

West Shore Lake Pontchartrain Hurricane and Storm Damage Risk Reduction Study



Final Integrated Feasibility Report and Environmental Impact Statement



**US Army Corps
of Engineers®**



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

November 2014



Hurricane Isaac flooding in Laplace, Louisiana.

Comments: Please send comments or questions on this Final Integrated Feasibility Report and Environmental Impact Statement to the U.S. Army Corps of Engineers, New Orleans District, Attention: Sandra Stiles, P.O. Box 60267, New Orleans, LA 70160-0267; by e-mail: WSLPAdmin@usace.army.mil or by Fax: (504) 862-1892. Please direct questions by telephone: (504) 862-1583. **The official closing date for receipt of comments will be 30 days from the date on which the Notice of Availability of the document appears in the Federal Register.**



The West Shore Lake Pontchartrain Hurricane and Storm Damage Risk Reduction (WSLP) project proposed by the U.S. Army Corps of Engineers (USACE), Mississippi Valley Division, New Orleans District (CEMVN), will provide risk reduction measures to address tropical/hurricane storm surge events in St. Charles, St. John the Baptist and St. James Parishes in southeast Louisiana. Impacts from the National Economic Development (NED) plan are described in this Final Environmental Impact Statement (FEIS).

WSLP communities are at increasing risk to storm surge flooding due to wetland loss and relative sea level rise. The project purpose is to reduce the risk of flood damages caused by hurricane and tropical storm surges. An overview of the entire risk reduction system is shown on Figure 5-1. The Recommended Plan is Alternative C, which includes an 18.27-mile levee around Montz, Laplace, Reserve and Garyville, reducing risk to over 7,000 structures. The construction of the levee system in St. Charles and St. John the Baptist Parishes would be based on a 1% probability storm level of risk reduction (commonly known as a '100-year storm') and a 2020 intermediate sea level rise condition and would include future lifts to maintain that protection.

The recommended plan also includes the construction of localized storm surge risk reduction measures in St. James Parish which includes berms and flapgates on existing drainage and roadway features in the communities of Gramercy, Lucher and Grand Point which are located outside of the proposed levee system. The Recommended Plan also includes raising 14 residential structures; flood proofing 4 non-residential structures to +3.0 feet above the ground elevation; and constructing 5 smaller berms for 5 light industrial/warehouse facilities. All localized storm surge risk reduction measures will provide a level of risk reduction above a 1% probability storm level of risk reduction storm stage in 2020. Future lifts for the berms, to compensate for any relative sea level rise, are not included as part of this plan. The sponsor is responsible for the operation, maintenance, repair, rehabilitation and replacement (OMRR&R) of the berms at the elevation for which the berms were designed and constructed. That OMRR&R may require lifts to address subsidence or settlement. In the future, the effectiveness of the localized storm surge risk reduction measures would depend on the actual rate of relative sea level rise.

There is a potential for direct, indirect and cumulative impacts to wetlands, wildlife, fisheries, and water quality due to the implementation of the recommended plan. Habitat impacts that require compensation include 1,090 Average Annual Habitat Units (AAHUs) of swamp habitat and 99 AAHUs of bottomland hardwood (BLH) habitat. To compensate for these impacts, the mitigation plan includes restoration of 3,002 acres of swamp, 156 acres of BLH and the purchase of 72 AAHUs of swamp mitigation bank credits (details can be found in Appendix A, Annex K). Mitigation would be constructed in St. Charles, St. James, Ascension, and Livingston Parishes.

Comments: Please send comments or questions on this FEIS to the U.S. Army Corps of Engineers, New Orleans District, Attention: Sandra Stiles, P.O. Box 60267, New Orleans, LA 70160-0267; by e-mail: WSLPAdmin@usace.army.mil; or by Fax: (504) 862-1892. Please direct questions by telephone: (504) 862-1583. The official comment period closing date for this project would be 30 days from the date on which the Notice of Availability of this document appeared in the *Federal Register* (<https://www.federalregister.gov/articles/search>).





The U.S. Army Corps of Engineers (USACE), Mississippi Valley Division, New Orleans District (CEMVN) prepared this Final Integrated Feasibility Report and Environmental Impact Statement for the West Shore Lake Pontchartrain Hurricane and Storm Damage Risk Reduction study. The Pontchartrain Levee District is the study non-Federal Sponsor. The Coastal Protection Restoration Authority of Louisiana Board (CPRAB) will be the non-Federal sponsor for the construction, operation, maintenance, repair, rehabilitation and replacement (OMRR&R) of the project. The report and the recommended plan reflect sponsor, agency and public input. It presents solutions to reduce damages from hurricane and tropical storm surge events in St. Charles, St. John the Baptist and St. James Parishes, Louisiana, on the east bank of the Mississippi River.

The area has a bounty of natural resources. Historically it was subject to floods from the Mississippi River and nearby lakes. Settlers built river levees in the 1700s to combat floods. River levees allowed people to settle the area, grow crops and harvest natural resources. The management of Mississippi River flood risks and the development of interior drainage systems allowed urban and suburban expansion into the region beyond the high ground adjacent to the river. The study area has no coastal storm levees and remains susceptible to damages from surges resulting from hurricanes and tropical storms. Some natural buffer protection is afforded by a large cypress swamp that separates developed areas from nearby tidal lakes. The swamp has degraded over time and the buffer it provides between the lakes and towns is decreasing. Population is increasing with suburban and industrial development along the river corridor between Baton Rouge and New Orleans. Residents are attracted to the area's employment opportunities, quality of life and access to recreation. Increasing population and degrading natural buffers combine to increase risk of property damage from hurricane and tropical storm surges. Future anticipated relative sea level rise exacerbates the risks of damage from storm hurricane and tropical storm surge events.

In August 2012, Hurricane Isaac struck the region causing storm surge flooding in the study area. The storm illustrates the risks faced in low-lying communities. President Obama toured the damaged area and met with residents and community leaders. Thousands of residents and businesses were flooded and continue to work towards community recovery today. Key industries line the river corridor. The Port of South Louisiana is the largest volume port in the Western Hemisphere and the world's ninth largest port. It stretches along the Mississippi River between New Orleans and Baton Rouge and plays a critical role in the export of agricultural commodities from the Nation's heartland. Hurricane Isaac disrupted port logistics. Storm surge blocked facility access, closing the port for days. Oil refineries, including the nation's third largest, were shut down during and after the storm due to post-storm emergency response efforts. Gasoline and chemical production stopped; thereby influencing an important industrial sector that supports national energy security. Regional and national fuel prices spiked. The storm caused agricultural losses due to an inability to drain flooded fields. Storm surge flooded ground-level parts of Interstate-10 and access ramps to Interstate-55, two critical transportation routes that support the regional and national economies and play a vital role in repopulation and post-storm recovery.

Eleven management measures were crafted to reduce future damage from hurricane and tropical storm surge events. Structural and nonstructural features included levees, elevating buildings, and flood proofing of structures; the plan also contains compensatory mitigation for unavoidable impacts to bottomland hardwoods and cypress swamp. Measures were combined into 12 alternative plans. After screening, a focused array of four plans was evaluated; a No-Action Alternative, Alternative A, Alternative C and Alternative D. Alternatives A and C consist of nonstructural measures and levee alignments and Alternative D consists of a levee and floodwalls.

The Recommended Plan is Alternative C, an 18.27-mile levee around Montz, Laplace, Reserve and Garyville, reducing storm damage risk to over 7,000 structures. Four miles of I-10 that flooded during Hurricane Isaac are within the proposed risk reduction system. The final Recommended Plan also included localized storm surge risk reduction measures for structures in St. James Parish. The Recommended Plan would prevent an estimated \$98 million in total equivalent annual hurricane/tropical storm surge damages during a period of analysis from 2020 to 2070. Areas of controversy include wetland impacts, acceptance of certain nonstructural measures and the potential for induced flooding. All impacts will be mitigated. Coordination of the features in St. James Parish has resolved some local concerns. The estimated construction cost is \$718.1 million and annualized net benefits are \$63.8 million with a benefit to cost ratio of 2.8. The formulation process also identified an unjustified project increment that would address other state and local concerns. This unjustified project increment is not included in the recommended plan. This increment, if implemented at all, would be implemented by the State of Louisiana or local entities that is independent of the Federally Recommended Plan. The estimated construction cost of the unjustified increment is \$18.2 Million.





Abstract (*NEPA Required)	ii
Executive Summary (*NEPA Required)	iii
Table of Contents	iv
List of Acronyms, Abbreviations and Symbols	viii
1.0 Introduction	1-1
1.1 Background.....	1-1
1.2 Purpose, Scope, and Need for the Study (*NEPA Required).....	1-1
1.3 Problems, Needs and Opportunities	1-2
1.4 Need for Action.....	1-3
1.5 Objectives of Action	1-3
1.6 USACE Civil Works Guidance and Initiatives	1-4
1.7 Non-Federal Sponsor.....	1-5
2.0 Affected Environment (*NEPA Required)	2-1
2.1 General Setting.....	2-1
2.2 Water Environment	2-2
2.3 Human Environment (Socioeconomics).....	2-6
2.4 Natural Environment.....	2-14
2.5 Cumulative Impacts for the Future Without Project Condition	2-24
3.0 Plan Formulation	3-1
3.1 Prior Studies	3-1
3.2 Planning Constraints	3-2
3.3 Management Measures Considered and Screened (*NEPA required)	3-2
3.4 Initial Array of Alternatives (*NEPA required).....	3-3
3.5 Final Array of Alternatives (*NEPA required).....	3-5
3.6 Cost Estimates	3-7
3.7 Summary of Accounts and Comparison of Alternatives	3-8
3.8 Identifying the Tentatively Selected Plan.....	3-10
3.9 Additional Plan Formulation	3-10
3.10 TSP Confirmation	3-19
4.0 Environmental Consequences for Comparative Analysis (*NEPA Required)	4-1
4.1 Water Environment	4-1
4.2 Human Environment.....	4-5
4.3 Natural Environment.....	4-9
4.4 Cumulative Effects	4-20
4.5 Mitigation Requirements Associated with the Recommended Plan	4-32
5.0 Recommended Plan (Previously Tentatively Selected Plan) (*NEPA Required)	5-1
5.1 Description of the Recommended Plan.....	5-1
5.2 Hazardous, Toxic, and Radioactive Waste	5-6
5.3 Adaptive Management & Monitoring	5-7
5.4 Real Estate Requirements Associated with the Recommended Plan.....	5-7
5.5 Relocations with the recommended plan	5-8
5.6 OMRR&R associated with the Recommended Plan	5-8
5.7 Benefit Analysis Associated with the Recommended Plan.....	5-9
5.8 Risk & Uncertainty Analysis associated with the Recommended Plan.....	5-9
5.9 Implementation Requirements	5-14
5.10 Views of the Non-Federal Sponsor.....	5-14
6.0 Environmental Laws & Compliance (*NEPA Required)	6-1
6.1 Clean Air Act of 1972 (Air Quality)	6-1
6.2 Clean Water Act of 1972 – Section 401 (Water Quality)	6-1
6.3 Clean Water Act of 1972 – Section 404(b)(1) (Wetlands).....	6-1
6.4 Coastal Zone Management Act of 1972 (Coastal Zone Development).....	6-1



6.5	Endangered Species Act of 1973 (Threatened & Endangered Species).....	6-1
6.6	Bald and Golden Eagle Protection Act of 1940 (Bald Eagles)	6-1
6.7	Louisiana State T&E Species and Rare and Unique Habitat.....	6-2
6.8	Colonial Nesting Water Birds.....	6-2
6.9	Farmland Protection Policy Act of 1981 (Farmland)	6-2
6.10	Fish and Wildlife Coordination Act of 1934 (Fish & Wildlife).....	6-2
6.11	Magnuson-Stevens Fishery Conservation and Management Act of 1976 and The Magnuson-Stevens Act Reauthorization of 2006 (Essential Fish Habitat).....	6-9
6.12	Marine Mammal Protection Act of 1972 (Marine Mammals)	6-9
6.13	Migratory Bird Treaty Act of 1918 and Migratory Bird Conservation Act of 1929	6-9
6.14	National Historic Preservation Act of 1966 (Cultural and Historic Resources)	6-9
6.15	Resource Conservation and Recovery Act of 1976	6-10
6.16	Wild and Scenic River Act of 1968 (Rivers).....	6-10
6.17	Executive Order 11514, Protection and Enhancement of Environmental Quality	6-10
6.18	Executive Order 11988, Floodplain Management	6-10
6.19	Executive Order 11990, Protection of Wetlands	6-13
6.20	Executive Order 12898, Environmental Justice.....	6-13
6.21	Executive Order 13112, Invasive Species.....	6-14
6.22	Executive Order 13186, Responsibilities of Fed. Agencies to Protect Migratory Birds.....	6-14
6.23	Land and Water Conservation Act of 1965	6-14
7.0	Public Involvement	7-1
7.1	Public Meetings and Other Coordination Efforts	7-1
7.2	Draft Report Recipients (*NEPA Required)	7-1
7.3	Views of the Public	7-3
8.0	Recommendations.....	8-1
8.1	Recommended Plan	8-1
8.2	Plan Implementation.....	8-2
9.0	List of Preparers (*NEPA Required).....	9-1

Map Annex*

Appendices*

Appendix A: Environmental

Appendix B: Engineering

Appendix C: Real Estate

Appendix D: Economics

Appendix E: Plan Formulation

Appendix F: References

Appendix G: Value Engineering

* Full document and appendices are on the enclosed disc included with this document.



List of Tables

Table 1-1	NEPA-required information in this report	1-5
Table 2-1	Project area land use.....	2-1
Table 2-2	Relative sea level rise in the project area.....	2-2
Table 2-3	Parish-wide population (in 1000s).....	2-6
Table 2-4	Number of households in study area (in 1000s).....	2-6
Table 2-5	Summary of parish-wide storm damage insurance payments 1978 through 2012.....	2-6
Table 2-6	Damages by Probability Event in 2020 and 2070 Intermediate Sea Level Rise	2-7
Table 2-7	Historical parish-wide non-farm employment (in 1000s)	2-8
Table 2-8	Mean height (elevation) of major hurricane evacuation routes.....	2-9
Table 2-9	Potential transportation impacts	2-10
Table 2-10	Parish-wide per capita income.....	2-10
Table 2-11	St. James Parish communities percent minority and low income.....	2-13
Table 2-12	St. Charles Parish communities percent minority and low income.....	2-13
Table 2-13	St. John the Baptist Parish communities percent minority and low income.....	2-13
Table 2-14	Essential Fish Habitat for life stages of species in Lake Pontchartrain	2-20
Table 3-1	Relevant prior reports and studies	3-1
Table 3-2	Screening and Ranking Initial Array Plans against Objectives and Constraints.....	3-4
Table 3-3	Comparative details for final array of alternative plans	3-6
Table 3-4	Estimated first costs for final array of alternative plans	3-8
Table 3-5	Comparison of annual OMRR&R costs for final array of alternative plans.....	3-8
Table 3-6	Economic comparison of final array of alternative plans on Gross Investment	3-9
Table 3-7	Economic comparison of final array of alternative plans	3-10
Table 3-8	Economic evaluation of potential localized storm surge risk reduction components	3-12
Table 3-9	Additional plan formulation based on environmental factors.....	3-15
Table 4-1	Relationship between the project impact area and the 3 Parish Area for EJ analysis	4-9
Table 4-2	Sensitive noise receptors within 1000ft impacted from project construction	4-18
Table 4-3	Description of past, present, and reasonably foreseeable future projects	4-21
Table 4-4	Cumulative effects of key significant resources	4-24
Table 4-5	Impacts to swamp and BLH.....	4-32
Table 4-6	Restored swamp and BLH	4-32
Table 5-1	Total equivalent annual net benefits by flood risk management (FRM) Component.....	5-9
Table 5-2	Equivalent annual residual damages by components of the recommended plan.....	5-10
Table 5-3	2020 and 2070 storm stages by components of recommended plan	5-11
Table 5-4	Cost apportionment of the Recommended Plan.....	5-14
Table 7-1	List of report recipients	7-2

List of Figures in Map Annex

Figure 1-1	West Shore Lake Pontchartrain authorized study area.....	MA-1
Figure 1-2	Old logging canals in Maurepas Swamp.	MA-2
Figure 1-3	Area storm surge patterns	MA-3
Figure 1-4	Hurricane tracks within 65 nautical miles of Laplace, Louisiana	MA-4
Figure 1-5	Hurricane Isaac flooding in Laplace, Louisiana.....	MA-5
Figure 2-1	WSLP Land Classification Map.....	MA-6
Figure 2-2	Relative sea level rise in the project area.....	MA-7
Figure 2-3	Hurricane Isaac flooding in Laplace	MA-8
Figure 2-4	Hurricane Isaac flooding of important transportation routes	MA-9
Figure 2-5	First floor evaluations (existing conditions)	MA-10
Figure 2-6	First floor evaluations (future without-project conditions)	MA-11
Figure 2-7	100YR Still Water Elevations for 2020-Intermediate Condition – Without Project.....	MA-12
Figure 2-8	100YR Still Water Elevations for 2070-Intermediate Condition – Without Project.....	MA-13



Figure 2-9	EFH for white shrimp (green) and red drum (red)	MA-14
Figure 2-10	Habitats and land loss within the project area	MA-15
Figure 3-1	Typical levee, floodwall (T-wall) and control structure	MA-16
Figure 3-2	Supplemental nonstructural plan area in St. James Parish	MA-17
Figure 3-3	Economic reaches, FWOP condition.....	MA-18
Figure 3-4	Final array of alternative plans.....	MA-19
Figure 3-5	Alignment and features of Alternative A.....	MA-20
Figure 3-6	Alignment and features of Alternative C	MA-21
Figure 3-7	Alignment and features of Alternative D.....	MA-22
Figure 3-8	Study area drainage patterns	MA-23
Figure 3-9	Details of further developed nonstructural component.....	MA-24
Figure 3-10	Overview of potential impacts due to a maximum 2 tenths WSE increase	MA-25
Figure 3-11	Capability Assessment of Alternative A.....	MA-26
Figure 4-1	Model results of w/and w/o proposed levee alignment on tidal circulation.....	MA-27
Figure 4-2	Modeling simulation flows during month of May for Area 5	MA-28
Figure 4-3	Wetland areas within all alternatives in the final alternative array.	MA-29
Figure 5-1	Overview of the entire risk reduction system	MA-30
Figure 5-2	Overview of the nonstructural System	MA-31
Figure 6-1	Overview of the areas reviewed for Executive Order 11988, Floodplain Management ..	MA-32



LIST OF ACRONYMS, ABBREVIATIONS AND SYMBOLS

AAHUs	Average Annual Habitat Units
ACE	Annual Chance Exceedance Event
ACHP	Advisory Council on Historic Properties
ADCIRC	Advanced Circulation Modeling
AEP	Annual exceedance probability
AM&M	Adaptive Management & Monitoring
ARDC	Amite River Diversion Canal
ASACW	Assistant Secretary of the Army for Civil Works
ATV	All Terrain Vehicle
BCR	Benefit to Cost Ratio
BLH	Bottomland hardwood
BLH1	Bonnet Carre Bottomland Hardwood Restoration
BMP	Best management practices
BR	Baton Rouge
CAA	Clean Air Act
CBRD	Convent Blind River Diversion
CC	Coefficient of Conservatism
CEMVN	U.S. Army Corps of Engineers, Mississippi Valley Division, New Orleans District
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cfs	Cubic Feet Per Second
CIAP	Coastal Impact Assistance Program
CPRAB	Coastal Protection Restoration Authority of Louisiana Board
CRMS	Coastwide Reference Monitoring System
CWA	Clean Water Act
CWPPRA	Coastal Wetlands Planning, Protection and Restoration Act
cy	Cubic Yards
dBA	A-weighted Decibels
DIVR	Division Regulation
DO	Dissolved oxygen
Draft Report	Draft Integrated Feasibility Report and Environmental Impact Statement
EAD	Equivalent annual damages
EFH	Essential Fish Habitat
EJ	Environmental Justice
EJView	Environmental Protection Agency Mapping
EO	Executive Order
EPA	Environmental Protection Agency
EQ	Environmental Quality
ER	Engineering Regulation
ESA	Environmental Site Assessment
ESA	Endangered Species Act
ESJHS	East St. John High School
FEIS	Final Environmental Impact Statement



FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
Final Report	Final Integrated Feasibility Report and Environmental Impact Statement
FIRM	Flood Insurance rate maps
FPPA	Farmland Protection Policy Act
FQI	Floristic Quality Indices
FRM	Flood risk management
ft	Feet
FWCA	Fish and Wildlife Coordination Act
FWCAR	Coordination Act Report
GIS	Geographic Information System
HEC-FDA	Hydrologic Engineering Center Flood Damage Analysis
HHS	U.S. Department of Health and Human Services
HI	Hydrologic Indices
HSI	Habitat Suitability Index
HSDRRS	Hurricane and Storm Damage Risk Reduction System
HTRW	Hazardous, Toxic and Radioactive Waste
Hwy	Highway
I-10	Interstate 10
I-55	Interstate 55
LaDOTD	Louisiana Department of Transportation and Development
LCA	Louisiana Coastal Area
LDWF	Louisiana Department of Wildlife and Fisheries
LERRD	Land, Easements, Rights-Of-Way, Relocation, and Disposal Areas
LF	Linear Foot
LIDAR	Light Detection and Ranging data
LNHP	Louisiana Natural Heritage Program
LPV	Lake Pontchartrain and Vicinity
MBI	Mitigation Banking Instrument
MII	Micro-Computer Aided Cost Estimating System
MOU	Memorandum of Understanding
MR&T	Mississippi River and Tributaries
MRGO	Mississippi River Gulf Outlet Canal
MRL	Mississippi River Levee
MS	Mississippi
NAAQS	National Ambient Air Quality Standards
NAVD	North American Vertical Datum
NCC	Notice of Construction Completion
NED	National Economic Development
NEPA	National Environmental Policy Act
NER	National Ecosystem Restoration
NFIP	National Flood Insurance Program
NFS	Non-Federal Sponsor
NGO	Non-Governmental Organizations



NOAA	National Oceanic and Atmospheric Administration
NOLA	New Orleans
NORM	Naturally Occurring Radioactive Materials
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
OCPR	Office of Coastal Protection and Restoration, Louisiana
OMRR&R	Operation, Maintenance, Repair, Rehabilitation and Replacement
OSE	Other Social Effects
PED	Preconstruction Engineering and Design
PIER 36	Programmatic Individual Environmental Report for Pontchartrain and Vicinity
PLD	Pontchartrain Levee District
PMP	Project Management Plan
Polder	Tract of land enclosed by embankments
PO-29	River Reintroduction into Maurepas Swamp
PPA	Project Partnership Agreement
PPT	Parts Per Thousand
Principles and Guidelines	1983 Economic and Environmental Principles and Guidelines for Water and Related Land Implementation Studies
REC	Recognized Environmental Conditions
RED	Regional Economic Development
REP	Real Estate Plan
ROW	Right of way
RSLR	Relative Sea Level Rise
SHPO	State Historic Preservation Office
SLR	Sea Level Rise
SMART	Specific, Measurable, Attainable, Risk Informed, Timely
STWAVE	Steady-State Spectral Wave
SVI	Submergence Vulnerability Indices
SWMP1	Swamp Mitigation Bank Credit Purchase
SWMP2	Blind River Swamp Restoration
SWMP3	Bonnet Carre Swamp Restoration
SWMP4	Maurepas Crawfish Ponds Restoration
SWMP6	Lutcher Polder Farmlands Swamp Restoration
SWPPP	Storm Water Pollution Prevention Plan
T&E	Threatened and Endangered
TMDL	Total Maximum Daily Load
TSP	Tentatively Selected Plan
TY	Target Year
URA	Uniform Relocation Assistance
US-44	U.S. Highway 44
US-51	U.S. Highway 51
US-61	U.S. Highway 61



USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
WIK	Work-In-Kind
WMA	Wildlife Management Area
WRDA	Water Resources Development Act
WSE	Water Surface Elevation
WSLP	West Shore Lake Pontchartrain Hurricane and Storm Damage Risk Reduction
WVA	Wetland Value Assessment



1.0 INTRODUCTION

The U.S. Army Corps of Engineers (USACE) Mississippi Valley Division, New Orleans District (CEMVN) prepared this Final Integrated Feasibility Report and Environmental Impact Statement (Final Report) for the West Shore Lake Pontchartrain Hurricane and Storm Damage Risk Reduction (WSLP) study. It includes input from both the study and the construction, operation, maintenance, repair, rehabilitation and replacement (OMRR&R) non-Federal sponsors, natural resource agencies, and the public. This report identifies solutions designed to reduce damages from hurricane and tropical storm surge events in St. Charles, St. John the Baptist and St. James Parishes, Louisiana (for additional information see: <http://www.mvn.usace.army.mil/About/Projects/WestShoreLakePontchartrain>).

