge protection and mainly serve as method of removing rainfall via pumps when gravity drainage is not sufficient. The follow communities have local levee systems with varying degrees of protection:

Local Levee System	Communities Protected	Description:
Backwater Protection Levee in South Vacherie	Vacherie	Levee -Two 48-inch pumps and 270 hp diesel engines
Golden Star Plantation Levee	Vacherie (Ag)	Levee
Sunset Drainage District	Bayou Gauche, Des Allemands and Paradis	Levee and pump
Ellington Plantation	Boutte Mimosa Park	2 existing pump stations
Willowridge	Willowdale Willowridge Estates	1 existing pump station

3.1.2 Climate and Climate Change

The 2014 USACE Climate and Resiliency Policy Statement states the “USACE shall continue to consider potential climate change impacts when undertaking long-term planning, setting priorities, and making decisions affecting its resources, programs, policies, and operations.” The most significant impact on coastal wetlands resulting from climate change is sea level change. The UBB Study is not intended to construct flood risk management structures that last in perpetuity.

The climate in the study area is influenced by the many water surfaces of the nearby wetlands, rivers, lakes, and streams. Warm, moist southeasterly winds from the Gulf of Mexico prevail throughout most of the year, with occasional cool, dry fronts dominated by northeast high pressure systems. Extreme changes in climate (temperature, rain, evaporation, wind) could result in conditions that cannot support the types of habitat restored, reducing the effectiveness of the proposed plan and any associated mitigation. Extreme climate change could essentially eliminate the benefits of any constructed flood protection in the basin.

Seasons in the study area are characterized by long, humid, and hot summers, comparatively short, mild winters, and abundant rainfall. In winter, the average temperature is approximately 54 degrees Fahrenheit, and the average daily minimum temperature is 44 degrees. In summer, the average temperature is approximately 81

degrees, and the average daily maximum temperature is 90 degrees. The total annual precipitation averages approximately 60 inches. Hurricanes and tropical storms can occur from June through November. Tropical storms occur typically every 1-2 years, and hurricanes every 3-5 years. Tropical storms occur with a frequency of approximately one storm every 1.6 years and hurricanes occur once every 4.1 years within a 75 mile radius of New Orleans (U.S. National Hurricane Center, 1995). These storms can bring periods of intense rainfall and wind accompanied by storm surges from the Gulf of Mexico.

Normal annual precipitation for the UBB is 70.96 inches. Southerly, maritime winds prevail for much of the year, resulting in the potential for highly variable rainfall over the basin. Daily variations are frequently measured in inches. 30-year averaging measures annual precipitation throughout the UBB between 68 to 72 inches. The wettest month is June with an average monthly normal rainfall of 8.59 inches. November is the driest month averaging 4.03 inches. See Appendix C for the monthly temperature and precipitation normals recorded from the Thibodaux 4 SE, LA monitoring station by the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (NCDC).

High cumulative rainfall events (e.g., 6 inches or more in less than 72 hours) over large areas of the UBB are caused under two typical scenarios: slow moving cold fronts encountering warm moist coastal air in late-winter or early spring; and slow moving tropical storms in summer or early fall. High short-term localized rainfall intensities (e.g., over one inch in an hour) can occur under these two scenarios, and are also experienced in a third scenario—heavy summer-time thunderstorms. Record floods often result when significant rainfall events occur in the context of above-average seasonal rainfall patterns, which sustain high soil moisture saturation and floodplain water levels. In addition to rainfall-riverine flood events, the lower portion of the basin is also subject to wind-driven coastal flooding associated with slow-moving tropical storms and prolonged heavy southerly winds cause high water levels along the southeastern Louisiana coast.

Current projections of storm frequencies from CPRA Coastal Master Plan Report (2017) anticipates increased frequencies for hurricanes and decreased frequencies for tropical storms. See Table 3-1 below for the average annual number of North Atlantic Basin tropical storms and major hurricanes (CPRA 2017).

Table 3-1. North Atlantic Basin tropical storms and major hurricanes based on the plausible range of future tropical storm frequency.

Table 3-1: North Atlantic Basin Tropical Storms

	1981-2010 Average	Projected Average for 2015-2065	Range of Frequency change (2015-2065)
All tropical storms	12.1	8.8 to 12.6	-28%
Major Hurricanes	2.7	3.1 to 8.6	+13% and +83%

3.1.3 Sea Level Change

ER 1100-2-8162 provides guidance for incorporating direct and indirect physical effects of projected future sea level change across the project life cycle in managing, planning,

engineering, designing, constructing, operating, and maintaining USACE projects and systems of projects. Potential relative sea level change must be considered in every USACE coastal activity as far inland as the extent of estimated tidal influence.

Potential increases in sea level (SLR) could affect the performance and therefore ability of a mitigation project to achieve replacement of the services and functions of the impacted habitat types. Because all of the mitigation projects were designed based on the intermediate SLR scenario to account for potential uncertainties in future SLR impacts, the risk of the proposed projects not successfully meeting the mitigation requirement due to SLR has been minimized.

The intent of compensatory mitigation is to offset unavoidable habitat losses by replacing those impacted habitats by restoring (re-establishment or rehabilitation), establishing (creation), or enhancing a naturally-functioning system. Once the project meets its long-term success criteria, it will experience natural successional phases common to that habitat type. Once the functions and services of the affected habitat have been replaced and the mitigation project becomes a naturally-functioning, self-sustaining system whose habitat is protected in perpetuity, the compensatory mitigation obligation is satisfied.

Using USACE-predicted future water levels under the SLR scenarios, those water levels were converted into relative sea level rise (RSLR) rates, incorporating sea level rise effects measured at the gauges and land loss experienced in the extended project area for each project. No operations and maintenance activities were planned for any of the projects in relation to future elevation changes. The WVA then utilized the RSLR rates and project design to predict FWP acres left at the end of the 50-year period of analysis. Long-term sustainability (percent land left at the end of the period of analysis) was used to analyze the impact that different SLR scenarios had on the project areas. Comparison between the long-term sustainability numbers experienced under the intermediate and high SLR scenarios for all of the mitigation projects in the final array supported the choice of the TSPs, that is, all the TSPs for all habitat types performed the best under the influence of both the intermediate and high SLR scenarios.

Climate change analysis required by ECB 2018-14 for the inland hydrology and this analysis is contained within the Engineering Appendix A (Annex). This analysis speaks to relative sea level rise and subsidence among other concerns of climate change. Also, following ER 1100-2-8162, the TSP will be evaluated under a low, intermediate, and high SLR scenario.

3.1.4 Geology

Most of the present landmass of southeast LA was formed by deltaic processes of the Mississippi River. Over the past 7,000 years, the Mississippi River deposited massive volumes of sediment in five deltaic complexes. The study area lies within the Mississippi Deltaic Plain which contains natural levee ridges, man-made levees, fresh, intermediate, brackish and saline marshes, forested wetlands, lakes and bays, barrier islands, and estuaries.

The Deltaic Plain is comprised of highly organic soils, and floating marshes and peat deposits are also prevalent in this service area. Subsidence rates in the Deltaic Plain are much higher than the Chenier Plain and is one of the most critical problems in this area. Combined with wave attack along coastal Louisiana and loss of river-borne sediment supply, it constitutes the primary cause of severe land loss in the marshlands. With the disappearance of exterior marshes, swamps and barrier islands, inland marshes are degrading as a result of wave and saltwater inundation.

A portion of study area is located in the coastal marshes of south Louisiana's Lafourche Parish. This area of Louisiana is characterized by extensive coastal marshes with residential and commercial development primarily limited to the communities and scattered development adjacent to Louisiana State highways LA 1, LA 3090, and LA 3235.

Because of the lack of mineral sediment accretion in upper basin marshes, those marshes are characterized by highly organic substrates that in many areas are floating or semi-floating. Such marshes are vulnerable to potential catastrophic degradation and loss if exposed to brackish water conditions. Additionally, such floating marshes are more susceptible to storm surge impacts than heavier mineral soil marshes.

Riverine freshwater and sediment inputs once available to the study area via Bayou Lafourche were eliminated when the bayou was dammed in 1903. Seasonal freshwater and suspended sediment inputs from the Mississippi River were eliminated by construction of flood protection levees along the Mississippi River following the catastrophic 1927 Mississippi River flood. The elimination of the riverine suspended sediment inputs has resulted in net subsidence as sediment inputs are no longer available to counteract subsidence and sea level rise. This problem, manifested in wetland loss, is most severe in the middle and lower basin (CPRA 2017) and with additional time may impact the upper basin study area as well. To address this coastal wetland loss crisis, the Davis Pond Freshwater Diversion Project was authorized and began operating in 2002. The Mid-Barataria Sediment Diversion Project, currently in engineering and design, is planned to introduce large amounts of Mississippi River water and sediments into the middle basin.

3.1.5 Relevant Resources

Table 3-2 of this section provides summary information of the institutional, technical, and public importance of these resources. The resources described in this section are those recognized as significant by laws, Executive Orders (EOs), regulations, and other standards of Federal, state, or regional agencies and organizations; technical or scientific agencies, groups, or individuals; and the general public.

Table 3-2: List of Relevant Resources

Resource	Institutionally Important	Technically Important	Publicly Important
Wetlands	Clean Water Act of 1977, as amended; Executive Order 11990 of 1977, Protection of Wetlands; Coastal Zone Management Act of 1972, as amended; and the Estuary Protection Act of 1968., EO 11988, and Fish and Wildlife Coordination Act.	They provide necessary habitat for various species of plants, fish, and wildlife; they serve as ground water recharge areas; they provide storage areas for storm and flood waters; they serve as natural water filtration areas; they provide protection from wave action, erosion, and storm damage; and they provide various consumptive and non-consumptive recreational opportunities.	The high value the public places on the functions and values that wetlands provide. Environmental organizations and the public support the preservation of marshes.
Aquatic Resources/ Fisheries/Water Bottoms	Fish and Wildlife Coordination Act of 1958, as amended; Clean Water Act of 1977, as amended; Coastal Zone Management Act of 1972, as amended; and the Estuary Protection Act of 1968.	They are a critical element of many valuable freshwater and marine habitats; they are an indicator of the health of the various freshwater and marine habitats; and many species are important commercial resources.	The high priority that the public places on their esthetic, recreational, and commercial value. Environmental organizations and the public support the preservation of water quality and fishery resources.
Essential Fish Habitat (EFH)	Magnuson-Stevens Fishery Conservation and Management Act of 1996, Public Law 104-297	Federal and state agencies recognize the value of EFH. The Act states, EFH is "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity."	Public places a high value on seafood and the recreational and commercial opportunities EFH provides.
Wildlife	Fish and Wildlife Coordination Act of 1958, as amended and the Migratory Bird Treaty Act of 1918	They are a critical element of many valuable aquatic and terrestrial habitats; they are an indicator of the health of various aquatic and terrestrial habitats; and many species are important commercial resources.	The high priority that the public places on their esthetic, recreational, and commercial value.
Threatened and Endangered Species	The Endangered Species Act of 1973, as amended; the Marine Mammal Protection Act of 1972; and the Bald Eagle Protection Act of 1940.	USACE, USFWS, NMFS, NRCS, EPA, LDWF, and LDNR cooperate to protect these species. The status of such species provides an indication of the overall health of an ecosystem.	The public supports the preservation of rare or declining species and their habitats.
Cultural Resources	National Historic Preservation Act of 1966, as amended; the Native American Graves Protection and Repatriation Act of 1990; and the Archeological Resources Protection Act of 1979	State and Federal agencies document and protect sites. Their association or linkage to past events, to historically important persons, and to design and construction values; and for their ability to yield important information about prehistory and history.	Preservation groups and private individuals support protection and enhancement of historical resources.
Recreation Resources	Federal Water Project Recreation Act of 1965 as amended and Land and Water Conservation Fund Act of 1965 as amended	Provide high economic value of the local, state, and national economies.	Public makes high demands on recreational areas. There is a 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.

Resource	Institutionally Important	Technically Important	Publicly Important
Aesthetics	USACE ER 1105-2-100, and National Environmental Policy Act of 1969, the Coastal Barrier Resources Act of 1990, Louisiana's National and Scenic Rivers Act of 1988, and the National and Local Scenic Byway Program.	Visual accessibility to unique combinations of geological, botanical, and cultural features that may be an asset to a study area. State and Federal agencies recognize the value of beaches and shore dunes.	Environmental organizations and the public support the preservation of natural pleasing vistas.
Air Quality	Clean Air Act of 1963, Louisiana Environmental Quality Act of 1983.	State and Federal agencies recognize the status of ambient air quality in relation to the NAAQS.	Virtually all citizens express a desire for clean air.
Water Quality	Clean Water Act of 1977, Fish and Wildlife Coordination Act, Coastal Zone Mgt Act of 1972, and Louisiana State & Local Coastal Resources Act of 1978.	USACE, USFWS, NMFS, NRCS, EPA, and State DNR and wildlife/fishery offices recognize value of fisheries and good water quality and the national and state standards established to assess water quality.	Environmental organizations and the public support the preservation of water quality and fishery resources and the desire for clean drinking water.

3.1.5.1 Natural Environment

3.1.5.1.1 Hydraulics and Hydrology

Historically, wetlands in the Barataria Basin were nourished by the fresh water, sediments, and nutrients delivered via overbank flooding of the Mississippi River and through its many distributary channels such as Bayou Lafourche, Bayou Barataria, and Bayou Grand Cheniere. As the flow of fresh water and sediments from the Mississippi River was restricted by flood protection levees and the closure of Bayou Lafourche, the basin began to gradually deteriorate from saltwater intrusion, subsidence, wave action, and sediment deprivation. Historically, Bayou Perot, and the longer, narrower Bayou Dupont-Bayou Barataria-Bayou Villars channels provided limited hydrologic connection between the upper and lower basin. The hydrologic connections between the Upper and Lower Barataria Basin are much greater today, due to the Barataria Bay Waterway, Bayou Segnette Waterway, Harvey Cutoff, and substantial erosion and interior marsh loss along Bayous Perot and Rigolettes. The frequency of high salinity events has also increased in the Barataria Basin (Swenson and Turner 1998), probably as a result of the increased tidal connectivity. From 1932 to 1990, the basin lost over 245,000 acres of marsh (LCWCRTF 1993) and from 1978 to 1990 it has experienced the highest rate of wetland loss along the entire Louisiana Coast (Barras et al. 2003).

The Mississippi River's influence on the basin has now been reduced to freshwater diversion projects (e.g., Davis Pond Freshwater Diversion Project) and the periodic opening of locks which connect the river to navigation channels. The Davis Pond Freshwater Diversion Project (Davis Pond Project), located on the west bank of the Mississippi River near Luling, would most likely have the most significant impact on the hydrology of the Barataria Basin since Federal flood protection levees were constructed along the Mississippi River in the early 1900s.

Davis Pond Diversion

The Davis Pond Diversion project impacts the study area hydrology and salinity and influence localized land creation. All of these have varying impacts on the ecology. As part of the Louisiana Coastal Area, the modification of Davis Pond Diversion project has potential to influence more than one million acres. The project modification is in feasibility study phase to address freshwater, sediment and nutrients within the Barataria Basin. The existing project was completed in 2002 and has a maximum operating capacity of 10,650 cubic feet per second and has been operated as a salinity management feature by adjusting Mississippi River diversion discharges to meet basin salinity targets.

For more information on the hydrological influences within the study area, see the Hydrology report contained in Appendix G.

3.1.5.1.2 Wetlands

The marshland in Barataria Basin can be broken down into four general types: saline marsh, brackish marsh, intermediate marsh and fresh marsh. The major factors that influence the type of wetland community are elevation, hydrology, salinity, and soil type. Elevation is critical to the type of wetland occurring in an area, and small elevation changes can result in major shifts in community type (Connor et al, 1981). Freshwater habitats generally have salinities less than 0.5 ppt, salinities in intermediate marsh range between 0.5-5.0 ppt, brackish marsh has salinities of 5-18 ppt, and saline marsh salinities vary between 18-30 ppt.

The upper portion of the Barataria Basin is largely a freshwater-dominated system of natural levee ridges, swamps, and fresh marsh habitats. Freshwater marsh is found surrounding bodies of open water and is located in the study area specifically along the edge of Lac des Allemands, Lake Boeuf, Bayou des Allemands, and Dufrene Ponds.

Invasive Plants

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 Chickweed, purple nutsedge, mimosa tree. 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 affects plankton biomass production. Alligatorweed, Chinese tallow and Chinese privet are of minimal wildlife value and can proliferate until they become the only dominant plant species in the area, limiting food available for wildlife.

Wetland 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. Coastal Louisiana wetlands are one of the most critically threatened environments in the United States. These wetlands are in peril because Louisiana currently experiences greater coastal wetland loss than all other states in the contiguous United States combined (Couvillion, et al., 2017). The Louisiana coastal plain accounts for 90 percent of the total coastal marsh loss in the nation (USACE 2004). Couvillion et al. (2011) analyses shows coastal Louisiana has undergone a net change in land area of about -1,883 square miles of wetlands from 1932 to 2010. Trend analyses from 1985 to 2010 show a wetland loss rate of about 16.57 square miles per year.

Appendix C contains a more detailed description of wetlands and other flora found in the study area.

3.1.5.1.3 Wildlife

There are a variety of habitats in the study area for wildlife species use including: open fields used for foraging, forested wetlands, fresh marsh, lines of trees and shrubs along drainage ditches and denser tree growth along waterways that provide cover and connectivity. As the study area is located within the Mississippi Flyway, an area that experiences significant seasonal migrations of waterfowl species, which are of particular interest to recreational hunters. Flooded fields are especially valuable to wildlife when they are located adjacent to flooded bottomland hardwood forests because they provide nocturnal roosting sites for many species.

See Tables 3-3 through 3-6 for the list of species. Appendix C contains more information on wildlife utilizing the project area.

Table 3-3: Waterfowl Species

Representative Waterfowl Species Found in the Study Area	
Common Name	Scientific Name
Northern shoveler	<i>Anas clypeata</i>
Wood duck	<i>Aix sponsa</i>
Hooded-merganser	<i>Lophodytes cucullatus</i>
Blue-winged teal	<i>Spatula discors</i>
Green-winged teal	<i>Anas crecca</i>
Mallard	<i>Anas platyrhynchos</i>
Canvasback	<i>Aythya valisineria</i>
Northern pintail	<i>Anas acuta</i>
Gadwall	<i>Mareca strepera</i>
American wigeon	<i>Mareca americana</i>
Mottled duck	<i>Anas fulvigula</i>
Lesser Scaup	<i>Aythya affinis</i>
Redhead duck	<i>Aythya americana</i>
Ring-necked duck	<i>Aythya collaris</i>
Red-breasted merganser	<i>Mergus serrator</i>

Table 3-4: Bird Species

Representative Nongame Species Found in the Study Area	
Common Name	Scientific Name
Little blue heron	<i>Egretta caerulea</i>
Great blue heron	<i>Ardea herodias</i>
Green-backed heron	<i>Butorides virescens</i>
Yellow-crowned night heron	<i>Nyctanassa violacea</i>
Black-crowned night heron	<i>Nycticorax nycticorax</i>
Tricolored heron	<i>Egretta tricolor</i>
Great egret	<i>Ardea alba</i>
Snowy egret	<i>Egretta thula</i>
Cattle egret	<i>Bubulcus ibis</i>
White ibis	<i>Eudocimus albus</i>
Killdeer	<i>Charadrius vociferus</i>
Black-necked stilt	<i>Himantopus mexicanus</i>
Boat-tailed grackle	<i>Quiscalus major</i>
Red-winged blackbird	<i>Agelaius phoeniceus</i>
Northern harrier	<i>Circus hudsonius</i>
Glossy ibises	<i>Plegadis falcinellus</i>
Bald eagle	<i>Haliaeetus leucocephalus</i>
Screech owl	<i>Megascops asio</i>
Great horned owl	<i>Bubo virginianus</i>
Barred owl	<i>Strix varia</i>
Common snipe	<i>Gallinago gallinago</i>
Belted kingfisher	<i>Megaceryle alcyon</i>
Mockingbird	<i>Mimus polyglottos</i>
Yellow-billed cuckoo	<i>Coccyzus americanus</i>
Northern parula	<i>Setophaga americana</i>
Yellow-rumped warbler	<i>Setophaga coronata</i>
Prothonotary warbler	<i>Protonotaria citrea</i>
White-eyed vireo	<i>Vireo griseus</i>
Carolina chickadee	<i>Poecile carolinensis</i>
Tufted titmouse	<i>Baeolophus bicolor</i>
American woodcock	<i>Scolopax minor</i>
Common flicker	<i>Colaptes auratus</i>
Brown thrasher	<i>Toxostoma rufum</i>
Pileated woodpecker	<i>Dryocopus pileatus</i>
Red-headed woodpecker	<i>Melanerpes erythrocephalus</i>
Downy woodpecker	<i>Picoides pubescens</i>
Common grackle	<i>Quiscalus quiscula</i>
Common crow	<i>Corvus brachyrhynchos</i>
Red-tailed hawk	<i>Buteo jamaicensis</i>
Red-shouldered hawk	<i>Buteo lineatus</i>
Mississippi kite	<i>Ictinia mississippiensis</i>

Table 3-5: Reptile and Amphibian Species

Representative Reptile & Amphibian Species Found in the Study Area	
Common Name	Scientific Name
American alligator	<i>Alligator mississippiensis</i>
Green anole	<i>Anolis carolinensis</i>
Water moccasin	<i>Agkistrodon piscivorus</i>
Speckled kingsnake	<i>Lampropeltis getula</i>
Copperhead	<i>Agkistrodon contortrix</i>
Southern leopard frog	<i>Lithobates sphenoccephalus</i>
Ground skink	<i>Scincella lateralis</i>
Five-lined skink	<i>Plestiodon fasciatus</i>
Broad-headed skink	<i>Plestiodon laticeps</i>
Gulf coast ribbon snake	<i>Thamnophis proximus</i>
Yellow-bellied water snake	<i>Nerodia erythrogaster</i>
Western cottonmouth	<i>Agkistrodon piscivorus leucostoma</i>

Pygmy rattlesnake	<i>Sistrurus miliarius</i>
Broad-banded water snake	<i>Nerodia fasciata confluens</i>
Diamond-backed water snake	<i>Nerodia rhombifer</i>
Spiny softshell turtle	<i>Apalone spinifera</i>
Red-eared turtle	<i>Trachemys scripta elegans</i>
Southern painted turtle	<i>Chrysemys picta</i>
Mississippi mud turtle	<i>Kinosternon subrubrum</i>
Stinkpot turtle	<i>Sternotherus odoratus</i>
Common snapping turtle	<i>Chelydra serpentina</i>
Alligator snapping turtle	<i>Macrochelys temminckii</i>
Dwarf salamander	<i>Eurycea quadridigitata</i>
Three-toed amphiuma	<i>Amphiuma tridactylum</i>
Lesser western siren	<i>Siren intermedia</i>
Central newt	<i>Notophthalmus viridescens</i>
Gulf coast toad	<i>Incilius valliceps</i>
Eastern narrow-mouthed toad	<i>Gastrophryne carolinensis</i>
Green treefrog	<i>Hyla cinerea</i>
Squirrel treefrog	<i>Hyla squirella</i>
Pig frog	<i>Lithobates grylio</i>
Bullfrog	<i>Lithobates catesbeianus</i>
Bronze frog	<i>Rana clamitans</i>
Upland chorus frog	<i>Pseudacris feriarum</i>
Southern cricket frog	<i>Acris gryllus</i>
Spring peeper	<i>Pseudacris crucifer</i>

Table 3-6: Mammal Species

Representative Mammal Species Found in the Study Area	
Common Name	Scientific Name
Muskrat	<i>Ondatra zibethicus</i>
American mink	<i>Neovison vison</i>
River otter	<i>Lontra canadensis</i>
Raccoon	<i>Procyon lotor</i>
Swamp rabbit	<i>Sylvilagus aquaticus</i>
White-tailed deer	<i>Odocoileus virginianus</i>
Coyote	<i>Canis latrans</i>
Virginia Opossum	<i>Didelphis virginiana</i>
Nine-banded armadillo	<i>Dasypus novemcinctus</i>
Eastern cottontail	<i>Sylvilagus floridanus</i>
Gray squirrel	<i>Sciurus carolinensis</i>
Fox squirrel	<i>Sciurus niger</i>
Nutria	<i>Myocastor coypus</i>
Striped skunk	<i>Mephitis mephitis</i>
Bobcat	<i>Lynx rufus</i>
Gray fox	<i>Urocyon cinereoargenteus</i>
Red bat	<i>Lasiurus borealis</i>
Marsh rice rat	<i>Oryzomys palustris</i>
White-footed mouse	<i>Peromyscus leucopus</i>
Eastern wood rat	<i>Neotoma floridana</i>
Harvest mouse	<i>Micromys minutus</i>
Least shrew	<i>Cryptotis parva</i>
Southern flying squirrel	<i>Glaucomys volans</i>

3.1.5.1.4 Threatened and Endangered Species and Other Protected Species

To aid the USACE in complying with proactive consultation responsibilities under the Endangered Species Act, the USFWS provided a Planning Aid Letter dated 31 January 2019 which lists those threatened and endangered species and their critical habitats within the study area. Species addressed as being of concern for this study area include the pallid sturgeon and the West Indian manatee. While pallid sturgeon are a riverine

species and not likely to be of concern within the project area, the Service expressed concern about any dredging in the Mississippi River, which could potentially impact the species. The West Indian manatee is sometimes seen in the coastal waters of Louisiana, as their range extends throughout the coast of the Gulf of Mexico, into the waters off the Yucatan peninsula, and throughout the Caribbean. More information on these and other at-risk species may be found in Appendix C.