1.1 Background

The study area (see Figure 1-1 in the Map Annex) is in southeast Louisiana between the Mississippi River, and Lakes Maurepas and Pontchartrain. The towns of Montz, Laplace, Reserve, Litcher, Gramercy, Grand Point, Convent, Garyville and Romeville are area communities. The 235,581 acre area occupies a portion of one of the oldest delta complexes in the Mississippi River Deltaic Plain. It is in the lower Mississippi River alluvial plain in the Pontchartrain Basin. The area includes residential and commercial developments south of Interstate 10 (I-10). West of Laplace, a majority of the developed areas are found between U.S. Highway 61 (US-61) and the Mississippi River levee. The area north of I-10 comprises the State of Louisiana's Maurepas Swamp Wildlife Management Area (WMA). The project area includes lands potentially impacted by the proposed action.

Hurricane or tropical storm winds push on the sea surface, causing a rise of water over and above predicted tides. This is called storm surge. Hurricanes and tropical storms are an important part of Louisiana's history and culture. The region experiences tropical waves, depressions, storms and hurricanes. The study area is highly susceptible to storm surge. The destruction caused by a 1915 hurricane was recounted years later:

"... an enormous storm surge advanced with great rapidity upon the western shore of Lake Pontchartrain well ahead of the eye of the hurricane which very nearly struck Frenier head on. As the storm came ashore in the New Orleans area, fifty people drowned as a thirteen foot storm surge swept the Rigolets railroad bridge away. It should also be emphasized that damage and destruction to homes and property were occurring even as the eye of the hurricane was 165 miles from Frenier. Two-hundred seventy-five Louisianians lost their lives as a result of the "Great West Indian Hurricane of 1915." (Landry 1996)

Recent hurricanes impacting the area include Katrina and Rita in 2005, Gustav and Ike in 2008, and Isaac in 2012. These storms threatened a region that plays a vital national economic role and that serves as a key transportation corridor.

Swamp plays an important role in the natural defense against storm surge. An important swamp buffer that separates development from nearby lakes in the area has been impacted over time due to natural and anthropogenic influences. For example, the closure of bayous and the construction of levees cut off the floods that historically nourished and maintained the cypress/tupelo habitat in the Maurepas Swamp. The cypress forests of the swamp were logged in the 1890s–1930s. Canals and railroads were built through the swamp to remove timber (Figure 1-2). In the early 1970s roadways were built through the swamp further impacting the habitat. Additionally, the area may experience up to 2.32 feet of relative sea level rise (RSLR) over the next 50-years under an "intermediate" RSLR scenario. As a result of these natural and man-made influences, the swamp is converting to fragmented marsh and open water (USACE 2010a, USACE 2010b), and the swamp's surge buffer benefits are expected to continue to diminish as it degrades and disappears and as sea level rises.

1.2 Purpose, Scope, and Need for the Study (*National Environmental Policy Act Required)

The study purpose is to provide a recommendation for Federal participation in hurricane and tropical storm damage risk reduction for St. Charles, St. John the Baptist and St. James Parishes that would be economically and environmentally justified. The study addresses flooding caused by storm surge but does not address





rainfall flooding. There is a need to reduce the risk of damage from hurricanes and storms to the communities in the area. There have been significant changes to the study area's natural and human landscape over the last 40 years. Population has grown over the past few decades, increasing the number of people and business at risk from hurricane and tropical storm surge-related damages. This report presents a collaboratively-developed plan prepared in accordance with the National Environmental Policy Act (NEPA) and Engineering Regulation (ER) 1105-2-100, the USACE Planning Guidance Notebook in accordance with SMART¹ Planning principles and processes. It consists of an integrated feasibility report and EIS, together with associated appendices, and identifies the expected benefits, estimated cost and implementation responsibilities for the recommended plan. The report provides an overview of the study and summarizes the feasibility design of the recommended plan presented in the technical appendices. The report is in response to the study authority.

1.3 Problems, Needs and Opportunities

Problems in the Study Area

1. Storm surge flooding of approximately 7,698 structures (6-8 feet in some areas).
2. Hurricane evacuation routes, for emergency response vehicles, become impassable and are damaged during storm surges events.
3. Agricultural losses resulting from prolonged periods of standing water (e.g., inability to drain saltwater).

Storm surge flooding damages homes, businesses and infrastructure. Surge travels from the Gulf of Mexico into the basin and floods the three study area parishes and beyond (Figure 1-3). Since 1855, 70 hurricanes have made landfall within 65 nautical miles of Laplace (Figure 1-4). Hurricanes Betsy (1965), Camille (1969), Juan (1985), Andrew (1992), Katrina and Rita (2005), Gustav and Ike (2008), and Isaac (2012) caused storm surge flooding. Hurricane Isaac's surge, measured from 6 to 8 feet in the area, threatened lives and damaged more than 7,000 homes, closed roads and disrupted the nationally-significant energy industry (Figure 1-5).

Businesses and workers serving the Port of South Louisiana are located in the area. The port is the largest volume port in the Western Hemisphere and the ninth largest in the world. It stretches 54 miles on the Mississippi River between New Orleans and Baton Rouge. Hurricane Isaac disrupted port logistics. Storm surge blocked facility access closing the port. Oil refineries, including the nation's third largest, were shut down. Gasoline production stopped. Regional and national fuel prices spiked. The storm caused extensive agricultural losses due to an inability to drain storm surge water from fields.

The study area setting offers a bounty of natural resources but historically it has been subject to floods from the river and nearby lakes. Levees were built along the Mississippi River starting in the 1700s to combat annual floods. These levees allowed settlement of the area and agricultural production and the harvesting of natural resources. The area remains susceptible to floods from tropical storms and hurricanes. Some natural protection is afforded by a large cypress swamp that separates developed areas from nearby tidal lakes. The swamp has degraded over time and the storm surge buffer it provides between the lakes and towns is decreasing. As a result, storm surge flooding (Figure 1-3) remains a risk that is expected to increase over time. The management of Mississippi River flood risk, and the accompanying development of interior drainage systems, allowed suburban expansion in much of the region beyond the natural high-ground near the Mississippi River. Population has increased with development between Baton Rouge and New Orleans. Residents are attracted to the area because of employment opportunities, quality of life, and access to recreation. These factors, increasing population and degrading natural buffers, combine to increase storm surge flooding risks.

¹SMART: Specific, Measurable, Attainable, Risk Informed, Timely. In 2012 the USACE revised its approach to planning studies and emphasized risk-based decision-making and early vertical team engagement to effectively execute and deliver feasibility studies in a timely manner.



1.4 Need for Action

The U.S. Congress recognized the need for a hurricane and storm damage risk reduction project in the area. Two Congressional resolutions authorize this study. The first was adopted on July 29, 1971 by the U.S. House of Representatives Committee on Public Works.

“RESOLVED BY THE COMMITTEE ON PUBLIC WORKS OF THE HOUSE OF REPRESENTATIVES, UNITED STATES, that the Board of Engineers for Rivers and Harbors is hereby requested to review the report of the Chief of Engineers on Lake Pontchartrain and Vicinity, Louisiana, published as House Document No. 231, 89th Congress, First Session, and other pertinent reports, with a view to determining whether modifications to the recommendations contained therein are advisable at this time, with particular reference to providing additional levees for hurricane protection and flood control in St. John the Baptist Parish and that part of St. Charles Parish west of the Bonnet Carré Spillway.”

The U.S. Senate Committee on Public Works adopted a resolution on September 20, 1974.

“RESOLVED BY THE COMMITTEE ON PUBLIC WORKS OF THE UNITED STATES SENATE, that the Board for Rivers and Harbors is hereby requested to review the report of the Chief of Engineers on Lake Pontchartrain and Vicinity, Louisiana, published as House Document No. 231, 89th Congress, First Session, and other pertinent reports, with a view to determining whether modifications to the recommendations contained therein are advisable at this time, for hurricane protection and flood control in St. James Parish.”

The study was first funded in the 1980s. A 1985 Reconnaissance Report found that there was no justified structural plan suitable for Federal participation. A 1987 reconnaissance report indicated that under Federal criteria a solution could not be found that would be economically justified or environmentally acceptable. Because of increasing population and economic activity, a 1997 reconnaissance report recommended proceeding to a feasibility phase. A Feasibility Cost Share Agreement was executed with the Pontchartrain Levee District (PLD) in 1998. The study stopped in 2002. Following Hurricane Katrina, renewed levee district interest led to an amended agreement in 2008. Planning was underway when Hurricane Isaac hit in 2012. President Obama went to Laplace, Louisiana after the storm to view the damage and visit with residents and local leaders. The President said, ***“We’re getting on the case to figure out what happened here and what we can do to make sure it won’t happen again.”*** The USACE’s post-Isaac damage assessment met the first part of the President’s commitment. This study will help deliver the second part.

1.5 Objectives of Action

Identifying problems, needs, opportunities, and objectives ensures unity of purpose in the planning process. Solving problems and taking advantage of these opportunities provides a basis for effective solutions. **Critical needs** were identified based on the problems.

Critical Needs in the Study Area

1. Keep hurricane evacuation routes open before and after storms for emergency response vehicles.
2. Reduce property damage.
3. Inform public of increased risk of living in flood prone areas.

Opportunities to solve problems were identified based on these needs.

Study Opportunities

1. Reduce hurricane flood risks and damages.
2. Provide smart growth education.
3. Educate local planners and public officials on potential future stages (e.g. 2070).
4. Improve flood warnings for preparation and/or evacuation.
5. Develop measures to reduce damages to evacuation routes due to storm surge.
6. Recommend future modifications to the roadway systems to maintain emergency response vehicle access during hurricane and tropical storm events.
7. Develop measures to reduce the flood risk to agricultural areas.



A **study goal** based on the problems, needs and opportunities was developed to help create and evaluate alternative plans. It is the overarching intent of the project.

Study Goal

Reduce the risk of storm surge damages.

A **planning objective** states the intended purposes of the planning process. It is a statement of what solutions should try to achieve. Objectives provide a clear statement of the study purpose.

Planning Objectives

1. Reduce hurricane storm surge related damages through 2070.
2. Reduce risk to resident's life and health by decreasing flooding to the maximum extent practical.
3. Increase public awareness of hurricane risks in developed flood prone areas.
4. Enhance public awareness of the risk to life and property of development in flood prone areas.
5. Reduce the risk of damage and loss of critical infrastructure (I-10/I-55 hurricane evacuation routes).

1.6 USACE Civil Works Guidance and Initiatives

USACE planning is grounded in the 1983 Economic and Environmental Principles and Guidelines for Water and Related Land Implementation Studies (hereafter "Principles and Guidelines"). The Principles and Guidelines provide for the formulation of reasonable plans responsive to National, state and local concerns. With this framework, the USACE seeks to balance economic development and environmental needs as it addresses water resources problems. The Federal objective of water and related land resources planning is to contribute to National Economic Development (NED) consistent with protecting the nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements. The Planning Guidance Notebook provides the overall direction to formulate, evaluate and select projects for implementation. The study was conducted under the USACE's Civil Works Planning modernization process by utilizing the SMART planning to effectively execute and deliver the study in a timely manner. The study also meets the USACE Campaign Plan goals and the USACE Environmental Operating Principles by undertaking a proactive public involvement campaign, including a project website, regular stakeholder visits, and targeted stakeholder meetings. Active and responsive public involvement has informed the development of solutions to the problems this study seeks to address, and has facilitated the sharing and distribution of data and knowledge. The relationships that the study team has developed with non-governmental organizations (NGOs), local officials, community and special interest groups, the academic community and agency partners has facilitated the consensus-building process to create a mutually supportable economic and environmentally sustainable solution for the nation.

NEPA requires the USACE to integrate environmental values into their decision making processes by considering the environmental impacts of their proposed actions and reasonable alternatives to those actions. Federal regulations to implement NEPA are found in Title 40 Code of Federal Regulations (CFR) Parts 1500-1508. The intent of NEPA is to ensure that information is made available to public officials and citizens about major actions taken by Federal agencies, and to identify and consider public concerns and issues. "*Any environmental document in compliance with NEPA may be combined with any other agency document to reduce duplication and paperwork*" (40 CFR §1506.4). This report integrates discussions that normally would appear in an Final Environmental Impact Statement (FEIS) into the feasibility report. Report sections include NEPA-required discussions marked "*(*NEPA Required)*" in the Table of Contents and in the body of the document to assist readers. Table 1-1 lists the required FEIS information and its location in this document.



1.6.1 NEPA Scoping Process

NEPA provides for an early and open process to determine the scope of issues to be addressed and identify the significant issues related to a proposed action. A Notice of Intent to prepare an FEIS was published in the Federal Register (Volume 73, No. 235) on December 5, 2008. The scoping period ended on February 16, 2009. Scoping identified concerns and preferences for levees. People are concerned about construction times, wetlands, hurricane evacuation routes and funding. The scoping report is available upon request.

Table 1-1: NEPA-required information in this report.

EIS Requirement	Location in this Document
Cover sheet	Cover page
Summary	Executive Summary
Table of Contents	Table of Contents
Purpose of and Need for Action	Chapter 1
Alternatives Including Proposed Action	Chapter 3
Affected Environment	Chapter 2
Environmental Consequences	Chapter 4
List of Preparers	Chapter 9
List of Report Recipients	Chapter 7
Index	Appendix F
Appendices	Listed in the Table of Contents

1.7 Non-Federal Sponsors

The Pontchartrain Levee District is the study non-Federal sponsor (NFS). The Louisiana Coastal Protection and Restoration Authority of Louisiana Board (CPRAB) and the Pontchartrain Levee District will be the NFS for construction, and for OMRR&R.



2.0 AFFECTED ENVIRONMENT (*NEPA Required)

This chapter describes the affected environment. The historic and existing conditions and a forecast of the “future without-project” conditions provide the basis for plan formulation. The future without-project condition is the No Action Alternative. Important resources potentially impacted by the proposed action and their significance are explained in Appendix A. Topics in this chapter mirror Chapter 4 and Chapter 5, where the “future with-project” conditions are considered for screening plans and the recommended plan.

Water use, water supply and ground (drinking) water were assessed and determined to not be significantly affected by the proposed action. These resources will not be further discussed in this report. For more information on other water quality issues see 2.2.3 and Appendix A, Annex M.

2.1 General Setting

Climate: The climate is subtropical marine with long humid summers and short moderate winters. The seasonal rainy period occurs from mid-December to mid-March with dry periods in May, October and November. Average annual rainfall is 60 inches with a monthly maximum of 20 inches. The heaviest rainfalls usually occur during the summer, with July being the wettest month averaging 6.42 inches. October is usually the driest month, averaging 3.01 inches of rain.

Physical Features: The geology of the lower Mississippi River alluvial valley and the Louisiana coast is summarized in the Louisiana Coastal Area (LCA) Ecosystem Restoration Study (USACE 2004). Lakes Maurepas and Pontchartrain occupy a portion of the old Mississippi River pathway known as the St. Bernard Delta. The complex formed in what was then Pontchartrain Bay, enclosing a portion of it to form Lake Pontchartrain. The St. Bernard delta complex was formed by Mississippi River deposits between 3,000 and 4,000 years ago (Frazier 1967). The majority of other landform features include inland swamp, tidal channels, shallow lakes and bays, natural levee ridges along active and abandoned channels, barrier islands and beaches.

Land Use and Land Loss: The 235,581-acre study area contains residential and commercial development south of I-10. West of Laplace most development is between US-61 and the Mississippi River levee. The area north of I-10 is undeveloped wetlands in the Maurepas Swamp WMA. Figure 2-1 and Table 2-1 present various land cover classifications from the most recent land cover database. Land loss is a key environmental factor in coastal Louisiana. The LCA habitat data from 1956 to 2000 shows a trend of landscape changes in the study area (Figure 2-10).

Table 2-1: Project area land use.

Classification Dataset	Acres	Percent of Project area
Open Water	67,262	28.55%
Developed	23,262	9.87%
Barren Land	409	0.17%
Deciduous Forest	17	0.01%
Mixed Forest	5	0.00%
Shrub/Scrub	834	0.35%
Grassland/Herbaceous	88	0.04%





Pasture/Hay	1,827	0.78%
Cultivated Crops	19,895	8.45%
Woody Wetlands	97,817	41.52%
Emergent Herbaceous Wetlands	24,166	10.26%
Total	235,581	100.00%
National Land Cover Database 2011 (NLCD 2011)		

2.2 Water Environment

Water Stage Duration and Frequency: Normal astronomical tides in Louisiana are diurnal (one high tide and one low tide per day) and can have a spring range of as much as 2 feet. The mean tidal range is approximately 0.51 feet (NOAA 2013a). Amplitudes are influenced by tides, but are generally controlled by meteorological events. East winds drive water into the lake.

Relative Sea Level Rise: Sea level rise (SLR) conditions were modeled. Mesh and grid elevations were not adjusted for subsidence in this analysis. Rather, the predicted subsidence levels were incorporated in the initial water level parameter to capture the combined effects of subsidence and local SLR into a single relative sea level rise (RSLR) value. For the 2020 and 2070 hydrology simulations, unique RSLR values were added to the 2011 initial water surface elevations (WSE) to calculate the initial WSE appropriate for each year and SLR rate. SLR and RSLR data is listed in Table 2-2 and shown in Figure 2-2.

Table 2-2: Relative sea level rise in the project area.

Scenario	SLR (NAVD88 feet)		RSLR (NAVD88 feet)	
	2020	2070	2020	2070
Low SLR	0.06	0.33	0.30	1.81
Intermediate SLR	0.10	0.85	0.34	2.32
High SLR	0.23	2.47	0.47	3.95

2.2.1 Flow and Water Levels

Historic and Existing Conditions

Changes in the Mississippi River have been responsible for changes in the flow and water levels in the area over several geological periods. Processes involved in the formation of the various deltaic lobes controlled both water levels and flow directions. Seasonal flooding of the Mississippi River has contributed to the historic flow and water level characteristics of the area. Large flood events would bring freshwater, sediment and nutrients to the back swamp areas.

River levees were built in the area beginning in the 1700s by local landowners and governments. Levee building continued through the settlement period and by 1812, the year Louisiana became a state, levees stretched 130 miles upstream from New Orleans to Baton Rouge. Levees permanently altered the hydrology of the area by preventing riverine flooding and reducing freshwater inputs to the backwater swamps and Lakes Maurepas and Pontchartrain (USACE 2010). The Mississippi River and Tributaries project (MR&T) was authorized by Congress after the Mississippi River Flood of 1927. The project provides flood risk reduction for the Mississippi River and tributaries system from Cape Girardeau, Missouri to the Head of Passes, Louisiana. Although the river is no longer directly connected to Lake Maurepas, it is connected to Lake Pontchartrain through the Inner Harbor Navigational Canal and by openings of the Bonnet Carré Spillway.



The area's water budget is composed of inflows and outflows through precipitation, evaporation, stream flow, base flow; direct groundwater flow, as well as flows in and out of the estuary. Lake Maurepas is a shallow, fresh to intermediate basin, receiving daily mean freshwater discharge, primarily from the Amite and Tickfaw Rivers; and to a lesser extent, the Blind River (American Institute of Hydrology, 2006). Lake Pontchartrain is a shallow, brackish basin that receives freshwater discharge from the Tangipahoa, Pearl, and Tchefuncte Rivers, as well as Bayous Lacombe and Liberty, and many smaller creeks.

LCA restoration projects in the study area are closely related and intended to function together to increase freshwater and nutrient inputs to the Maurepas Swamp (USACE 2004). The LCA Convent Blind River Diversion (CBRD) would introduce Mississippi River water to the Maurepas Swamp near Convent, Louisiana (USACE 2010a). The LCA Amite River Diversion Canal (ARDC) would have modified the canal to spread freshwater into the swamp between the Amite River and the Blind River (USACE 2010b). On December 9, 2011, the USACE and the CPRAB entered into a Design Agreement for six LCA projects, including the CBRD. In a letter dated August 20, 2012 the State of Louisiana suspended further state participation in Federal design efforts for the majority of those projects; however, CPRAB expressed its desire to continue design of the full CBRD feature. Both USACE and the CPRAB desire to proceed with design of CBRD; however, at present further design work is suspended, pending negotiation of a new Project Management Plan (PMP) for the design of the feature. The ARDC project is being pursued by the state and Livingston Parish under the Coastal Impact Assistance Program (CIAP).

The Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) project "River Reintroduction into Maurepas Swamp (PO-29)" would divert Mississippi River water to the Maurepas Swamp through Hope Canal. Construction of this project has transitioned for independent implementation by the State of Louisiana. The WSLP project has been coordinating activities between the project development teams. As part of the WSLP scoping effort, a letter from CPRA (formerly the Office of Coastal Protection and Restoration, Louisiana (OCPR) requested that the CWPPRA project features be incorporated into the WSLP study. The letter emphasized that any storm damage control structure built in the area should allow for the exchange of water in the swamp north and south of I-10. Recently, the State of Louisiana submitted a permit application to construct the project, but for the purposes of the WSLP study, we do not consider the diversion project as a future landscape feature, since the State has not identified funding and has not received approval on the final permits. The USACE will continue to monitor the status of the diversion project.

Because of uncertainty as to the entities that would implement the ARDC and PO-29 diversion projects, further references in this report to the ARDC and PO-29 diversions will be collectively referred to as "Maurepas Swamp Diversions," and will not reference Federal or State responsibility for implementation.

Future Without-Project Conditions (No Action Alternative)

There would be no additional direct, indirect or cumulative impacts caused by the No Action Alternative. Existing conditions and future changes to flow and water levels would continue to change at the predicted trend.

2.2.2 Sedimentation and Erosion

Historic and Existing Conditions

The area has one of the highest land subsidence rates in the country, estimated at 0.4 inches annually. The rate is variable along the coast (Battelle 2005). Coastal Louisiana is more prone than other areas to subsidence and land loss. Human actions have exacerbated the problem.

Shoreline erosion along Lake Maurepas, measured by the United States Geological Survey (USGS) Coastal and Marine Geology Program since 1899, shows an average shoreline loss between 1899 and 1995 of approximately 3.25 feet per year (Zganjar et al. 2002). Erosion may be attributed to any number of factors including storm surge, lack of sediment entering the area, canal construction, logging and wave activity. RSLR



and associated saltwater influx has increased erosion in coastal wetland areas.

Saucier (1963) calculated Lake Pontchartrain shoreline retreat by comparing aerial photographs from 1931 through 1937, with photographs from 1950 through 1954. The data shows average annual erosion for one-mile stretches of shoreline. The southwestern shoreline retreats at a mean rate of 8.9 feet per year compared to 3.6 feet per year for the north shore and about 5.6 feet per year for the south shore. Saucier attributed shoreline erosion to subsidence, lack of sediment input, increasing fetch and SLR.

The Maurepas swamp, which includes the 103,263-acre Maurepas Swamp WMA, is isolated from Mississippi River fresh water, sediment, and nutrient inputs by levees (LDWF 2005). The only soil building in the swamp is from organic wetland production (Shaffer et al. 2003). Area subsidence is classified as intermediate. (Shaffer et al. 2003). When coupled with minimal soil building, net lowering of ground surface elevation results (Shaffer et al. 2003).

The CBRD and the Maurepas Swamp Diversions are intended to sustain this unique swamp system (USACE 2004, 2010a and 2010b). The diversion(s) would increase flow through the southwestern portions of the area, which is intended to provide a constant source of oxygen- and nutrient-rich waters to the swamp. Benefits would include measurable increases in productivity, which could help build swamp substrate and balance subsidence, reduce mortality, and increase soil bulk density. As accretion improves, there could be an increase in recruitment of new cypress and tupelo. Anticipated sediment benefits could include direct contribution to accretion, as well as contribution to biological productivity through the introduction of sediment-associated nutrients, which also could contribute to production of substrate.

Future Without-Project Conditions (No Action Alternative)

There would be no additional direct, indirect or cumulative impacts caused by the No Action Alternative. Existing conditions and trajectories of change to sedimentation and erosion in the area would persist as would potential offsets to those losses by restoration impacts from the CBRD and the Maurepas Swamp Diversions. Soil erosion and land loss would continue at the same or increased rates. Natural and man-made levees would continue to subside and organic soils would not maintain elevations due to subsidence, decreased plant productivity, and wave erosion (USACE 2004). Sediments would continue to be transported from terrestrial areas into Lakes Maurepas and Pontchartrain.

2.2.3 Water Quality and Salinity

Historic and Existing Conditions

Water Quality Influences: Area water quality is influenced by basin elevations, surface water budget, land cover and use, coastal deltaic processes, and regional weather. The study area is in the western portion of the Pontchartrain Basin. The basin is influenced by several rivers which provide freshwater to estuarine lakes connected to each other and, ultimately, to the Gulf of Mexico via several major passes. The estuary has experienced hydro-modification via the construction of canals and embankments such as road and railroad beds and hurricane storm damage risk reduction features (Keddy et al. 2007, Sikora and Kjerive 1985, Tate et al. 2002). The basin includes upland forest and agricultural land north of the estuary, wetlands and open water in the estuary, development and agriculture along the Mississippi River corridor and in nearby urban areas (Demcheck et al. 2004, Brown et al. 2010, Wu and Xu 2007, Turner et al. 2002, Patil and Deng 2008). Chemical transformations occurring in the estuary can be biologically mediated by wetlands (Mitsch and Gosselink 2000). A diversity of wetland types exist in the estuary which are affected by coastal deltaic processes and anthropogenic factors (Gosselink 1984, Keddy et al. 2007). Weather patterns can affect estuary marine influence, flow direction, water level, and wetlands biogeochemistry (Gosselink 1984). Timing and amount of precipitation can also affect water quality (Demcheck et al. 2004, Keddy et al. 2007).

Literature Review: Development in the basin in the 20th century led to degradation of estuary waters (Hastings 2009). Historical pollution sources include sewage discharges, increased urbanization and farming, mining of water bottoms, and oil and gas activities. While recently many of these sources are curtailed or eliminated,



urbanization and farming are increasing (Patil and Deng 2008, Brown et al. 2010, Turner et al. 2002, Wu and Xu 2007). Garrison (1999) provides a water quality summary for data collected in Lake Maurepas from 1943-1995. Sikora and Kjerve (1985) and Tate et al (2002) both compared pre-/post-Mississippi River Gulf Outlet Canal (MRGO) salinity trends, finding a 0.2-0.4 parts per thousand (PPT) increase at Pass Manchac. Patil and Deng (2008) investigated water quality of the Amite River; dissolved oxygen (DO) levels in the river decreased by 1 mg/L between 1975-1990 and 1991-2005. Findings of the study implicate continued mining in the river and increased urbanization of the watershed. Recently, a total maximum daily load (TMDL) for the river for DO was developed (LDEQ 2011). Studies were conducted in support of the diversion of Mississippi River water into the Maurepas Swamps (e.g., Lee Wilson and Associates 2001, Shaffer et al. 2003, Hoepfner et al. 2008, Lane et al. 2003, Shaffer et al. 2009), and discuss water quality, and suggest that diversions may be beneficial during droughts.

Louisiana Water Quality Inventory: Historical (1998-2012) Clean Water Act Section 305(b) assessments of study area sub-segments were evaluated. For each sub-segment, an average designated use support value was calculated (0=always impaired, 1=unimpaired; see Appendix A, Annex M for methodology and details). Long-term average support values reveal that impairments are commonplace in sub-segments west of the Maurepas land bridge. The most commonly suspected causes included in the 305(b) assessments were non-native aquatic plants; low DO, mercury, fecal coliform, total phosphorus, sedimentation/siltation, and elevated turbidity, while the most commonly suspected sources were unknown sources such as atmospheric deposition, introduction of non-native organisms, on-site treatment systems, wetland habitat modification, and site clearance for land development/redevelopment. In the current (2012) 305(b) assessment, the most frequently cited suspected causes of impairment include non-native aquatic plants, low DO, mercury, elevated turbidity, and fecal coliform, while most frequently cited suspected sources of impairment include wetland habitat modification, introduction of non-native organisms, atmospheric deposition, unknown sources, on-site treatment systems, natural sources, and agriculture.

Water Quality Monitoring: See Appendix A, Annex M for water quality details. For each monitoring station in the study area, data for selected parameters was summarized by means of box plots (overall and seasonal), quantile plots and trend analysis. Findings suggest differences in water quality based on habitat, salinity and season. Low DO is common in the Maurepas Swamp. Pass Manchac is experiencing increased marine influence.

Future Without-Project Conditions (No Action Alternative)

Direct and Indirect Impacts: There would be no direct impacts. DO and salinity gradient trends are expected to continue. Without a project there would be an increased risk of damage from storm surge resulting from hurricane and tropical storm events in the area. Drainage of storm waters containing elevated nutrients, metals, and organics into water bodies connected to the Maurepas Swamp and Lake Maurepas is a possibility (Farris et al. 2007). Without the proposed project, the area would still be affected by the following:

- Restoration and Other Efforts – the LCA CBRD project (USACE 2010a) has the potential to locally reduce salinity stress and improve DO. Multiple diversion projects throughout the Pontchartrain Basin may concurrently have the potential to generate significant changes in wetlands biogeochemistry, some of which may negatively affect wetland plant community resiliency (Swarzenski et al. 2005).
- Federal and state water quality programs – may address land use practices in the Mississippi River basin and could impact the area water quality (Broussard 2008).
- Coastal processes – the Maurepas Swamp is anticipated to continue to decline and convert to marsh and open water, in turn affecting local water quality conditions.
- Development – development in watersheds affecting the study area.
- Climate change, sea-level rise and hurricane/tropical storm surge frequency may impact water quality through increased frequency of saltwater intrusion (Mousavi et al. 2011).



2.3 Human Environment (Socioeconomics)

2.3.1 Population and Housing

Historic and Existing Conditions

Table 2-3 shows the population trend in the three-parish area. Population increases between 2000 and 2010 are likely the result of population influx after Hurricane Katrina (2005). The three parish total population in 2010 was 120,806 residents. The 2012 population in the three parishes declined to 119,161 (U.S. Census 2013) due mainly to Hurricane Isaac impacts.

Table 2-3: Parish-wide populations (in 1000s). (U.S. Census 2013)

Parish	1970	1980	1990	2000	2010
St. Charles	29.5	37.5	42.5	48.2	52.8
St. James	19.7	21.6	20.8	21.4	22.1
St. John the Baptist	23.8	32.3	40.1	43.1	45.9
Total	73.0	91.4	103.4	112.7	120.8

The 2012 study area population was 62,900 residents. Housing trends (Table 2-4) parallel population growth. Almost all residential and non-residential development is on the higher ground adjacent to the Mississippi River. Major area communities include: Laplace, the largest urban area in the study; Reserve and Garyville in St. John the Baptist Parish; Gramercy and Lutcher in St. James Parish; and Montz in St. Charles Parish. The area was most recently flooded by Hurricane Isaac (2012) storm surge (Figure 2-3 and Figure 2-4).

Table 2-4: Number of households in study area (in 1000s). (U.S. Census 2013)

Parish	1970	1980	1990	2000	2010
St. Charles	7.59	11.6	14.4	16.5	17.2
St. James	4.63	6.1	6.4	7.0	6.9
St. John the Baptist	5.77	9.4	12.7	14.3	15.1
Total	17.99	27.1	33.5	37.8	39.2

Approximately 20,000 residential structures were inventoried in the study area. Federal Emergency Management Agency (FEMA) data indicates storm surge and rainfall flood claims for the three parishes were paid between 1978 and 2012 totaling \$338 million (Table 2-5). Evaluations show that under the modeled 100-year storm surge conditions approximately 7,689 structures' first floors would potentially be inundated under the existing conditions. First floor elevations were determined via field approximations (Figure 2-5).

Table 2-5: Summary of parish-wide storm damage insurance payments 1978 through 2012. (FEMA 2013)

Parish	# of Claims	Total Nominal Dollar Amount (in millions)	Average Dollar Amount per Claim
St. Charles	5907	\$100.13	\$16,950
St. James	135	\$1.74	\$12,870
St. John the Baptist	4851	\$236.18	\$48,690
Total	10898	\$338.05	\$31,030

Future Without-Project Conditions (No Action Alternative)

Population and housing are expected to follow trends in the local, regional, and national economies. An increase of 33,000 residents and approximately 11,000 residential structures are projected. In the absence of storm surge damage risk management measures population and housing could be adversely affected.



Evaluations of the future without-project conditions showed that under the modeled 100-year storm surge conditions 14,486 structures' first floors would potentially be inundated under the 2070 intermediate RSLR conditions (Figure 2-6). One or a series of catastrophic hurricane/tropical storm surge events would result in severe negative impacts to residents and cause significant damage to structures.

In modeling the future without-project conditions it was determined that there are significant damages starting at the 4 percent (25 yr) Annual Chance Exceedance Event (ACE) (Table 2-6). As the RSLR increases in the future, the extent of the storm surge extends further west into the study area (Figure 2-7 and Figure 2-8) causing additional damages. The total equivalent annual damages (EAD) without project damages during the period of analysis; 2020 to 2070; based on 2012 prices were approximately \$190 Million. Additional information on the without-project condition damages by specific economic reaches can be found in Appendix D within Table 17.

Table 2-6: Damages by Probability Event in 2020 and 2070 Intermediate RSLR
Residential, Non-Residential, Mobile Homes and Industrial
Existing and Future Without-Project Conditions
(Damages in Millions using 2012 Price Levels)

Annual Chance Exceedance Event	Residential	Non-Residential	Mobile Home	IND	Total
Base year 2020					
0.99 (1 yr)	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
0.20 (5 yr)	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
0.10 (10 yr)	\$0.81	\$1.32	\$0.05	\$0.00	\$2.17
0.04 (25 yr)	\$45.69	\$17.62	\$0.45	\$0.00	\$63.76
0.02 (50 yr)	\$492.04	\$112.85	\$3.74	\$0.01	\$608.65
0.01 (100 yr)	\$1,060.30	\$177.28	\$6.77	\$0.34	\$1,244.69
0.005 (200 yr)	\$1,428.44	\$402.94	\$11.24	\$0.69	\$1,843.30
0.002 (500 yr)	\$1,634.42	\$526.76	\$13.30	\$0.88	\$2,175.36
Future year 2070 Intermediate RSLR					
0.99 (1 yr)	\$0.09	\$0.04	\$0.00	\$0.00	\$0.13
0.20 (5 yr)	\$9.02	\$1.03	\$0.15	\$0.00	\$10.20
0.10 (10 yr)	\$154.13	\$59.33	\$1.50	\$0.13	\$215.09
0.04 (25 yr)	\$472.49	\$117.00	\$3.75	\$0.59	\$593.82
0.02 (50 yr)	\$1,741.94	\$642.69	\$15.15	\$1.73	\$2,401.51
0.01 (100 yr)	\$2,966.93	\$1,492.51	\$21.19	\$1.83	\$4,482.45
0.005 (200 yr)	\$3,687.30	\$1,766.87	\$24.87	\$1.83	\$5,480.88
0.002 (500 yr)	\$4,059.89	\$2,067.55	\$28.04	\$1.83	\$6,157.31

Additionally, residents in these communities could potentially incur higher insurance premiums offered by the National Flood Insurance Program (NFIP) should flood insurance rate maps (FIRM) be updated to reflect an increase in storm damage risk over time.

Direct and Indirect Impacts: The No Action Alternative would have no direct impacts. Indirect impacts would include a potential for permanent displacement of population as residents relocate to areas with less risk.



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

Historic and Existing Conditions

Table 2-7 shows the growth of non-farm employment in the three-parish-wide area. Increase in employment is likely the result of the influx of population and businesses after Hurricane Katrina (2005). Leading employment sectors include education, health care and social assistance, manufacturing, and retail. Approximately 1,900 non-residential structures are in the area including: petroleum services and river services companies, Zapp's Potato Chip Factory and the Marathon refinery. Approximately 10 percent of the area (23,800 acres) is devoted to agriculture, and about half of these acres are sugar cane crops. This percentage differs from land use percentages described in Table 2-10, which indicates only 543 acres are in agriculture. This apparent discrepancy is because the data was developed for land loss comparisons in the LCA (2004) study; land uses in over 40 percent of the study area were not included.

Table 2-7: Historical parish-wide non-farm employment (in 1000s). (Moody's 2013)

Parish	1970	1980	1990	2000	2010
St. Charles	9.0	18.1	18.5	20.1	24.3
St. John the Baptist	5.4	9.8	9.4	7.6	8.1
St. James	4.2	9.4	11.0	13.4	15.0
Total	18.5	37.2	39.0	41.1	47.4

Future Without-Project Conditions (No Action Alternative)

Growth in employment, business and industrial activity is expected to follow economic trends in the local, regional, and national economies. An additional 22,790 jobs are projected by the year 2080. However, without flood risk management alternatives, the stability of employment, business and industrial activity could be adversely affected. One or more catastrophic hurricane/tropical storm surge events could result in severe negative impacts to employment and business activity and cause significant damage to non-residential structures. Additionally, business owners in these communities could potentially incur higher flood insurance premiums should the FIRMs be updated to reflect an increase in flood risk over time.

Direct and Indirect Impacts: The No Action Alternative would have no direct impacts. Indirect impacts would include a higher potential for temporary interruption or permanent displacement of employment, business, and industrial activity as businesses temporarily or permanently relocate to areas with less storm damage risk.

2.3.3 Public Facilities and Services

Historic and Existing Conditions

Public facilities and services have historically grown to meet population demands. The area includes a mixture of community centers, schools, hospitals, police, and fire protection. An airport, technical college, and facilities associated with the Port of South Louisiana are located in the area. During the threat of hurricanes and severe storms public buildings are occasionally used for shelter. A total of 402 public and quasi-public buildings were inventoried to calculate damages in the three-parish area in 2012.

Future Without-Project Conditions (No Action Alternative)

Public facilities and services are expected to grow with the needs of the population and would follow growth trends. In addition to the 402 public and quasi-public buildings, an additional 165 such facilities are projected by 2070. These facilities would be more susceptible to damages resulting from hurricane/tropical storm surge events. The increased risk of damage to public facilities and the resulting temporary and/or permanent relocation of these facilities would have a negative impact on services.

Direct and Indirect Impacts: There would be no direct impacts. Indirect impacts would include a greater potential for permanent displacement of public facilities and services due to hurricane/tropical storm surge events.



2.3.4 Transportation

Historic and Existing Conditions

Transportation infrastructure includes major roads and navigable waterways that have developed historically to meet the needs of the public. I-10, an east-west route connecting New Orleans and Baton Rouge, crosses the northern part of the area and is a primary hurricane evacuation route. US-61, another evacuation route through the project area, is located south of I-10 and is the northern boundary of the local industrial sector in the area. Most of I-10 and US-61 are either just below or just above the 100-year floodplain. Other major highways in the project area include Interstate 55 (I-55), which runs north-south and intersects I-10 in the northeastern portion of Laplace; U.S. Highway 44 (US-44), which is located in the southern portion of the project area and runs parallel to the Mississippi River; and U.S. Highway 51 (US-51), which runs north-south through Laplace and parallels I-55.

Other transportation modes in the area include water transport along the Mississippi River via vessels and barges, rail, and aviation via the St. John the Baptist Parish airport. Of the three area railroads, two are owned by Canadian National Railroad and one is owned by Kansas City Southern Railroad.

During Hurricanes Ike and Isaac portions of US-61, I-10, and the I-10/I-55 interchange were inundated by a combination of storm surge and rainfall (See Table 2-8 identifying reaches that flooded during Hurricane Isaac). This interfered with emergency service access and prevented local and regional residents from returning to their primary residence. This delay in re-population equates to higher emergency costs during storm events, due to the longer time periods required for sheltering residents until the area is made safe to return. There is also the added travel time and cost for taking alternative routes during re-population following tropical storm events.

Travel from Baton Rouge (BR) to New Orleans (NOLA) typically takes approximately 1.5 hours without traffic delays. If access routes are congested this extends to two hours (Table 2-9). Most of the alternative routes are on local roads. Traffic congestion on local roads could extend travel time.

Table 2-8: Mean height (elevation) of major hurricane evacuation routes.

Highway Reach	Mean Height (ft. NAVD 88)	Length (miles)	Type
I-10 Laplace Area	5.42	3.76	4 lanes divided
I-10 Reserve Canal Underpass to Mississippi Bayou	7.58	0.88	4 lanes divided
I-10 Mississippi Bayou to Hope Canal	7.91	3.39	4 lanes divided
I-10 Hope Canal to Gramercy Exit	8.28	2.30	4 lanes divided
I-10 Gramercy to Blind River	7.66	1.80	4 lanes divided
I-10 Blind River to Bayou Conway	7.64	2.53	4 lanes divided
US-61 Last Reach	5.65	0.65	4 lanes divided
US-61 Last Reach to Pipeline	5.78	1.55	4 lanes divided
US-61 Pipeline to Boatclub	5.72	1.84	4 lanes divided
US-61 Boatclub to Canal	6.14	0.98	4 lanes divided
US-61 Low area	5.51	1.12	4 lanes divided
US-61 Low area to Gramercy	6.15	0.21	4 lanes divided
US-61 Gramercy Exit	6.28	3.21	2 lanes

*Reaches shown in **bold** flooded during Hurricane Isaac.