3.1.5.1.5 Aquatic Resources and Water Bottoms

Primary fresh and intermediate water bodies in the Barataria Basin include Lake Salvador, Lake Des Allemands, Lake Cataouatche, The Pen, Lake Boeuf and Bayous Boeuf, Des Allemands, Chevreuil, Grand (12 miles), Citamon, Segnette, and Bayou Verret. In addition, there are many miles of manmade canals throughout the basin including the GIWW and Barataria Waterway.

Wetlands throughout the study area abound with small resident fishes and shellfishes such as least killifish (*Heterandria Formosa*), rainwater killifish (*Lucania parva*), sheepshead minnow (*Cyprinodon variegatus variegatus*), mosquitofish (*Gambusia affinis*), sailfin molly (*Poecilia latipinna*), grass shrimp, and others. Those species are typically found along marsh edges and among submerged aquatic vegetation, and provide forage for a variety of fish and wildlife. Fresh water and low-salinity marshes provide habitat for commercially and recreationally important resident freshwater fishes such as largemouth bass (*Micropterus salmoides*), yellow bass (*Morone mississippiensis*), black crappie (*Pomoxis nigromaculatus*), bluegill (*Lepomis macrochirus*), redear sunfish (*Lepomis microlophus*), warmouth (*Lepomis gulosus*), blue catfish (*Ictalurus furcatus*), channel catfish (*Ictalurus punctatus*), freshwater drum (*Aplodinotus grunniens*), bowfin (*Amia calva*), and gar (*Lepisosteidae*). Water bodies having minimal water exchange and heavy cover of floating vegetation may exhibit low dissolved oxygen conditions and reduces fisheries abundance.

The project area fresh marshes also provide nursery habitat for estuarine-dependent commercial and recreational fishes and shellfishes that are tolerant of fresh water such as blue crab (*Callinectes sapidus*), white shrimp (*Litopenaeus setiferus*), Gulf menhaden (*Brevoortia patronus*), Atlantic croaker (*Micropogonias undulates*), red drum (*Sciaenops ocellatus*), southern flounder (*Paralichthys lethostigma*), bay anchovy (*Anchoa mitchilli*), striped mullet (*Mugil cephalus*), and others. Fresh marshes also provide habitat for largemouth bass (*Micropterus salmoides*), sunfish (*Mola mola*), warmouth (*Lepomis gulosus*), black crappie (*Pomoxis nigromaculatus*), blue catfish (*Ictalurus furcatus*), bowfin (*Amia calva*), and gar (*Lepisosteidae*).

Table 3-7: Aquatic Resource Species

Species	Life Stage	EFH
Brown Shrimp (<i>Farfantepenaeus aztecus</i>)	Juvenile	<18m; SAV, sand/shell/soft bottom, emergent marsh, oyster reef
White Shrimp (<i>Litopenaeus setiferus</i>)	Larvae/postlarvae	<82m; pelagi, soft bottom, emergent marsh
	Juvenile	<30m; soft bottom, emergent marsh

Red Drum (<i>Sciaenops ocellatus</i>)	Larvae/postlarvae	all estuaries planktonic, SAV, sand/shell/soft bottom, emergent marsh
	Juvenile	GOM, <5m Vermilion Bay & E; all estuaries SAV, sand/shell/soft/hard bottom, emergent
	Adults	OM 1-46 m Vermilion Bay & E; SAV, sand/shell/soft/hard bottom, emergent marsh

Additional information on the aquatic resource species that may be found in the study area may be found in Appendix C.

3.1.5.1.6 Essential Fish Habitat (EFH)

As required by the Magnuson-Stevens Fishery Conservation and Management Act, all marine and estuarine waters of the northern Gulf of Mexico have been designated as Essential Fish Habitat (EFH) through regulations promulgated by the NMFS and the Gulf of Mexico Fishery Management Council. EFH is described as waters and substrates necessary for Federally-managed species to spawn, breed, feed, and grow to maturity. In the northern Gulf of Mexico, EFH has generally been defined as “areas where individual life-stages of specific Federally-managed species are common, abundant or highly abundant”. In estuarine areas, EFH is defined as “all estuarine waters and substrates (mud, sand, shell, rock and associated biological communities), including the subtidal vegetation (submerged aquatic vegetation and algae) and adjacent intertidal vegetation (marshes and mangroves)”. To assist in meeting our consultation requirements, the National Marine Fisheries Service local field office reviewed the study area and provided comments on 30 January 2019 that identified the following species as being of concern for this study: brown shrimp, white shrimp, and red drum.

Table 3-8 lists the expected salinity zones of the managed species expected. Table 3-9 shows the EFH for the managed species expected in those areas. Appendix C contains more information on EFH within the study area.

Table 3-8: Salinity Zones and Abundance for Federally Managed Species

Salinity Zone	Life Stage	Brown Shrimp	White Shrimp	Red Drum
0 -0.5 ppt.	Adults			
	Eggs			
	Juveniles			
	Larvae			
	Spawners			
0.5 - 5 ppt.	Adults	R	R	R to C
	Eggs			
	Juveniles	C to HA	C to A	C
	Larvae			
	Spawners			
5 -15 ppt.	Adults	R	C	R to C
	Eggs			
	Juveniles	C to HA	C to A	C
	Larvae			
	Spawners			
Relative Abundance: Blank - Not Present A – Abundant C – Common R – Rare HA - Highly Abundant (Variation in abundance due to seasonality) (NMFS, 1998)				

Table 3-9: Essential Fish Habitat for Life Stages

Species	Life Stage	EFH
Brown Shrimp	Adults	Gulf of Mexico <110 m, Silt sand, muddy sand
	Juvenile	Marsh edge, SAV, tidal creeks, inner marsh
White Shrimp	Adults	Gulf of Mexico <33 m, Silt, soft mud
	Juvenile	Marsh edge, SAV, marsh ponds, inner marsh, oyster reefs
Red Drum	Adults	Gulf of Mexico & estuarine mud substrate, oyster reef
	Juvenile	SAV, estuarine mud substrate, marsh/water interface

NMFS, 1998

3.1.5.1.7 Water Quality

The dominant bodies of water in the basin are Lac Des Allemands, Lake Cataouatche, Lake Salvador, and Barataria and Caminada Bays. Numerous bayous, canals and channels cross through the basin and the hydrology of the basin is greatly affected by the fact that the elevation of the basin hovers right at sea level, plus or minus a foot.

Water quality in the main channels of the basin is greatly influenced by non-point source agricultural runoff, and to a lesser extent by residential and commercial point sources (LDEQ, 2004, 2007). Water quality in the interior wetlands, however, is often quite different because of hydrological modifications, mainly low levee spoil banks formed from drainage canal and pipeline construction, which have isolated surrounding wetlands from the main drainage channels. Spoil banks have been found to decrease the net flux of materials to and from nearby wetlands, making these areas prone to excessive inundation (Swenson and Turner, 1987; Bryant and Chabreck, 1998).

The United States Geological Survey has delineated all the discrete watersheds in the United States and it describes each discrete watershed unit with a hydrologic unit code (HUC). The study area is located in the East Central Louisiana Coastal HUC 08090301.

As part of its surface water quality monitoring program, the Louisiana Department of Environmental Quality (LDEQ) routinely monitors 25 parameters on a monthly or bimonthly basis using a fixed station, long-term network (Monitored Assessments) (LDEQ 1996). Based upon those data and the use of less-continuous information (Evaluated Assessments), such as fish tissue contaminants data, complaint investigations, and spill reports, the LDEQ has assessed water quality fitness for the following uses: primary contact recreation (swimming), secondary contact recreation (boating, fishing), fish and wildlife propagation, drinking water supply and shellfish propagation (LDEQ 1996). Based upon existing data and more subjective information, water quality is determined to either fully, partially, or, not support those uses. A designation of “threatened” is used for waters that fully support their designated uses but that may not fully support certain uses in the future because of anticipated sources or adverse trends in pollution.

According to the LDEQ Final 2018 Louisiana Water Quality Inventory: Integrated Report (305(b)/303(d)), the “Bayou Des Allemands – From US-90 to Lake Salvador (Scenic)” subsegment LA020301 is “not supporting designated use” for primary contact recreation (i.e., swimming); “fully supporting designated use” for secondary contact recreation (i.e., boating); and is “not supporting designated use” for fish and wildlife propagation (i.e., fishing) (LDEQ 2018). The “Bayou Gauche” subsegment LA020302 is “fully supporting designated use” for primary contact recreation (i.e., swimming); “fully supporting designated use” for secondary contact recreation (i.e., boating); and is “not supporting designated use” for fish and wildlife propagation (i.e., fishing) (LDEQ 2018). The study area is located within both of the above LDEQ designated subsegments. The proposed alignment from the Barge Gate at Bayou Des Allemands extending southwest to Louisiana State Highway 308 falls within subsegment LA020301. The proposed alignment from the Barge Gate at Bayou Des Allemands extending to the southeast then to the north to the Paradis Hydraulic Control Structure falls within subsegment LA020302.

3.1.5.2 Human Environment

3.1.5.2.1 Geographic Location

The study area extends from the City of Donaldsonville south to the City of Mathews and includes the watersheds of Bayou Chevreuil-Lac des Allemands, Bayou Verrett, and the northwestern portion of Bayou Des Allemands-Lake Salvador. An inventory of residential and non-residential structures was developed using the National Structure Inventory (NSI) for the portions of the seven parishes impacted by storm surge associated with the future without project condition. The inventory consists of a little less than 25,000 structures with 90 percent categorized as residential and 10 percent categorized as commercial. Figure 3-1 shows the structure inventory and the study area boundary.

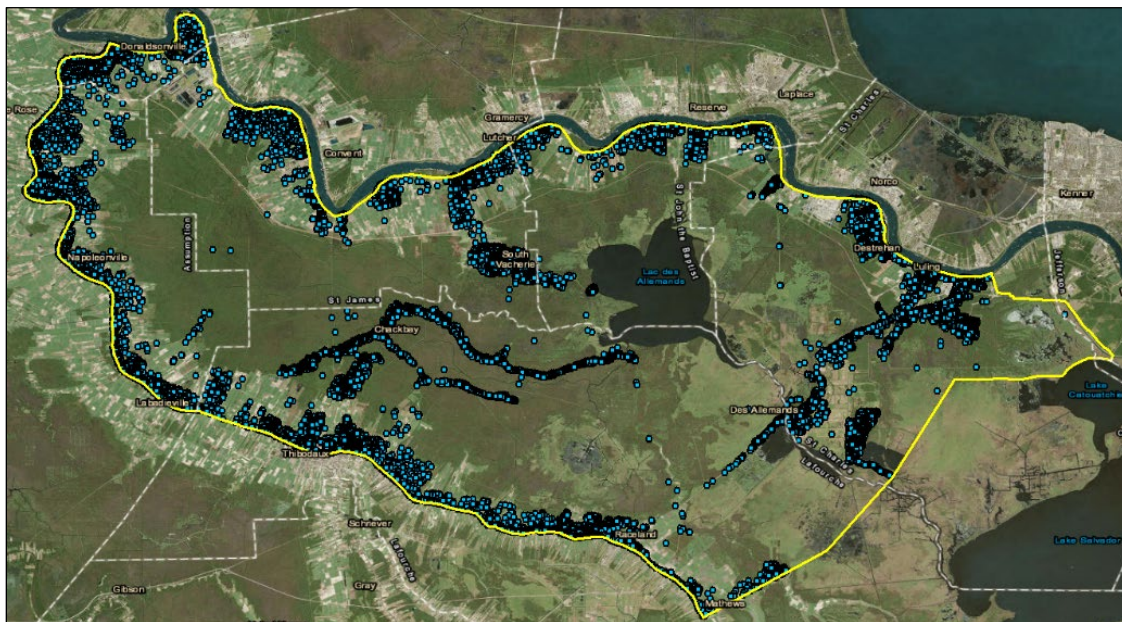


Figure 3-1: Upper Barataria Basin Louisiana National Structure Inventory

3.1.5.2.2 Land Use

The total number of acres of developed, agricultural, and undeveloped land in the study area are shown in Table 3-10. As shown in the table, the majority of the study area is undeveloped land; with only 8 percent of the total acres in the study area are currently developed land.

Table 3-10: Upper Barataria Basin Louisiana Land Use in the Study Area

Land Class Name	Acres	Percentage of Total
Developed Land	159,197	8%
Agricultural Land	523,431	25%
Undeveloped Land	1,397,531	67%
Total	2,080,159	100%

Source: USGS National Land Cover Database

Flood History

3.1.5.2.3 Tropical Flood Events

Coastal Louisiana experiences localized flooding from both excessive rainfall events, leading to riverine flooding, and storm surge events from tropical storms and hurricanes. Table 3-11 displays the FEMA disaster declarations which involved the seven parishes of the study area. Overall, there were 22 disaster declarations related to hurricane and tropical storm incidents in the study area from 1964 to 2016. During the same timeframe, the seven parishes were included in 19 disaster declarations related to flooding incidents. Since 1851, NOAA reported 62 tropical events that have made landfall along the south central portion of the Louisiana coast. (Table 3-12)

Table 3-11: Upper Barataria Basin Louisiana FEMA Disaster Declaration by Parish 1964-2016

Parish	Hurricane and Tropical Storm Incidents	Flooding Incidents
Ascension	18	16
Assumption	16	8
Jefferson	19	7
Lafourche	20	8
St. Charles	20	8
St. James	16	7
St. John the Baptist	18	6
Total Unique Declarations	22	19

Source: Federal Emergency Management Agency (FEMA)

Table 3-12: Upper Barataria Basin Louisiana Top Tropical Storms by Amount Paid by FEMA

Event	Month & Year	Number of Paid Claims	Total Amount Paid (millions)
2016 Louisiana Floods	August 2016	26,909	\$2,455.7
Tropical Storm Lee	September 2011	9,900	\$462.2
Hurricane Ike	September 2008	46,684	\$2,700.1
Hurricane Gustav	September 2008	4,545	\$112.6
Hurricane Rita	September 2005	9,354	\$466.2
Hurricane Andrew	August 1992	5,587	\$169.1

Source: Federal Emergency Management Agency (FEMA)

Note 1: Total amount paid is at price level at time of the event.

Note 2: Claims and amount paid are for entire event, which may include areas outside of the study area.

3.1.5.2.4 FEMA Flood Claims

The most recent named storms to affect the study area include, Tropical Storm Lee in 2011 and Hurricanes Ike and Gustav, both in 2008. Of the three, Hurricane Gustav brought the most damage to the study area, causing an estimated \$2.15 billion in damage to insured property and five deaths in the state of Louisiana.

Table 3-13: Upper Barataria Basin FEMA Flood Claims by Parish 1978 - 2018

Parish	Total Number of Claims	Number of Paid Claims	Total Payments (millions)
Ascension	6,607	5,658	\$336.89
Assumption	979	785	\$4.45
Jefferson	129,149	96,712	\$3,410.58
Lafourche	5,335	3,920	\$66.93
St. Charles	5,963	4,130	\$101.05
St. James	249	204	\$6.19
St. John the Baptist	4,942	3,996	\$264.24
Total	153,224	115,405	\$4,190.34

Source: Federal Emergency Management Agency (FEMA)

Table 3-14: Upper Barataria Louisiana FEMA Severe Repetitive Loss Properties by Parish

Parish	Number of Structures
Ascension	394
Assumption	84
Jefferson	8,844
Lafourche	450
St. Charles	643
St. James	19
St. John the Baptist	230
Total	153,224

Source: Federal Emergency Management Agency (FEMA)

3.1.5.3 Socio-economics

3.1.5.3.1 Transportation

The transportation infrastructure includes major roads, highways, railroads, and navigable waterways that have developed historically to meet the needs of the public. Interstate 90 (I-90), an east-west bi-coastal thoroughfare that connects Houston and Baton Rouge, crosses the south-eastern part of the area and is a primary route for hurricane evacuation and post-storm emergency response. Rail and aviation facilities are spread throughout.

3.1.5.3.2 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, and schools.

Population and Housing

3.1.5.3.3 Historic and Existing Conditions

Tables 3-15, 3-16, and 3-17 display the population, number of households, and the employment (number of jobs) for each of the seven parishes for the years 2000 and 2010, as well as projections for the years 2017, 2025, and 2045. The 2000 and 2010 estimates for population and number of households are from the U.S. Census. The 2000 and 2010 estimates for employment are from the U.S. Bureau of Labor Statistics. All projections were developed by Moody's Analytics (ECCA) Forecast, which has projections to the year 2045.

Table 3-18 shows the actual and projected per capita personal income levels for the seven parishes from 2000 to 2025. The 2000 and 2010 estimates are from the U.S. Bureau of Economic Analysis while the projections for 2017 and 2025 are from Moody's Analytics (ECAA) Forecast.

Table 3-15: Upper Barataria Basin Louisiana Historical and Projected Population by Parish

Parish	2000	2010	2017	2025	2045
Ascension	77,335	107,850	123,272	136,988	161,973
Assumption	23,324	23,352	22,775	22,408	21,733
Jefferson	454,936	432,745	440,790	457,149	479,966
Lafourche	89,775	96,681	98,574	98,970	99,479
St. Charles	48,118	52,845	53,359	55,339	58,101
St. James	21,201	22,006	21,790	22,599	23,727
St. John the Baptist	43,248	45,621	44,078	45,713	47,995
Total	757,937	781,101	804,637	839,166	892,975

Sources: 2000, 2010, 2017 from U.S. Census Bureau; 2025, 2045 from Moody's Analytics (ECCA) Forecast

Table 3-16: Upper Barataria Basin Existing Condition and Projected House Households by Parish

Parish	2000	2010	2017	2025	2045
Ascension	26,995	38,050	44,890	51,815	66,244
Assumption	8,234	8,719	8,776	8,946	9,336
Jefferson	176,405	169,886	179,711	192,879	217,453
Lafourche	32,054	35,654	37,627	39,070	42,122
St. Charles	16,473	18,598	19,586	21,099	23,960
St. James	7,002	7,691	7,945	8,561	9,727
St. John the Baptist	14,381	15,875	16,005	17,249	19,602
Total	281,545	294,473	314,539	339,619	388,444

Sources: 2000, 2010 from U.S. Census Bureau; 2017, 2025, 2045 from Moody's Analytics (ECCA) Forecast

Table 3-17: Upper Barataria Basin Existing Condition and Projected Employment by Parish

Parish	2000	2010	2017	2025	2045
Ascension	36,431	49,414	59,670	65,803	82,614
Assumption	9,370	8,902	8,663	8,806	8,958
Jefferson	221,554	200,303	205,796	213,741	240,657
Lafourche	39,295	42,305	41,186	41,195	41,995
St. Charles	22,627	23,594	24,027	24,954	28,096
St. James	8,102	8,949	8,940	9,257	10,448
St. John the Baptist	18,702	19,252	18,794	19,479	21,968
Total	356,080	352,717	367,075	383,236	434,737

Sources: 2000, 2010 from U.S. Bureau of Labor Statistics; 2017, 2025, 2045 from Moody's Analytics (ECCA) Forecast

Table 3-18: Upper Barataria Basin per Capita Income (\$) by Parish

Parish	2000	2010	2017	2025
Ascension	24,052	39,416	47,628	60,180
Assumption	19,613	32,771	40,543	54,195
Jefferson	28,376	42,033	48,959	63,399
Lafourche	23,485	40,391	46,045	56,959
St. Charles	24,634	39,557	47,618	63,678
St. James	18,722	38,421	45,219	60,576
St. John the Baptist	20,002	33,894	41,505	57,423

Sources: 2000, 2010 from U.S. Bureau of Economic Analysis;
2017, 2025 from Moody's Analytics (ECCA) Forecast

3.1.5.3.4 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.

3.1.5.3.5 Tax Revenues 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.

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

The leading employment sectors are Trade; Transportation; and Utilities, Government, Local Government, and Office Using Industries. Table 3-19 shows the unemployment rate in three of the six parishes (Assumption, St. John, and St. James) is higher than the State of Louisiana Unemployment Rate. Table 3-20 shows the growth of non-farm employment over the last four decades but is predicted to decrease by the year 2040.