Future Without-Project Conditions (No Action Alternative)

Transportation infrastructure would be more susceptible to damage from hurricane/tropical storm surge events. There would be an increased risk that access to infrastructure would be reduced due to storm surge.

Direct and Indirect Impacts: With no action there would be no direct impacts. Indirect impacts would include a higher potential for damages to transportation infrastructure in the area as a result of hurricane/tropical



storm surge events, coupled with the interruption of use by emergency responders and residents.

Table 2-9: Potential transportation impacts.

Scenario	Travel Distance BR to NOLA	Average Travel Time* BR to NOLA	Added Travel Distance from Scenario # 1	Average Added Travel Time from Scenario # 1	Comments
Scenario #1: No Impacts	83.90 miles	1.43 hours	-	-	-
No access to I-10	96.30 miles	1.70 hours	12.40 miles	16 mins	No exit to Laplace Area
I-10 impacted between Laplace and Belle Terre exits	87.50 miles	1.60 hours	3.60 miles	10 mins	4 lane local highway ~ 13 stop lights
I-10 impacted between Gramercy /Lutcher and Belle Terre exits	88.60 miles	1.67 hours	4.70 miles	14 mins	4 lane local highway ~ 19 stop lights
I-10 impacted between Sorrento and Gramercy/Lutcher exits	89.90 miles	1.63 hours	6.00 miles	12 mins	4 lane local highway ~ 20 stop lights
I-10 and US-61 impacted thru Maurepas Swamp	91.70 miles	1.83 hours	7.80 miles	24 mins	2 lane local roadway >20 stop lights

*BR = Baton Rouge. NOLA = New Orleans; travel times are based on number of lanes, distances and speed limits. Road conditions (e.g. traffic density) were not factored into calculations.

2.3.5 Community and Regional Growth

Historic and Existing Conditions

Community and regional growth are influenced by national trends, but depend significantly upon local attributes. Table 2-10 shows per capita income growth since 2000 in the area. Growth has been aided by the flood risk reduction provided by the MR&T levee system.

Table 2-10: Parish-wide per capita income. (U.S. Census 2013)

Parish	1990	2000	2010	2012
St. Charles	\$17,297	\$24,228	\$32,599	\$34,992
St. John the Baptist	\$14,231	\$18,327	\$29,663	\$31,492
St. James	\$14,440	\$19,720	\$29,351	\$31,349

Future Without-Project Conditions (No Action Alternative)

Risk reduction from hurricane/tropical storm surges would not be provided for communities in the project area. Property owners in these communities could potentially incur higher flood insurance premiums should FIRMs be updated to reflect an increase over time in the risk of storm surge damage. While community and regional growth is expected to follow national and local economic trends, increased insurance premiums associated with damage resulting from hurricane/tropical storm surge events could have a negative impact on community and regional growth relative to areas with lower flood insurance premiums.



Direct and Indirect Impacts: With no action there would be no direct impact. Indirect impacts under the No Action Alternative would include a higher potential for less community and regional growth due to increasing risk of damage from hurricane/tropical storm surge events.

2.3.6 Tax Revenues and Property Values

Historic and Existing Conditions

Damages from hurricane/tropical storm surge events can significantly impact businesses, industries, farms, property values, local employment and income, which then negatively impacts the tax base created by these activities. Reduction in the risk of damages from hurricane/tropical storm surge events can have a commensurate positive impact on tax revenues and property values. Conversely, the lack of reduction of risk of damages from hurricane/tropical storm surge events in areas highly susceptible to these damages could limit the growth of tax revenues and property values.

Residential (19,958) and non-residential (1,882) structures were inventoried to calculate potential storm-related damages. The median value of owner-occupied housing units are \$175,200 in St. Charles Parish, \$114,000 in St. James Parish, and \$148,800 in St. John the Baptist Parish. Future losses to these properties will tend to reduce tax revenues.

Future Without-Project Conditions (No Action Alternative)

Growth in tax revenues and property values are expected to follow local, regional and national economic trends. However, without storm surge damage risk reduction measures, the economic stability, tax revenues and property values could be adversely affected. Community residents could incur higher flood insurance premiums should FIRMs be updated to reflect an increase over time in the risk of damage from hurricane/tropical storm surge events. Higher insurance premiums could negatively affect property values.

Direct and Indirect Impacts: There would be no direct impacts under the No Action Alternative. Indirect impacts could include lower tax revenues as property values decline due to high risk of damage from storm surge events and residents and businesses relocate to lower-risk areas.

2.3.7 Community Cohesion

Historic and Existing Conditions

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 project area, which was originally settled in the 1700s, is comprised of communities with established public and social institutions including places of worship, schools, and community interaction.

The construction of water resource projects can impact community cohesion in different ways. For example, prior to the Great Flood of 1927, the area was subject to periodic riverine flood damage events from the Mississippi River. However, with the construction of the MR&T levee system, the risk of inundation from the river has been greatly reduced and the community cohesion of the area was positively impacted.

The area is highly susceptible to storm surge damage. In August 2012, communities in St. John the Baptist Parish, including the town of Laplace, were inundated by the storm surge from Hurricane Isaac. The study area does not currently have a storm surge damage risk reduction system in place. Hence, following Hurricane Isaac, local populations were temporarily forced to relocate thereby disrupting community cohesion.

Future Without-Project Conditions (No Action Alternative)

The area will become more susceptible to damage caused by hurricane/tropical storm surge events that is projected to increase over the period of analysis. The increased risk of damage to residential and non-residential structures and the resulting temporary and/or permanent relocation of populations would negatively affect the community cohesion in many communities.



Direct and Indirect Impacts: There would be no direct impacts. Indirect impacts would include a higher potential for a reduction in community cohesion if the civic infrastructure in the area continues to be damaged as a result of hurricane/tropical storm surge events. Community cohesion may be reduced if residents and businesses relocate to lower-risk areas.

2.3.8 Environmental Justice

Executive Order (EO) 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, was signed by President Clinton in 1994. It directs federal agencies, “to the greatest extent practicable and permitted by law, to make achieving environmental justice (EJ) part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions...” As directed, the USACE has developed an analysis methodology to evaluate EJ areas affected by water resource projects that are consistent with Environmental Protection Agency (EPA) recommendations, USACE policy, and Executive Order 12898.

For a full picture of the potential EJ related impacts included in this analysis, the overall Socioeconomics Section and Other Social Effects (OSE) appendices should be viewed. To assist agencies in identifying potential EJ communities, the EPA recommends using two types of analysis to assess population demographics: (1) the meaningfully greater analysis; and (2) the general 50 percent analysis. To avoid diluting the affected population in large areas, assessment of the meaningfully greater population is generally the recommended approach. However, because of the type of project proposed, the presence of existing levee systems in the project vicinity, the low population density in the western portion of the study area, and the results of the overall socioeconomic analysis, the decision was made to utilize the 50 percent analysis. Selection of this assessment methodology has been coordinated with EPA.

A potential disproportionate impact may occur when the percent minority and/or low-income population in an area is greater than those in the reference community, which in this instance has been defined as the 3-parish area of St. John the Baptist, St. James and St. Charles. To assess for potential disproportionate impacts, the team identified low-income and minority populations within the study area using 2010 U.S. Census records (parish and city/town), aerial photographs, EPA mapping (EJView), and poverty thresholds as described by the U.S. Department of Health and Human Services (HHS), which currently includes areas above 20 percent of a population. Overall parish figures were used, however, because a significant portion of the study area is located on the east bank of the Mississippi River, the decision was made, in consultation with EPA, to also examine census tracts and block groups in order to obtain a more accurate estimate of the demographics located on the east bank of the Mississippi River to further assist in identifying potential EJ communities in the project area.

Following the identification of potential communities of concern, additional community outreach activities including canvassing neighborhoods (door-to-door contact), posting informational flyers in public places such as schools and libraries; and conducting small neighborhood meetings were utilized. These public involvement strategies are consistent with EPA recommendations, Corps policy, and EO 12898.

Historic and Existing Conditions:

The study area has historically been utilized as farm land, and later as residential, commercial, and industrial land with much of St. James Parish remaining largely underdeveloped. Tables 2-11, 2-12 and 2-13, which are broken down by parishes, identified the percent minority and low-income population by community that could potentially be impacted by the proposed action. Analysis of the tabled results is presented below.



Table 2-11: St. James Parish communities percent minority and low income.

	St. James Parish*	Gramercy	Lutcher	Grand Point	Convent
Total Population	22,102	3,613	3,559	2,473	711
% Minority	53%	49%	54%	27%	69%
% Low Income	15%	13%	21%	8%	10%
Census Tract	N/A	N/A	LA093040200	N/A	N/A
Census Block Group(s)	N/A	LA0930401001	LA0930402001 LA0930402002 LA0930402003 LA0930402004	N/A	N/A

*Includes total parish population demographics.

Table 2-12: St. Charles Parish communities percent minority and low income.

	St. Charles Parish*	Montz
Total Population	52,880	1,918
% Minority	35%	22%
% Low Income	13%	0%
Census Tract	N/A	N/A
Census Block Group(s)	N/A	N/A

*Includes total parish percent minority and low income.

Table 2-13: St. John the Baptist Parish communities percent minority and low income.

	St. John the Baptist Parish*	Laplace	Reserve	Garyville
Total Population	45,824	29,872	9,766	2,811
% Minority	61%	59%	65%	54%
% Low Income	15%	9%	20%	8%
Census Tract	N/A	LA095070400 LA095070500 LA09507900 LA095071000	LA095070500 LA095070700 LA095070800	LA095070600
Census Block Group(s)	N/A	LA0950703003 LA0950709001	LA0950705001 LA0950707001 LA0950707002 LA0950707003 LA0950707005 LA0950708001 LA0950708002	LA0950706001 LA0950706002

*Includes total parish percent minority and income.

Based on the above data, St. James and St. John the Baptist Parishes have majority minority populations. To avoid artificially diluting the results of the analysis and to further identify vulnerable groups that may exist within these parishes at a smaller level, the census tracts and block groups were assessed. The communities of Lutcher and Convent (in St. James Parish), and Reserve, Laplace and Garyville (in St. John the Baptist Parish) were identified as having majority minority populations, and therefore are identified as areas of potential EJ concerns. Specific EJ communities that could be affected under with-project conditions are discussed in Section 5.2.2.8.



No-Action Alternative (FWOP condition) Direct and Indirect Impacts

Direct impacts would be those associated with existing and future rain/flood induced damages to communities and property in low lying areas caused by hurricane and tropical storm surge events. Indirect impacts include continued degradation of wetlands between Lakes Maurepas and Pontchartrain and communities on the east bank of the Mississippi River. These wetlands currently provide a buffer from hurricane and tropical storm surge risk for minority and low-income residents in the area. Under the no action alternative, residents would continue to incur costs associated with damages to structures, utilities, infrastructure, and the local economy following major storm events.

People living and working in the area, irrespective of race or income, would be impacted by storm surge events in the future without project condition. There could be disproportionate impacts on low-income residents in a mandatory evacuation due to the lack of financial resources. However, Federal, state, parish and local programs are available to assist all residents in the evacuation and rebuilding process after storms.

2.4 Natural Environment

2.4.1 Soils, Water Bottoms and Prime and Unique Farmlands

Historic and Existing Conditions: Soils are hydric and non-hydric. Most of the undeveloped area is forested wetlands/swamp habitat comprised of the Barbary-Sharkey soil association. The Convent-Silty alluvial land association is found immediately along the Mississippi River. The Commerce-Sharkey soil association is primarily found on agricultural and undeveloped lands. Convent-Commerce-Sharkey soil association and Convent-Barbary soil association are typically found in undeveloped and rural/suburban/urban developed areas, respectively (USDA 2013).

Water bottoms include Lakes Maurepas and Pontchartrain; the Mississippi and Blind Rivers; Mississippi Bayou and Bayou Fusil; parish canals, such as the Reserve Relief Canal, Hope Canal, and Godchaux Canal; and shallow swamp, ponds and sloughs. Lakes Pontchartrain and Maurepas, and the Mississippi River are state water bottoms. Because of the typical stagnant swamp conditions, the loss of sediment inputs, reduced primary productivity, and limited consolidation, net phosphorus and organic matter export from the swamp is likely low. Therefore, support for dependent systems downstream (e.g., Lake Maurepas) is likely limited and substantially reduced from historic levels (USACE 2010b).

Historically, forested wetlands, swamps and associated water bottoms were typically subjected to flooding and drying events. Water bottoms provided an outwelling of organic matter (Odum 1980) and a sink for phosphorus and nitrogen that supported the health of downstream ecosystems in Lake Maurepas (Lane et al. 2003). However, cessation of Mississippi River floods has limited the capacity of these functions and services.

Approximately 44,672 acres, or 24.2 percent, of the study area meet the soil requirements for prime farmland (NRCS 2013). Not all of these soils are presently utilized for agricultural purposes. In addition, these acres and percentage differ from agricultural land use acres and percentage described in Table 2-10, which indicates only 543 acres are in agriculture. This apparent discrepancy is because Table 2-10 was developed for land loss comparisons in the LCA (2004) study. Nevertheless, this is the only readily available land use information for the area. As such the analysis does not include land uses in over 40 percent of the study area, as indicated in Table 2-10. Unique farmland is not located in the study area. Prime farmland is limited to natural ridge tops and consists of the following soil associations: Cancienne silt loam, Cancienne silty clay loam, Carville silt loam, Gramercy silty clay, Schriever clay, and Vacherie very fine sandy loam. Not all of prime farmlands in the study area are used for agriculture. Crops include mainly common bermudagrass, improved bermudagrass, soybeans, wheat, sugar cane, bahiagrass, and corn. Hydrologic conditions and regulations may prevent some of these areas from functioning to prime capacity. Coordination with the Natural Resources Conservation Service regarding prime farmlands has been completed (Appendix A).



The Bonnet Carré Spillway has been used as a Government Furnished borrow source since 1985. The area has been disturbed by sand haulers maintaining the Spillway, and borrow pits are scattered throughout the area. Use of the Bonnet Carré potential borrow site is documented in the 2007 “Final Phase I Environmental Site Assessment, Bonnet Carré Borrow Area, North of Airline Highway, St. Charles Parish, Louisiana.”

Soils in the nonstructural plan project area consist primarily of Cancienne (CmA and CnA), Gramercy (GrA), and Schriever (SkA) types. These types are classified as prime farmlands. The only identified water bottom in the nonstructural project areas is Sportsman Pond (17.2 acres) at the northwest corner of Polder 1 (Gramercy Berm).

Future Without-Project Conditions (No Action Alternative)

Direct and Indirect Impacts: There would be no direct impacts. Existing conditions and trajectories of change to area water bottoms, soils and prime and unique farmlands would persist. The area and the known proposed borrow site would continue to experience changes in RSLR that could potentially affect the spatial limits, depths and frequency of inundation to existing wet (hydric) and non-wet (non-hydric) soils in low lying areas. Existing non-hydric soils could be converted to hydric type soils, and existing hydric soils could become permanent water bottoms as swamp habitats are converted to open water. Portions of the area and the Maurepas Swamp could be permanently inundated under both the intermediate and high RSLR scenarios (Table 2-2). Prime farmlands could be converted to other uses.

Under both the intermediate and high RSLR scenarios (Table 2-2), soils would likely remain nutrient poor, exhibit atypically low bulk densities for forested wetlands due to insufficient sediment content, and exhibit a corresponding loss in soil bearing capacity. There would be continued degradation and conversion of forested wetland and swamp habitats to marsh and open water. Saltwater intrusion from Lakes Maurepas and Pontchartrain during storms would continue. Degradation and conversion of existing swamp habitats (hydric soils) to water bottoms would likely continue resulting in less accretion and continued subsidence. Decomposition of swamp vegetation would initially increase the availability of nutrients and detritus. However, the continued conversion of fresh swamp to marsh and eventually to shallow open water would ultimately decrease available nutrients and detritus for the Maurepas Swamp system.

2.4.2 Vegetation Resources

Historic and Existing Conditions

The area includes forested wetlands, swamps, estuarine emergent wetlands, and submerged aquatic vegetation (SAV). Land cover and habitat analysis is displayed in Figure 2-10. These quantities are based upon the USGS land loss data analysis from the LCA Study (2004) and do not represent land cover or habitats for the entire study area. Hence, the 543 acres (0.29 percent) of agricultural/pasture grassland is not representative of the entire study area. Wetlands in the area provide protection from wave action, erosion, and storm damage and offer various consumptive and non-consumptive recreational opportunities.

Vast virgin stands of bald cypress-tupelo swamp habitat once stretched from the bottomlands of north Louisiana to the Gulf of Mexico (Conner and Day 1976). The Maurepas Swamp was vegetated by an expanse of old growth, freshwater forested swamp that extended as far as 26 miles north from the Mississippi River to the Baton Rouge-Denham Springs fault line. The area was subjected to extensive logging through the 1930s. Remnant logging railroad embankments and canal systems used to extract the harvested timber has resulted in increased land loss. Consequently, existing forested wetlands and swamp habitats in the area are rapidly converting to fresh marsh and shallow open water habitats due to impounding, saltwater intrusion, and a lack of nutrient and sediment inputs. This habitat shift has caused a significant loss of wetland functions, including loss of forested wetlands/swamp habitats for wildlife and aquatic species, recreational opportunities, aesthetics, and storm surge protection. To address these forested wetland losses the CBRD and the Maurepas Swamp diversion studies were authorized for study or construction. The State of Louisiana has made restoration of the most severely degraded portions of the swamp a priority by including it in their master plan.



Forested wetlands/swamp and BLH typical dominant and co-dominant species include bald cypress, water tupelo, green ash, swamp red maple, blackgum, diamond oak, black willow, southern wax myrtle buttonbush and Chinese tallow. BLH species in the project area include: swamp red maple, green ash, swamp tupelo, and various oak species. Swamp red maple and green ash typically comprise the sub-dominant mid-story (Beyer et al. 1906, Conner and Day 1976). Scrub species, including black willow, wax myrtle, and buttonbush are sporadically present in areas with diminished canopy cover. Detailed descriptions of common area plants are presented in LCA (USACE 2004, 2010a and 2010b).

SAV communities were historically dominated by native species such as fanwort, coontail, small pondweed, bladderwort, water nymph, widgeon grass, and wild celery. Native communities are largely confined to areas of higher flows, including natural waterways and natural cuts into the swamp interior. Shallow water habitats with insufficient flow may be choked with floating vegetation, greatly limiting light penetration into the water column. SAV are an important food source and habitat for both aquatic organisms and terrestrial wildlife. SAV provides structure and habitat for many invertebrates that are food for various life stages of fish. SAV also provides food for waterfowl and feeding habitat for fish-eating birds such as herons and egrets.

Invasive plants include water hyacinth, alligatorweed, hydrilla, common salvinia, giant salvinia, Chinese tallow, and Chinese privet. 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. This impacts plankton biomass production. Alligatorweed, Chinese tallow and Chinese privet are of minimal wildlife value and can proliferate until nearly monocultural stands exist, limiting food available for wildlife.

The Louisiana Natural Heritage Program database identifies the following state-listed threatened and endangered species and rare, unique or imperiled vegetative communities in the area: cypress-tupelo swamp rare or unique habitats, swamp milkweed, floating antler fern and rooted spike-rush (LDWF 2013).

The vegetation resource of the nonstructural project area is characterized primarily as grassy vegetated back yards of property and residential landowners or agricultural fields bordering swamp habitat. There are also some areas of BLH and swamp.

Future Without-Project Conditions (No Action Alternative)

Direct and Indirect Impacts: There would be no direct impacts. Existing conditions and trajectories of ecological change to area vegetation would persist. Undeveloped vegetated lands, including wetlands, would continue to be lost to development. Wetlands along major highways would continue to be lost to development as seen along Belle Terre Boulevard in Laplace, and areas north of US-61. Forested wetlands/swamp, BLH and associated sub-canopy species would continue to be subjected to saltwater intrusion and subsidence. Forested wetlands/swamps would continue to convert to marsh and open water (USACE 2010a and 2010b).

Much of the area, as well as portions of the Maurepas Swamp could be permanently inundated under the intermediate and high RSLR scenarios likely further changing existing habitats. The area would continue to be subjected to increases in RSLR which could increase the geographic extent of saltwater intrusion, potentially convert vast areas of existing forested wetlands and swamp habitats to marsh and eventually open water. There could also be a shift from fresh water dominant species to species that can tolerate higher salinity.

Degradation and loss of forested wetland and swamp habitats will accelerate the decline in interdependent processes of plant production and habitats used by various biota necessary for a stable ecosystem. The moderation of storm surge provided by cypress-tupelo swamp and the contribution of vertical accretion to offset subsidence would be lost.



2.4.3 Wildlife Resources

Historic and Existing Conditions: The status, functions of interest, trends, and projections from 1985 through 2050 for the Pontchartrain basin fish and wildlife can be found in Appendix C Section 7 of *Coast 2050: Toward a Sustainable Coastal Louisiana* (http://www.coast2050.gov/reports/app_c.pdf).

Birds: Area wetlands have historically supported an abundance of neotropical and other migratory and non-migratory birds. Diving ducks, seabirds, rails, coots, and gallinules have preferred the open water habitats of Lake Maurepas and the West Manchac Land Bridge, while wading birds typically utilize fresh swamp habitats in the area. The area also supports the bald eagle and colonial nesting waterbird (e.g., herons, egrets, ibis, night-herons, and roseate spoonbills) rookeries. The bald eagle was delisted (2007) as a federally threatened and endangered species for most of the United States; however, it is protected under the Bald and Golden Eagle Protection Act, and the Migratory Bird Treaty Act. Habitats suitable for use by the bald eagle are present in St. Charles, St. John the Baptist and St. James Parishes, and occurrences of the bald eagle have been recorded there. The bald eagle is known to nest and forage in the Maurepas WMA (personal communication, Ms. Brigitte Firmin, USFWS on May 10, 2013). According to USFWS maps depicting active and inactive eagle nests, all active nests are beyond 1,500 feet from the proposed project construction sites. The USFWS considers this sufficient distance not to be of concern for potential impacts by construction activities. The area is also known to support colonial nesting waterbirds (e.g., herons, egrets, and others). The U.S. Fish and Wildlife Service (USFWS) (personal communication, USFWS January 9, 2009) provided recommendations for minimizing disturbance to colonies containing nesting wading birds during construction. The USFWS recommended that on-site contract personnel be informed of the need to identify colonial nesting birds and their nests, and to avoid affecting them during the breeding season. The recommendations will be followed to the maximum extent practicable. Since 1985, most bird species and species groups in the area have exhibited either increasing or stable populations in the area.

Area forested wetlands, swamp, bottomland hardwood (BLH), and other wetlands provide birds and wildlife with shelter, nesting, feeding, roosting, cover, nursery, and other life requirements. Wetlands provide neotropical migrants with essential stopover habitat on annual migrations (Stouffer and Zoller 2004, Zoller 2004). The greatest threat is habitat loss (American Bird Conservancy 2009). Bottomland hardwood forests provide critical bird breeding habitat (Wekeley and Roberts 1996).

Mammals: Since 1985, furbearer populations have typically remained stable across the Upper Pontchartrain Basin (LCWCRTF & WCRA 1999). Rabbits have experienced declines in the Amite/Blind and West Manchac Land Bridge mapping units, as have squirrels in the West Manchac Land Bridge mapping unit. However, squirrels have remained steady throughout the remainder of the area, whereas deer populations have increased. The West Indian manatee, federally-listed as an endangered species, is known to occur or occasionally enter the area.

Reptiles: Due to the ecological and economic importance of the American alligator, historical and current figures on population numbers are available. In contrast, data on other reptiles in the area is unavailable. LDWF survey data from 1996 to 2000 shows alligator nest densities in the area are classified as medium (approximately 1 nest per 250 acres). Alligator spotlight surveys in the Maurepas Swamp from June to August 2006 found that alligator density, and especially the density of large alligators, appeared to increase with proximity to Lake Maurepas (Fox et al. 2007). There are at least four lizard species, 16 snake species, and 9 turtle species documented in bald cypress-tupelo swamps of southern Louisiana (Dundee and Rossman 1989). The lack of recorded evidence obscures accurate historic and existing conditions for other reptile species that are known or are likely to have inhabited the Maurepas Swamp.

Amphibians: The bald cypress-tupelo ecosystem supports a wide variety of frogs, toads, and salamanders. Abundant water, shelter, and food resources enable several species to thrive. At least 13 frog and toad species and six salamander species inhabit this community type in south Louisiana. Amphibians are often exceptional indicators of wetland ecosystem health. Limited information exists on historic and existing population trends



of area amphibians. In a study on similar habitat located in close to the area, Tinkle (1954) observed numerous amphibian species over the course of a year. Literature accounts and museum specimens suggest the presence of pig frogs (Dundee and Rossman 1989) in Ascension and St. James parishes.

Invasive Wildlife Species: Prior to the introduction of nutria to Louisiana in 1930s (USGS 2000, Baroch et al. 2002), no invasive wildlife species were known to be present. A substantial population increase of nutria is attributed to the decline in the price of pelts in 1989 (USGS 2000, Baroch et al. 2002). Areas of extensive nutria damage, or “eat outs,” alter the composition and habitat type of wetland communities (USGS, 2000). Aerial surveys estimated 80,000 acres of marsh in the State of Louisiana were damaged by nutria (Keddy et al. 2007). Throughout the Maurepas Swamp, nutria eat seedling cypress and other forested wetland and swamp tree species preventing regeneration (USACE 2010a).

The Louisiana Natural Heritage Program database identifies the following state-listed threatened and endangered species, the bald eagle, alligator snapping turtles, osprey, and manatee, (LDWF 2013).

Future Without-Project Conditions (No Action Alternative)

Direct and Indirect Impacts: There would be no direct impacts. Existing conditions and trajectories of ecological change to wildlife in the area would persist. Continued human encroachment and development would result in loss of existing wildlife wetland habitats. The area would be subjected to increases in RSLR which could increase saltwater intrusion and exacerbate ongoing conversion of existing forested wetland and swamp habitats to marsh and open water (USACE 2010a, USACE 2010b). The area and the Maurepas Swamp could be inundated to some unknown extent, under both the intermediate and high RSLR scenarios, thereby potentially reducing available forested wetland and swamp wildlife habitat. Migratory neotropical avian species currently utilize the area as stopover habitat. As forested wetlands and swamp habitats are lost, there would be a corresponding reduction in overall species diversity and abundance. Most mammal, amphibian and reptile species would be required to relocate to more suitable swamp habitats. There could be an increase in the population and distribution of nutria due to the conversion of swamp into open water and marsh which are the preferred habitats by nutria.

2.4.4 Aquatic and Fisheries Resources

Historic and Existing Conditions: Plankton and benthic organisms serve as the lowest food resource level for many species of fish and shellfish. Plankton can often indicate benthic, nutrient, and water quality health (Stone et al. 1980). Like plankton, benthic invertebrate communities are good indicators of ecological health. Because many benthic organisms are sessile or have limited mobility, they cannot move away from environmental stressors. Therefore community profiles reveal information about environmental health (Porrier et al. 2009). There is little data available on Lake Maurepas and the upstream Maurepas Swamp plankton communities. Data for Lake Maurepas suggests the dominance of Anabena, dinoflagellates, diatoms, and cyanobacteria with occasional strong presence of chlorophytes (Atilla et al. 2007).

Benthic macroinvertebrates tend to dominate deepwater swamp invertebrate communities. Characteristic species include crayfish, clams, oligochaete worms, snails, freshwater shrimp, midges, amphipods, and various immature insects (Mitsch and Gosselink 1993). One of the main functions of a benthic community is secondary production, the conversion of plant material by benthic detritivores and herbivores to animal tissue, thereby forming major links in the aquatic food web between plants and predators. Compared to other habitat types, bald cypress-tupelo wetlands may support higher invertebrate densities.

Limited data exists on area benthic communities. Species present are likely typical of deepwater forested wetlands and slow-flowing rivers in the region. However, the increased duration of inundation and the low flow and exchange due to impoundment have promoted a system characterized by low DO levels and limited drawdown of water levels to below surface elevations. These conditions likely have resulted in reduced diversity of benthic organisms. Species composition has likely shifted towards species more tolerant of low DO levels, such as oligochaetes and midges. Reduced soil bulk densities and changes in average particle size,



texture, and organic content due to low sediment input may further influence habitat suitability and species presence (Day et al. 1989). Within Blind River, woody debris introduced from the adjacent swamp may provide suitable substrate for invertebrates to colonize and thus support benthic community diversity.

The Maurepas Swamp benthic community is seasonally abundant. Typically, winter months have higher DO concentrations when water temperatures are cooler. Organisms found in winter include a variety of segmented and flatworms, snails, crustaceans, and insects. During summer, when lower DO is present, the benthic community is sparse. Air-breathing insects and crustaceans; a few tubificid oligochaetes and dipterans, which can tolerate lower oxygen conditions; and crawfish, especially burrowing crawfish, may be found. During periods when the swamp floor dries, these organisms survive through the resistance stages (eggs, cocoons, etc.) and repopulate the area when water returns to the swamp (Loden 1978).

Salinity strongly influences species composition of invertebrate communities. Higher abundance of benthic organisms has been associated with decreasing salinity from saline to freshwater sites in Louisiana (Philomena 1983). Invertebrate species vary in the range of salinity within which they can survive and their tolerance to fluxes (Day et al. 1989). The Maurepas Swamp, Blind River, and the bayous and canals in the area are primarily freshwater, but salinity intrusion can occur. Throughout the area higher salinity occurs during drought years (Shaffer et al. 2003). The relatively low salinity of these waters provides transitional habitat for freshwater fish and provides nursery and foraging habitat for marine fish and shellfish. Freshwater fish, such as largemouth bass, sunfish, catfish, and crappie are taken by recreational fishermen (LDWF 2009, Hastings 2001). Crawfish and crabs may be harvested from the swamp (Fox et al. 2007).

A survey from January 1976 to August 1977, (Watson et al. 1981) sampled fish species at six locations along Blind River from south of US-61 to Lake Maurepas. The 57 species of finfish collected included 12 estuarine, 43 freshwater, one catadromous and one anadromous species. Freshwater species were dominant both spatially and temporally. Finfish diversity appeared to be higher at the lower stretches of Blind River, below the Amite River Diversion Canal and closer to Lake Maurepas. Multiple studies have been conducted on diversion projects in the area. Data from these studies show an overall decrease in the number of taxa collected. However, different sampling gear and sample locations could explain the trends. Additionally, an overall a trend toward less freshwater species collected is evident (Fox et al. 2007).

Fox et al. (2007) sampled fish at 20 locations in the Maurepas Swamp. There were 26 taxa collected with a total of 1,425 individuals. Spotted gar and striped mullet were dominant species making up 76.5 percent of all fish. Physiochemical data was collected as well, study (Fox et al. 2007) ranged from 1.52 to 6.25, and species richness ranged from 2 to 12 species, indicating a very variable community. Lower diversity, evenness and richness were observed in the interior, in areas of low flow, low DO and low pH. Most of the species specific analyses were consistent with known habitat preferences. For example, spotted gar was negatively correlated with high surface DO levels. This species can breathe air, and it is usually found in hypoxic areas.

The areas available for aquatic and fisheries resources in the nonstructural project area are limited to the small drainage canals that transect the area. These canals have limited tidal influence and are dominated by fresh water species such as sunfish, bowfin, catfish, and crawfish when flooded.

The Louisiana Natural Heritage Program database identifies the following state-listed threatened and endangered species: paddlefish and manatee (LDWF 2013).

Future Without-Project Conditions (No Action Alternative)

Direct and Indirect Impacts: There would be no direct impacts. Existing conditions and trajectories of ecological change to aquatic and fisheries resources would persist. The area would be subjected to increases in RSLR which could increase saltwater intrusion and lead to increases in and the potential conversion of vast areas of forested wetlands and swamp habitats to marsh and open water. Much of the area, as well as the Maurepas Swamp could be permanently inundated under both the intermediate and high RSLR scenarios. There could



be a shift from fresh water dominate species to those species that can tolerate higher salinity.

2.4.5 Essential Fish Habitat (EFH)

Historic and Existing Conditions: Table 2-14 and Figure 2-9 show two EFH species and their likely occurrence in the area by life stage. Blind River and various bayous and canals in the Maurepas Swamp provide EFH, including nursery, foraging, and spawning and breeding grounds. Aquatic and wetland habitats in the area include estuarine emergent wetlands, submerged aquatic vegetation, mud substrates, and estuarine water column. These provide EFH for white shrimp and red drum. Waterbodies and wetlands provide nursery and foraging habitats for a variety of fish, some of which may serve as prey for other fish species designated as EFH species (e.g., mackerel, snapper, and grouper) and highly migratory fishes (e.g., billfish and sharks). The area also provides foraging and nursery habitat for economically important marine fishery resources including striped mullet, Atlantic croaker, blue crab, and Gulf menhaden. The area is important for Federal and state-managed species. It provides foraging and nursery areas for prey species (gulf menhaden and bay anchovy) (Penland et al. 2002) eaten by predators, such as sand seatrout, spotted seatrout, catfish and crappie (LDWF 2009, Hastings 2001), and highly migratory species.

Table 2-14: Essential Fish Habitat for life stages of species in Lake Pontchartrain.

Species	Life Stage (occurrence in project area)	Essential Fish Habitat Zone and Habitat Type
White Shrimp (<i>Litopenaeus setiferus</i>)	Adult (rare)	Near shore and offshore sand/shell, and soft bottoms.
	Juvenile (common to abundant)	Estuarine emergent marshes and soft bottoms.
Red Drum (<i>Sciaenops ocellatus</i>)	Adult (common to rare)	Estuarine SAV, soft bottoms, sand/shell and emergent marshes. Near shore pelagic and sand/shell, and hard bottom habitat (used for spawning. Offshore sand/shell and hard bottom).
	Juvenile (common to rare)	Estuarine SAV, soft bottoms and near shore sand/shell, and hard bottom.

(GMFMC 2004, NMFS 2013b, USACE 2008, NMFS 2009)

Future Without-Project Conditions (No Action Alternative)

Direct and Indirect Impacts: There would be no direct impacts. Existing conditions and trajectories of change to essential fish habitat would persist. The area and Maurepas Swamp could be inundated to some unknown extent, under the intermediate and high RSLR scenarios, thereby potentially increasing the extent of saltwater intrusion that could potentially convert existing EFH nursery swamp habitats to marsh and open water EFH.

2.4.6 Threatened and Endangered Species

Historic and Existing Conditions

A complete list of threatened and endangered species and critical habitats in the project area is presented in USACE (2010a) and (USACE 2010b). Two threatened and endangered species, the Gulf sturgeon (*Acipenser oxyrinchus desotoi*) and the West Indian manatee (*Trichechus manatus*), and one delisted species, the bald eagle (*Haliaeetus leucocephalus*), are known to occur or occasionally enter the area. There are no threatened or endangered plants in the area.

West Indian Manatee: Substantial food sources (submerged or floating aquatic vegetation) have not been observed in the area. Given the extensive areas of relatively undisturbed wetlands in the region and the paucity of food sources in the project area, it is considered unlikely for the manatee to frequent and utilize the inshore waters of Lake Maurepas and Pontchartrain as habitat, although manatees could pass through this area while transiting the lake.



Gulf Sturgeon. The area is not Gulf sturgeon critical habitat.

There are no threatened or endangered species known to occur within the nonstructural project areas. The delisted Bald eagle and colonial nesting waterbirds could potentially utilize the areas. However, it is unlikely that they would nest in these areas since these features are along the interface of urban land and forested wetlands.

Future Without-Project Conditions (No Action Alternative)

Direct and Indirect Impacts: There would be no direct impacts on threatened or endangered species, or their designated critical habitats, bald eagles or colonial nesting waterbirds. The Gulf sturgeon and the West Indian manatee, along with the bald eagle, would continue to occasionally enter the project area. The West Indian Manatee has been infrequently sighted near the project area. Continued conversion of forested wetlands and swamp habitat to marsh and open water would provide more favorable conditions for the Gulf Sturgeon and the West Indian Manatee, but would provide only foraging habit for the bald eagle and colonial nesting waterbirds. As forested wetlands and swamp habitats are lost, there would be a corresponding reduction in overall species diversity and abundance.

2.4.7 Cultural and Historic Resources

Historic and Existing Conditions: Eight cultural units are used to characterize the prehistoric cultural sequence in southeast Louisiana: Paleo-Indian (10000–8000 B.C.), Archaic (8000–1000 B.C.), Poverty Point (1700–500 B.C.), Tchefuncte (500 B.C.–A.D. 100), Marksville (A.D. 100–500), Baytown (A.D. 400–700), Coles Creek (A.D. 700–1200) and Mississippian/Plaquemine (A.D. 1200–1700). Historic perspectives generally cover the colonial period to approximately 1764, Acadian migration to the area, end of the Colonial period, the Antebellum period, the Civil War, late 19th century reconstruction, and the early 20th century.

Not all project areas have been adequately examined for cultural resources, especially along natural waterways. The area contains natural levee of the Mississippi River, where numerous historic cultural resources, such as plantation buildings, have been recorded. Although cultural resources surveys have crossed many portions of the project area, undiscovered cultural resources may still exist.

Plantation properties that overlap the area include 16AN31 (Monroe Plantation), 16SJB8 (Belle Point Plantation), 16SJB10 (Laplace Plantation), 16SJB12 (Sunnyside Plantation), 16SJ11 (Hester Plantation), 16SJ12 (St. Elmo Plantation), 16SJ20 (Wilton Plantation), 16SJ21 (Helvetia Plantation), 16SJ30 (Colomb Plantation), 16SJ34 (St. Rose Plantation), 16SJ49 (Rapidan Plantation), 16SJ37 (Welham Plantation). These often contain outbuildings or components to a plantation operation, and may cover several acres.

Less definable cultural resources within lands protected by the artificial Mississippi River Levee include 16SC54, 16SC79, 16SJB8, 16SJB66, 16SJ19, 16SJ29, 16SJ64. The site identified as 16SJ1 is a National Register of Historic Places (NRHP) prehistoric site located in agricultural lands, and 16SJ50 and 16SJ51 are additional prehistoric sites that may be contemporaneous and related to site 16SJ1. Further sites include 16SJ5, 16SJ7, 16SJ9, 16SJ15, 16SJ16, 16SJ18, and 16SJ57 that have been determined as ineligible for the NRHP.

Cultural sites on the Mississippi River batture includes 16SJ13, 16SJ31, 16SJ39, and sites 16SJ41 – 16SJ48 that are ineligible for the NRHP. Site 16SJ38 has remnants of the Bourbon Plantation sugar house. Cultural resources in the Maurepas Swamp include parts of rail lines and water crossings used for logging (16SJ71, 16SJ72, 16SJ73). Other recorded resources includes two historic coffins (16SJ58, 16SJ61) eroded from a cemetery probably associated with 19th-20th century Blind River hunting camps. Recorded resources along the shores of Lake Maurepas, Lake Pontchartrain, or waterways include 16SJB4, 16SJB33, NRHP site 16SJB2, the Schloesser Cemetery (16SJB3), and remnant civil war fortifications (16SJB7).

Future Without-Project Conditions (No Action Alternative)

Direct and Indirect Impacts: No direct impacts to cultural and historic resources would occur. Indirect impacts



would be the continuation of existing conditions. Changes in RSLR could affect the spatial limits, depths and frequency of inundation to existing cultural and historic resources.

2.4.8 Aesthetics and Visual Resources

Historic and Existing Conditions: Aerial photography between 1992 and 2010 shows visual conditions of the area changed over 20 years. The landscape along with view sheds has changed due to development, the conversion of swamps into marsh and open water. Photographs show that the same public thoroughfares that are in place today were in place in 1992; however, the scenery has changed from natural to a more developed state with residential, commercial and industrial development dominating US-61, US-51 and US-44, and other corridors. The only major exception is I-10, which traverses the area, giving near unobstructed views of a native landscape that remains aesthetically pleasing. Primary view sheds then, as they are today, were best taken from the local road system, and, in some instances, the Mississippi River levee.

There are two Scenic Streams in or near the area. Blind River stretches south 25 miles from Lake Maurepas, crossing under I-10 and ending near US-61 on the west side of the area. Bayous LaBranche and Trepagnier are located to the east outside of the study area sourcing from Lake Pontchartrain and stretching south, crossing under I-10 and US-61 and ending near the Norco (Bayou Tepagnier) and Good Hope (Bayou LaBranche). Other water resources include the Mississippi River, and numerous canals, streams and creeks that crisscross the native habitat between I-10 and the developed areas along the river (LDWF 2013).

“Blind River’s surrounding habitat is composed almost entirely of deep, wooded swamp with Spanish moss draped bald cypress and water tupelo being the dominant plant species. The habitat exhibits moderate plant species diversity and moderately high animal diversity. Natural levees and spoil banks provide the only upland habitat available near the river.”

Scenic Byways include the Great River Road traversing US-61. 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.

Future Without-Project Conditions (No Action Alternative)

Direct and Indirect Impacts: There would be limited to no direct impacts to visual resources. Visual resources would most likely evolve from existing conditions in a natural process, or change as dictated by future land use maintenance practices and policies.

2.4.9 Recreation Resources

Historic and Existing Conditions

The area includes the 103,263-acre Maurepas Swamp WMA. There are a few private camps in the WMA. The Louisiana Department of Wildlife and Fisheries (LDWF) estimates that there were 22,673 WMA recreation users in 2012. Access into the WMA area is generally by boat; however, several locations provide foot access. Consumptive recreation includes hunting deer, squirrels, rabbits and raccoons; fishing for bass, sunfish and crappie; and trapping alligators and nutria. Non-consumptive recreation includes bird watching, sightseeing, and boating. There is a 0.5 mile nature trail and two tent-only camping areas.

Many canals and bayous traverse the area, including Pipeline, Hope, Grand Point, and Reserve Relief Canals; and Mississippi and Manchac Bayous. Blind River is one of the most used waterways in the WMA. Recreation includes boating, fishing, hunting, and crawfishing. There is a public boat launch (Hope Canal) in the WMA. There are boat launches near the WMA boundary providing access into the WMA, including Tchakenhou Bayou, Ruddock Canal, Reserve Relief, and St. James Boat Club launch. Additionally, the St. James Boat Club boat launch, funded by the Land and Water Conservation Fund, provides access to Blind River. It includes playground facilities and is used as the Choupique Rodeo Site. Three launches access the I-55 canal. There are no designated parking lots; parking occurs along the highway. The canal provides access to Lake Maurepas. A launch is located at the end of Peavine Road to access Lake Pontchartrain. Three launches are located off US-



61, I-55, and I-10. The US-61 launch provides access to Conway Canal and Old New River. The I-55 and I-10 boat launches provide access to adjacent canals and Lake Maurepas.

Cajun Pride Swamp Tours is located off Frenier Road near US-51. This commercial operation provides boat tours in their private refuge and in the Manchac Swamp. Belle Terre Country Club and Golf Course is located in the area. This provides various recreational facilities including a golf course, outdoor swimming pool, and tennis courts. There are local recreational parks including Regala Park, Montz Park, Bethune Park, and Laplace Recreation and Youth Organization (Larayo) Youth Park. Regala Park facilities include an outdoor swimming pool, softball/baseball fields, picnic pavilions, tennis courts, playground, racquetball courts, 1 mile walking path, and soccer field. Montz Park provides a 1,561-foot walking path, baseball fields, basketball courts, playground, and picnic pavilions. Bethune Park provides baseball fields and as does Larayo Youth Park which also provides tennis courts and a swimming pool.

The Grand Point boat launch is north of Polder 3. Sportsman Pond is a private reservoir north of Polder 1 and is not available for public use.

Future Without-Project Conditions (No Action Alternative)

Direct and Indirect Impacts: There would be no direct impacts. Recreational infrastructure would remain vulnerable to surges. Parks, boat launches, and golf courses could be damaged. Storm surge and salt water could have a negative impact on freshwater forests and habitats and could reduce recreational resources (e.g., fishing, hunting, bird watching, and other).