Table 3-19: Upper Barataria Basin Louisiana Unemployment Rates

Unemployment Rate (%) BLS; Moody's Analytics (ECCA) Forecast						
	Dec-1990	Dec-2000	Dec-2010	Dec-2020	Dec-2030	Dec-2040
Ascension Parish (LA)	6.45	5.29	7.45	5.90	6.20	5.99
Assumption Parish (LA)	6.56	6.43	11.57	8.14	8.01	7.64
Lafourche Parish (LA)	4.09	4.49	6.14	5.87	6.50	6.42
St. Charles Parish (LA)	6.07	5.58	7.41	6.69	6.83	6.39
St. James Parish (LA)	7.87	8.59	11.66	9.45	9.64	9.02
St. John the Baptist Parish (LA)	7.95	6.79	10.60	8.61	8.78	8.22
Louisiana	6.20	5.30	7.97	6.88	7.06	6.71

Table 3-20: Upper Barataria Louisiana Employment by Industry

Description:	Employment by Industry							
	U.S. Bureau of Labor Statistics: Census of Employment & Wages (QCEW - ES202); Moody's Analytics (ECCA) Forecast							
	Dec-1970	Dec-1980	Dec-1990	Dec-2000	Dec-2010	Dec-2020	Dec-2030	Dec-2040
Total Nonfarm Payroll, (Ths.)	47.42	84.75	86.68	107.14	125.72	148.03	158.74	172.19
Natural Resources and Mining, (Ths.)	2.23	3.09	2.58	2.14	2.69	2.29	2.13	2.09
Construction, (Ths.)	4.75	12.98	11.00	10.19	10.94	20.39	22.29	24.83
Manufacturing, (Ths.)	12.62	19.54	18.90	21.28	17.99	19.74	18.89	18.46
Food; Beverage; and Tobacco Manufacturing, (Ths.)	1.98	2.05	1.96	1.82	1.51	1.24	1.18	1.12
Textile; Fiber; and Printing Manufacturing, (Ths.)	0.81	1.13	0.94	0.71	0.54	0.56	0.54	0.53
Chemical; Energy; Plastic; and Rubber Manufacturing, (Ths.)	6.71	10.79	11.20	12.47	10.52	12.35	12.14	11.93
Metals and Mining Based Manufacturing, (Ths.)	1.58	2.63	2.78	2.86	2.49	2.61	2.30	2.16
Machinery Manufacturing, (Ths.)	0.36	0.62	0.48	1.00	0.88	1.22	1.06	1.01
Electronic and Electrical Manufacturing, (Ths.)	0.08	0.14	0.13	0.15	0.14	0.22	0.23	0.22
Transportation Equipment Manufacturing, (Ths.)	1.02	2.05	1.29	2.10	1.69	1.32	1.24	1.26
Furniture and Misc. Manufacturing, (Ths.)	0.08	0.14	0.12	0.18	0.20	0.20	0.21	0.22
Trade; Transportation; and Utilities, (Ths.)	11.74	19.99	20.55	25.48	31.43	35.66	37.19	39.08
Wholesale Trade, (Ths.)	2.28	4.06	3.67	4.43	5.21	6.29	6.65	6.92
Retail Trade, (Ths.)	5.08	8.60	9.42	12.33	14.02	16.25	17.38	19.04
Transportation; Warehousing; and Utilities, (Ths.)	4.38	7.33	7.47	8.72	12.20	13.13	13.16	13.12
Transportation and Warehousing, (Ths.)	3.93	6.62	6.22	7.61	11.14	11.94	12.00	11.99
Utilities, (Ths.)	0.44	0.71	1.24	1.11	1.06	1.18	1.17	1.14
Information, (Ths.)	0.40	0.79	0.78	1.17	0.78	0.84	0.89	0.96
Financial Activities, (Ths.)	1.93	3.42	3.98	4.75	4.75	5.01	5.24	5.51
Professional and Business Services, (Ths.)	1.68	3.91	4.64	7.44	12.02	13.51	15.42	17.99
Education & Health Services, (Ths.)	1.04	2.04	3.75	6.53	10.87	13.00	14.26	15.70
Leisure and Hospitality, (Ths.)	1.56	2.99	3.78	6.71	9.12	11.54	13.08	15.03
Other Services (except Public Administration), (Ths.)	0.76	1.20	1.74	2.57	3.51	4.52	4.86	5.20
Government, (Ths.)	8.72	14.81	14.98	18.88	21.63	21.54	24.48	27.34
Federal Government, (Ths.)	0.42	0.76	0.80	0.68	0.76	0.68	0.71	0.76
Local Government, (Ths.)	7.18	12.07	12.04	15.96	18.65	18.95	21.67	24.31
State Government, (Ths.)	0.11	0.07	0.05	0.04	0.04	0.04	0.00	0.00
Office-using Industries, (Ths.)	4.06	7.92	9.36	13.39	17.73	18.91	20.39	22.42
High Technology Industries, (Ths.)	0.56	1.14	1.12	1.52	1.30	1.99	2.20	2.40

3.1.5.3.7 Environmental Justice and Other Social Effects

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 2017 are those whose income is at or below \$25,094 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.

An Environmental Justice (EJ) analysis focuses on the potential for disproportionately high and adverse impacts to minority and low-income populations during the construction and normal operation of the Federal action, in this case, the proposed storm surge flood risk-reduction system. A detailed assessment identifies specific EJ communities near structural alternatives and will assess if EJ communities are disproportionately exposed to high and adverse effects of the Federal action. If 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, then there may be a disproportionate finding.

If a disproportionate impact is found, mitigation measures should be developed specifically to address potential disproportionately high and adverse effects to minority and/or low-income communities. When identifying and developing potential mitigation measures to address environmental justice concerns, members of the affected communities would be consulted. Enhanced public participation efforts would also be conducted to ensure that effective mitigation measures are identified and that the effects of any potential mitigation measures are fully analyzed and compared. Mitigation measures may include a variety of approaches for addressing potential effects and balancing the needs and concerns of the affected community with the requirements of the action or activity.

The communities in the study area include Luling, Boutte, Paradis, Des Allemands, and Bayou Gauche, all in St. Charles Parish and Mathews and Raceland in Lafourche Parish. All seven of these communities are identified by the U.S. Census Bureau as Census of Designated Places (CDP).

In order to identify whether the potential alternatives may disproportionately affect minorities or impoverished citizens, an analysis was conducted utilizing CDP data, obtained from the U.S. Census Bureau's American Community Survey (ACS). The following information was collected for the seven communities in the study area.

Racial and Ethnic Characteristics

Race and ethnic populations in each CDP were characterized using the following racial categories: White, Black or African American, American Indian and Alaska Native, Asian, Native Hawaiian and Other Pacific Islander, Some Other Race, and Two or more Races. Persons of Hispanic Origin are also identified. These categories are consistent with the affected populations requiring study under Executive Order 12898. See Tables 3-21 through 3-23 for a listing of race and ethnic characteristics for the CDP in the Study area.

Percentage of Minority Population

As defined by the U. S. Census Bureau, the minority population includes all non-Whites. According to Council of Environmental Quality (CEQ) guidelines, “Minority populations should be identified where either: (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.” For this study, the comparison geographic unit is St. Charles and Lafourche Parishes.

Low-Income Population

The percentage of persons living below the poverty level, as identified in the 2013-2017 ACS, was one of the indicators used to determine the low-income population in a CDP. Low-income population is defined as a CDP with 20 percent or more of its residents below the poverty threshold.

Only one CDP, Boutte, is considered an Environmental Justice community using the Minority criteria, having approximately 67 percent of residents identifying as minority. The vast majority of these residents are Black or African American while those identifying as “Two or more Races” comprise 4.4 percent of the CDP population. Persons of Hispanic or Latino population (of any race) is no higher than 3.5 percent in any CDP. St. Charles Parish is majority White, or 70 percent of the Parish population while Minority races are approximately 30 percent of total population. Boutte CDP minority population percentage is nearly twice that of the St. Charles Parish reference area. Des Allemands CDP crosses into Lafourche Parish, however the majority of the population resides in St. Charles Parish.

Two CDPs that are in the study area, Mathews and Raceland, area located in Lafourche Parish, and are majority White as is the Parish as a whole. The largest minority in Mathews is Asian race and those identifying as being of “Two or More Races”.

Of the seven CDPS in the Study Area, only Boutte and Raceland CDPs are considered EJ communities, when using the poverty threshold criteria. Approximately 31 percent and 20.7 percent, respectively, of people residing in these communities have incomes below the poverty level, which are above the 20 percent threshold. The percentage of the Boutte population whose income is below the poverty level is nearly two and a half times larger than the reference area, St. Charles Parish, while the percentage living in Raceland who

are below the poverty level (20.7%) is just above the Lafourche Parish percentage of 16.0 percent.

The Boutte CDP is both a minority and low-income EJ community, with percentages well above the reference community of St. Charles Parish. Special attention to impacts associated with levee alignments, staging areas and stockpile sites affecting the Boutte community will be provided in the Environmental Consequences section of the EJ resource.

Table 3-21: Population by Race and Percentage Minority Population, CDP, St. Charles Parish

							Des					
ACS 2013-17	Luling		Boutte		Paradis		Allemands		Bayou Gauche		St. Charles Parish	
RACE												
Total population	13,088	100%	2,695	100%	1,616	100%	1,462	100%	2,557	100%	52,728	100%
One race	12,938	98.9%	2,577	95.6%	1,536	95.0%	1,354	92.6%	2,557	100.0%	52,195	99.0%
White	10,576	80.8%	884	32.8%	1,514	93.7%	1,232	84.3%	2,557	100.0%	36,851	69.9%
Black or African American	1,889	14.4%	1,675	62.2%	0	0.0%	113	7.7%	0	0.0%	14,008	26.6%
American Indian and Alaska Native	89	0.7%	0	0.0%	0	0.0%	9	0.6%	0	0.0%	136	0.3%
Asian	208	1.6%	0	0.0%	22	1.4%	0	0.0%	0	0.0%	567	1.1%
Native Hawaiian and Other Pacific Islander	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Some other race	176	1.3%	18	0.7%	0	0.0%	0	0.0%	0	0.0%	633	1.2%
Two or more races	150	1.1%	118	4.4%	80	5.0%	108	7.4%	0	0.0%	533	1.0%
Minority	2,512	19.2%	1,811	67.2%	102	6.3%	230	15.7%	0	0.0%	15,877	30.1%
HISPANIC OR LATINO												
Total population	13,088		2,695		1,616		1,462		2,557		52,728	
Hispanic or Latino (of any race)	403	3.1%	96	3.60%	18	1.10%	9	0.60%	82	3.20%	3,062	5.80%

Source: U.S. Census Bureau, 2013-2017 American Community Survey 5-Year Estimates

Table 3-22: Low Income Population by CDP, St. Charles and Lafourche Parishes, Study Area

PERCENTAGE OF PEOPLE WITH INCOME BELOW POVERTY LEVEL IN THE PAST 12 MONTHS			
CDP/Parish	Population Estimate*	Population Below Poverty Level	Percent of Population Below Poverty
Luling	12,933	1,410	10.90%
Boutte	2,695	841	31.20%
Paradis	1,616	115	7.10%
Des Allemands	1,462	88	6.00%
Bayou Gauche	2,557	46	1.80%
St. Charles Parish	51,926	6,337	12.20%
Matthews	2,556	120	4.70%
Raceland	10,153	2,102	20.70%
Lafourche Parish	95,542	15,299	16.00%

*Population for whom poverty status is determined

Source: U.S. Census Bureau ACS, 2013-2017

Table 3-23: Population by Race and Percentage Minority Population, CDP, Lafourche Parish

ACS 2013-17	Mathews		Raceland		Lafourche Parish	
RACE						
Total population	2,556	100%	10,322	100%	98,112	100%
One race	2,509	98.2%	10,032	97.2%	95,651	97.5%
White	2,468	96.6%	6,732	65.2%	77,388	78.9%
Black or African American	0	0.0%	3,188	30.9%	12,819	13.1%
American Indian and Alaska Native	0	0.0%	87	0.8%	2,442	2.5%
Asian	41	1.6%	0	0.0%	789	0.8%
Native Hawaiian and Other Pacific Islander	0	0.0%	0	0.0%	21	0.0%
Some other race	0	0.0%	25	0.2%	2,192	2.2%
Two or more races	47	1.8%	290	2.8%	2,461	2.5%
Minority	88	3.4%	3,590	34.8%	20,724	21.1%
HISPANIC OR LATINO						
Total population	2,556		10,322		98,112	
Hispanic or Latino (of any race)	28	1.10%	354	3.40%	4,281	4.40%

3.1.5.3.8 Cultural Resources

The Barataria Basin results from the formation of the delta complexes of the Mississippi River. Initial delta formation began approximately 4700 B.P., with the river following its present course and a distributary leading down Bayou Lafourche. As these two arms grew outward into the Gulf of Mexico, they formed the margins of the delta plain that developed between them, largely comprised of freshwater swamp and lakes. Other crevasses and lobes of the river opened or were active until more recently, including the Bayou des Familles lobe that is important for known prehistoric sites in the study area, and for historic settlement still present today.

In terms of resource potential and human settlement potential, the study area has been relatively stable for approximately 2000 years. As may seem obvious, the high portions of land that are natural levees along waterways past or present, have been and are the most desired locations for settlement or temporary resource use. However, the broad range of resources available both from land and water, have created plentiful opportunity that remains of past human activity may be found within the study area.

Since European settlement within the project area, numerous occupations and remains have been created and left behind. The most obvious and remnant of these exist along the Mississippi River, Bayou Lafourche, and Bayou des Familles. Other natural

waterways with high levee ground alongside, have also been settled for some time. Of most importance in terms of cultural resources that may be found within proposed work zones of this project, plantations, lumbering, the fur industry, and hunting and fishing all engage or leave remnants of activity on both high land and further into the backswamp areas. While many signs of it may not be considered significant resources, the oil and gas industry has also reached far across and left cultural landmarks in all land and water types of the study area.

Cultural resources surveys have been completed for some components of alternative alignments for this project, while the majority of areas within any alignment have not been surveyed for cultural resources. Coordination with the State Historic Preservation Officer (SHPO) and Federally-recognized Tribes would be required to determine if and where further cultural resources surveys are required. The land itself is variable probability to contain unrecorded cultural resources, depending on the historic conditions of wet or dry. Some locations eligible for the National Register of Historic Places (NRHP) have been recorded that intersect some portions of alternatives, and the project would avoid these resources if possible.

Within the non-structural alternative, it is important to note that some historic properties are recorded within the project area. The proper documentation or treatment of these properties would be addressed by coordination with the SHPO, if the non-structural alternative may affect these properties.

3.1.5.3.9 Recreation Resources

The recreational resources study area includes portions of Ascension, Assumption, Lafourche, St. Charles, St. James, and St. John the Baptist parishes. It is included in region 3 of the Louisiana State Comprehensive Outdoor Recreation Plan (SCORP). Major bodies of water located in the study area, listed in descending order by size, include Lac Des Allemands, Lake Boeuf, Patit Lac Des Allemands, Dufrene Ponds, Bayou Des Allemands, and many other natural and manmade waterways including numerous oil field canals. Most of the study area is forested uplands and swamp with freshwater marsh. The more significant ridges along navigable bayous have historically supported development of small communities and provide key points of access to the vast coastal wetland resources of the study area. Recreational facilities include camps, marinas, boat launch ramps and small neighborhood parks. The communities within the study area are very much connected to the water evidenced by the way many waterfront residents extend personal property into the waterways in the forms of docks, piers, camps, and homes.

Like much of coastal southeast Louisiana, the study area has experienced substantial coastal erosion, loss of wetlands, and increasing salinity levels. These conditions are due to numerous factors, such as extensive oil and gas exploration via a maze of canals and pipelines, subsidence, and coastal storm surges. Bayou Lafouche and the Mississippi River no longer provide freshwater replenishment and nutrients as they once did with precipitation being the main source of freshwater input for the area. The study area has traditionally provided excellent freshwater fishing and, in recent years, because of the

increased salinity levels, anglers have been able to catch saltwater species much farther inland than in the past.

The study area includes the Lake Boeuf Wildlife Management Area (WMA), at 800 acres, is located east of LA Hwy 308, north of Raceland. The WMA is only accessible by boat via Theriot Canal, Foret Canal, or Lake Boeuf. Recreation activities include archery, hunting, and annual youth lottery deer gun hunts (Louisiana Department of Wildlife & Fisheries). The most prominent recreational activities within the study area are Freshwater based consumptive uses include freshwater fishing, crawfishing, hunting for waterfowl, as well as hunting for deer or small game along natural ridges and in wooded swamp lands. Non-consumptive recreational activities attract far fewer participants and include hiking, wildlife observation, boating, camping and photography.

Just southeast of the study area, the Salvador WMA is located in St. Charles Parish, Louisiana, along the northwestern shore of Lake Salvador. The Salvador WMA was acquired by the Louisiana Department of Wildlife and Fisheries (LDWF) in 1968 and is 34,520 acres. Access to the Salvador WMA is limited to boat travel. The area is primarily freshwater marsh and open water habitats. Several large stands of cypress timber are evident in the northern portions. These stands of trees grow on old natural stream levees. Game species include waterfowl, deer, rabbits, squirrels, rails, gallinules, and snipe. Furbearing animals present are mink, nutria, muskrat raccoon, opossum, and otter. The Salvador WMA supports a large population of alligators, as well as providing nesting habitat for bald eagle. Freshwater fishing is available on the Salvador WMA. Timken WMA is a marsh island, located immediately east of Salvador WMA. LDWF leases the property from the City Park Commission of New Orleans. Like Salvador WMA, Timken WMA consists of freshwater to intermediate marsh.

Factors contributing to the high proportion of boating activity for fishing include the high quality of the recreational fishery, especially an abundance of freshwater fish habitat for 3 species of catfish (flathead, channel, and blue), bass, crappie, and panfish. Pleasure boating occurs to a lesser degree than boat fishing. According to data compiled by the Louisiana Oil Spill Coordinator's Office (LOSCO), there were approximately 30 boat launches catalogued within the study area as of 2004. One indicator of the amount of recreational fishing that occurs in the study area is the number of recreational boats registered in the parishes of Ascension, Assumption, Lafourche, St. Charles, St. James, and St John. In 2011, approximately 10% of the boats registered with the State of Louisiana were registered within the six parishes. In 2017, approximately 10% of the resident basic fishing licenses and 7% of the resident basic hunting licenses issued by the State of Louisiana were issued within the same parishes.

The table below illustrates the number of fishing licenses, hunting licenses, and boat registrations, respectively, within the study area. The fishing and hunting license and boat registration data are provided by the Louisiana Department of Wildlife and Fisheries (LDWF) <http://www.wlf.louisiana.gov/licenses/statistics>

Table 3-24: Licenses and Registrations

Parish	2017 Resident- Basic Fishing	2017 Resident- Basic Hunting	2011 Boat Registrations
Ascension	11,438	3,342	8,530
Assumption	2,583	1,581	3,607
Jefferson	TBD	TBD	TBD
Lafourche	13,577	3,517	11,878
St. Charles	5,149	1,185	4,343
St. James	2,057	612	2,135
St. John	3,103	603	2,269
Statewide Totals	376,945	152,165	320,819

The table below illustrates funding from the Land and Water Conservation Fund (LWCF) has supported 5 recreation projects implemented in the study area since 1964 according to the United States Department of the Interior National Park Service Land & Water Conservation Fund.

Table 3-25: Area Parks

Park	Parish	Grant Sponsor	Amount	Date Approved	Expiration Date
Modeste Park Development	Ascension	Ascension Parish Police Jury	\$39,159.45	8/4/1981	6/30/1986
Donaldsonville Riverfront Park	Ascension	City of Donaldsonville	\$6,735.75	9/22/1972	12/31/1975
Thibodaux Water Reservoir	Lafourche	City of Thibodaux	\$103,073.00	1/16/2002	12/31/2006
Killona Park	St. Charles	St. Charles Police Jury	\$366,662.00	1/13/2005	12/31/2011
Rathborne Park Development	St. Charles	St. Charles Parish Government	\$150,000.00	1/22/2010	12/31/2014

3.1.5.3.10 Aesthetics

The study area offers resources and viewsheds that are unique to the Mississippi Alluvial Plain Ecoregion. Within this Level III Riverine Ecoregion, the study area landscape can be further divided into Level IV Ecoregions which include the Southern Helocene Meander Belts Ecoregion to the north and east along the Mississippi River and to the west along Bayou Lafourche; the Inland Swamps Ecoregion between the Mississippi River and Bayou Lafouche; and the Deltaic Coastal Marshes and Barrier Islands Ecoregion extending south of U.S. Highway 90 ("Louisiana Speaks" and "USGS Eco-Region Map", Daigle, J.J., Griffith, G.E. Omernik, J.M., Faulker, P.L., McCulloh, R.P., Handley, L.R., Smith, L.M., and Chapman, S.S., 2006, Ecoregions of Louisiana color poster with map, descriptive text, summary tables, and photographs: Reston, Virginia, U.S. Geological Survey). Swamp forests with numerous bayous and canals veining into Lac Des Allemands dominate the interior landscape. Primary vistas into this interior are limited and are generally provided to residents and visitors traveling through the area from roadways such as U.S. Highway 90, State Highways 20, 304, 307, and 3127 which transect the study area. However, most of these views are only available from boat access as either

great distances from paved roads or visual impediments make viewing this interior landscape difficult.

The communities within the study area are very much connected to the water evidenced by the way many waterfront residents extend personal property into the waterways in the forms of docks, piers, camps, and homes. Bayou Des Allemands, connecting Lac Des Allemands to Lake Salvador and accessible by U.S. Highway 90, is designated as part of the Louisiana Natural and Scenic Rivers System. Numerous boat launches in the study area provide support for boaters seeking access to Lac Des Allemands and surrounding areas that are not easily accessible, allowing views of tranquil and entrancing shorelines lined with native flora and fauna flourishing throughout this bottomland hardwood forest swamp.

In Lafourche Parish, State Highways 20, 304, and 307 comprise portions of the Wetlands Cultural Byway, which is an integral part of the Louisiana Scenic Byways Program and recognized by the National Scenic Byways Program. “The landscape of the roadway is mainly prairie and wetland. With natural bayous and tree-lined swamps, fresh, brackish, and saltwater marshes surrounding much of the environment, water dictates the byway’s twists and turns...”

(<https://byways.louisianatravel.com/sites/default/files/resources/Wetlands%20Trail.pdf>)

Additionally, there is a Louisiana Scenic Byway bounding the north and east of the study area referred to as the Louisiana Great River Road. This is but one segment to an overall scenic byway that stretches on multiple thoroughfares from Canada to the Gulf of Mexico. It is state and Federally designated and has an “All American Road” status, making it significant in culture, history, recreation, archeology, aesthetics and tourism.