2.4.10 Noise

Historic and Existing Conditions: There are many different noise sources throughout the area including commercial and recreational boats, and other recreational vehicles; automobiles and trucks, and all terrain vehicles; aircraft; machinery and motors; and industry-related noise. There are noise ordinances in St. Charles and St. John the Baptist Parishes. St. James Parish does not have any specific ordinances regarding construction noise. The maximum permissible sound levels for St. John the Baptist Parish during the hours of 7:00 am to 10:00 pm are 70 dBA for residential areas and 75 dBA for business and commercial areas ([St. John the Baptist Sound Levels](#)). The maximum permissible sound levels for St. Charles Parish during the hours of 7:00 am to 10:00 pm are 60 dBA for residential areas and 65 dBA for commercial areas ([St. Charles Sound Levels](#)).

A number of parks and the WMA are located adjacent to or near the nonstructural project areas. These public lands are sensitive noise receptors where serenity and quiet are an important public resource. The areas with the greatest number of sensitive noise receptors, such as residential homes and apartments, schools, churches, and parks are also located in St. James Parish. They are located along Hwy 3125 for the nonstructural system. In addition, neighborhood communities in which the nonstructural system polders such as Gramercy (Polder 1), Grand Point South (Polder 2) and Grand Point North (Polder 3) contain a large number of residential sensitive noise receptors in St. James Parish.

Background Noise

Noise levels surrounding the St. Charles, St. James, St. John the Baptist Parishes are variable depending on the time of day and climatic conditions. Near developed areas, automobile and train traffic, and to a lesser extent air traffic, contribute to the background noise levels.

Sensitive Noise Receptors

A number of parks, WMAs, and wildlife refuges are located adjacent to or near the project area. These public lands are sensitive noise receptors where serenity and quiet are an important public resource. The areas with the greatest number of sensitive noise receptors, such as residential homes and apartments, schools, churches, and parks, are located in St. James and St. John the Baptist parishes. They are located adjacent to the I-10 and I-55 highway system and along Highway (Hwy) 3125. In addition, rural neighborhood communities such



as Gramercy and Grand Point contain a large number of residential sensitive noise receptors in St. James parish.

2.5 Cumulative Impacts for the Future Without Project Condition

Cumulative impacts would be the incremental direct and indirect impacts of not implementing a storm risk reduction system for each of the significant resources described above in addition to the direct and indirect impacts attributable to other storm damage risk reduction systems which have not and would not be implemented in the Pontchartrain Basin, Louisiana and the nation. There is little, if any, published data with which to provide a quantitative comparison regarding proposed hurricane/tropical storm damage risk reduction projects which have not been implemented. Primary cumulative impacts would include the incremental effects of not providing hurricane/tropical storm damage risk reduction. These would be localized and would affect different parts of the area and, as discussed in more detail above, would include impacts on:

- an estimated 62,900 residents and 20,000 residential structures in the area;
- an estimated 70,190 non-farm jobs; 1,900 non-residential structures; 23,800 farm acres;
- a projected 165 public and quasi-public facilities;
- transportation infrastructure;
- community and regional growth;
- tax revenues and property values;
- community cohesion, especially during hurricane and storm surge events;
- potential degradation and or loss of cultural and historic resources;
- the continued loss of wetland habitats due to human development and conversion of existing forested wetlands and swamp habitats to marsh and open water; and
- potential salt water intrusion and inundation during hurricane and storm surge events.



3.0 PLAN FORMULATION

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. Sections 3.1 through 3.8 describe the plan formulation process used to identify the tentatively selected plan (TSP) identified in the Draft Report which was released to the public in August 2013. Section 3.9 describes additional planning efforts that followed, which took into account comments received on the Draft Report as well as additional engineering and environmental investigations performed to achieve feasibility level of design. These additional planning efforts allowed the team to modify and further refine features identified in the TSP. See chapter 5 for complete details of the finalized plan and recommendations.

3.1 Prior Studies

Problems and opportunities are documented in prior reports. Table 3-1 lists relevant studies.

Table 3-1: Relevant prior reports and studies.		Relevance to WSLP Study				
		Data Source	Consistency	Structural Measures	Nonstructural Measures	FWOP Conditions
Comprehensive Planning Studies						
1980	LA Coastal Resources Program	X	X	X	X	X
1999	Coast 2050: Toward a Sustainable Coastal LA	X	X	X	X	X
2004	LA Coastal Area (LCA), LA Ecosystem Restoration Study	X	X	X	X	X
2012	LA's Comprehensive Master Plan for a Sustainable Coast	X	X	X	X	X
Related Hurricane and Flood Damage Risk Reduction Projects and Reports						
1927	"Flood Control, Mississippi River and Tributaries" Published as House Document 90, 70 th Congress 1 st Session	X	X	X	X	X
1965	Chief of Engineers Report on Lake Pontchartrain and Vicinity, LA Hurricane Protection Project	X	X	X		X
1967	Amite River and Tributaries, Comite River Basin, LA	X	X	X		X
1984	Chief of Engineers Report on Lake Pontchartrain and Vicinity, LA Hurricane Protection Project	X	X	X		X
1990	LA Coastal Area Mississippi River Delta Study	X	X	X		X
1994	LA Coastal Wetlands Restoration Plan	X	X	X	X	X
1994	Southeast LA Hurricane Preparedness Study	X	X	X	X	X
2010	LCA Ecosystem Restoration Study, Volume II of VI, Final Integrated Feasibility Study and Supplemental Environmental Impact Statement for the Amite River Diversion Canal Modification Ascension and Livingston Parishes, LA	X	X	X	X	X
2010	LCA Ecosystem Restoration Study, Volume IV of VI, Final Integrated Feasibility Study & Supplemental Environmental Impact Statement for the Small Diversion at Convent/Blind River St. James Parish, LA	X	X	X	X	X
Previous West Shore Lake Pontchartrain Reports						
1985	West Shore Lake Pontchartrain Initial Evaluation Report	X	X	X		X
1987	Lake Pontchartrain West Shore, LA Hurricane Protection Reconnaissance	X	X	X		X
1997	West Shore Lake Pontchartrain, LA Hurricane Protection Project, Reconnaissance	X	X	X		X
2003	St. John the Baptist Parish, LA East Bank Urban Flood Control Reconnaissance Report	X	X	X		X





3.2 Planning Constraints

Plans are formulated to achieve objectives. **Objectives** and **constraints** are linked to problems and opportunities. Constraints are restrictions that limit the extent of the planning process.

Planning Constraints

1. Minimize impacts to wetlands.
2. Minimize impacts to the Small Diversion at Convent/Blind River project and River Reintroduction into Maurepas Swamp project.
3. No loss of flood protection from existing flood damage reduction projects.
4. Minimize impacts to the Maurepas Swamp Wildlife Management Area and surrounding wetlands.
5. Minimize infrastructure impacts (pipelines, highways, hospitals, schools, fire and police stations).

3.3 Management Measures Considered and Screened (*NEPA required)

A **management measure** is a feature or an activity that can be implemented at a specific geographic site to address one or more planning objectives. They can be used individually or combined with other management measures to form alternative plans. Measures were developed to address problems and to capitalize upon opportunities. They were derived from a variety of sources including prior studies, the public scoping process, and the team. This study considered structural measures and nonstructural measures to provide risk reduction and maximize project benefits. All measures were screened for capability to meet objectives and avoid constraints, for engineering and economic feasibility, and for the level of risk reduction provided over the period of analysis (2020 to 2070). Measures that warranted continued consideration were assembled into **alternative plans**. Below are the structural and nonstructural measures that were considered. Those measures carried forward for further consideration are shown in **blue boxes**. Figure 3-1 illustrates some of these measures. Detailed information about the measures and screening process can be found in Appendix E.

Nonstructural Measures

- **Full Acquisition/Buy-out:** Relocate residents outside of the flood plain by physically moving structures or by purchasing replacement structures. An acquisition program would reduce flood vulnerability and decrease future flood damages. *Carried forward for further consideration.*
- **Limited Acquisition/Buy-out:** Remove structures that receive repetitive damages from high frequency storm events (1 year, 5 year, 10 year, and 25 year frequencies). *Carried forward for further consideration.*
- **Flood proofing and Elevation:** Raise residential structures above the 2070 flood plain and flood proof other structures, such as public facilities, to reduce damages. *Carried forward for further consideration.*
- **Floodplain Management Measure:** Update local flood plain zoning rules based on changes due to RSLR. *Carried forward for further consideration.*
- **Cypress Reforestation:** Enhance and/or restore forest on the Maurepas Landbridge and in the Maurepas Swamp to reduce surge heights. *Eliminated from consideration because it would be ineffective in reducing the level of risk reduction.*
- **Flood Forecast and Warning Measures:** Develop more robust flood forecasting and warning systems. *Eliminated from consideration because the area has an ample forecast/warning system provided by local government. National Oceanic and Atmospheric Administration (NOAA), FEMA, and the USACE already take the responsibility of producing storm surge maps under existing flood plain management authorization.*



Structural Measures

- **Levees/Floodwall:** Block storm surges. *Carried forward for further consideration.*
- **Control Structures on Canals and Bayous:** Place control structures on canals and bayous to reduce the risk of flood damages. *Carried forward for further consideration.*
- **Seawall:** Construct a seawall along the rim of Lakes Maurepas and Pontchartrain. *Eliminated because it would have adverse environmental impacts by enclosing swamp, and would stop drainage systems by preventing water exchange with Lake Maurepas. Mitigation features for this measure would not be cost effective.*
- **Floodgates on Tidal Passes:** Place a large tide control structure on Pass Manchac, and potentially North Pass, to prevent storm surge from entering the area. *Eliminated from consideration because it would have adverse impacts on the environment and drainage systems by restricting tides and limiting the ability of the upper basin to drain during storms. The mitigation features would be cost prohibitive. Additionally, it would be ineffective due to surge flanking.*
- **Highway/Levee:** Raise I-10 to serve as a levee to reduce risk of surge damage. *Eliminated from consideration because it would require massive changes to the highway system, and would require replacement of the highway during scheduled levee lifts.*

3.4 Initial Array of Alternatives (*NEPA required)

Structural Measures (levee and floodwalls) were combined into an **initial array of 12 alternative plans**. Plans start in the eastern study area, and incrementally expanded west.

- **Plan 1:** Bonnet Carré Spillway to Reserve Canal.
- **Plan 2:** Bonnet Carré Spillway to East St. John High School (ESJHS).
- **Plan 3:** Bonnet Carré Spillway to ESJHS along the wetland/non-wetland interface.
- **Plan 4:** Bonnet Carré Spillway to ESJHS offset from I-10.
- **Plan 5:** Bonnet Carré Spillway to Marathon.
- **Plan 6:** Bonnet Carré Spillway to Reserve enclosing US-51.
- **Plan 7:** Bonnet Carré Spillway to Marathon following the wetland/non-wetland interface.
- **Plan 8:** Bonnet Carré Spillway to Ascension Parish/Mississippi River.
- **Plan 9:** Bonnet Carré Spillway to Hope Canal/Mississippi River.
- **Plan 10:** Bonnet Carré Spillway to the Hope Canal/Mississippi River enclosing I-10.
- **Plan 11:** Bonnet Carré Spillway to the Hope Canal/Mississippi River avoiding pipelines.
- **Plan 12:** Bonnet Carré Spillway to Ascension Parish enclosing I-10.

To determine the plans to evaluate further, each plan was scored from 5 (high performing) to 1 (low performing) based on how well it met objectives and avoided constraints (see Table 3-2). The scores were totaled and the plans were compared, evaluated and screened. Scores for meeting the objectives and avoiding constraints were developed by reviewing existing available data sources and newly modeled storm surge impacts. For example, data sources such as existing habitat maps were used to determine which plans impacted the least amount of wetlands. Plans were displayed in a geographical information system (GIS) and plans that affected lower acres of wetlands were given a higher score for avoiding wetlands. Other data sources such as the local infrastructure (e.g. pipelines, major highways, drainage features) were also used to score the plans. Plans that crossed these features typically add additional costs and failure risks to a system. Plans that avoid major infrastructure were given higher scores. Storm surge modeling was also developed to investigate the impacts to the landscape and structures. For example, the future equivalent annual damages by reach, inundation maps, and the number of structures included in the risk reduction system were all used to evaluate the ability of a plan to reduce hurricane storm surge related damages through 2070. The storm surge data was also used to make assumptions on the potential impacts related to induced-stages outside of a plan's risk reduction system. Maps and detailed descriptions of the scoring for each of the alternatives can be found in Appendix E.



Table 3-2: Screening and ranking initial array plans against objectives and constraints

Condensed Plan ID	Objectives Ranked* (5=High, 4=Medium High, 3=Medium, 2=Medium-Low 1=Low)			Avoids Constraint (5=High, 4=Medium High, 3=Medium, 2=Medium-Low 1=Low)					SUM
	#1 Storm damages	#2 Reduce risk to life and health	#5 Reduce the risk of damage and loss of critical infrastructure	#1 Min. impacts to wetlands	#2 Min. impacts to diversion projects	#3 No loss of existing flood protection	#4 Avoid impacts to WMA & wetlands	#5 Min. impacts to critical infrastructure	
Plan 11: Spillway to Hope Canal/MS River (Pipeline Avoidance)	4	4	4	3	3	3	3	5	29
Plan 9: Spillway to Hope Canal/MS River	4	4	4	5	4	1	5	1	28
Plan 10: Spillway to Hope Canal/MS River (I-10 Protection)	4	4	4	2	3	3	2	5	27
Plan 12: Spillway to Ascension Parish (I-10 Protection)	5	4	5	1	1	4	1	4	25
Plan 8: Spillway to Ascension Parish/MS River	5	4	5	1	1	4	1	4	25
Plan 3: Spillway to ESJ (wetland/non-wetland)	2	1	3	5	4	1	5	2	23
Plan 2: Spillway to East St. John High School (ESJ)	2	1	3	4	4	2	4	2	22
Plan 7: Spillway to Marathon (wetland/non-wetland)	2	2	3	4	4	1	4	1	21
Plan 4: Spillway to ESJ (I-10 Offset)	2	1	3	2	4	2	4	3	21
Plan 5: Spillway to Marathon	3	2	3	2	4	1	4	1	20
Plan 1: Spillway to Reserve Canal	2	1	3	2	4	2	4	2	20
Plan 6: Spillway to Reserve (US-51 Protection)	2	1	2	4	4	1	4	1	19

*Objectives 3 and 4 were not used. These are planning objectives that would be met with the transmittal of the final report.

Plans 1-6 were eliminated from further consideration because they did not maximize the planning objectives. (See Table 3-2, objectives ranked column.)

Plan 7 and Plan 9 alignments follow the wetland/non-wetland interface through St. John the Baptist Parish. However, Plan 7 would not provide risk reduction to the town of Garyville. By increasing the length of the levee by 500 feet, Plan 9 provided risk reduction to Garyville while only minimally increasing costs. Plan 7 was thus eliminated. Plan 8 and Plan 12 would provide risk reduction to the same area. The difference between the two Plans is the tie-in points at the two closest high ground areas to prevent storm surge from flanking the levee. Plan 12 would extend into Ascension Parish and tie into the Marvin Braud pump station. Plan 8 would tie into Hwy-70 in St. James Parish adding 4 miles to the alignment. Plan 12 was carried forward instead of Plan 8 because it was less costly and the direct environmental impacts were less than Plan 8.

The four remaining structural plans were carried forward: Plan 9, Plan 10, Plan 11 and Plan 12.

Nonstructural measures were also considered. A stand-alone nonstructural plan would require acquisition or elevation of 14,486 structures in the flood plain and would cost \$3,260,000,000, far exceeding estimated benefits and costs of other plans. The stand-alone nonstructural plan was eliminated from evaluation, but



other nonstructural measures were carried forward to complement structural alignments. After screening the structural plans, the remaining plans (Plan 9, Plan 10, Plan 11 and Plan 12) were evaluated to identify if there was a risk of storm surge related damage not completely addressed by the structural alignments. While Plan 12 would provide risk reduction to most of the developed study area, Plans 9, 10, and 11 would not provide risk reduction to St. James Parish.

Nonstructural measures were added to complement Plans 9, 10, and 11 due to the risk of potential storm surge damages to areas west of Hope Canal. With nonstructural measures, Plans 9, 10, and 11 would provide benefits commensurate with Plan 12 (Figure 3-2).

The number of structures expected to be impacted by storm surge is highly influenced by RSLR. Under the base condition, (year 2020) damages in St. James Parish resulting from a 1% probability hurricane/tropical storm event would impact approximately 219 structures. As discussed in Chapter 2 and presented in the Economic Appendix, there are a limited number of existing damages in the western portion of the study area, in St. James Parish (Figure 3-3). Less than 10% of the total \$190 million EAD without project damage occurs in this area, but the damages are expected to increase with the effects of RSLR over time. By the end of the 50-year period of analysis, approximately 1,571 structures out of 4,921 structures in St. James Parish would be affected by a 1% probability hurricane/tropical storm event. Due to the uncertain impacts of RSLR, a range of costs were developed based on a minimum expected number of structures based on the 2020 flood plain and a maximum number of structures based on the 2070 flood plain. These costs were used in the economic evaluation for determining the average annual cost for each plan.

Four plans, three of which contained nonstructural measures, were carried forward and identified as follows:

Plan 9 + nonstructural → Alternative A	Plan 11+ nonstructural → Alternative C
Plan 10 + nonstructural → Alternative B	Plan 12 → Alternative D

These alternatives were further evaluated considering alignments with respect to the I-10 corridor. Alternative B would not provide greater risk reduction for I-10 than any other plans. Alternative B would reduce risk to the same number of structures as Alternative C but would enclose about 4,000 more acres of wetlands. For these reasons, alternative B was eliminated.

3.5 Final Array of Alternatives (*NEPA required)

The final array of alternatives carried forward for consideration included **the No Action Alternative, Alternative A, Alternative C, and Alternative D** (Figure 3-4). For Engineering details, see Appendix B. Table 3-3 shows comparative details. For screening to determine the TSP, the team assumed that Alternatives A, C, and D would provide equal levels of risk reduction. With the inclusion of the nonstructural measures for Alternatives A and C, the alternatives would provide risk reduction to the same group of structures behind Alternative D. Using this assumption the least costly plan would have the highest net benefits. The analysis was based on a 1% probability hurricane/tropical storm event.

No Action Alternative (Future without-project condition)

Under the No Action Alternative no risk reduction would occur. The area would continue to experience storm surge damages. This would be exacerbated by RSLR and increased impacts to wetlands due to salinity. As wetlands erode and subside, they would provide less risk reduction.



Table 3-3: Comparative details for final array of alternative plans.

Plan	Length of Alternative	Size of Study Area Behind Alternative	Number of Structures Behind Alternative	Communities Behind Alternative	Miles of I-10 Behind Alternative	Wetlands Behind Alternative	Number of Pipeline Crossings
A	20 miles	38 sq miles	16,919	Montz, Laplace, Reserve, Garyville	4 miles	~5 sq miles	70
C	18 miles	47 sq miles	16,919	Montz, Laplace, Reserve, Garyville	4 miles	~16 sq miles	36
D	28 miles	160 sq miles	21,840	Montz, Laplace, Reserve, Garyville, Lucher, Gramercy, Grandpoint	15 miles	~79 sq miles	14

Alternative A: Bonnet Carré Spillway to the Hope Canal to Mississippi River

Alternative A (Figure 3-5) would provide risk reduction to St. Charles, St. John the Baptist and St. James Parishes. The approximately 20.41-mile levee and floodwall alignment begins at the West Guide levee of the Bonnet Carré Spillway, north of transmission line and pipeline corridors and extends west around the I-10/I-55 interstate interchange and along the wetland/non-wetland interface. The alignment turns south near Hope Canal, until it reaches the Mississippi River Levee (MRL). The plan included in the final array included nonstructural measures to acquire or elevate 1,571 structures outside of the levee alignment to reduce the risk of storm surge-related damages in the areas west of Hope Canal. The plan would not reduce risk to infrastructure in St. James Parish.

Construction of this plan would require roughly 3,100,000 cubic yards of earthen borrow material; 3,700,000 square yards of geotextile fabric; 30,000 cubic yards of aggregate limestone road; nearly 5,000 feet of T-walls to cross under the interstate, or as frontal risk reduction for pump stations; 1,200 feet of flood gates; 240 feet of drainage gates; and 2 railroad gates. Eight pump stations on the alignment would require 25,000 cubic yards of concrete, 230,000 square feet of sheet pile, nearly 7,000 tons of riprap, and 151,000 linear feet of concrete piles. Multiple flap gate culverts would be built. Because the alternative hugs the wetland/non-wetland interface, Alternative A has the least adverse indirect wetland impacts. However, the plan has the greatest residual risk (the risks left after all construction and safety measures have been assessed) because overtopping of the levee by surge would immediately inundate populated areas. It also has the most pump stations which would result in more maintenance and greater system failure risks. It is the least adaptable because expansion of the levee could require the purchase and/or relocation of existing structures.

Alternative C: Bonnet Carré Spillway to the Hope Canal to Mississippi River

Alternative C (Figure 3-6) would avoid multiple pipeline and utility crossings. It follows the Alternative A alignment between the West Guide levee of the Bonnet Carré Spillway to the US-51 interchange, where it then tracks north across US-51 and along a pipeline corridor. The approximately 18.27-mile alignment crosses I-10 and follows the pipeline corridor through wetlands near the Belle Terre exit until it reaches Hope Canal. The alignment then turns south and extends to the MRL. The plan included in the final array, included nonstructural measures to acquire or elevate 1,571 structures outside of the levee alignment to reduce the risk of storm surge-related damages in the areas west of Hope Canal. The plan would not have reduced risk to infrastructure in St. James Parish.