Land use within the study area is primarily woody wetlands constituting the interior landscape and encompassing Lac Des Allemands. Emergent herbaceous wetlands are generally located in the southeast of the study area as U.S. Highway 90 essentially runs along this wetland transition zone. On the perimeter of the study area and along the Mississippi River and Bayou Lafourche, land use consists of cultivated crops and hay/pasture. It is along State Highway 18, also referred to the Louisiana Great River Road, and State Highway 308 following Bayou Lafouche, that agricultural communities have prospered. The drive along these thoroughfares is scenic and visually interesting. Patches of oaks and other hardwoods dot the area blending and growing denser as you look away from the water channels and into the backdrop of dense wetland forest. The landscape here is pastoral and serene, tremendously adding to the visual quality of the area. The communities within the study area are very much connected to the water as land use has advanced along these waterways and property lines protract perpendicular to the waterfront.

3.1.5.3.11 Air Quality

This resource is considered institutionally significant because of the Louisiana Environmental Quality Act of 1983, as amended, and the Clean Air Act of 1963, 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. It is publicly significant because of the desire for clean air expressed by virtually all citizens.

The Clean Air Act Amendment of 1990 directed the U.S. Environmental Protection Agency (EPA) to establish National Ambient Air Quality Standards (NAAQS) for all regulated air pollutants. Federal air quality standards have been established for six criteria air pollutants:

- Carbon monoxide (CO);
- Nitrogen dioxide (NO₂);
- Ozone (O₃);
- Sulfur oxides (commonly measured as sulfur dioxide [SO₂]);
- Lead (Pb);
- Particulate matter no greater than 2.5 micrometers (µm) in diameter (PM_{2.5}); and
- Particulate matter no greater than 10 µm in diameter (PM₁₀).

The EPA classifies air quality by Air Quality Control Region (AQCR) according to whether the region meets primary and secondary air quality standards. An AQCR or portion of an AQCR may be classified as attainment, nonattainment, or unclassified. A classification of attainment indicates that air quality for one or more criteria air pollutants within the region is within NAAQS values. A nonattainment classification indicates that regional air quality for one or more criteria air pollutants is not within NAAQS values. A classification of unclassified indicates that air quality within the region cannot be classified (generally because of lack of data). A region designated as unclassified is treated as an attainment region. The study area is located in the Southern Louisiana AQCR.

The EPA Green Book Nonattainment Areas for Criteria Pollutants (Green Book) maintains a list of all areas within the United States that are currently designated nonattainment areas with respect to one or more criteria air pollutants. Nonattainment areas are discussed by county or metropolitan statistical area (MSA). MSAs are geographic locations, characterized by a large population nucleus, that are comprised of adjacent communities with a high degree of social and economic integration. MSAs are generally composed of multiple counties. The study area is within the Baton Rouge MSA which includes Ascension Parish. Based on review of the Green Book Ascension Parish is the only parish in the study area currently designated as a nonattainment area and is listed for 8-Hr. Ozone. All other parishes within the study area are in attainment.

3.1.5.3.12 HTRW

A preliminary investigation was conducted on February 26, 2019, for the UBB Feasibility Study. Several crude oil pipelines and natural gas pipelines were found to be within the footprint of the proposed project alternatives. Several oil and gas wells were also noted to be within the project area. The pipelines and wells may be considered as potential recognized environmental conditions (REC) and caution must be exercised during construction to avoid breakage of or damage to the pipelines.

Alternative 7, Non-Structural, presents a lesser chance of impact to any potential REC. Please see the map in Appendix E for locations of wells and pipelines of concern.

4 Formulate Alternative Plans

Plan formulation supports the USACE water resources development mission. A systematic and repeatable planning approach is used to ensure that sound decisions are made. The Principles and Guidelines describe the process for Federal water resource studies. It requires formulating alternative plans that contribute to Federal objectives. Alternative plans are a set of one or more management measures functioning together to address one or more planning objectives. A management measure is a feature or activity that can be implemented at a specific geographic site to address one or more planning objectives.

The initial plan formulation strategy was to focus on regional solutions (e.g., levees, floodwalls, and gates with and without pump stations) followed by formulation based on economics damage centers (e.g., where the greatest consequences are) minimizing life loss, and/or more local protection. A quantitative assessment of life safety will be conducted using accepted USACE methods and tools. This section also describes the plan formulation process to identify the tentatively selected plan (TSP) which includes development of cost estimates and economic analysis.

The plan formulation process utilized the best available information at this phase of the study to identify a TSP. However, during the final phase of this feasibility study, additional analyses (optimization) will be completed to refine the design and cost estimates of the TSP features. The optimized design and costs will be incorporated into the numerical modeling (Hydraulics and Economics) in order to develop an accurate assessment of the performance and cost-effectiveness of the plan.

4.1 Management and Screening of Measures

The study area largely overlaps with a previous USACE study, Donaldsonville to the Gulf of Mexico Feasibility Study. Donaldsonville to the Gulf was a reconnaissance and feasibility study for coastal storm risk management that considered various measures such as levees, floodwalls, pump stations, nonstructural applications, flood gates, ring levees, and others to address flood damages in its study area. That study effort concluded in 2012, with a negative report as no evaluated alternatives had positive net benefits. However, because the two study areas have large areas of overlap and the damage centers are largely the same, there are opportunities for the study to use much of the measures, screening criteria, and alternatives development data from the Donaldsonville to the Gulf of Mexico Feasibility Study. Therefore, the formulation process was able to capitalize on the Donaldsonville formulation and incorporate its assessments to provide an advanced starting point for alternatives evaluation. The study has taken multiple measures from the Donaldsonville study and repackaged them into new alternatives for further evaluation. It has also carried forward the Highway 90 alignment alternative for further evaluation due to its preference by the NFS. For these reasons, and to capitalize on efficiency, a new individual measure development and screening process was not completed. It was determined by the PDT that no natural or nature based solutions be developed because the area is already populated by natural based features to prevent storm damages. A brief description of the structural and nonstructural measures follows:

Structural Measures:

- Levees: An earthen embankment or similar structure whose purpose is to reduce flood damages could be constructed to protect communities and other significant structures and/or lands.
- Flood Walls: These measures are similar to levees in that they reduce risk from flood damages, but they can be constructed in a smaller footprint than earthen levees.
- Flood Gates: Flood gates tie into the levee or floodwall system when there is a need to cross a waterway and maintain the existing hydrologic regime.
- Pumping Stations: Pumping stations would transport water produced from rainfall events or surge across levees.
- Ring Levees: Ring levees/dikes could be constructed to protect communities and other significant structures and/or lands on a smaller scale.

Nonstructural (NS) Measures:

- Physical: Consists of property acquisition (buyouts), relocation, elevation, and/or flood proofing of structures.
- Non-physical: Consists of flood warning system/evacuation plans.

4.2 Development of Alternative Plans

The formulation process capitalized on the formulation strategy from the Donaldsonville to the Gulf of Mexico Feasibility Study and incorporated its assessments to provide an advanced starting point for alternative development. A planning and design charrette with the Federal Agencies (USFWS and NOAA), the Coastal Protection and Restoration Authority Board (CPRAB), and the PDT was held 12 December 2018 to further develop alternatives. General public meeting comments from 10 January 2019 and public scoping meetings May 1 and May 2 of 2019 also has an impact on formulation of alternatives. Based on the information discussed at the charrette and review of the existing information on each measure's combinability, alternatives were developed. 10 regional alternatives (i.e. addressing flood risk over a large swath of the study area) were carried forward for further analysis including hydraulic modeling, development of conceptual designs, rough order of magnitude quantities, and parametric cost estimates for comparison. A total of 11 alternatives, including the no-action alternative, were developed. These alternatives including the no-action alternative are described in the initial array of alternatives below with exception of alternatives 9 and 10, which were developed for the revised final array.

For more detail associated with structures and the vertical reference frame within the alignments below, please reference Appendix A.

4.3 Initial Array of Alternatives

4.3.1 Alt 1: Hwy 90 – Segment 1 Extension

This structural alternative would incorporate building a 7.5 foot levee extending out from the existing St. Charles Parish Levee continuing south improving the Sunset Levee and include

a vehicle crossing at Bayou Gauche. Then the levee system would cross Bayou Des Allemands just south of US Highway 90 with a 270ft barge gate structure 9.5 feet high. The levee system will then parallel US Highway 90 until high ground near Raceland (Natural Ridge). Hydraulic control structures will be placed to in the section paralleling US Highway 90 to maintain existing water exchanges. CPRA has a structural protection plan in the 2017 Master Plan (project number 022.HP.06) following a similar alignment. This alignment would be approximately 18.3 miles in length and incorporate a little over 15.9 miles of earthen levee, 2.3 miles of flood wall, and a 270ft barge gate structure (Figure 4-1). The levee is designed to a 2% Annual Exceedance Probability (AEP) (50-year level of risk reduction) from storm surge and the damages prevented are in St Charles and Lafourche Parishes.

The 270 feet barge gate, also incorporated in many other alternatives in the study, across Bayou Des Allemands will only be closed during a storm event. This gate (270 feet barge) can pivot in and out of position and sunk in place to prevent the surge from entering the basin via Bayou Des Allemands.

4.3.2 Alt 2: Hwy 90 – Full Alignment

This structural alternative was carried forward from the previous Donaldsonville to the Gulf Feasibility Study. This Highway 90 levee alignment alternative would incorporate a levee extending out from the existing St. Charles Parish Levee continuing south improving the Sunset Levee and include a vehicle crossing at Bayou Gauche. Then the levee system would cross Bayou Des Allemands just south of US Highway 90 with a 270 foot barge gate structure 10.5 feet high. The levee system will then parallel US Highway 90 until high ground near Raceland (Natural Ridge). Hydraulic control structures will be placed to in the section paralleling US Highway 90 to maintain existing water exchanges. The levee elevation would be built to an 8.5 foot elevation, therefore elevating the existing St. Charles Parish levee. This levee would be approximately 30.4 miles in length (Figure 4-2). The levee is designed to a 1.5% AEP (75-year level of risk reduction) from storm surge and the damages prevented are in St Charles and Lafourche Parishes.

4.3.3 Alternative 3: Des Allemands-Paradis Levee

This is a structural alternative in the form of a 7.5 foot levee extending out from the existing St. Charles Parish Levee continuing south improving the Sunset Levee and include a vehicle crossing at Bayou Gauche. The alignment would then continue around the Des Allemands community and tying around the back side of Paradis into a local parish levee. This levee would be approximately 20.6 miles in length (Figure 4-3). The levee is designed to a 2% AEP (50-year level of risk reduction) from storm surge and the damages prevented are only in St Charles Parishes.

4.3.4 Alternative 4: Raceland Levee

This is a structural alternative (ring berm) in the form of a levee that extends around Raceland (looking at variety of percent AEPs). This alignment capitalizes on the natural ridges around Raceland. It stretches approximately 11.3 miles in length and would include a 45 foot rail road crossing gate and a 45 foot roller gate structures where the alignment crosses US Highway 90 (Figure 4-4). The damages prevented would only be in Lafourche Parishes.

4.3.1 Alternative 5: Basin Edge Levee

This is a structural alternative in the form of a 7.5 feet levee extending out from the existing St. Charles Parish Levee continuing south improving the Sunset Levee and include a vehicle crossing at Bayou Gauche. Then the levee system would cross Bayou Des Allemands just south of US Highway 90 with a 270ft barge gate structure 9.5 feet high. The levee system will then parallel US Highway 90 until just past Dufrene Ponds where it will tie into US Highway 90. This levee would be approximately 12.5 miles in length (Figure 4-5). The levee is designed to a 2% AEP (50-year level of risk reduction) from storm surge and the damages prevented are in St Charles and Lafourche Parishes.

4.3.2 Alternative 6: Highway 90 Alignment – Master Plan

The Master Plan alignment would be constructed along the same alignment as the 2017 Coastal Master Plan project number 022.HP.06. Similar to the State Master Plan Project, this alternative would be built to the 1% AEP from a storm surge event and include (1) 270 feet barge gate, a total of 40.2 miles of earthen levee, 8,200 feet of T-wall, (4) 10 feet sluice gates, and (2) 40 feet swing gates (Figure 4-6).

4.3.3 Alternative 7: Nonstructural

Physical nonstructural alternatives would consist of elevation and/or flood proofing of residential and non-residential structures within the study area. Nonstructural measures can be stand-alone or used in combination with structural alternatives. The nonstructural alternative (Figure 4-7) will be economically evaluated by flood plain mapping of all frequencies, Non-Structural Method 1 (NS1).

4.3.4 Alternative 8: Hwy 90 Lift Alignment

This alternative was developed with U.S. Fish and Wildlife as a possible environmentally preferred plan to restore the natural hydrology across the basin. This Highway 90 levee alignment alternative would incorporate building a 1% AEP (100-Year Coastal Storm Event) connecting the northeast to the southeast side of the basin near the natural ridge at Bayou Lafourche and the natural ridge just south of Raceland respectively. This levee would be approximately 32.5 miles in length and incorporate a 270 feet barge gate 14 feet high across Bayou Des Allemands. The section of levee west of Bayou Des Allemands would have U.S. Highway 90 upon it for approximately 10 miles (Figure 4-8). This section of levee would have a 115 feet crown to allow for all 4 lanes of traffic. Close coordination with the US Department of Transportation would be required. The majority of damages prevented are in St Charles and Lafourche Parishes.

4.3.5 Alternative 9: No Action

NEPA regulations (40 CFR 1502.14(d)) require that no action always be considered a viable alternative in any final array of plans. It represents the future that will likely occur if USACE takes no action. The no action is the default choice.



Figure 4-1: Hwy 90 – Segment 1 Extension

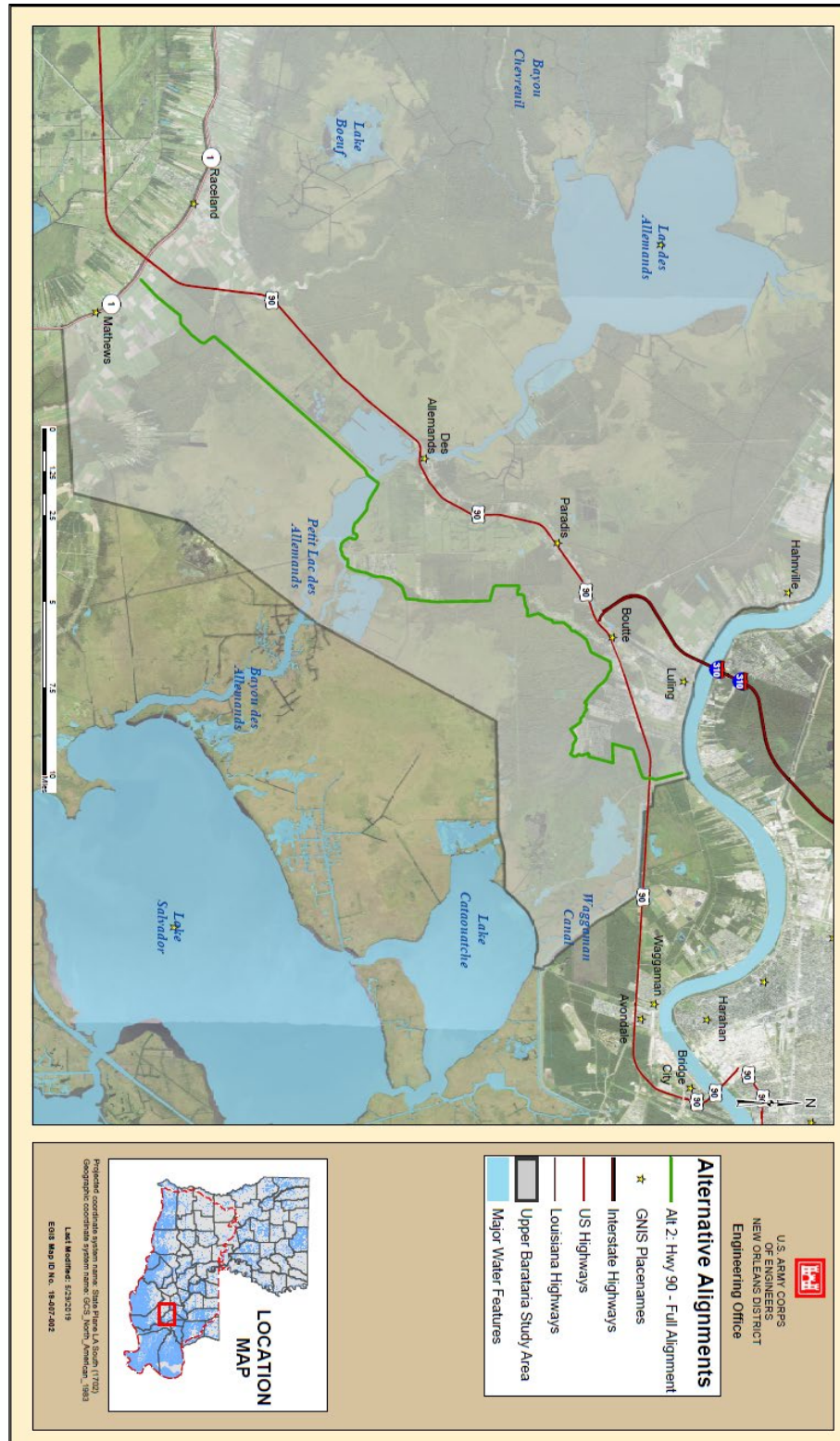


Figure 4-2: Hwy 90 - Full Alignment



Figure 4-3: Des Allemands-Paradis Levee



Figure 4-4: Raceland Levee



Figure 4-5: Basin Edge Levee



Figure 4-6: Hwy 90 Alignment - Master Plan

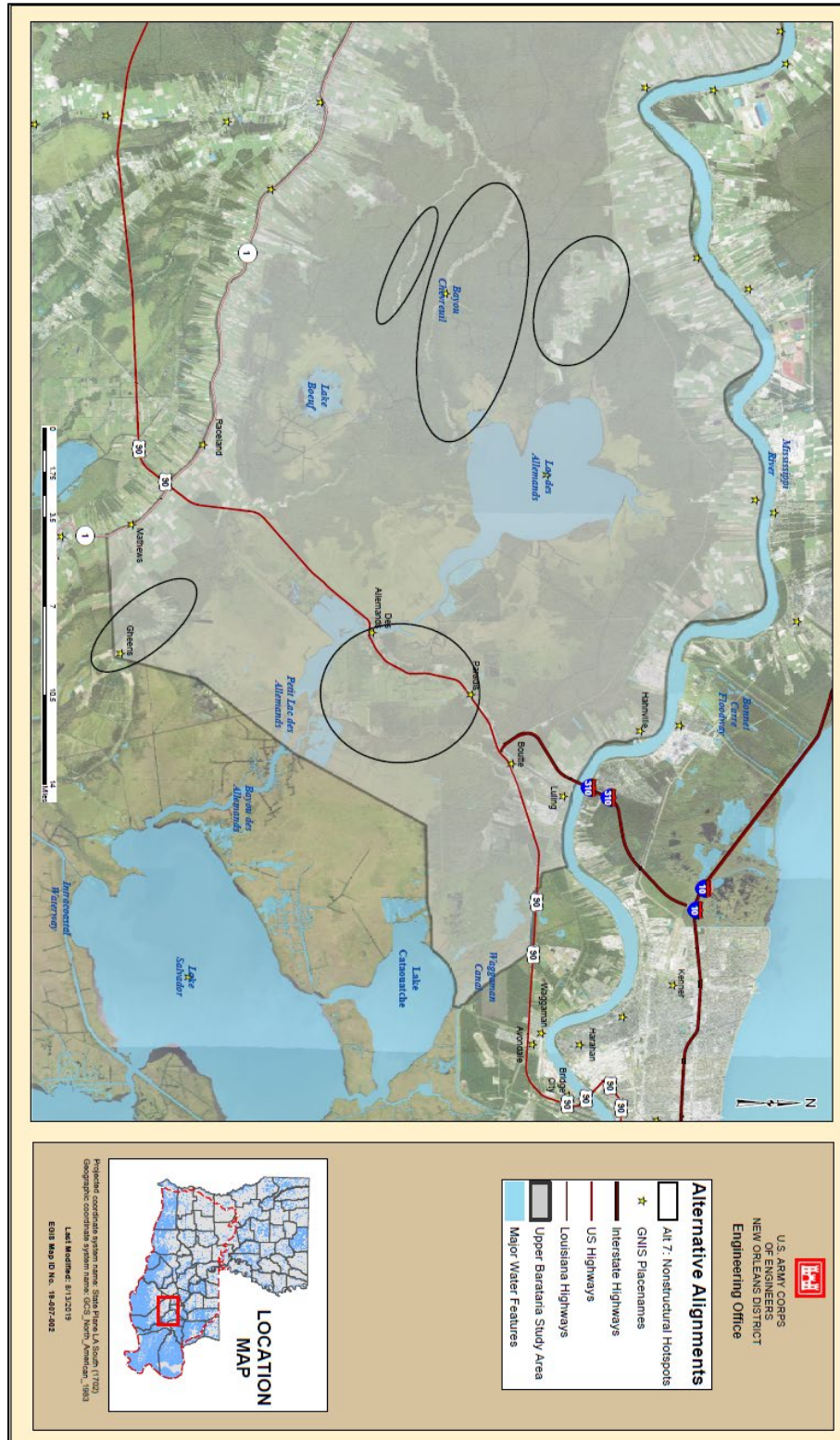


Figure 4-7: Nonstructural Alternative

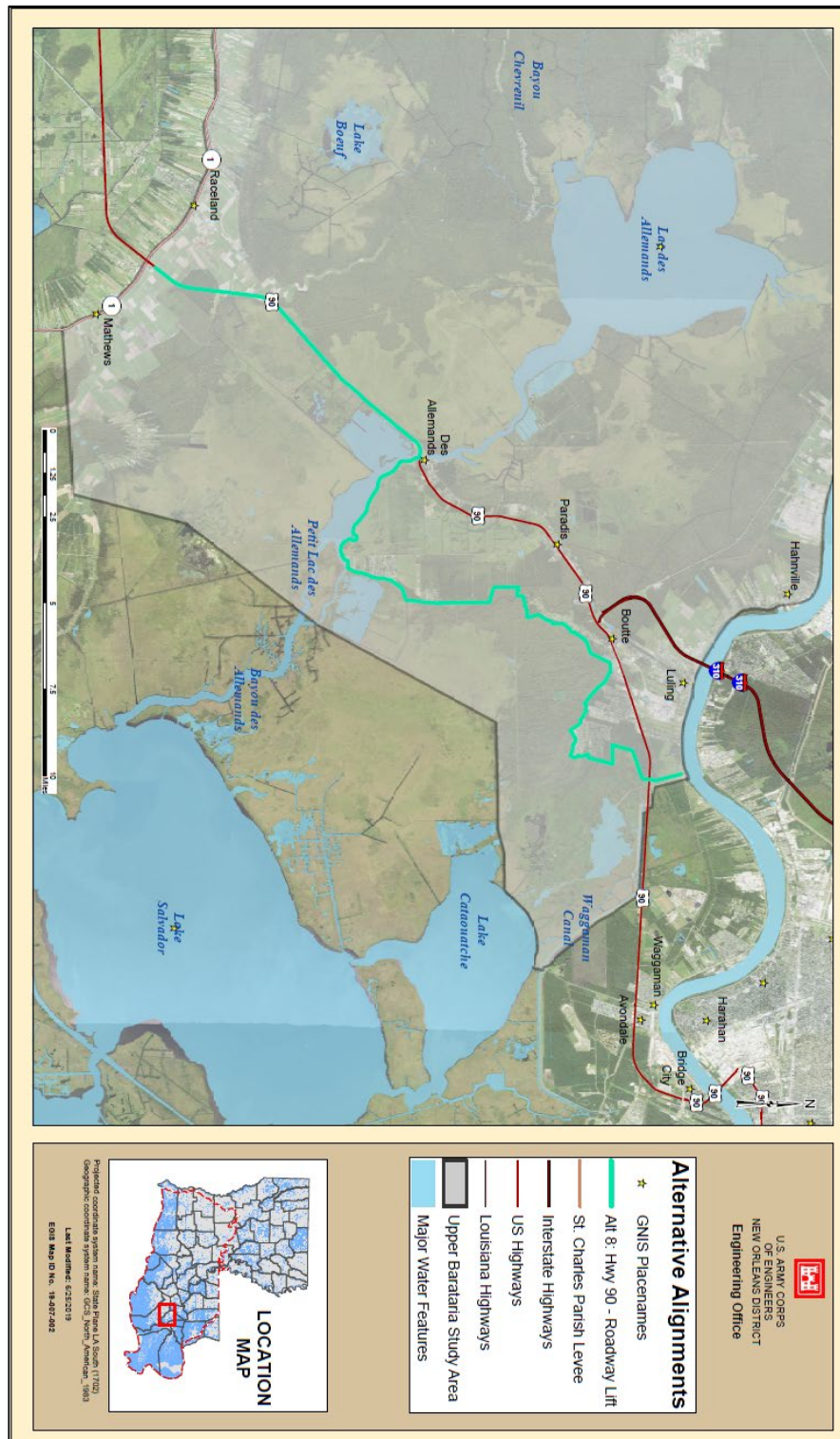


Figure 4-8: Hwy 90 Lift Alignment

4.4 Screening of Initial Ray of Alternatives

Screening of the initial array of alternatives (8 alternatives) began after Hydraulics and Hydrology (H&H) ran the existing conditions and the FWOP Advanced Circulation (ADCIRC) models. The FWOP condition does not consider the St. Charles Parish Levee, which has been constructed to Corps specifications, in place because it is a non-complete system by itself. Coastal storm surge damages were calculated for no action, 2%, 1%, 0.5%, and 0.2% AEP for each reach using the available 2010 ADCIRC model. Rainfall damages were calculated for no action, 50%, 20%, 10%, 5%, 2%, 1%, 0.5%, and 0.2% AEP. The results of the Hydrology and Hydraulics (H&H) models and the economic functions were inserted into the HEC-FDA model and those results were brought into Excel for tabulation. Costs were estimated based on the value of levee construction and key structures (barge gate, roller gates, floodwalls, etc.). The BCRs shown in Table 4-1, were estimated by comparing the total annual benefits to the total annual cost. The nonstructural alternative was evaluated within the revised final array of alternatives.

Upon evaluating the future without project results, Alternative 4 (Raceland Levee) did not receive damages out to a 0.2% AEP. Therefore, Alternative 4 did not have enough damages to support a project.

With Alternative 8, policy prohibits a large highway from being placed upon a Federal Levee. LADOTD in the past does not support placing roadways upon levees. The alternative also would not meet multiple USACE levee and earthen dam engineering and design regulations (Engineering Memorandum (EM) 1110-2-2300), risk analysis regulations (Engineering Regulation (ER) 1105-2-101 and EM 1110-2-1619), encroachment regulations, cost analysis regulations (ER 1110-2-1302), NFIP levee certification regulations (Engineering Circular (EC) 1110-6067), flood fighting and emergency operations regulations (ER 1130-2-530), and Operations, Maintenance, Repair, Replacement and Rehabilitation (OMRRR) regulations (ER1130-2-530 and ER1110-2-401).

The NS1 nonstructural alternative was not evaluated until the revised final array of Alternatives.

Table 4-1: Initial Array of Alternatives

Plan	Damage Reduced (EAD)	Construction Cost	Average Annual Cost	Net Benefits	B/C Ratio
Alternative 1, Hwy 90-Segment 1 Extension	\$13,541,000	\$314,000,000	\$11,916,000	\$1,626,000	1.14
Alternative 2, Hwy 90-Full Alignment	\$16,061,000	\$422,000,000	\$16,015,000	\$47,000	1.00
Alt 3 - Des Allemands Loop	\$8,712,000	\$288,000,000	\$10,930,000	\$(2,218,000)	0.80
Alt 5 - Open Basin	\$10,634,000	\$284,000,000	\$10,778,000	\$(144,000)	0.99
Alt 6 - Hwy 90 Alignment-Master Plan	\$19,655,000	\$1,053,000,000	\$39,960,000	\$(20,306,000)	0.49

4.5 Initial Final Array of Alternative Plans

After only considering structural quantities and material quantities in the parametric costs in the Table 4-1, total costs were developed on alternatives 1 and 2 are considered the initial final array. The additional costs include estimates from Real Estate, Cultural Resources, Relocations, Environmental Mitigation, Operations and Maintenance (O&M), and included all contingencies based on an abbreviated risk analysis. The BCRs for the focused array are contained in Table 4-2.

Table 4-2: Initial Final Array

Plan	EAD Benefits	Construction Cost	Average Annual Cost	Net Benefits	B/C Ratio
Alternative 1, Hwy 90-Segment 1 Extension, 7.5ft	\$13,846,000	\$513,423,000	\$20,358,000	\$(6,512,000)	0.7
Alternative 2, Hwy 90-Full Alignment, 8.5ft	\$16,060,000	\$665,108,000	\$26,238,000	\$(10,178,000)	0.6

4.6 Revised Final Array of Alternative Plans

Before evaluating the nonstructural alternative in detail, the PDT looked back into the H&H model. Another H&H ADCIRC model was adopted with a more recent model (2017 CPRA ADCIRC model). Two additional alternative plans (Alternatives 10 and 11) were then developed for the revised final array.

4.6.1 Alternative 10: Basin Rainfall Alternative

This structural alternative was developed to prevent rainfall damages back inside the basin north-west of US Highway 90. It incorporates a pump station and a 270 foot barge gate structure across Bayou Des Allemands where US Highway 90 crosses Bayou Des Allemands (Figure 4-9). This alternative was developed to reduce tailwater elevations to in turn drop the headwater water elevations during heavy rainfall events.

4.6.2 Alternative 11: 1% AEP (100-Year Coastal Storm Event) Open Basin

Alternative 10 was developed to reduce the highest concentration of damages around Des Allemands and Paradis. This is a structural alternative in the form of a 12 feet levee extending out from the existing St. Charles Parish Levee continuing south improving the Sunset Levee and include a vehicle crossing at Bayou Gauche. Then the levee system would cross Bayou Des Allemands just south of US Highway 90 with a 270ft barge gate structure 14 feet high. The levee system will then parallel US Highway 90 until just past Dufrene Ponds where it will tie into US Highway 90. This would also incorporate raising the existing St. Charles Parish Levee to an elevation of 12 feet. This alternative would be approximately 24 miles in length (Figure 4-10). The majority of damages prevented are in St. Charles and Lafourche Parishes.

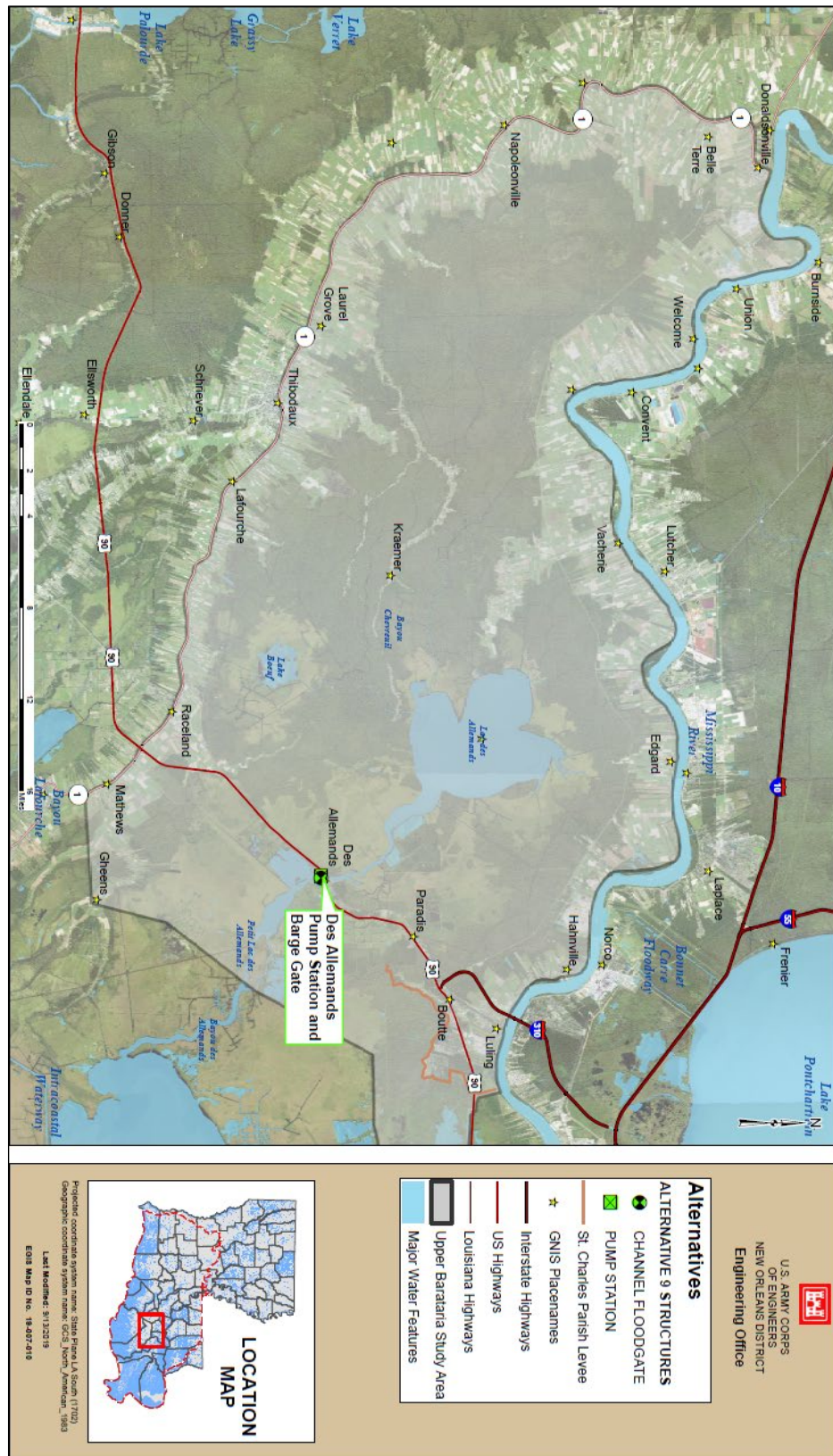


Figure 4-9: Basin Rainfall Alternative

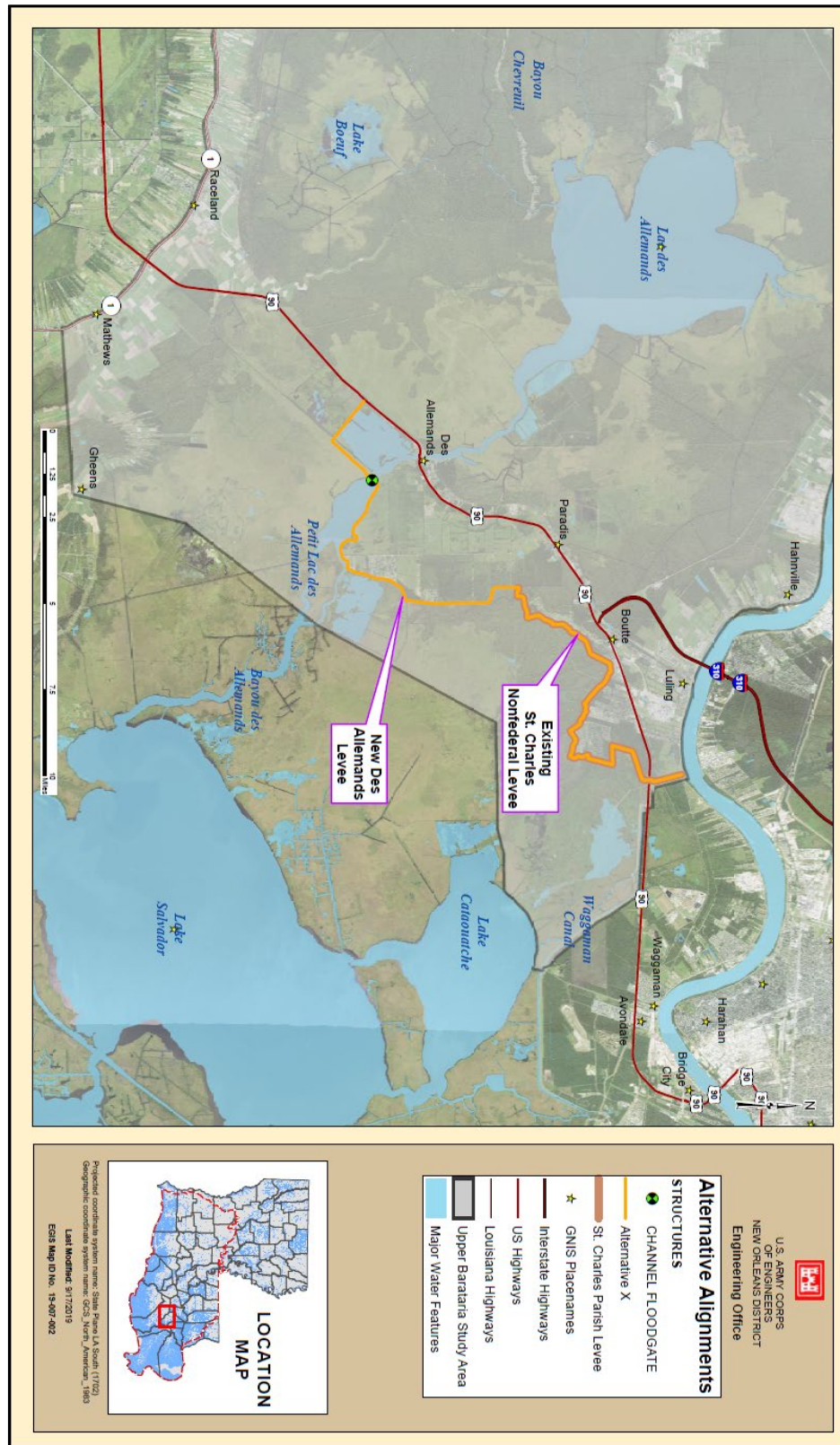


Figure 4-10: 100-Year Open Basin Alternative

4.7 Screening of the Final Array of Alternatives

Alternative 9 was screened out based on the storage capability of 17 billion cubic feet within the Upper Barataria Basin north of US Highway 90 which would equate to 1 foot in water surface elevation. Economic results indicated minimal damages down in the basin where Alternative 9 would be most effective. Therefore, there were nearly no damages to be prevented with a basin wide rainfall alternative.

In the initial final array analysis, it was assumed that the levee alternatives would have no resiliency once overtopped. However in the revised final array, the design was altered to include substantial armoring of the project levee and the existing St. Charles Parish Levee, thereby making the levee completely resilient once overtopped. As a result, the levee significantly reduces stages interior to the levee resulting in damage reductions well past the target elevation of the levee. The Future with Project (FWP) Hydraulic model runs will verify these early overtopping assumptions and be used to optimize the levee designs. These levees will be designed and optimized to Hurricane and Storm Damage Risk Reduction System (HSDDRS) specifications. These assumptions have been made based on the storage in the basin.

Alternatives 1 and 2 were carried forward from the initial final array of alternatives along with alternative 10 and alternative 7 (nonstructural) to be further evaluated with the 2017 ADCIRC H&H model within the revised final array.

The NS1 nonstructural alternative was evaluated by including all frequencies up to the 0.2% AEP and all structures located within the flood plain affected by surge. The economic results for the nonstructural alternative and the structural alternatives without costs for armoring were calculated in Table 4-3.

Table 4-3: Revised Final Array of Alternatives

Plan	EAD Benefits	Construction Cost	Average Annual Cost	Net Benefits	B/C Ratio
Alternative 1, Hwy 90-Segment 1 Extension, 7.5ft	\$30,261,000	\$513,423,000	\$20,358,000	\$9,904,000	1.5
Alternative 2, Hwy 90-Full Alignment, 8.5ft	\$30,465,000	\$665,108,000	\$26,238,000	\$4,228,000	1.2
Alternative 10, 1% AEP Open Basin 12.0ft	\$30,875,000	\$908,484,000	\$32,574,000	(\$1,700,000)	0.95
Nonstructural (NS1)	\$17,559,000	\$1,568,912,000	\$58,312,000	(\$40,753,000)	0.3

Based on the economic analysis of the focused array (Table 4-3) the NED plan is the Alternative 1, Hwy 90 – Segment 1 Extension at 7.5 feet. Nonstructural measures could be used to reduce the residual risk associated with the TSP. The B/C ratio for the elevations of 7.5 thru 12 ft, shows that flexibility exist with the final design, to consider structural superiority resiliency and life safety concerns.

System of Accounts

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

- The intent of comparing alternative flood risk reduction plans in terms of NED account was to identify the beneficial and adverse effects that the plans may have on the national economy. Beneficial effects were considered to be increases in the economic value of the national output of goods and services attributable to a plan. Increases in NED were expressed as the plans' economic benefits, and the adverse NED effects were the investment opportunities lost by committing funds to the implementation of a plan.
- The EQ account was another means of evaluating the plans to assist in making recommendations. The EQ account was intended to display the long-term effects that the alternative plans may have on significant environmental resources. The Water Resources Council defined significant environmental resources as those components of the ecological, cultural and aesthetic environments that, if affected by the alternative plans, could have a material bearing on the decision-making process.
- The RED account was intended to illustrate the effects that the proposed plans would have on regional economic activity, specifically, regional income and regional employment.
- The OSE account typically includes long-term community impacts in the areas of public facilities and services, recreational opportunities, transportation and traffic and man-made and natural resources. Table 4-4 compares the completeness and effectiveness by measurement of the four accounts (national economic development, environmental quality, regional economic development, and other social effects).

Table 4-4: Evaluation of 4 Accounts

Four Accounts	Alternative 1, HWY 90 – Segment 1	Alternative 2, HWY 90 – Full Alignment
National Economic Development (NED)	Avg. Annual Benefits-\$30.3M Avg. Annual Costs-\$20.4M \$10M in net benefits. 1.5 BCR Ranked 1st	Avg. Annual Benefits-\$30.5M Avg. Annual Costs-\$26.3M \$4.3M in net benefits. 1.2 BCR Ranked 2nd
Environmental Quality (EQ)	Construction footprint is the in the middle of the other structural plans (310 acres). Ranked 1st	Construction footprint is the largest structural plans (408 acres). Ranked 2nd
Regional Economic Development (RED)	The project cost supports a large amount of regional employment from construction of the project. Ranked 2nd	The project cost supports a large amount of regional employment from construction of the project. Ranked 1st
Other Social Effects (OSE)	A human impact to EJ resources is not expected. No buy outs or relocations are projected as of now. Ranked Equivalent	A human impact to EJ resources is not expected. No buy outs or relocations are projected as of now. Ranked Equivalent

4.8 Identifying the Tentatively Selected Plan

Per USACE Guidance, the PDT tentatively selects the alternative that maximizes net benefits as the recommendation for this CSRM study; this is also called the NED Plan. In order to determine which alternative is the NED Plan, the costs and benefits for the Final Array of Alternatives were compared. The alternative with the greatest net benefits is the apparent NED Plan, and thus the TSP. The TSP identified from the final array is Alternative 1, Hwy 90 – Segment 1 Extension. The TSP levee elevations will be optimized during the feasibility study design. This TSP is also the NED Plan.

As shown in Table 4-3, the net annual benefits for Alternative 1, Hwy 90 – Segment 1 Extension are \$10 million and the benefit cost ratio is 1.5. As the levee design is refined, it is anticipated that the cost will increase due to armoring. This additional cost will be addressed in the Tentatively Selected Plan Section.

4.9 Alternatives Eliminated from Detailed Analysis

In turn, from the formulation of alternative plans section, the revised final array consists of alternatives 1, 2, 10, nonstructural, and the No Action. Alternatives 1 and 2 were found to have positive net benefits. Alternatives 3, 4, 5, 6, 8, 9, and nonstructural were eliminated from the detailed analysis.

In turn, from the formulation of alternative plans section, the revised final array consists of alternatives 1, 2, 10, 7 (nonstructural), and 11 (No Action). Alternatives 1 and 2 were found to have positive net benefits. Alternatives 3, 4, 5, 6, 8, 9, and 7 (nonstructural) were eliminated from the detailed analysis.

5 Environmental Consequences

In accordance with NEPA, this chapter includes the scientific and analytic basis for comparison of the considered alternatives identified in Section 4 – Formulate Alternative Plans. This chapter assesses the project's potential environmental impact on those resources identified in Section 3, Inventory and Forecast Conditions. The discussion includes the environmental impacts of the considered alternatives, any adverse environmental effects which cannot be avoided, and the cumulative effects of proposed actions.

5.1 Summary of Environmental Consequences by Each Alternative

This chapter describes the environmental consequences associated with implementing the final array of alternatives.

This chapter contains a brief summary of the effects of the proposed alternatives. A more detailed comparison is contained in Appendix C. The analyzed alternatives include:

- No Action Alternative
- Alternative 1: Hwy 90 - Segment 1 Levee Extension
- Alternative 2: Hwy 90 – Full Alignment

5.2 Environmental Impacts

5.2.1 Future without Project Conditions (No Action Alternative)

Under the No Action Alternative, wetlands and other surface waters, wildlife, threatened and endangered species, fisheries, aquatic resources, water quality, EFH, cultural resources, recreational resources, aesthetic resources, air quality, noise, HTRW, socioeconomics/land use, environmental justice, transportation, navigation, and commercial fisheries, would not be directly impacted from construction.

Without implementation of the proposed action, the existing marsh has little protection and is subject to winds, subsidence, and sea level rise. Study-area fresh marshes will likely remain relatively healthy provided salinities do not increase and provided that SLR remains relatively low. Increases in salinity or rapid SLR will likely result in gradually increasing marsh loss. Continued operation of the Davis Pond Freshwater Diversion should help to preclude detrimental salinity increases. However, under the higher SLR scenarios, continued loss of middle and lower basin marshes would allow tidal exchange to increase project area salinities despite Davis Pond Diversion freshwater inputs.