Construction of this plan would require about the same amount of borrow material as Alternative A. It would require 3,365,000 square yards of geotextile fabric; 26,000 cubic yards aggregate limestone road; 5,300 linear



feet of T-walls; 300 linear feet of flood gates; 200 linear feet of drainage gates; 4 pump stations; and 2 railroad gates. Environmental structures similar to those for Alternative A would be built. This alternative encloses more wetlands than Alternative A, therefore would require more environmental structures to maintain existing hydrology. Alternative C has less residual risk because levee overtopping would not immediately inundate communities. Because the alignment does not abut existing structures, Alternative C is more adaptable should changing conditions result in future authorizations that require structure modifications.

Alternative D: Bonnet Carré Spillway to Ascension Parish

Alternative D (Figure 3-7) is a westward extension of Alternative C along the I-10 corridor into Ascension Parish. It continues west at the St. James Parish line slightly north of I-10 until it reaches the Old New River, where it proceeds north to the non-Federal Laurel Ridge levee in Ascension Parish. Measures to maintain water flow and to reduce impacts to wetlands would be built. Alternative D reduces risk to communities in St. Charles, St. John and St. James Parishes and provides a level of risk reduction to a segment of the I-10 hurricane evacuation route.

Construction of the approximately 28-mile alternative would require 3,700,000 cubic yards of borrow material, 3,037,000 square yards of geotextile fabric; approximately 37,000 cubic yards of aggregate limestone road; just over 4,000 linear feet of T-walls; 300 feet of flood gates; 400 feet of drainage gates; approximately 6 pump stations; nearly 24,000 cubic yards of concrete; almost 200,000 square feet of sheet pile; approximately 5,900 tons of rip rap; 154,000 linear feet of concrete piles; and environmental structures, most notably at Blind River, a State designated Louisiana Scenic River. It encloses the most acres of wetlands requiring more environmental structures than any of the other alternatives. Similar to concerns expressed in connection with Alternative C, there is concern about potential impounding of large areas of wetlands under this alternative, especially if the river diversion projects are constructed. Alternative D would reduce risks to roads and other infrastructure in St. James Parish.

3.6 Cost Estimates

Estimated costs for levees, floodwalls, and pump stations; real estate costs; OMRR&R; environmental mitigation; and nonstructural features included in Alternatives A and C (which at that time in the planning process included acquiring or elevating 1,500+ structures) were totaled for alternatives and compared to help identify a TSP. Because costs for the nonstructural features of Alternative A and C, and costs associated with mitigation for indirect impacts were uncertain at that time, a cost range was developed for each feature.

Nonstructural Cost: A 100% structure survey of area improvements was available. The cost of raising and/or acquiring structures located in the 2020 and 2070 100-year flood plains was evaluated by comparing the cost of elevating the structure to the cost of acquiring the structure. The lesser cost was used to determine the nonstructural feature cost. RSLR greatly impacts the number of structures to be raised, resulting in uncertainty as to how many structures would have to be raised by any given date. A minimum cost of the nonstructural feature of \$53,143,789 was developed based on the cost of reducing risk to structures in the 2020 100-year flood plain. A maximum cost of \$305,256,794 was developed based on the cost of reducing risk to structures in the 2070 100-year flood plain. The maximum cost was used for comparison. (Later, during the feasibility level of design phase, a detailed investigation of this component was conducted to determine which increment of the nonstructural cost would be justified and to identify other effective and less costly opportunities to provide storm surge risk reduction in St. James Parish.)

Indirect Impact Cost: At this stage, mitigation costs for indirect impacts remained uncertain due to limited hydrologic information and lack of a full wetland value assessment (WVA). To reduce the uncertainty of costs associated with mitigating for indirect impacts, a maximum cost based on Morganza to the Gulf and Lake Pontchartrain and Vicinity project estimates, and a minimum cost based on local mitigation bank costs were developed. These costs were averaged. In place of WVA analysis, habitat reduction values from 5 - 75 percent were calculated. Using these values, the average estimated mitigation cost associated with indirect impacts



ranged from \$871,000,000 to \$980,000,000 for Alternative A, \$844,000,000 to \$1,000,000,000 for Alternative C, and \$672,000,000 to \$2,200,000,000 for Alternative D.

The habitat reduction value impacts were estimated to be approximately 15 percent of the total enclosed wetlands, as shown in Table 3-4. Because risk reduction features were designed to maintain existing hydrologic flows to the extent practicable, indirect impacts are expected to be limited to those that occur during closure of structures for storm surge events, an estimated 8.5 days per year. (A WVA analysis based on hydrologic modeling was later conducted on the TSP during feasibility design.)

Table 3-4: Estimated first costs for final array of alternative plans used to select the TSP.

	Alternative A	Alternative C	Alternative D
Levees & Floodwalls	\$335,898,670	\$334,156,997	\$339,508,346
Pump Stations	\$132,162,500	\$112,687,500	\$166,437,500
Pipeline Relocations*	\$70,300,000	\$35,100,000	\$11,693,750
Real Estate	\$3,849,000	\$3,283,000	\$2,434,000
Direct Habitat Impacts	\$17,000,791	\$35,710,811	\$43,323,364
Indirect Mitigation Cost (15%)	\$23,123,679	\$54,655,968	\$327,687,626
Nonstructural 2070**	\$305,256,794	\$305,256,794	\$0
Total Cost	\$887,591,434	\$880,851,070	\$891,084,586

*Pipeline Relocation cost are part of the NFS' LERRD Responsibility; these cost are borne 100% by the NFS. **Some nonstructural costs are NFS LERRD costs. The nonstructural costs have been spread over the entire period of analysis and have been heavily discounted. They result in less than 17% of the total average annual costs.

OMRR&R Cost: Table 3-5 provides preliminary OMRR&R cost estimates for each alternative (used to select the TSP).

Table 3-5: Comparison of annual OMRR&R cost for final array of alternative plans used to select a TSP.

Alternative	Levee Grass Cutting		Structure OMRR&R (\$)	Total OMRR&R (\$)
	(acres)	(\$)		
Alternative A	390	\$234,000	\$7,277,050	\$7,511,050
Alternative C	868	\$520,800	\$3,607,275	\$4,128,075
Alternative D	1269	\$761,400	\$5,421,538	\$6,182,938

NOTE: Based on levee right-of-way acres, 2012 dollars, and includes a 25% contingency. OMRR&R costs for mitigation are not included. Cost include grass cutting; pump station and flood gate replacement; and other planned OMRR&R activities.

3.7 Summary of Accounts and Comparison of Alternatives

Plans in the final array were assumed to provide equal levels of risk reduction. To facilitate evaluation and comparison of the alternatives, four Federal Accounts were used to assess the effects of alternatives. The accounts are National Economic Development (NED), Environmental Quality (EQ), Other Social Effects (OSE), and Regional Economic Development (RED).

No Action Alternative: No NED benefits would be associated with the No Action Alternative. There would continue to be adverse impacts to the EQ as salinity levels increase in the area, affecting wetlands and eventually causing impacts to residents (OSE) in the immediate vicinity of the study by reducing the natural swamp buffer. Reducing the natural buffer could also cause uncertainty to RED by impacting major oil refineries in the region and the overall economy.

Alternative A: Alternative A provides NED benefits, but less net benefits than Alternative C. It encloses the fewest wetlands, resulting in the least adverse impacts to EQ. However, it risks immediate inundation of communities in an overtopping event; thus reducing safety to residents (OSE) in the area. It limits future modification or system reinforcement due to its proximity to structures. It would risk disruptions to the local



drainage patterns if design parameters are exceeded (Figure 3-8). While Alternatives C and D would disrupt existing drainage if design parameters are exceeded, the damage resulting would be greatest for Alternative A due to the close proximity of the levee to existing structures. There is no risk reduction to roads in St. James Parish which could flood, preventing employees from accessing vital industries.

Alternative C: Alternative C maximizes benefits. It has more adverse impacts on EQ than Alternative A but reduces impacts to wetlands compared to Alternative D. In case of a major storm surge event that exceeds the federally authorized project design, Alternative C could reduce the risk to OSE because storm surge would, over time, first fill in the wetlands before potentially inundating developed areas. Also because this alternative is set back from existing structures the alignment can be enlarged should RSLR be greater than anticipated without displacing area residents. There would have been no risk reduction to roads in St. James Parish as originally formulated prior to selection of the TSP. (The final recommended plan for St. James Parish would provide some measure of risk reduction to those roads located within the berms.)

Alternative D: Alternative D provides NED benefits, but does not maximize those benefits. It provides risk reduction to a larger area thus reducing risk to more area residents. Structural risk reduction is provided to roads in St. James Parish, reducing the risk that employees would be unable to access critical infrastructure and places of employment. Additionally, because the levee is not located in close proximity to existing structures, the threat of flooding due to exceedance of design parameters is lessened. Alternative D poses potential uncertainties concerning the impoundment of large areas of wetlands, especially if the river diversion projects are constructed. While it would prevent saltwater intrusion, it would risk impacting hydrology by enclosing approximately 54,800 acres of swamp and would impact the EQ of the Maurepas WMA as well as Blind River, a Louisiana Scenic River.

Economic Costs Comparison: The parametric implementation costs were annualized using the current interest rate (3.75%) at the time of the Draft Report and a 50 year period of analysis (2020-2070). In 2020, only 5% of the benefits would have been derived from St. James Parish and only 219 structures would have been located within the 100-year flood plain. During the study period prior to the selection of the TSP, it was determined that the cost of the nonstructural features for Alternatives A and C would have increased from approximately \$53,000,000 (in year 1) to over \$305,000,000 (in year 50) due to RSLR. Most of the structures would not have resided in the 100-year flood plain until late in the period of analysis. Because of this, the nonstructural costs for features proposed prior to the determination of the tentatively selected plan were spread evenly over a 53-year period beginning in 2017 and ending in 2069; and then compounded or discounted to the 2020 base year. The annual benefits were compared to the cost assuming a 100-year level of risk reduction. The total annual benefits were then compared to the total annual costs. Table 3-6 provides an overview of the Total NED Project Costs (Gross Investment) and annual cost between each alternative. Gross investment cost includes interest cost (+/-) for construction and OMR&R. There is an \$83 million differential gross investment cost between Alternatives C and A, and a \$220 million differential gross investment cost between Alternatives C and D.

Table 3-6: Economic comparison of final array of alternative plans that were used to select a TSP.

	Total NED Project Cost (Gross Investment in Millions)	Annual Costs (\$ millions)
Alternative A	\$909.4	\$40.5
Alternative C	\$826.7	\$36.8
Alternative D	\$1,047.2	\$46.7

As discussed in Section 3.5, the team assumed that Alternatives A, C, and D would provide equal levels of risk reduction with the inclusion of the nonstructural features associated with Alternatives C and A. The least costly plan would have the highest net benefits. The preliminary benefit to cost ratio (BCR) for Alternative C



equaled 1.63 to 1 with annualized net benefits of approximately \$23,000,000. For Alternative A the BCR equaled 1.48 and for Alternative D, 1.28 with net benefits of \$19,400,000 and \$13,200,000, respectively.

Table 3-7: Economic comparison of final array of alternative plans used to select a TSP.

Alternative	First Costs (\$ millions)	Annual OMRR&R (\$ millions)	Equivalent Annual Benefits (\$ millions)	Annual Costs (\$ millions)	Benefit-to- Cost Ratio	Annualized Net Benefits (\$ millions)
A	887.6	7.5	59.9	40.5	1.48	19.4
C	881.0	4.1	59.9	36.8	1.63	23.0
D	891.1	6.2	59.9	46.7	1.28	13.2

Benefits such as reductions in emergency costs and damage to roadways were not calculated. These benefits, if calculated, would have been expected to be greatest for Alternative D and the least for Alternative A, but these benefits are usually minimal and would not impact the selection of the TSP.

Alternative A tracks the wetland/non-wetland interface in Laplace to its termination at the Hope Canal in western St. John the Baptist Parish. It requires the largest number of pump stations (8 pump stations) compared to Alternative C (4 pump stations) and would require approximately \$7,500,000 in OMRR&R costs to maintain the fully constructed alternative compared to \$4,100,000 in OMRR&R for Alternative C.

3.8 Identifying the Tentatively Selected Plan

Alternative C was identified as the TSP and the NED plan as determined by the evaluation criteria. It fulfills the planning objectives in Section 1.5. It reasonably maximizes net benefits, consistent with protecting the nation's environment in accordance with national environmental statutes, applicable Executive Orders, and other Federal planning requirements.

3.9 Additional Plan Formulation

After the release of the Draft Report, the team conducted additional engineering and environmental investigations. Items investigated included the optimization of storm surge risk reduction measures in St. James Parish, the development of a detailed mitigation plan, and the development of a detailed cross-section of the levee system. Information gathered through these additional investigations in conjunction with consideration of concerns raised by the public and by agencies assisted the team in further refining the design of the TSP. The subsections below provide a summary of how the team conducted these investigations and addressed public and agency concerns.

3.9.1 Optimization of Storm Surge Risk Reduction Measures in St. James Parish

To address public and agency concerns the team further optimized the component of TSP in St. James Parish. The Draft Report presented a nonstructural raising or a buyout program in St. James Parish. The original nonstructural assumption for the cost and benefit analysis in the Draft Report was based on 100% public participation rate and included removing or modifying over 1,500 structures. Based on public comments, this type of program would likely receive very little public participation if the program were voluntary due to the number of structures potentially removed from the community. As stated in Section 3.6, the team evaluated the incremental justification of the nonstructural component presented in the Draft Report. In reviewing the nonstructural plan alone, it was determined that the BCR was less than 1 for the nonstructural increment as it was proposed in the TSP described in the Draft Report. In subsequent discussions with the local stakeholders and experts in the field of storm surge risk reduction measures, the study team determined that lower cost, localized storm surge risk reduction measures could be implemented to achieve similar levels of storm surge risk reduction presented in the Draft Report. This, in turn, would raise the BCR above unity for this increment of the TSP.



After reviewing the limits of storm surge flooding and St. James Parish flooding characteristics, the team determined that different combinations of localized storm surge risk reduction measures could be used to increase the anticipated rate of public participation. These combinations could also decrease the cost to be included as justified project increments. In early screening efforts, the team had already reviewed large ring levees or extending a large levee system around all of the structures in St. James Parish and had determined that the equivalent annual damages would not economically support a large levee system. This plan was not revisited for this effort.

In order to focus on economically justified and environmentally compliant increments the team focused on measures that reduced the existing risk of storm surge damage without significantly altering the nature or extent of flooding in the area. The characteristics of storm surge flooding in the western portion of the study area (St. James Parish) are significantly different from what is seen in the eastern portion of the study area. In the developed areas of St. James Parish, storm surge flooding is less than 3 ft deep on average and the area is in an interior (low velocity) area of the coastal flood plain. In some areas, flooding only occurs because storm surges travel upstream via drainage pipes under a highway (Hwy 3125). Using this information, the USACE reviewed the use of berms and flap gate closures along Hwy 3125 to address a large portion of the existing flooding in St. James Parish. The flap gate closures are similar to one-way check valves that prevent storm surge from traveling upstream through drainage features. Because the study area is a very large, flat coastal flood plain, there is a very low risk that berms or flap gate closures would significantly alter the nature or extent of flooding. In addition, these features would have minimal environmental impacts due to the small footprint of the features, which would in turn lead to lower cost for implementing the measures. The area enclosed by the localized storm surge risk reduction measures account for less than 2% of the total study area.

Appendix E provides the details of the plan formation process, but during the final feasibility phase of the study, the USACE shifted its primary focus away from the Draft Report's plan for complete structure elevations and buyouts. This shift to other localized storm surge risk reductions measures mainly focused on the closures and flapgates on Hwy 3125 and a proposal to construct three berms around a small group (polder) of structures in the Grand Point and Gramercy/Lutcher areas (Figure 3-9). Additional individual flood proofing measures for 23 individual structures were also included to address any remaining frequent surge-related flood risk that might exist outside of the berms and flap gates. Buyouts for these structures were not used because flood proofing measures for these structures could be implemented at a much lower cost, approximately \$18.5 million for buyouts vs. \$6.7 million for flood proofing.

The initially optimized increment of the TSP contained five major components:

- **Polder 1 (Gramercy Berm)** a berm around a small group of structures in the Gramercy/Lutcher area north of Hwy 3125.
- **Polder 2 (Grand Point South)** a berm around a small group of structures in the Grand Point area north of Hwy 3125 near Longview Park. (Grand Point North).
- **Polder 3 (Grand Point North)** a 1 berm around a small group of structures in the Grand Point area north of Hwy 3125, near the Grand Point Boat Launch (Grand Point South).
- **Flap Gates and Closures on drains under Hwy 3125** to reduce risk to structures south of the highway.
- **Flood proof structures north of Hwy 3125** in St. James Parish which are located outside of the berms with a first floor below a 2020 1% probability hurricane/tropical storm event.



Table 3-8. shows the economic evaluation of each separable localized storm surge risk reduction element.

Table 3-8. Economic evaluation of potential localized storm surge risk reduction components

Localized Storm Surge Risk Reduction Component	Equiv Annual Benefits 2014 Prices and 3.5% Discount Rate (2020-2070) (\$1,000)	Total Annual Costs 2014 Prices and 3.5% Discount Rate (2020-2070) (\$1,000)	BCR Ratio
Polder 1 (Gramercy Berm)	\$1,073	\$842	1.27
Polder 2 (Grand Point South)	\$229	\$1,057	0.22
Polder 3 (Grand Point North)	\$956	\$839	1.14
Flap Gates and Closures on drains under Hwy 3125	\$1,119	\$464	2.41
Flood proof structures north of Hwy 3125	\$2,290	\$299	7.67

A review of each component determined that every component considered, except for Polder 2 (Grand Point South), was economically justified on its own. The USACE's ER 1105-2-100 states that separable elements have to be incrementally justified to be included in the final recommendation. Polder 2 (Grand Point South) BCR's ratio was less than unity when evaluated separately. At this point, Polder 2 (Grand Point South) was removed from the overall localized storm surge risk reduction system associated with the final TSP.

The TSP was then changed to include the Alternative C levee alignment and four justified localized storm surge risk reduction components:

- **Alternative C Levee Alignment**
- **Polder 1 (Gramercy Berm)**
- **Polder 3 (Grand Point North)**
- **Flap Gates and Closures on drains under Hwy 3125**
- **Flood proof structures north of Hwy 3125.**

Details associated with Polder 2 (Grand Point South) that were developed prior to the removal of the polder from the overall localized storm surge risk reduction components are still included in Chapter 4 and related appendices. This information is presented to allow for other state and local stakeholder to address storm surge flooding concerns not fully addressed by the recommended plan. Under the no action scenario, the area would still experience an estimated \$905,000 in total equivalent annual hurricane/tropical storm surge damages.

Inclusion of the optimized and justified components would not have changed the TSP selection presented in the Draft Report. Alternative A as presented in the Draft Report included the same initial nonstructural components as Alternative C. Alternative C still would have lowest cost and the highest net benefits compared to Alternatives A or D.

Including the optimized and justified component in the final design would reduce storm surge damages in St. James to the 2020 100 yr level of storm surge initially. Chapter 5.1 outlines the features and specifications of the localized storm surge risk reduction measures. The NFS will be required to maintain the two berms in the localized storm surge risk reduction features to their initial design height for so long as the project remains authorized. Even with this requirement, the effectiveness of these components in the future would depend on the actual rate of RSLR. The NFS is not obligated to address this loss of risk reduction through future berm lifts or highway lifts, but they will still be required to repair, rehabilitate or provide replacement of components associated with the construction of berms and flap gates to maintain the original project benefits. As stated above, the initial screening efforts indicated that the equivalent annual damages in the St.



James Parish would not economically support berms with future lifts similar to a levee system where future levee lifts are included to maintain an initial level of risk reduction. The NFS will also not be obligated to OMRR&R the flood proofing measures that constitute elevation of individual residential structures or construction of small ring berms around individual non-residential or light industry/warehouse structures.

3.9.2 Development of a detailed mitigation plan

The objective of the mitigation plan is to restore swamp and BLH to compensate for unavoidable project-induced impacts. WVA models were run on the feasibility design of the TSP to determine the functions and values of the impacted habitats, expressed in AAHU. The models predict that approximately 1,189 AAHU would be lost due to direct and indirect habitat impacts over the 50-year period of analysis. Of the total 1,189 AAHU, impacts to swamp habitat would account for approximately 1,089 AAHU and impacts to BLH would account for the remaining 99 AAHU.

By drawing from many existing reports for restoration actions in nearby swamps, the team was able to assemble a mitigation plan to compensate for project-related direct and indirect impacts to swamp and BLH. The plan complies with the requirements of the Water Resources Development Acts of 1986 and 2007, USACE regulations, and mitigation standards. Details of the mitigation features are included in Chapter 4 and in the Environmental Appendix.

The Swamp WVA model predicts that Alternative C's indirect impacts to enclosed forested wetlands will require mitigation for 494.5 AAHUs. Alternative C has been designed in a manner to eliminate hydraulic impacts to the enclosed swamp and this design has been verified with the 1D HEC-RAS hydraulic modeling (See Engineering Appendix, Interior H&H). The design of the levee system includes both a protected and flood-side ditch as well as six drainage structures to maintain day-to-day tidal changes in the study area. The system will only be closed during hurricane and storm surge events. The drainage structures have been placed along existing canals that currently drain both upland and wetland areas during rainfall events. The majority of gravity drainage is confined to these existing waterways and the expected result of this design would minimize indirect environmental impacts to the enclosed swamps. Although the system has been optimized for hydraulic interchange when the system is not in use, there remain some indirect impacts that are attributable to enclosing swamp. These impacts are based on best professional judgment and experience in the vicinity. The HET assumed that placement of the levee would result in a reduction in efficiency of drainage on the protected side thereby affecting water quality and increasing impoundment. The HET assumed that these impacts may not have been adequately captured in the H&H modeling effort or in its margin of error. Additional investigations will be conducted during the Preconstruction Engineering and Design phase to ensure that the project's design minimizes impacts to both the enclosed swamp and the water levels to the maximum extent practicable.