Fish and wildlife resources that use area marshes may initially benefit from increased marsh loss as degradation would convert project area marshes having no internal open water to a complex having more interspersed internal water areas. With continued marsh loss, fish and wildlife habitat quantity and quality will decrease, thereby reducing fish and wildlife abundance. As lower basin marshes continue to degrade, estuarine-dependent fisheries will increasingly seek to utilize upper basin marshes and degrading forested wetlands. This would partially offset the loss of nursery habitat in the middle and lower

basin and extend the period of high Barataria Basin estuarine fisheries production. But eventually should upper basin wetlands degrade sufficiently, fisheries production will decrease substantially.

Because of semi-permanent or permanent inundation, a majority of the upper basin cypress-tupelo forests are unsustainable and will gradually thin out and convert to marsh or open water. If rapid salinity increases occur, the mortality of cypress will be accelerated and impacted swamps would be more likely convert to open water rather than marsh. The bottomland hardwoods, already suffering from excessive inundation, will convert to degraded swamp, scrub-shrub, or marsh. Migratory songbirds which use these coastal forests as important stop-over habitat when migrating northward across the Gulf, will have to fly further north to encounter suitable stop-over habitat. Resident forest-dependent wildlife will be gradually displaced to adjoining developed areas and there suffer from loss of food resources and increased mortality.

Under future without project conditions, no impacts to threatened or endangered species are expected to occur. However, the future opportunity for the Barataria Basin to provide habitat for threatened or endangered species would most likely diminish. Existing conditions would persist and listed species would likely continue to be subject to institutional recognition and further regulations.

Without intervention, communities within the study area would continue to be at risk from high water events induced by coastal storm surges and rainfall events. Visual resources would continue to evolve from existing conditions as a result of both land use trends and natural processes over the course of time. Waterways would continue to swell and overflow seasonally. Communities near these waterways would continue to experience high water events. Land loss would likely continue and there could be an overall loss of habitat within the system that once provided cover, resting, nesting and foraging habitat. Where tranquil and entrancing shorelines once lined with native flora and fauna flourished there could be additional expanses of open water.

Recreational resources would continue to evolve from existing conditions as a result of both land use trends and natural processes over the course of time. Land loss would likely continue and there could be an overall loss of habitat within the system that once provided cover, resting, nesting and foraging habitat. The loss of these habitats, and the effect such losses would have on wildlife and aquatic species, could cause recreational resources in the basin to transition. The study area has traditionally provided excellent freshwater fishing and, in recent years, because of the increased salinity levels, anglers have been able to catch saltwater species much farther inland than in the past.

Table 5-1 identifies those resources that would be temporarily or permanently impacted, directly or indirectly, by construction. A more detailed description of the impacts to these resources may be found in Appendix C.

Table 5-1: Impacts to Relevant Resources

Relevant Resource	Impacted	Not Impacted
Wetlands	X	
Aquatic Resources/Fisheries/Water Bottoms	X	
Essential Fish Habitat	X	
Wildlife	X	
Threatened and Endangered Species		X
Cultural Resources		X
Recreational Resources		X
Aesthetics	X	
Air Quality	X	
Water Quality	X	
HTRW		X
Socioeconomics		X
Environmental Justice		X
Noise	X	

Of those resources that are impacted, noise, HTRW, air quality and water quality would only suffer temporary minimal impacts and are therefore not discussed further.

5.2.2 Natural Environment

5.2.2.1 Wetlands

Alternative 1 – Hwy 90 - Segment 1 Levee Extension

Direct, Indirect, and Cumulative Impacts

Implementation of the TSP would result in direct permanent impacts to approximately 345 acres resulting from construction of the levees and floodwalls. Approximately 259.67 acres of freshwater emergent wetlands would be converted to upland habitat with construction of the levee with approximately 9.94 acres of open water habitat impacted from construction of the barge gate. The remaining approximately 39.76 acres of impact would come from construction of the floodwall portions in those areas of the alignment that are already heavily impacted by development.

An additional approximately 25 acres of freshwater emergent wetlands would be temporarily impacted by the construction of access roads and establishment of temporary staging areas during construction. An approximately 10.5 acres of freshwater emergent wetlands habitat being permanently impacted by access road construction. Staging areas and temporary access roads would be returned to preconstruction conditions upon project completion.

Cumulative impacts to wetlands would be the result of this and combined impacts from other Federal, state, local and private flood protection efforts.

Alternative 2 – Hwy 90 Full Alignment

Direct, Indirect, and Cumulative Impacts

Impacts from Alternative 2 would be similar to the TSP except there would be an increase in the acres of direct impacts to wetlands with approximately 445 acres impacted from construction of the levees and floodwalls.

5.2.2.2 Wildlife

Alternative 1 – Hwy 90 - Segment 1 Levee Extension

Direct, Indirect, and Cumulative Impacts

Implementation of the TSP would result in direct permanent impacts to approximately 345 acres resulting from construction of the levees and floodwalls. Approximately 259.67 acres of freshwater emergent habitat would be converted to upland habitat with construction of the levee with approximately 9.94 acres of open water habitat impacted from construction of the barge gate. The remaining approximately 39.76 acres of impact would come from construction of the floodwall portions in those areas of the alignment that are already heavily impacted by development.

An additional approximately 25 acres of fisheries habitat would be temporarily impacted by the construction of access roads and establishment of temporary staging areas during construction. An approximately 10.5 acres of freshwater emergent wetlands habitat being permanently impacted by access road construction. Staging areas and temporary access roads would be returned to preconstruction conditions upon project completion.

Alternative 2 – Hwy 90 Full Alignment

Direct, Indirect, and Cumulative Impacts

Impacts from Alternative 2 would be similar to the TSP except there would be an increase in the acres of direct impacts to aquatic resources, fisheries and water bottoms with approximately 445 acres impacted from construction of the levees and floodwalls.

5.2.2.3 Threatened and Endangered Species and Other Protected Species

Alternative 1 – Hwy 90 - Segment 1 Levee Extension

Direct Impacts, Indirect and Cumulative Impacts

Implementation of the TSP is not expected to have an adverse impact to T&E critical habitat. There is the potential that construction of the barge gate could have minimal impacts on the West Indian manatee which may occasionally occur in and around the project area. Any potential impacts associated with displacement of West Indian manatee during project construction would be minimal because of the immense amount of similar habitat in the project vicinity. Displaced West Indian manatee would likely move to other areas with more suitable habitat.

To ensure there are no adverse effects to any T&E species potentially occurring in the area, construction guidelines including manatee protection measures will be placed within

the plans and specifications. An Intra-Service Section 7 Endangered Species Act consultation memo and coordination with USFWS on the TSP's potential impacts on the West Indian manatee is currently ongoing.

Alternative 2 – Hwy 90 Full Alignment

Direct Impacts, Indirect and Cumulative Impacts

Impacts would be similar to those described for the TSP.

5.2.2.4 Aquatic Resources and Water Bottoms

Alternative 1 – Hwy 90 - Segment 1 Levee Extension

Direct Impacts, Indirect and Cumulative Impacts

Implementation of the TSP would result in direct permanent impacts to approximately 345 acres resulting from construction of the levees and floodwalls. Approximately 259.67 acres of freshwater emergent habitat would be converted to upland habitat with construction of the levee with approximately 9.94 acres of open water habitat impacted from construction of the barge gate. The remaining approximately 39.76 acres of impact would come from construction of the floodwall portions in those areas of the alignment that are already heavily impacted by development.

An additional approximately 25 acres of fisheries habitat would be temporarily impacted by the construction of access roads and establishment of temporary staging areas during construction. An approximately 10.5 acres of freshwater emergent wetlands habitat being permanently impacted by access road construction. Staging areas and temporary access roads would be returned to preconstruction conditions upon project completion.

Cumulative impacts to aquatic resources would be the result of this and combined impacts from other Federal, state, local and private flood protection efforts.

Alternative 2 – Hwy 90 Full Alignment

Direct Impacts, Indirect and Cumulative Impacts

Impacts from Alternative 2 would be similar to the TSP except there would be an increase in the acres of direct impacts to aquatic resources, fisheries and water bottoms with approximately 445 acres impacted from construction of the levees and floodwalls.

5.2.2.5 Essential Fish Habitat (EFH)

Alternative 1 – Hwy 90 - Segment 1 Levee Extension

Direct Impacts, Indirect and Cumulative Impacts

Emergent wetland is the primary type of EFH that would be impacted with construction of the TSP. Approximately 259.67 acres of freshwater emergent habitat would be converted to upland habitat with construction of the levee with approximately 9.94 acres of open water habitat impacted from construction of the barge gate. The remaining approximately

39.76 acres of impact would come from construction of the floodwall portions in those areas of the alignment that are already heavily impacted by development.

Construction of the levee feature would impact estuarine emergent wetlands affecting post-larval and sub-adult brown and white shrimp, post-larval and sub-adult red drum. An additional approximately 25 acres of fisheries habitat would be temporarily impacted by the construction of access roads and establishment of temporary staging areas during construction. An approximately 10.5 acres of freshwater emergent wetlands habitat being permanently impacted by access road construction. Staging areas and temporary access roads would be returned to preconstruction conditions upon project completion.

Where tidally-influenced waters designated as EFH are converted to a non-tidal elevation, loss of EFH would result. However, these impacts are considered minimal when compared with the size of the basin and similar EFH located in the project vicinity. EFH losses would be quantified and presented in the final EIS report.

Alternative 2 – Hwy 90 Full Alignment

Direct Impacts, Indirect and Cumulative Impacts

Impacts from Alternative 2 would be similar to the TSP except there would be an increase in the acres of direct impacts to EFH with approximately 445 acres impacted from construction of the levees and floodwalls.

5.2.3 Human Environment

5.2.3.1 Socio-economics

Alternative 1 – Hwy 90 - Segment 1 Levee Extension

Direct, Indirect, and Cumulative Impacts

There will be negligible direct impacts to socio-economic resources. There will be minor temporary indirect impacts during construction.

Alternative 2 – Hwy 90 Full Alignment

Direct, Indirect, and Cumulative Impacts

There will be negligible direct impacts to socio-economic resources. There will be minor temporary indirect impacts during construction.

5.2.3.2 Transportation

Alternative 1 – Hwy 90 - Segment 1 Levee Extension

Direct, Indirect, and Cumulative Impacts.

There will be minor temporary direct impacts to transportation during construction.

Alternative 2 – Hwy 90 Full Alignment

Direct, Indirect, and Cumulative Impacts

There will be minor temporary direct effects to transportation during construction.

5.2.3.3 Cultural Resources

Alternative 1 – Hwy 90 - Segment 1 Levee Extension

Direct Impacts, Indirect and Cumulative Impacts

The construction footprint has potential to cause direct impacts to any cultural resources that exist within it, via required processes of excavation and construction. Indirect impacts of construction can affect cultural resources because of changes to the water and drainage patterns that have existed previously. Cultural Resources Surveys are necessary to identify existing cultural resources.

Alternative 2 – Hwy 90 Full Alignment

Direct Impacts, Indirect and Cumulative Impacts

Impacts would be similar to those described for the TSP.

5.2.3.4 Recreation Resources

Alternative 1 – Hwy 90 - Segment 1 Levee Extension

Direct Impacts, Indirect and Cumulative Impacts

Consumptive and non-consumptive recreation resources would be directly impacted by wetland habitat transitions. Approximately 309.37 acres would be directly impacted resulting from construction of the levees and floodwalls. Approximately 299.43 acres of freshwater emergent wetlands would be converted to upland habitat with construction of the levee. Approximately 9.94 acres of open water habitat would be impacted from construction of the barge gate.

During construction, there could be short-term indirect impacts to recreational resources along the immediate levee area, temporary access roads and staging areas. Mobile wildlife species associated with hunting and fishing may attempt to move from the area of influence. Non-consumptive recreation resources relating to sports and leisure could be impacted by noise and/or dust associated with construction activity.

Alternative 2 – Hwy 90 Full Alignment

Direct Impacts, Indirect and Cumulative Impacts

The Full Alignment is similar to the TSP and includes an additional foot of design elevation and levee lifts along the St. Charles Parish levee. Impacts from the Full Alignment would be similar to the TSP. The St. Charles Parish Levee Lift is in close proximity to the Rathborne Park Development in St. Charles Parish. This park was a recipient of funding in 2014 from the Land Water Conservation Fund. All indirect impacts would be avoided, minimized and reduced to the maximum extent practicable and mitigated as necessary.

5.2.3.5 Aesthetics

Alternative 1 – Hwy 90 - Segment 1 Levee Extension

Direct Impacts, Indirect and Cumulative Impacts

The TSP consists of levee and floodwall (T-Wall) construction east of Des Allemands along the Paradise canal, one roller gate structure at Bayou Gauche, and one barge gate structure across Bayou Des Allemands. Direct impacts to visual resources would be minimal as most of the site is remote and public access is limited. The barge gate structure across Bayou Des Allemands would be visible from the channel by boaters and from the Highway 90 Bridge. The man-made structure may be considered obtrusive against a tranquil and entrancing shoreline. However, man-made structures currently occupy stretches of shoreline and multiple bridges cross Bayou Des Allemands just north of the proposed barge gate structure.

Alternative 2 – Hwy 90 Full Alignment

Direct Impacts, Indirect and Cumulative Impacts

The full alignment is similar to the TSP and includes an additional foot of design elevation and levee lifts along the St. Charles Parish levee. Impacts from the full alignment would be similar to the TSP.

5.3 Cumulative Effects Analysis

The Council on Environmental Quality (CEQ) Regulations define cumulative impacts as “the impact on the environment which results from the incremental impact of the action 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. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.” (40 CFR §1508.7).

Cumulative effects are not caused by a single project, but include the effects of a particular project in conjunction with other projects (past, present and future) on the particular resource. Cumulative effects are studied to enable the public, decision-makers and project proponents to consider the “big picture” effects of a given project on the community and the environment. In a broad sense, all impacts on affected resources are probably cumulative; however, the role of the analyst is to narrow the focus of the cumulative effects analysis to important issues of national, regional and local significance (CEQ, 1997).

The CEQ issued a manual entitled Cumulative Effects under the National Environmental Policy Act (CEQ, 1997). This manual presents an 11-step procedure for addressing cumulative impact analysis. The cumulative effects analysis concentrates on whether the actions proposed for this study, combined with the impacts of other projects, would result in a significant cumulative impact, and if so, whether this study’s contribution to this impact would be cumulatively considerable.

6 Tentatively Selected Plan

Based on the cost and benefit analysis of the final array of alternatives, the TSP (Alternative 1) is the NED Plan of the HWY 90 – Segment 1 Extension. This plan is estimated to produce nearly \$30.3 million in average annual benefits at an average annual cost of nearly \$20.4 million (total project cost of little less than \$514 million not including armoring costs for resiliency), for a BCR of 1.5 at the current Federal Discount Rate (FDR) of 2.75 percent.

The levee design elevation is at a 2% AEP existing but the system provides levels of risk reduction up to the 0.2% AEP future based off of capitalizing on the storage within the basin during an event. This plan specifically addresses coastal storm events. Structures behind the levee alignment will be benefited based on lowering of water stages and preventing damages during a coastal storm event.

To allow for resiliency during elevated overtopping rates, concrete will be used where access roads are on top of the levee and High Performance Turf Reinforced Mat (HPTRM) would be placed upon the levee. An additional cost of \$47,000,000 for HPTRM and \$140,000,000 for concrete was added to the first cost of the TSP to armor the entire alignment and the existing St. Charles Parish Levee, which has been built to the USACE specifications. HPTRM armoring protects the levee from wave overtopping. Wave overtopping testing has shown that wave topping erosion occurs on the land side levee slope, extending between 5 to 8 feet from the land side toe. Testing also determined that HPTRM combined with Bermuda grass provides resiliency and erosion resistance to these vulnerable areas of the levee with significant overtopping would occur. Table 6-1 breaks out the Alternative 1 BCR with HPTRM and with concrete across the entire length of levee (including armoring of the St. Charles Parish Levee) in the most extreme armoring case. Alternative 1 BCR reduces to 1.4 and 1.2 for HPTRM and Concrete armoring respectively. Please reference Appendix A for more details on armoring.

Table 6-1: TSP with Armoring

	Alt 1 With Armoring - Matting	Alt 1 With Armoring - Concrete
First Cost	\$560,423,000	\$653,423,000
Annual Costs	\$22,122,000	\$25,614,000
Annual Benefits	\$30,261,000	\$30,261,000
Net Annual Benefits	\$8,139,000	\$4,647,000
Benefit to Cost Ratio	1.4	1.2

6.1 National Significance of the Project

The intent of comparing alternative flood risk reduction plans in terms of NED is to identify the beneficial and adverse effects that the plans may have on the national economy. Beneficial effects were considered to be increases in the economic value of the national

output of goods and services attributable to a plan. Increases in NED were expressed as the plans' economic benefits, and the adverse NED effects were the investment opportunities lost by committing funds to the implementation of a plan. The NED costs and benefits for the final array are described in Table 4-3. Alternative 1 (NED Plan) has the greatest net benefits.

6.2 Implementing the Plan

Subject to project authorization, appropriation and availability of funding, full environmental compliance, and execution of a binding agreement with the NFS, construction will be scheduled to begin in 2020. The schedule assumes a complete risk reduction system in place by 2023. The project requires construction authorization and the appropriation of construction funds. A continuous funding stream is needed to complete this project within the anticipated timeline, which requires continuing appropriations from Congress and the State of Louisiana in order to fund the detailed design phase and fully fund construction contracts.

Once construction funds are appropriated for this project, the NFS, and the Department of the Army will enter into a Project Partnership Agreement (PPA). After the signing of a PPA, the NFS can acquire the necessary land, easements and rights of way to construct the project.

Since project features cannot be advertised for construction until the appropriate real estate interests have been acquired, obtaining the necessary real estate in a timely fashion is critical to achieving the project schedule. At the completion of construction, or functional portions thereof, the NFS would be fully responsible for OMRR&R of the project or of the completed functional portion of the project.

6.2.1 Real Estate

The TSP will require approximately 592 acres to be acquired in perpetual flood protection levee easement and 54 acres of Temporary Work Area Easement (Borrow). The project footprint is estimated to impact approximately 75 landowners. Using preliminary information, there are no structures within the footprint that would need to be relocated. Mitigation will be required for unavoidable impacts and it is not determined at this time if mitigation banks or USACE constructed mitigation sites will be necessary. If USACE constructed sites are needed, these sites will be acquired in Fee, Excluding Minerals. Total Real Estate Costs for the TSP are \$4,884,000. This cost is not only land costs, but also acquisition costs, and contingencies. Please reference Appendix D for more details on Real Estate estimates.

6.2.2 HWY 90 – Segment 1 Extension Design (TSP)

The TSP consists of a structural alternative that extends from the existing St. Charles Parish levee, building to a 7.5 foot design elevation and totaling 96,726 feet in length, into high ground across the basin near Raceland. The levees were designed to HSDRRS specifications 1V:4H with a 10 foot crown. Engineering designed to 7.5 foot elevation

across the basin and will construct to 8.5 feet to allow for settlement in reaches D-H in Figure 6-1.

All alignment structures were designed with 2 feet structure superiority (Gates and Floodwall). An average ground surface elevation of 1.5 feet was used when calculating the soil quantity of 1,086,096 cubic yards needed.

Borrow sites were estimated within 15 miles of where US Highway 90 crosses Bayou Des Allemands. Potential sites were also called out in the conceptual design report developed by St. Charles Parish. One of which is known as the Raceland Raw Sugar Borrow Pits. In total, there is approximately 84,158 linear foot levee, 12,253 linear foot of floodwall (T-Wall) east of Des Allemands along the Paradise canal, one 45 linear foot roller gate structure at Bayou Gauche, and one 270 linear foot barge gate structure across Bayou Des Allemands. The smaller structures will be captured in the Alternative 1 detailed Figure 6-2.



Figure 6-1: Levee Hydraulic Reaches



Figure 6-2: Detailed Alternative 1 Alignment

List of structures associated with Figure 6-2:

1. Floodwall section in Hydraulic Reach D
2. Floodwall section in Hydraulic Reach D and E
3. Crawford Canal P.S. Fronting Protection
4. Floodwall section in Hydraulic Reach E and F
5. 45 foot Bayou Gauche Roller Gate
6. 270 foot Barge Gate crossing Bayou Des Allemands
7. Drainage Structure – 4-6 feet X 6 feet RC box culverts with sluice gates
8. Drainage Structure – 4-6 feet X 6 feet RC box culverts with sluice gates
9. Drainage Structure – 2-84 inch RCP culverts with sluice gates
10. Drainage Structure – 1-60 inch RCP culvert with sluice gates
11. Stop log gate at Godchaux Canal (Access road will be used)
12. Paradis Control Structure

Hydraulic Connectivity

Hydrologic connectivity would be maintained to the extent practicable through water control structures except during closure for hurricanes or tropical storms. The risk reduction system is only authorized to address storm surge caused by hurricane and tropical storm events. It is not authorized to mitigate for or reduce impacts caused by higher day-to-day water levels brought about by increases in sea level rise. Rainfall events and high tides could still cause significant flooding of the swamps within the levee-enclosed area. All drainage features through the levee system were sized to match the existing gravity drainage system, and would mimic the existing drainage patterns when the system is not closed. Any operational changes implemented to address changing SLR conditions or for any other non-project-related purpose would be considered a separate project purpose requiring separate authorization, new NEPA documentation, and/or permit approvals.

Access for Construction

Reach H and a portion of G will be accessed using Amarada Hess Rd. For access along the project site, assume access would be for the length of the reach, 40 feet wide at least 15 feet from the levee toe.

Reach G will be accessed from U.S. Highway 90 via constructing a permanent access route (7,925 feet) to the alignment just south west of Dufrene Ponds (Figure 6-3, Red route).

Reach F will be accessed via an 8,293 foot temporary access route from US Highway 90 to eastern side of Bayou Des Allemands via Down the Bayou Road near the proposed barge gate placement site. Figure 6-4

Reach E will be accessed from Highway 306 (Bayou Gauche Road). Reach D will be accessed using a temporary access route (1, 527 linear feet) located between highway 632 and Paradis Canal. Please refer to the red path in Figure 6-5.



Figure 6-3: Access Route 1



Figure 6-4: Access Route 2



Figure 6-5: Access Route 3

Staging areas

The staging areas are typically 1 per contract, allow about 2 acres per site. We can assume each reach is a separate contract for around 16 staging areas per alternative.

Type of Equipment

Construction equipment-typical complex construction equipment, cranes, backhoes, dozers, pile drivers, rollers.

Armoring

Armoring will be the typical High Performance Turf Reinforcement Mat (HPTRM) that will be anchored in a 1 foot trench on the flood side slope extending across the crown and down the land side slope past the levee toe by 15 feet where it will be anchored in a 1foot trench. The HPTRM will then be covered by Bermuda sod. Concrete armoring may need to be laid in the areas of highest risk and access routes on the levee.

6.2.3 Monitoring and Adaptive Management

The alternatives were developed in accordance with USACE planning guidance at ER 1105-2-100 and other applicable USACE policies and regulations applicable to flood risk management studies. The Water Resources Development Act (WRDA) of 2007, Section 2036(a) and U.S Army Corps of Engineers (USACE) implementation guidance for Section 2036(a) (CECW-PC Memorandum dated August 31, 2009: "Implementation Guidance for Section 2036 (a) of the Water Resources Development Act of 2007 (WRDA 2007) – Mitigation for Fish and Wildlife and Wetland Losses") requires AM and monitoring plans

be included in all mitigation plans for fish and wildlife habitat and wetland losses. Adaptive Management is an iterative and structured process which reduces ecological and other uncertainties that could prevent successful project implementation and performance. AM establishes a framework for decision making which utilizes monitoring results and other information, as it becomes available, as a feedback mechanism used to update project knowledge and adjust management and mitigation actions to better achieve project goals and objectives.

6.2.4 Cost Sharing Requirements

Generally, feasibility studies funded by Public Law 115-123 will be conducted for not more than \$3 million and will be completed within 36 months, consistent with Section 1001 of WRRDA 2014. If a cost exemption is approved for a study, those additional costs may be funded from remaining Supplemental Investigations funds. However, if available remaining Supplemental Investigations funds are exhausted, then the additional costs will be cost shared and the Federal portion of those remaining costs will compete for funding from annual Investigations funding. If additional cost sharing is required, the FCSA will need to be amended.

Pursuant to the model Project Partnership Agreement (PPA) for structural flood risk management projects, the NFS shall contribute a minimum of 35 percent, up to a maximum of 50 percent, of construction costs. The NFS shall pay 5 percent of construction costs, with credit given for funds already provided by the NFS pursuant to the Design Agreement. See Section 6.2.7 herein for a list of the items of local (non-Federal) cooperation to be required under the PPA.

6.2.5 Federal Responsibilities for the Selected Plan

The Federal government will be responsible for Planning, Engineering, and Design (PED) PED and construction of the project in accordance with the applicable provisions of Public Law 99-662 (WRDA of 1986), as amended. The Government, 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.

6.2.6 Non-Federal Responsibilities for the Selected 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:

1. The NFS shall contribute a minimum of 35 percent, up to a maximum of 50 percent, of construction costs. The NFS shall pay 5 percent of construction costs, with credit given for funds already provided by the NFS pursuant to the Design Agreement
2. The NFS shall provide the real property interests, placement area improvements, and relocations required for construction, operation, and maintenance of the Project.

3. As functional portions of the work are completed, the NFS shall begin operation and maintenance of such work.
4. When the District Commander determines that construction of the Project, or a functional portion thereof, is complete, within 30 calendar days of such determination, the District Commander shall so notify the NFS in writing and the NFS, at no cost to the Government, shall operate, maintain, repair, rehabilitate, and replace the Project, or such functional portion thereof.
5. The NFS shall conduct its operation, maintenance, repair, rehabilitation, and replacement responsibilities in a manner compatible with the authorized purpose of the Project and in accordance with applicable Federal laws and specific directions prescribed by the Government in the OMRR&R Manual.
6. Not less than once each year, the NFS shall inform affected interests of the extent of risk reduction afforded by the Project.
7. The NFS shall participate in and comply with applicable Federal floodplain management and flood insurance programs.
8. In accordance with Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), the NFS shall prepare a floodplain management plan for the Project within one year after the effective date of this Agreement and shall implement such plan not later than one year after completion of construction of the Project. The NFS shall provide an information copy of the plan to the Government.
9. The NFS shall publicize floodplain information in the area concerned and shall 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 the Project.
10. The NFS shall prevent obstructions or encroachments on the Project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) that might reduce the level of flood risk reduction the Project affords, hinder operation and maintenance of the Project, or interfere with the Project's proper function.
11. The NFS shall not use Federal program funds to meet any of its obligations under this Agreement unless the Federal agency providing the funds verifies in writing that the funds are authorized to be used for the Project.
12. The NFS shall comply with all the requirements of applicable Federal laws and implementing regulations, including, but not limited to: Section 601 of the Civil Rights Act of 1964 (P.L. 88-352), as amended (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto; the Age Discrimination Act of 1975 (42 U.S.C. 6102); and the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), and Army Regulation 600-7 issued pursuant thereto.
13. If the NFS requests that the Government perform any betterments on behalf of the NFS and the Government agrees to such request, the NFS must provide funds sufficient to cover the costs of such work in advance of the Government performing the work.
14. The NFS shall acquire the real property interests that the Government has determined are required for the construction, operation, and maintenance of the Project and shall provide the Government with authorization for entry thereto in accordance with the Government's schedule for construction of the Project. The NFS shall ensure that real property interests provided for the Project are retained in public ownership for uses compatible with the authorized purposes of the Project.
15. The NFS shall construct the placement area improvements necessary for construction, operation, and maintenance of the Project in accordance with the Government's construction schedule for the Project.

16. The NFS shall perform or ensure the performance of the relocations necessary for construction, operation, and maintenance of the Project in accordance with the Government's construction schedule for the Project.
17. The NFS shall accept delivery of deeds for all real property interests acquired by the Government in the name of the NFS.
18. The Government's providing real property interests, placement area improvements, or performing relocations on behalf of the NFS does not alter the NFS's responsibility in accordance with provisions of the Project Partnership Agreement for the costs of any cleanup and response related thereto.
19. To the maximum extent practicable, no later than 3 months after it provides the Government with authorization for entry onto a real property interest or pays compensation to the owner, whichever occurs later, the NFS shall provide the Government with documents sufficient to determine the amount of credit to be provided for the real property interest in accordance with provisions of the Project Partnership Agreement. To the maximum extent practicable, no less frequently than on a quarterly basis, the NFS shall provide the Government with documentation sufficient for the Government to determine the amount of credit to be provided for other creditable items in accordance with in accordance with provisions of the Project Partnership Agreement.
20. As required by Sections 210 and 305 of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended (42 U.S.C. 4630 and 4655), and Section 24.4 of the Uniform Regulations contained in 49 C.F.R. Part 24, the NFS assures that (1) fair and reasonable relocation payments and assistance shall be provided to or for displaced persons, as are required to be provided by a Federal agency under Sections 4622, 4623 and 4624 of Title 42 of the U.S. Code; (2) relocation assistance programs offering the services described in Section 4625 of Title 42 of the U.S. Code shall be provided to such displaced persons; (3) within a reasonable period of time prior to displacement, comparable replacement dwellings will be available to displaced persons in accordance with Section 4625(c)(3) of Title 42 of the U.S. Code; (4) in acquiring real property, the NFS will be guided, to the greatest extent practicable under State law, by the land acquisition policies in Section 4651 and the provision of Section 4652 of Title 42 of the U.S. Code; and (5) property owners will be paid or reimbursed for necessary expenses as specified in Sections 4653 and 4654 of Title 42 of the U.S. Code.
21. The NFS shall be responsible for undertaking any investigations to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (hereinafter "CERCLA") (42 U.S.C. 9601-9675), that may exist in, on, or under real property interests required for construction, operation, and maintenance of the Project.
22. In the event it is discovered that hazardous substances regulated under CERCLA exist in, on, or under any of the required real property interests, within 15 calendar days of such discovery, the NFS and the Government, in addition to providing any other notice required by applicable law, shall provide written notice to each other, and the NFS shall not proceed with the acquisition of such real property interests until the parties agree that the NFS should proceed.
23. If hazardous substances regulated under CERCLA are found to exist in, on, or under any required real property interests, the parties shall consider any liability that might arise under CERCLA and determine whether to initiate construction, or if already initiated, whether to continue construction, suspend construction, or terminate construction. Should the parties initiate or continue construction, the NFS shall be

responsible, as between the Government and the NFS, for the costs of cleanup and response, including the costs of any studies and investigations necessary to determine an appropriate response to the contamination. Such costs shall be paid solely by the NFS without reimbursement or credit by the Government.

24. As between the Government and the NFS, the NFS shall be considered the operator of the Project for purposes of CERCLA liability. To the maximum extent practicable, the NFS shall operate, maintain, repair, rehabilitate, and replace the Project in a manner that will not cause liability to arise under CERCLA.
25. To the maximum extent practicable, no later than 3 months after it provides the Government with authorization for entry onto a real property interest or pays compensation to the owner, whichever occurs later, the NFS shall provide the Government with documents sufficient to determine the amount of credit to be provided for the real property interest in accordance with the Project Partnership Agreement.
26. The NFS shall obtain, for each real property interest, an appraisal of the fair market value of such interest that is prepared by a qualified appraiser who is acceptable to the parties. Subject to valid jurisdictional exceptions, the appraisal shall conform to the Uniform Standards of Professional Appraisal Practice. The appraisal must be prepared in accordance with the applicable rules of just compensation, as specified by the Government.
27. The NFS shall obtain, for each real property interest, an appraisal of the fair market value of such interest that is prepared by a qualified appraiser who is acceptable to the parties. Subject to valid jurisdictional exceptions, the appraisal shall conform to the Uniform Standards of Professional Appraisal Practice. The appraisal must be prepared in accordance with the applicable rules of just compensation, as specified by the Government.
28. The NFS shall hold and save the Government free from all damages arising from design, construction, operation, maintenance, repair, rehabilitation, and replacement of the Project, except for damages due to the fault or negligence of the Government or its contractors.
29. The NFS shall assure that books, records, documents, or other evidence pertaining to costs and expenses are reasonably available for examination, audit, or reproduction by the Government for a minimum of three years after the final accounting.

6.2.7 Risk & 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. Risk and uncertainty will be further considered during feasibility-level design and analysis.

6.2.7.1 **Environmental Factors**

Relative Sea Level Rise: There is uncertainty about how much sea level change (SLC) would occur in the region. Higher than estimated RSLR could cause salt water intrusion into the study area causing significant changes to the habitat in the study area.

An assessment of RSLR was included in plan formulation and alternatives analysis. The evaluation of RSLR is documented in Appendix A and will be refined during feasibility level design and analysis. Calculations based on EC 1165-2-212 determined that the low,

intermediate and high rates of RSLR at 2073 are 1.9 feet per year, 2.4 feet per year, and 4.3 feet per year, respectively. The PDT selected intermediate SLR due to the fact that the alts were in a similar alignment. It was also assumed that changes in sea level rise would have affected the alternatives equally. Additional sensitivity analysis will be conducted on the TSP to measure the impacts of sea level rise on the recommended plan. Because the project was developed using the intermediate RSLR rate, the TSP would provide more benefits than anticipated should the low RSLR rate result and less benefits with the high RSLR rate.

Storms

Risks associated with the TSP are primarily related to the possibility of extreme weather events. The uncertainty of the size or frequency of storms and 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 Katrina or a slow moving storm such as 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 are included in the modeling. By using a long-term record of different storm scenarios, the effects of such storms are incorporated into the modeling. The team is then able to reduce the uncertainty in the determination of project benefits (Appendix A).

6.2.7.2 Engineering Factors

Levee/Structure Failure

The risk associated with the levee/structure system is its stability. Analysis of the earthen levee and associated T-walls and gates will be evaluated during feasibility-level design and analysis, and included in Appendix A. The levee and other features will be constructed to meet USACE specifications.

Hydrologic Flows

There is uncertainty as to whether the levee system would potentially induce flooding internally and externally to the levee alignment. Modeling results will be analyzed during feasibility level design and included in the final report. Hydrologic modeling (ADCIRC and SWAN) will show if the TSP could potentially induce flooding in these area and allow for more accurate engineering and design of the levee system. The project will incorporate features to mitigate for any potential induced flooding.

The risk of running the ADCIRC and SWAN models is the assumption that the models appear to provide a specific response on the TSP 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. A sensitivity discussion will be completed during feasibility-level design and analysis and included in Appendix B of the final report. Another uncertainty is that a limited number of storm scenarios are modeled.

It is assumed that various storm scenarios over a number of years will represent a much higher indicator of the levees ability to withstand major storm events.

The models also use available historic data to extrapolate future storm conditions and frequency. The size and frequency of storms included in the model are based on statistical analysis but do not account for meteorological changes, such as El Nino and La Nina effects, that can increase or decrease storms over a period of several years. Neither do the models account for the potential of increased storms due to climate change.

6.2.7.3 Economic Factors

The risk for economics is 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 future without-project damages. This could potentially result in the TSP not being economically justified or preliminary estimates of the benefit cost ratios being overstated. A full economic analysis will be conducted during feasibility level design and documented in the final report. Additional uncertainty surrounding variables such as population growth, first floor elevations, structure value, depth damage relationships and additional inputs are consistent with typically accepted project uncertainty.

The Hydrologic Engineering Center Flood Damage Analysis (HEC-FDA) Version 1.4.2 certified model was used to calculate the damages for the without project existing and future conditions. Economic and engineering inputs were necessary for the model to calculate damages for the project base year (2023) and the final year in the period of analysis (2073). The inputs included structure inventory, future development, contents-to-structure value ratios, vehicles, first floor elevations and depth-damage relationships, ground elevations and without-project stage probability relationships.

The uncertainty surrounding each of the economic and engineering variables was entered into the model. Either a normal probability distribution, with a mean value and a standard deviation, or a triangular probability distribution, with a most likely, a maximum and a minimum value, was entered into the model to quantify the uncertainty associated with the key economic variables. A normal probability distribution was entered into the model to quantify the uncertainty surrounding the ground elevations. The number of years that stages were recorded at a given gage was entered for each study area reach to quantify the hydrologic uncertainty or error surrounding the stage-probability relationships.

7 Mitigation

Mitigation planning was integral part of the planning process. Measures to avoid and minimize impacts to significant resources were employed to the extent practicable. Nonetheless, unavoidable project-induced impacts to freshwater emergent marsh habitat would occur and would be offset through compensatory mitigation.

Law, regulations, and USACE policy ensure that adverse impacts to significant resources have been avoided or minimized to the extent practicable and that remaining, unavoidable impacts have been compensated to the extent justified. Section 1508.20 of the National Environmental Policy Act defines mitigation as the following actions:

- *Avoiding the impact altogether by not taking a certain action or parts of an action.*
- *Minimizing 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.*
- *Compensating for the impact by replacing or providing substitute resources or environments*

The appropriate application of mitigation is to formulate an alternative that first avoids, then minimizes, and lastly, compensates for unavoidable adverse impacts. Potential supplemental alternatives to the previously-authorized compensatory mitigation plan for the UBB study are evaluated in this DEIS. This document describes these supplemental mitigation plans, as required by 33 CFR 332.4(c) and 40 CFR 230.92.4(c).

Section 2036(a)(3)(A) of WRDA 2007 gives guidance on how USACE Civil Works mitigation plans shall be planned and implemented. It states:

To mitigate losses to flood damage reduction capabilities and fish and wildlife resulting from a water resources project, the Secretary shall ensure that the mitigation plan for each water resources project complies with the mitigation standards and policies established pursuant to the regulatory programs administered by the Secretary.

During a preliminary aerial survey of project footprint, CEMVN identified approximately 330 acres of freshwater emergent marsh habitat within TSP footprint. Any WVA assumptions will be addressed in the final integrated feasibility study report.

Mitigation for the TSP would include creation and restoration of up to a total of approximately 64 AAHUs of fresh marsh, 17 AAHUs of BLH and 1 AAHU of cypress-tupelo swamp as compensatory mitigation for some of the impacts resulting from construction of the TSP. The creation/restoration areas (mitigation areas) would be

located in areas identified at a later date and addressed in a separate environmental document.

In the draft CAR, USFWS recommends the impacts to swamp and BLH might be mitigated through use of nearby mitigation banks. Fresh marsh impacts associated with the TSP are rather large. Mitigation for those impacts might be achieved by creating marsh near the project site in the open areas north of the Bayou Gauche road (Highway 306) or in the Simoneaux Ponds area. If the mitigation site borders large open water areas, containment dikes might need to be armored to preclude erosional losses of the dikes and marshes therein. The deadlines for completion of this Coordination Act Report did not allow for a mitigation analysis of these areas.

Marsh creation mitigation projects should be monitored to ensure that the desired mitigation is achieved at a point 5 years after project implementation, and at 10 year intervals thereafter. Successful marsh creation will depend on achieving a settled disposal area elevation conducive to marsh vegetation establishment.

Earthwork associated with mitigation would mainly consist of removal (excavation; scraping; degrading) remnant spoil material (sand, sediments, gravel) in various portions of each of the mitigation sites in an effort to establish an appropriate hydroperiod for wetland species. Most of the material removed would be disposed of within portions of existing mine pit lakes adjacent to or near the mitigations sites (see enclosed drawings). Some of the material removed may be used to help achieve desired grades within some of the mitigation areas that have undesirably low soil surface elevations.

Earthwork would also include grading to ensure appropriate drainage, establishment of dirt access roads around the perimeter of the mitigation areas, establishment of dirt access roads within some of the mitigation areas, and tillage of soil in the mitigation areas. Any existing drainage features (drainage ditches, etc.) within or adjacent to the mitigation areas and within the property boundary would likely be removed to help assure appropriate site hydrology, unless doing so would adversely affect drainage on off-site lands. Any existing earthen berms or dikes a particular mitigation site that hinder sheetflow runoff and/or the exchange of water within areas of the site or between off-site lands and waters would be removed or gapped as long as this is allowed by LDEQ and would not adversely affect water levels and flow on off-site lands.

Note that the planted acreage of a few mitigation areas would be reduced by the Contractor's staging areas. Similarly, it is likely that the planted acreage of most of the mitigation areas would be reduced slightly by additional dirt roadways within the mitigation areas that may be established for access and maintenance purposes.

8 Environmental Laws and Regulations

Executive Order (E.O.) 11988 Floodplain Management

Executive Order 11988 directs Federal agencies to reduce flood loss risk; minimize flood impacts on human safety, health, and welfare; and restore and preserve the natural and beneficial values served by flood plains. Agencies must consider alternatives to avoid adverse and incompatible development in the flood plain. If the only practical alternative requires action in the flood plain, agencies must design or modify their action to minimize adverse impacts. The proposed action represents the least environmentally damaging alternative to accomplish the needed risk reduction system modifications.

Also, since the Corps actions in the flood plain are subject to NEPA, the Statement of Findings that is required as part of the conclusions in feasibility reports are required for actions pertaining to operations and maintenance will include, in addition to existing requirements, the following:

1. Reasons why the proposed action must be located in the flood plain.
2. Facts considered in making the determination to locate in the flood plain, including alternative sites and actions considered.
3. Statement on whether the proposed action conforms to applicable State or local flood plain protection standards.
4. Statement on whether the action affects the natural and beneficial values of the flood plain.
5. Steps taken to design or modify the proposed action to minimize potential harm to or within the flood plain; and
6. A general listing of involved agencies, groups, and organizations.

Fish and Wildlife Coordination Act of 1934

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 (CAR) that details existing fish and wildlife resources in a project area, potential impacts due to a proposed project and recommendations for a project.

The USFWS provided a Draft CAR on November 6, 2019 may be found in Appendix C and responses to the USFWS recommendations are as follows:

Additional Service involvement during the preconstruction engineering and design phase of this project, along with more-definitive project information, will be required so that we

can fulfill our responsibilities under the Coordination Act. With regard to indirect project effects, the Service offers the following recommendations:

USFWS 1. Additional drainage structures should be installed in the Bayou Des Allemands levee crossing should the hydrologic analysis show a with-project hydroperiod increase associated with heavy rainfall events.

USACE 1. Acknowledged. Efforts to avoid and minimize impacts associated with an increase in hydroperiod due to the project will be made.

USFWS 2. The project drainage structures should be designed to handle inputs associated with the two Mississippi River diversions identified in the 1993 CWPPRA Louisiana Coastal Wetlands Restoration Plan without corresponding widescale hydroperiod increases.

USACE 2. Acknowledged. Projects in the future without project conditions would include all authorized and permitted projects in the study area.

Available information indicates that substantial direct wetland losses will result from construction of project features. Consequently, avoidance and minimization of direct wetland impacts should be pursued to the greatest extent practicable. The Service provides the following recommendations to avoid and/or minimize project impacts on fish and wildlife resources, and for mitigating unavoidable impacts to those resources.

USFWS 3. The Corps should coordinate closely with the Service and other fish and wildlife conservation agencies throughout the engineering and design of project features including levees, floodgates, and environmental water control structures to ensure that those features are designed, constructed and operated consistent with wetland restoration and associated fish and wildlife resource needs.

USACE 3. Concur. The USACE will continue to coordinate with the resource agencies throughout the project phases.

USFWS 4. Estimates of all direct and indirect project-related wetland impacts should be refined for inclusion in the project's Final Report and Environmental Impact Statement.

USACE 4. Concur. WVAs will be completed in coordination with the resource agencies to better determine wetland impacts and mitigation needs.

USFWS 5. Locations of borrow for levee construction material should be identified and provided to the Service and other interested natural resource agencies.

USACE 5. Concur. The USACE will continue to coordinate with the resource agencies throughout the project phases.

USFWS 6. To the greatest degree practical, the proposed levees and borrow pits should be located to avoid and minimize direct and indirect impacts to 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.

USACE 6. Concur. All efforts will be made to avoid and minimize direct and indirect impacts to wetlands.

USFWS 7. If organic soils must be removed from the construction site, that material should be used to create or restore emergent wetlands to the greatest extent practicable. If that is not practicable, then use of that material to improve borrow pit habitat quality (e.g., construct bank slopes, reduce depths, etc.) should be examined.

USACE 7. Acknowledged. Beneficial use of organic soils will be explored during advanced design should their removal from the project site be necessary.

USFWS 8. Forest clearing associated with project features should be conducted during the fall or winter to minimize impacts to nesting migratory birds, when practicable.

USACE 8. Concur. USACE will conduct on site surveys, in coordination with USFWS, to determine the presence of any nesting birds or the potential of future nesting. If needed, USACE, in coordination with USFWS, will develop a bird abatement/nesting prevention plan to be implemented prior to and during construction.

USFWS 9. Avoid adverse impacts to bald eagle nesting locations and wading bird colonies through careful design of project features and timing of construction. Surveys prior to construction such be undertaken to ensure no nesting birds are within 1,000 feet of any proposed work. If nesting birds are found within 1,000 feet of any proposed work sites, the Service and the Louisiana Department of Wildlife and Fisheries should be contacted for procedures to avoid impacts.

USACE 9. Concur. USACE will conduct on site surveys, in coordination with USFWS, to determine the presence of any nesting bald eagles.

USFWS 10. The Service recommends that the Corps contact the Service for additional consultation if: 1) the scope or location of the proposed project is changed significantly, 2) new information reveals that the action may affect listed species or designated critical habitat; 3) the action is modified in a manner that causes effects to listed species or designated critical habitat; or 4) a new species is listed or critical habitat designated. Additional consultation as a result of any of the above conditions or for changes not covered in this consultation should occur before changes are made and or finalized.

USACE 10. Concur. The USACE will continue to coordinate with the resource agencies throughout the project phases.

USFWS 11. Full, in-kind compensation (quantified as AAHUs) should be provided for unavoidable net adverse impacts on forested wetlands, marsh, and associated submerged aquatic vegetation, including any additional losses identified during post-authorization engineering and design studies. To help ensure that the proposed mitigation features meet their goals, the Service provides the following recommendations.

- a. The Corps should fully compensate for any unavoidable losses of wetland habitat or non-wet bottomland hardwoods caused by project features.

USACE 11.a. Concur. The USACE has developed a General Mitigation Plan based on assumption pulled from the USFWS CAR. A Final Mitigation Plan will be developed, in coordination with USFWS, and included in the Final EIS.

- b. Levee construction borrow sites should be designed to avoid and minimize impacts to fish and wildlife habitat; in the event new borrow sites are identified, guidelines for the selection of borrow sites are found in Appendix C.

USACE 11.b. Concur. The assumption is that borrow for levee construction would come from agricultural land within 15 miles from the levee alignment.

- c. Mitigation measures should be constructed concurrently with the features that they are mitigating. If construction is not concurrent with mitigation implementation then revising the impact and mitigation period-of-analysis to reflect additional temporal losses will be required.

USACE 11.c. Concur.

- d. The Service and other fish and wildlife conservation agencies should be consulted in the development of plans and specifications for all mitigation features and any monitoring and/or adaptive management plans.

USACE 11.d. Concur. The USACE will continue to coordinate with the resource agencies throughout the project phases.

- e. To avoid shortfalls in marsh creation acreage, the contractor should be required to guarantee the creation of at least the target acreage of marsh platform, or excess acres should be created.

USACE 11.e Acknowledged. The number of AAHUs per habitat type impacted would be determined in coordination with the interagency environmental team and the mitigation designed such that it fully satisfies the mitigation requirement in-kind for the project.

- f. The acreage of marsh created to mitigate project impacts should meet or exceed the marsh acreage projected by the Habitat Evaluation Team for target year 5.

USACE 11.f Acknowledged. The mitigation project would be designed to fully satisfy the mitigation requirement in-kind within the period of analysis for the parent project (50 years). If excessive delays in implementation of the mitigation project(s) are incurred, CEMVN understands that additional impacts may be assessed to the project to account for the temporal lag in mitigation implementation.

g. The acreage of marsh created for mitigation purposes, and adjacent affected wetlands, should be monitored over the project life to evaluate project impacts, effectiveness of compensatory mitigation measures, and the need for additional mitigation should those measures prove insufficient.

USACE 11.g. Acknowledged. The mitigation project(s) would be monitored over the project life to evaluate their effectiveness and the need for additional mitigation should they fail to meet their applicable success criteria. Best management practices during construction of the mitigation projects would be utilized to avoid additional impacts to adjacent wetlands.

In the CAR, recommendations h. and i. are repeats of recommendation g and therefore the same response for g. applies.

j. The Corps should maintain full responsibility for all mitigation projects until the projects are found to be fully compliant with success and performance requirements.

USACE 11.j. Concur.

k. The Corps should maintain full responsibility for all mitigation projects until the projects are found to be fully compliant with success and performance requirements. Success requirements are provided in Appendix D.

USACE 11.k. Concur.

l. Dredged material borrow pits, including those utilized to create marsh for mitigation purposes, should be carefully designed and located to minimize anoxia problems and excessive disturbance to area water bottoms, and to avoid increased saltwater intrusion.

USACE 11.l. Concur.

m. If applicable, a General Plan for mitigation should be developed by the Corps, the Service, and the managing natural resource agency in accordance with Section 3(b) of the FWCA for mitigation lands. See Appendix E for details.

USACE 11.m. Concur. The USACE has developed a General Mitigation Plan based on assumption pulled from the USFWS CAR. A Final Mitigation Plan will be developed, in coordination with USFWS, and included in the Final EIS.

USFWS 12. Extensive additional information is needed by the Service to complete the required evaluation of project effects and fulfill our reporting responsibilities under Section 2(b) of the Fish and Wildlife Coordination Act. Much of that information may not be available until engineering and design of the project features has progressed. To help ensure that sufficient information is provided, the Service recommends that the Corps perform the following tasks during the engineering and design phase.

12.a Provide additional information on anticipated construction techniques and their associated wetland impacts, such as additional dredging to install floodgates and water control structures, dredging temporary by-pass channels, construction of access roads, and the method for disposing organic surface soils that are unsuitable for levee construction.

USACE 12.a. Concur. The USACE will continue to coordinate with the resource agencies throughout the project phases.

12.b Provide final levee footprint shape-files and designs for borrow sites used in levee construction.

USACE 12.b. Concur. The USACE will continue to coordinate with the resource agencies throughout the project phases.

12.c Provide with-out project channel cross-sections at or near where water control structures would be installed.

USACE 12.c Acknowledged. These would be provided prior to release of the final document and prior to signing of the ROD.

12.d Provide hydrologic model outputs on FWOP and FWP stages within the protected area wetlands following a variety of heavy rainfall events.

USACE 12.d Acknowledged. Hydrologic model outputs for FWOP and FWP stages within the protected area wetlands during rainfall events would be provided prior to release of the final document and prior to signing of the ROD.

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. All parishes in the state of Louisiana 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 1972 – 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 LDEQ that a

proposed project does not violate established effluent limitations and water quality standards. Coordination with LDEQ for a State Water Quality Certification is currently pending with a determination that the requirements for a WQC have been met.

Section 305(b) of the Clean Water Act requires each state to monitor and report on surface and groundwater quality, which the Environmental Protection Agency (EPA) synthesizes into a report to Congress. The LDEQ produces a Section 305(b) Water Quality Report that provides monitoring data and water quality summaries for hydrologic units (sub-segments) throughout the state.

Endangered Species Act of 1973

The ESA is designed to protect and recover Threatened and Endangered (T&E) species of fish, wildlife and plants. The NLAA letter may be issued at a later date for listed T&E species, including the migratory shorebirds, and species of management concern (i.e. rare and very rare species) that are known to occur or believed to occur within the study area and vicinity of the project area. No plants were identified as being threatened or endangered in the project area (Appendix C).

The proposed action would include Standard Manatee Conditions for In-Water Activities with the contractor instructing all personnel regarding the potential presence of manatees in the project area, and the need to avoid collisions with these animals. If a manatee(s) is sighted within 100 yards of the project area, moving equipment must be kept at least 50 feet away from the manatee or shut down. There would be restrictions on vessel operation, restrictions on the use of siltation barriers, and mandatory signage designed to avoid any harm to manatees in the project area. More specific information would be contained in any dredging contracts. This DEIS has been made available to agencies and the USFWS has concurred in its determination that the project will have no adverse effect to threatened and endangered species (Appendix C).

Hazardous, Toxic, and Radioactive Waste

The discharge of dredged material into waters of the United States is regulated under the CWA. In the absence of a known Hazardous, Toxic, and Radioactive Waste (HTRW) concern, the proposed action would not qualify for an HTRW investigation. The NFS, would be responsible for planning and accomplishing any HTRW response measures, and would not receive credit for the costs incurred.

An ASTM E 1527-13 Phase I ESA, HTRW investigation is to be completed in mid-December for the project area during the feasibility phase of planning to assist with the feature screening process and a copy will be maintained on file at CEMVN. Based on previous investigations from this area, the probability of encountering HTRW for the proposed action is low. If a recognized environmental condition (REC) is identified in relation to the project area, the CEMVN would take the necessary measures to avoid the REC so that the probability of encountering or disturbing HTRW would continue to be low. Given a Phase I ESA is valid for one year, another Phase I ESA will be conducted for the TSP prior to construction.

Migratory Bird Treaty Act

The study area is known to support colonial nesting wading/water birds (e.g., herons, egrets, ibis, night-herons and roseate spoonbills) and shorebirds (terns and gulls). Based on review of existing data, site visits, and with the use of USFWS guidelines, the CEMVN finds that implementation of the proposed actions would have no effect on colonial nesting water/wading birds or shorebirds. USFWS and USACE biologists would survey the proposed project area before construction to confirm no nesting activity as suitable habitat and the potential for nesting exist within the project area. If active nesting exists within 1,000 feet (water birds) or 1,300 feet (shorebirds) of construction activities then USACE, in coordination with USFWS, would develop specific measures to avoid adverse impacts to those species. A detailed nesting prevention plan may be necessary in order to deter birds from nesting within the aforementioned buffer zones of the Project footprint in order to avoid adverse impacts to these species. If a nesting prevention plan is necessary, it would be prepared in coordination with USFWS.

The bald eagle was removed from the List of Endangered and Threatened Species in August 2007, but continues to be protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act of 1918, as amended (MBTA). During nesting season, construction must take place outside of USFWS/LDWF buffer zones. A USACE Biologist and USFWS Biologist would survey for nesting birds. This would be done prior to the start of construction.

E.O. 12898 Environmental Justice

USACE is obligated under E.O. 12898 of 1994 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, or 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 are those whose income is the Census Bureau's statistical poverty threshold for a family of four. The Census Bureau defines a "poverty area" as a census tract or block numbering area with 20 percent or more of its residents below the poverty threshold level and an "extreme poverty area" as one with 40 percent or more below the poverty threshold level. Because the population within the study area does not meet the threshold for being a minority population or a poverty area, this project does not require additional evaluation of environmental justice considerations.

National Historic Preservation Act of 1966

The consideration of impacts to historic and cultural resources is mandated under Section 101(b)4 of NEPA as implemented by 40 CFR, Parts 1501-1508. Section 106 of the NHPA requires Federal agencies to take into account their effects on historic properties (i.e., historic and cultural resources) and allow the ACHP an opportunity to comment. Historic properties are identified by qualified agency representatives in consultation with

interested parties. USACE has chosen to address potential impacts to historic properties through the “Section 106 consultation process” of the NHPA as implemented through 36 CFR, Part 800.

In partial fulfillment of USACE’s Section 106 responsibilities, on April 2, 2019, USACE submitted an initial Section 106 consultation letter entitled: Notice of Intent to Prepare Programmatic Agreement Regarding “Upper Barataria Basin Louisiana, Coastal Storm Risk Management Feasibility Study (Appendix C) to the LA and MS SHPOs, Affected Tribes ACTT, CNO, CT, CTL, JBCI, MBCI, MCN, SNO, STF, TBTL, the NFS (LA DOTD), and the ACHP. The aforementioned letter provided information regarding the study area, initial array of alternatives being considered, alternative evaluation criteria, plan formulation milestones, and CEVMN’s proposal to develop a project-specific PA pursuant to 36 CFR § 800.14(b) to fulfill its responsibilities under Section 106 of the NHPA. Additionally, this letter invited stakeholders to provide input regarding the proposed undertaking and its potential to significantly affect historic properties and/or sites of religious and cultural significance and requested potential consulting parties’ assistance with identifying other relevant entities who may have an interest in participating in this consultation. On June 24, 2019, USACE received a written response from the ACHP stating that the agency “has not yet determined if Appendix A of the regulations, Criteria for Council Involvement in Reviewing Individual Section 106 Cases, applies to this undertaking” and requested additional information regarding the views of the SHPO, Tribes, other consulting parties, and the public in order to determine if their participation in this consultation is warranted. To date, no other responses to this letter were received from any of the other potential stakeholders consulted (SHPO/Tribal/NFS).

Additionally, on June 14, 2019, USACE posted a NHPA/NEPA Public Notice (Appendix C) to the following website: <https://www.mvn.usace.army.mil/About/Projects/BBA-2018/studies/Upper-Barataria-Basin/> for a 15-day comment period requesting the public’s input concerning the proposed undertaking and its potential to significantly affect historic properties, assistance in identifying any relevant parties who may have an interest in participating in this consultation, and USACE’s proposal to develop a project-specific PA pursuant to 36 CFR § 800.14(b). No comments were received. USACE will continue to follow its Section 106 procedures to develop a project-specific PA in furtherance of USACE’s Section 106 responsibilities for this undertaking. The PA would then govern USACE’s subsequent NHPA compliance efforts. Following the execution of the PA, USACE may proceed with issuing a ROD in compliance with Section 106 and NEPA.

Executive Order (EO) 13175 Consultation and Coordination with Indian Tribal Governments

It is the policy of the federal government to consult with Federally recognized Tribal Governments on a Government-to-Government basis as required in EO 13175 (“Consultation and Coordination with Indian Tribal Governments,” U.S. President 2000). The requirement to conduct coordination and consultation with federally recognized Tribes on and off of Tribal land finds its basis in the constitution, Supreme Court cases, and is clarified in later planning laws, such as the National Environmental Policy Act. When conducting a civil works planning activity

(<http://www.usace.army.mil/Missions/Civil-Works/Tribal-Nations/>), USACE is directed to follow six principles when engaging with Tribal Governments: these principles emphasize Tribal Sovereignty, the federal governments trust responsibility, Government-to-Government consultation, early and pre-decisional consultation, recognition of tribal self-reliance, focusing USACE on efforts at tribal capacity building, and requiring USACE to protect natural and cultural resources during project development and implementation. Moreover, the USACE Planning and Guidance Notebook (ER 1105-2-100), including Smart Planning, gives guidance in Appendix B, Public Involvement, Collaboration and Coordination (B-8) and Appendix C, Environmental Evaluation and Compliance (C-4), reinforcing the same authorities and processes. The most explicit and accessible guidance regarding USACE and Tribal interaction can be found in USACE's Tribal Consultation Policy (1 Nov 2012).

In addition to consulting with Tribes under the NHPA as described above (NHPA 1966 Section), USACE, is consulting in accordance with EO 13175, NEPA, and its 2012 Tribal Policy. The 2012 Tribal Consultation Policy directs that consultation should begin at the earliest planning stages before decisions are made and actions are taken (paragraph 3b); provides guidance that USACE should contact "[t]ribes whose aboriginal territories extend to the lands where an activity would occur...sufficiently early to allow a timely review of the proposed action" (paragraph 5.d.(1); and goes on to state that the USACE official interacting with federally recognized tribes should maintain open lines of communication through consultation with Tribes during the decision making process for matters that have the potential to significantly affect protected tribal resources, tribal rights (including treaty rights), and Indian lands (paragraph 6. d.). In sum, all of this guidance directs the agency to start early and to coordinate often.

In accordance with CEMVN's responsibilities under NEPA, NHPA, and E.O. 13175, USACE started the Tribal Consultation process by inviting Tribes to participate as cooperating agencies in the development of the DEIS, via letter on April 24, 2019. This correspondence was directed to the leadership of each of the Tribal governments whose aboriginal and historic territories or historic removal routes extended to the lands where the proposed activities would occur (i.e., the ACTT, CTL, CNO, CT, JBCI, MBCI, MCN, STF, SNO, and TBTL). No responses have been received. USACE also shared progress on this project via a monthly tribal conference call in (July, September, and October), providing updates to participating tribal representatives. USACE intends to keep the lines of communication open throughout the study, relying on the "Section 106 Process" to capture significant tribal concerns regarding historic properties, but remains open to the need to undertake Government-to-Government consultation, as necessary.

9 Public Involvement and Coordination

Public involvement is an important part of planning and decision-making. Agencies, non-governmental organizations, and citizens provided valuable input for the final recommendation. NEPA provides people, organizations, and governments an opportunity to review and comment on proposed major Federal actions. Engaging and receiving input from the public, interested parties, stakeholders, government agencies, and nongovernmental organizations regarding the content of the Draft IFR-EIS in all 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.

A Public Notice for the UBB Draft IFR-DEIS will be published in the Baton Rouge and New Orleans Advocate for the 45-day comment period beginning November 29, 2019 and ending January 13, 2019.

Preparation of this IFR and DEIS has been coordinated with appropriate Congressional, federal, Tribal, state, and local interests, as well as environmental groups and other interested parties. The following agencies, as well as other interested parties, will receive copies of the draft IFR and DEIS:

U.S. Department of the Interior, Fish and Wildlife Service
U.S. Environmental Protection Agency, Region VI
U.S. Department of Commerce, National Marine Fisheries Service
U.S. Natural Resources Conservation Service, State Conservationist
Coastal Protection and Restoration Authority Board of Louisiana
Advisory Council on Historic Preservation
Governor's Executive Assistant for Coastal Activities
Louisiana Department of Wildlife and Fisheries
Louisiana Department of Natural Resources, Coastal Management Division
Louisiana Department of Natural Resources, Coastal Restoration Division
Louisiana Department of Environmental Quality
Louisiana State Historic Preservation Officer
Louisiana Departments of Transportation and Development

9.1 Views of the Non-Federal Sponsor

The NFS (CPRAB) has been actively involved in all of the planning milestone meetings with the vertical team and weekly PDT meetings held from the beginning of the study. The NFS supports the TSP/NED plan.

9.2 Cumulative Effects

Potential positive and negative impacts from the proposed project consist of impacts to fresh-intermediate marsh, shallow open water, wetlands, wildlife and aquatic resources, EFH, water quality, air quality, recreational, aesthetics, and socioeconomic resources. Access from (soil borrow source) to the levee construction site would temporarily and

permanently impact fresh water emergent wetlands. Please refer to section 5 for more details on the cumulative impacts.

9.3 Conclusion

Information in this document was developed for feasibility analysis, with input from Federal agencies (USFWS and NMFS), local levee districts, local governments, and comments from the public, to help refine potential solutions to coastal storm risk within the Upper Barataria basin. Public involvement is an important part of the planning and decision-making process.

A Notice of Availability for this draft report will be published in the Federal Register and circulated for a 45-day public review period to federal, state and local agencies, non-governmental and other organizations and individuals who have an interest in the project. All comments received during the public review period will be considered and incorporated into the final report, as appropriate.

A Notice of Availability of the final report for a 30-day state, agency, and public review period will be published in the Federal Register. All comments received during this period will be considered prior to USACE making a final decision on the TSP and in preparing the ROD.

The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a 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 authorization and implementation funding (ER 1105-2-100).

9.4 List of Preparers

Information in this document has been prepared and submitted by the following individuals:

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Christie Nunez	Structural Engineering
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Matthew Roe	Public Affairs
Karen Roselli	Office of Council
Thomas Taff	Office of Council

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List of Acronyms and Abbreviations

USACE	United States Army Corps of Engineers
NEPA	National Environmental Policy Act
EIS	Environmental Impact Statement
ER	Engineer Regulation
O&M	Operation and Maintenance
LDOTD	Louisiana Department of Transportation and Development
USGS	United States Geological Survey
FEMA	Federal Emergency Management Agency
CSRM	Coastal Storm Risk Management
NED	National Economic Development
EFH	Essential Fish Habitat
CPRAB	Coastal Protection and Restoration Authority Board
EO	Executive Order
CTL	Chitimacha Tribe of Louisiana
CNO	Choctaw Nation of Oklahoma
CT	Coushatta Tribe of Louisiana
JBCI	Jena Band of Choctaw Indians
MBCI	Mississippi Band of Choctaw Indians
MCN	Muscogee (Creek) Nation
SNO	Seminole Nation of Oklahoma
STF	Seminole Tribe of Florida
TBTL	Tunica-Biloxi Tribe of Louisiana
NOAA	National Oceanic and Atmospheric Administration
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
ESA	Endangered Species Act
BGEPA	Bald and Golden Eagle Protection Act
NRHP	National Register of Historic Places
ACHP	Advisory Council on Historic Preservation
SHPO	State Historic Preservation Officer
WMA	Wildlife Management Area
LWCF	Land and Water Conservation Fund
EJ	Environmental Justice
ACS	American Community Survey
NRCS	Natural Resource Conservation Service
EPA	Environmental Protection Agency
FWOP	Future With Out Project
TSP	Tentatively Selected Plan
USFWS	US Fish and Wildlife Service
LDWF	Louisiana Department of Wildlife and Fisheries
LWFMP	Louisiana Statewide Comprehensive Water Based Floodplain Management Program
CEMVN	USACE New Orleans District
LDEQ	Louisiana Department of Environmental Quality

NS1	Non-Structural
OMRR&R	Operations, Maintenance, Repair, Rehabilitation, and Replacement
BCR	Benefit to Cost Ratio
EQ	Environmental Quality
OSE	Other Social Effects
RED	Regional Economic Development
CEQ	Council on Environmental Quality
PA	Programmatic Agreement
ROD	Record of Decision
FDR	Federal Discount Rate
PPA	Project Partnership Agreement
NAAQS	National Ambient Air Quality Standards
CWA	Clean Water Act
T&E	Threatened and Endangered
FWCA	Fish and Wildlife Coordination Act
FWCAR	Coordination Act Report
HTRW	Hazardous, Toxic, and Radioactive Waste
PED	Planning, Engineering and Design
NFS	Non- Federal Sponsor
REC	Recognized Environmental Condition
MBTA	Migratory Bird Treaty Act
PDT	Project Delivery Team
IFR	Integrated Feasibility Report
RPEDS	Regional Planning and Environmental Division South
FCSA	Feasibility Cost Sharing Agreement
MSC	Major Subordinate Command
FMC	Fish Management Counsel
USC	United States Code
AQCR	Air Quality Control Region
MSA	Metropolitan Statistical Area
CDP	Census of Designated Places
LORR	Level of Risk Reduction
H&H	Hydraulics and Hydrology
ADCIRC	Advanced Circulation
EM	Engineering Memorandum
EC	Engineering Circular
HSDRSS	Hurricane and Storm Damage Risk Reduction System
LERRD	Lands, Easements, Rights-of-Way, Relocations, and Disposal
OMRR&R	Operations, Maintenance, Repair, Replacement and Rehabilitation
EPA	Environmental Protection Agency
VOC	Volatile Organic Compound
NOX	Nitrogen Oxide
FWOP	Future With Out Project

TSP	Tentatively Selected Plan
USFWS	US Fish and Wildlife Service
USDA	US Department of Agriculture
LDWF	Louisiana Department of Wildlife and Fisheries
LWFMP	Louisiana Statewide Comprehensive Water Based Floodplain Management Program
CEMVN	USACE New Orleans District
LDEQ	Louisiana Department of Environmental Quality
NS1	Non-Structural
NSI	National Structure Inventory
NGVD	National Geographic Vertical Datum
OMRR&R	Operations, Maintenance, Repair, Rehabilitation, and Replacement
RSLR	Relative Sea Level Rise
BCR	Benefit to Cost Ratio
EQ	Environmental Quality
OSE	Other Social Effects
RED	Regional Economic Development
CEQ	Council on Environmental Quality
ROE	Right of Entry
WVA	Wetland Value Assessment
BMP	Best Management Practices
LDOA	Louisiana Division of Archaeology
PA	Programmatic Agreement
ROD	Record of Decision
URA	Uniform Relocation Assistance Act
FDR	Federal Discount Rate
PPA	Project Partnership Agreement
NAAQS	National Ambient Air Quality Standards
CWA	Clean Water Act
T&E	Threatened and Endangered
FWCA	Fish and Wildlife Coordination Act
FWCAR	Coordination Act Report
HTRW	Hazardous, Toxic, and Radioactive Waste
PED	Planning, Engineering and Design
NFS	Non- Federal Sponsor
REC	Recognized Environmental Condition
MBTA	Migratory Bird Treaty Act
ACHP	Advisory Council on Historic Preservation
HPTRM	High Performance Turf Reinforced Mat