3.9.3 Development of detailed cross-section of levee system

After the release of the Draft Report, additional hydraulic modeling was conducted on the TSP to determine the final design dimensions. Storm surge modeling was conducted to determine the final levee heights for the design. Under the planning phase, the levee heights were based on a limited number of storm simulations and still water elevations. Additional hydrological modeling was completed to determine the levee systems impacts on rain events and water exchanges. The results of additional modeling efforts led to changes (e.g. inclusion of floodside ditch, protected side canal) in the overall footprint of the levee cross-section. Details of the changes are included in Chapter 5 and in the Engineering Appendix.

3.9.4 Concerns with induced flooding impacts

There is a margin of error in both the economic model and the storm surge modeling (ADCIRC) which is recognized by team hydrologists and economists. In general, the potential impacts to communities outside of the proposed levee alignment would be similar with and without the recommended levee alignment. The ADCIRC modeling will be refined during preconstruction engineering and design to determine whether or not there will be induced flooding and to precisely estimate its magnitude. At feasibility level of design, the



model uncertainty and inclusion of localized storm surge risk measures adequately address the limited potential for induced flooding.

In order to address public and agency concerns related to the potential for induced flooding impacts associated with levee feature proposed, the team conducted additional investigation on the storm surge stages in St. James Parish under the future with project conditions.

A review of the storm surge modeling results (information available in the Engineering Appendix) of the with-project conditions (those conditions with Alternative C in place) found increased stages during a storm event that ranged between 0.1 and 0.2 feet of water. These elevated water stages were observed between the 50-500 year events. No induced flooding was observed in storm surge events between the 1-25 year events.

Nearly 5,000 structures were investigated outside of the proposed levee system for the future without project conditions. Of these 5,000 structures, approximately 1,900 of them are susceptible to surge damages from a 2070 intermediate RSLR 1% probability hurricane/tropical storm event. Introducing a 0.2 foot increase in water surface elevation to the 100 year 2070 intermediate RSLR scenario could result in approximately 50 additional structures being impacted. All of these structures are within the polders (Figure 3-10). The potential inducements due to the maximum 0.2 foot water surface elevation increase could result in approximately \$200,000 average annual damages. In contrast, there are nearly \$190,000,000 million in average annual damages attributed to storm surge stages in the study area.

3.9.5 Comparison of Final Feasibility Designed TSP to Estimated Final Feasibility Design for Alternatives A and D

This section compares the final feasibility designed TSP to other alternatives in the final array. This analysis was performed in order to conduct a comparative analysis of the impacts for each of the implementable alternatives (see Chapter 4) and in order to confirm that the final impact analysis and final mitigation requirements would not have changed the TSP identified in the Draft Report. Alternatives A and D were “brought up” to a similar level of detail using assumptions derived from data collected during the final feasibility design of the TSP. Table 3-9 presents, in comparative form, the data developed during feasibility design on the TSP and the estimates that were developed for purposes of this analysis on both Alternatives A and D. Because of the lack of detail as it relates to the required width of the Alternative D levee as it extends to the west, estimates were developed for two variations of Alternative D: Maximum Width (MaxW) and Minimum Width (MinW). Estimates for both variations were developed to confirm that the factor of “levee width” would not have changed the TSP selection.

The only significant change between the TSP and the recommended plan was the optimized localized storm surge risk reduction features in St. James Parish. Both Alternative A and Alternative C under the final array used a minimum cost of a nonstructural feature of \$53,143,789 and maximum cost of \$305,256,794. The cost for this TSP component has now been reduced to approximately \$40M and would be included in Alternative A and C. A detailed re-assessment of the benefit-to-cost ratios in the final alternative array would not provide any additional information sufficient to change the selection of the TSP. This is because Alternative A, as presented in the Draft Report, included the same initial nonstructural components as Alternative C. Alternative C still would have lowest cost and the highest net benefits compared to Alternatives A. In addition to the cost differences, other factors were investigated under the feasibility design to verify the selection of Alternative C as the recommended NED plan. A summary of these factors are discussed in the sections below.



Table 3-9. Additional plan formulation based on environmental factors

Draft Feasibility Design		Final Feasibility Design	Estimated Final Feasibility Design for Alternatives A and D ¹		
Attribute	TSP (Alternative C) ²		Final Feasibility Designed TSP (Alternative C)	Alternative A	Alternative D
				(Maximum Width) ³	(Minimum Width) ³
Length of levee and flood walls	18.27 miles	18.27 miles	20.41 miles	28 miles	28 miles (9.26 miles along Alternative C)
Tie in Location	Mississippi River Levee	Mississippi River Levee	Mississippi River Levee	Laurel Ridge Levee and Marvin Braud (May need to be longer to tie in to high ground in the future)	Laurel Ridge Levee and Marvin Braud (May need to be longer to tie in to high ground in the future)
Width of levee	387 feet	541 feet	541 feet	541 feet	541 feet for 9.26 miles and 442 feet for 19.74 miles
Localized storm surge risk reduction measures	Flood proofing 1,571 structures outside of the levee alignment by acquiring or elevating structures	Flood proofing through the use of two polders, Flap gates and closures on drains under Hwy. 3125, elevating 14 residential structures and flood proofing 9 commercial and industrial structures.	Same as Recommended plan.	None	None
Total Acres of direct impact ⁴	856 acres	1,198 acres	1,338 acres	1,836 acres	1,611 acres
Direct swamp Acres ^{5,6}	719 acres	1,114 acres	1,398 acres	1,951 acres	1,712 acres
Direct BLH Acres	56 acres	123 acres	123 acres	No Impacts to BLH	No Impacts to BLH
Direct Swamp AAHU ^{7,8}	N/A	595.6 AAHU	747.9 AAHU	1,032.4 AAHU	905.88 AAHU
Direct BLH AAHU ⁹	N/A	95.5 AAHU	95.5 AAHU	0 AAHU	0 AAHU
Swamp enclosed	8,424 acres	8,432 acres	3,564 acres	56,588 acres	56,588 acres
BLH Enclosed	0 acres	89 acres	89 acres	89 acres	89 acres





Draft Feasibility Design		Final Feasibility Design	Estimated Final Feasibility Design for Alternatives A and D ¹		
Attribute	TSP (Alternative C) ²		Final Feasibility Designed TSP (Alternative C)	Alternative A	Alternative D
				(Maximum Width) ³	(Minimum Width) ³
Indirect Swamp AAHU ⁸	N/A	494.5 AAHU	191.5 AAHU	2,235.8 AAHU	2,235.8 AAHU
Indirect BLH AAHU ⁹	N/A	3.1 AAHU	3.1 AAHU	3.1 AAHU	3.1 AAHU
Total AAHU ⁸ (direct and indirect)	N/A	1,188.7 AAHU	1,038.0 AAHU	3,268.2 AAHU	2,867.69 AAHU
Average Mitigation Cost ¹⁰	\$90,400,000	\$159,597,672 (Cost of actual Mitigation plan \$109,500,000)	\$69,400,000	\$768,200,000	\$674,100,000
Induced flooding potential	Limited	Limited	Limited	Potentially Significant	Potentially Significant

¹ Estimated final feasibility design based on Engineering and WVA calculation developed during based on the Final Feasibility design of the TSP.

² Carried over from the TSP analysis.

³ The Maximum Width is the same levee width used for the final feasibility designed TSP. The Minimum Width uses the width identified for the final feasibility designed TSP for that portion of the levee where Alignment C overlaps with Alignment D and for the remaining 19.74 miles, the original width estimates reported in the Draft Report. .

⁴ Acres of direct impact are based on the actual width of the direct impact area and include areas that are both wetland and not wet areas.

⁵ Includes one acre of direct impact from a localized storm surge risk reduction measure in both Alternatives C and A.

⁶ The WVAs for Alternative C were performed using a wider footprint (560 feet) then the actual (see body of table for levee width) footprint. Because of this, the total acres of wetlands reported may be higher than the total final footprint.

⁷ Includes 0.3 AAHU of direct impact from localized storm surge risk reduction measure in both Alternatives C and A.

⁸ AAHU estimates developed for both Alternatives A and D are based on assumptions made during the running of the Swamp WVAs for Alternative C. No new data was collected specific to Alternatives A and D. For approximately six miles Alternative A and Alternative C follow the same alignment and thus have the same direct impacts. The remaining portion of Alternative A's alignment was in a sub area of the indirect impacts for Alternative C and is at the most approximately 1.25 miles apart. The indirect impact area for Alternative A is a sub area of Alternative C indirect impact area. Alternative D follows the first 9.26 miles of Alternative C going from east to west thus should have the same direct impact for that length. The further west the alignment goes the less reliable the estimated height will be. Two widths were chosen to estimate for the remaining 19.74 miles (see footnote 3 above). The indirect impact areas for the eastern and central portion of Alternative C are the same for Alternative D. There is a risk that the data for the western portion of Alternative C is not reasonable for the far western portion of Alternative D's indirect impact area.

⁹ Both the directly impacted BLH in Alternative A and the indirectly impacted BLH in both Alternatives A and D make up the same area of BLH examined in Alternative C.

¹⁰ Based on Method 1 (see section 3.9.5.1) of cost estimation used in draft report using 34% reduction in HSI rather than 15% reduction in HSI. This Method Does not take into account a wider footprint.



3.9.5.1 Comparison based on Average Annual Habitat Reduction Values

During initial screening of Alternatives A, C and D, habitat reduction value impacts were estimated. A 15% habitat reduction value was based on professional judgment, an understanding of the ecosystem dynamics in the project area and the estimated direct and indirect impact acres for each alternative. A single reduction value for all alternatives was decided upon for initial screen based on preliminary information on the existing habitat, and the opinion of the hydraulic engineer that the indirect impacts would be similar for all alternatives. During feasibility design of the TSP, WVA analysis was conducted using habitat measurements and planning and habitat team assumptions. With this information the team was able to validate assumptions used for the Draft Report.

The following approaches were developed to compare indirect impacts across all alternatives (Alternatives A, C and D) and with the Draft Report methodology:

Method 1: To compare project costs among the final array alternatives, the team determined the percent change in the Alternative C WVA Habitat Suitability Index (HSI) by calculating the change from baseline condition at Target Year (TY) 0, with HSI of 0.76, to future with project conditions at TY 50 with HSI of 0.51, respectively. The future with project condition shows a 34 percent reduction in HSI. This value was then used to develop project cost estimates for each alternative in the final array.

Method 2: This method is explained in detail in Appendix A Annex R page 3 in the section “Early Habitat Assessment applied to Final Array”. Method 2 uses two ecological parameters (a floristic quality index (FQI) and hydrologic index (HI)) from the Coastwide Reference Monitoring System (CRMS) (<http://www.lacoast.gov/crms2/Home.aspx>) sites. These two ecological parameters from the CRMS “Site Level Report Cards” were added together as a HSI equivalent (HSIe). For Alternative A and C, the HSIe was 0.53 and for Alternative D HSIe was 0.47. These HSIe were then used in the WVA model for the FWOP condition at all years. The HSI equivalent was reduced for future with project conditions by 15 percent. These values, along with the number of acres impacted by each alternative were input into the Alternative WVA model to calculate AAHUs. Although this is not a certified method of use of the WVA, it allows comparison of AAHUs indirect impacts across all alternatives without having full field data to perform the WVA.

Method 3: This method assumes the WVA model results used in determining indirect impacts of implementing Alternative C is representative (see footnote 8 of table 3.9) of the areas impacted by Alternative A and Alternative D. Hence, the Alternative C WVA analysis was combined with the respective number of acres impacted by Alternative A and Alternative D to determine these alternatives’ respective AAHU. The AAHU for Alternative C were determined by the WVA analysis process utilizing habitat measurements and assumptions of the planning and habitat team. Whereas, for Alternative A and Alternative D, the AAHU are based on habitat analysis from the Alternative C area.

The comparison of alternatives by each method shows some general trends:

Method 1.

Comparison of 34 (Table 3-9) percent and 15 percent habitat impacts shows that the relative costs between Alternatives A and C remain nearly the same (42 percent compared to 43 percent, respectively). (See Table 3-9.) Whereas, Alternative D shows a 10 percent increase in costs relative to Alternatives A and C (Alternative D showed a 53 percent change, Alternative A shows 42 percent change and Alternative C shows a 43 percent change). Alternative A has the least habitat impacts and mitigation costs; Alternative D has the greatest impacts and mitigation costs.

Methods 2 and 3.

Comparing AAHU developed under Methods 2 and 3 shows that for both Alternatives A and D, AAHU were underestimated by relatively the same amount, 11 percent. Whereas, for Alternative C, AAHU were



underestimated by 21 percent. Using Method 3, Alternative D has the greatest impacts to swamp and BLH habitat (approximately 2,079.6 to 1,678.99 AAHUs more than Alternative C). Alternatives A and C are predicted to be roughly comparable in total impacts. The impact to BLH is identical between the two alternatives. Alternative C has fewer direct impacts to swamp by 152.3 AAHUs compared to Alternative A. Alternative C avoids and minimizes direct impacts to a greater extent due to the fact that the levee is a shorter alignment than Alternative A. Alternative C is predicted to have greater indirect impacts to swamp by 303 AAHUs as compared to Alternative A. Overall, Alternative A is predicted to require mitigation for approximately 150.7 AAHUs less than Alternative C. However, these differences in AAHU are not considered significant enough to drive selection of a different plan due to the fact that the projected difference in mitigation costs between Alternative C and Alternative A does not cause Alternative C to no longer be the NED plan.

While Alternative A is predicted to have fewer environmental impacts than Alternative C, Alternative C is the least environmentally damaging practicable alternative. An alternative can only be defined as practicable if it is capable of being implemented. To assess the ability to implement Alternative A we must factor in the lessons learned from the Interagency Performance Evaluation Task Force (IPET) and post event investigations of Hurricane Katrina. After consideration of the forensics of damages from Hurricane Katrina in 2005, Alternative A would not be a practicable alternative. The IPET report illustrates an effective platform for developing better policy and planning decisions when recommending and designing hurricane risk reduction systems. One of the key lessons learned was to use a system approach when assessing risk to make practicable, rational and defensible decisions. Assessing risk facilitates rational decision making in several areas, including:

- “Policy-level decisions on best expenditure of funding and other resources to minimize the risk of flooding from hurricanes.”
- “Planning level decisions on relative vulnerability of flood prone areas to focus efforts on areas of greatest risk.”
- “Planning level decisions on the value of different alternatives for reducing the risk of flooding and losses.”
- “Insights for design-level decisions on where to put gates or raise walls to reduce risk.”

One of the key areas of assessing risk is accomplished through analyzing a system’s performance for a given set of events. This performance is assessed by modeling how each structure and component of the system (levees, floodwalls, gates, etc.) would perform under the forces generated by surge and waves. Results from modeling of the Greater New Orleans Hurricane Storm Damage Risk Reduction system (HSDRRS) illustrated that as components are added to the system, the risk for failure increases. Similar lessons have been assessed in reviewing the Dutch storm surge risk reduction system. Application of this principle helped lower risk and improve system performance for the Greater New Orleans area.

If Alternative A were implemented, it would likely include over 42 different T-wall sections with 84 levee tie-in points (Figure 3-11). Alternative C only has 17 different T-wall sections with 34 levee tie-in points. Most of these T-walls locations are to address pipeline crossings. Alternative A crosses 70 pipelines vs. 36 pipelines for Alternative C. Relocating pipelines and handling potentially hazardous materials adds an additional risk to the environment. The more pipelines that have to be relocated, the higher the inherent risk of working with hazardous materials. There is greater risk to sensitive environments and nearby communities when relocating pipelines that carry hazardous materials.

Results from modeling the HSDRRS system under IPET also indicated that levee reaches with sharp bends and curves tend to stack storm surges and thus impose unacceptable stress on the system and inevitably create high risk areas for failure. These unnecessarily high-risk areas should be smoothed out into longer linear levee reaches when planning levee systems. A smoothed Alternative A was reviewed, but did not eliminate the tie-in issues discussed above until the alignment mimicked Alternative C.



Another area of risk assessment is the vulnerability of flooding related to residual risk. The flood risk that remains when a flood damage reduction project is implemented is called “Residual Risk”. Risk experts agree and IPET illustrated that there will always be residual risk with any system. It is imperative that flooding vulnerability from extreme events is factored into planning decisions. These decisions may require designing a system to allow for more effective evacuations or emergency responses to extreme events (i.e. greater than the recommended 100 year level of Risk Reduction). In the case of Alternative A, residual risk is high due to the proximity of the levee alignment to developed areas. Alternative A has the greatest residual risk since overtopping of the levee by storm surge during extreme events would immediately inundate vulnerable populated areas and key emergency service routes. Alternative C is set farther away from the developed areas of the study area and therefore has a lower residual risk in the event of extreme overtopping events.

When reviewing Alternative A’s components the alternative includes unnecessarily high-risk areas (Figure 3-11). As a result of past lessons, the USACE could not select Alternative A as capable alternative because it would be counter to these two critical risk assessment areas discussed in the IPET report (i.e., system complexity and residual risk).

Cost is an additional consideration that renders Alternative A impracticable. Annual OMRR&R costs for Alternative A are expected to exceed \$10M, whereas the average annual OMRR&R costs for Alternative C is estimated at approximately \$5M per year. This is a distinguishing difference between the two alternatives that may be considered unreasonable given the size of the communities. The pre-Katrina HSDRRS system is an example where long term OMRR&R costs should be taken into concern when planning a system. History has shown that systems that have very high burdens of OMRR&R costs lead to reduced system reliability, which in turn can develop into higher flooding risks to communities.

3.10 TSP Confirmation

Based on the information presented in Section 3.9, Alternative C still has the lowest total cost (including mitigation), the highest BC ratio, and the highest net benefits. In conclusion, Alternative C is still the plan that maximizes NED benefits while protecting the nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements.



4.0 ENVIRONMENTAL CONSEQUENCES FOR COMPARATIVE ANALYSIS (*NEPA Required)

This chapter describes the direct, indirect and cumulative environmental consequences of implementing the proposed hurricane and storm damage risk reduction plans. The order of discussion on resources mirrors that in Chapter 2. As detailed in Chapter 3, after completion of the draft report, final feasibility level designs were developed for the TSP (Alternative C) including additional field work, H&H model runs, and Wetland Value Assessments. As discussed in Section 3.9.5, in order to conduct a comparative analysis of the Final Alternative Array, Alternatives A and D were “brought up” to a similar level of detail using assumptions derived from data collected during the final feasibility design of the TSP. (See Table 3-9). Estimates developed in connection with that analysis provide the basis upon which the potential impacts (effects) of the alternatives in the Final Alternative Array to significant resources were compared to the No Action Alternative (future without-project conditions).

4.1 WATER ENVIRONMENT

4.1.1 Flow and Water Levels

Recommended Plan - Alternative C

Direct and Indirect Impacts: Structural measures would provide storm damage risk reduction for those areas with the greatest human development, including: Laplace and the immediately surrounding area of St. John the Baptist Parish; and the town of Montz, in St. Charles Parish. This alternative would reduce the risk of flow and water levels in the interior of the protected levee and pump system during a storm surge. During such an event the levee system would be closed thereby causing interior (protected side) water stages and flows to decrease, while being similar for rainfall events. For the exterior (unprotected side), water stages during storm events along the east bank of St. James Parish and east bank of Ascension Parish could increase when the levee system is closed. For more information, see section 3.9.4 of this report. Furthermore, the length of time water would inundate the swamps directly adjacent to the levee on the unprotected side could be less than under the No Action Alternative, as there could be less storm surge to drain from the interior with the proposed levee and associated features in place.

In St. James Parish, there are localized storm surge risk reduction measures consisting of approximately 4 miles of berms surrounding groups of structures (polders) that would directly impact the area within the proposed footprints. These areas currently consist of upland and open water. Approximately 0.17 acres of existing drainage canal open water would be directly converted into upland grass covered (berm) habitat. Another 0.02 acres (4 locations) would be converted to berms with culverts and flap gates. Of the 14,486 existing residential structures located in St. James Parish, an estimated 14 residential structures could be potentially elevated. Individual berms would be separately constructed around 9 non-residential structures. There would likely be no effects to flows or water levels attributable to this measure in the St. James Parish area.

Major indirect impacts of the structural measures would be a decrease in tidal interchange between the interior (protected side) and exterior (unprotected side) areas of the proposed levee alignment. The parallel drainage canals (modifications to the interior drainage system which have been included to mitigate for project-induced interior storm damage), would operate by gravity drainage, with pumps operating only during storm events that result in high exterior water levels. It was estimated the pumps would be operated, on average, for 1.7 storm events per year which equates to closure of gate structures on average 8.5 days per year. Consequently, hydrologic connectivity would generally be maintained between the wetlands within the 47 square mile levee-enclosed area and the surrounding swamps and Lakes Maurepas and Pontchartrain except during the closing of the system for storm events. Rainfall and high tides would still cause significant flooding of the swamps within the levee-enclosed area. As stated above, the system would only prevent flooding of these areas under storm events. Preliminary hydrologic modeling (that does not include rainfall) indicates that future without-project daily water stages on the protected side would be similar to future with-project conditions except during storm events as described above. Hydrologic modeling performed for the detailed feasibility designs later confirmed this.





Early in the planning process, the PDT identified the potential for significant indirect impacts of structural measures brought about by a decrease in hydrologic connectivity/tidal interchange between the interior (protected side) wetlands and exterior (unprotected side) wetlands and surrounding areas of the proposed levee alignment. In order to evaluate water levels and water flows that may be impacted by the structural alignment, a 1D HEC-RAS hydraulic model was completed on Alternative D during the alternatives screening phase. The hydraulic model was run on Alternative D because this was considered to be the alignment that had the highest potential to impact swamp due to the amount of wetlands it would enclose. Although this modeling was done for Alternative D only, the results are expected to be similar for the area enclosed by Alternative C since all the area enclosed by Alternative C is further enclosed by Alternative D. The limitation of the 1D HEC-RAS model is that it averages water surface across an area. This means that the model reflects stages that are separated by large geographic distances are the same when in reality there would be variations in water surface elevations. This gives a broad view of how potential tidal interchange is operating both in the without and with-project conditions.

Results of a 1D HEC-RAS hydraulic model (that does not include rainfall) indicated that future without-project water elevations on the protected side would be similar to future with-project conditions, except during storm events. That notwithstanding, to offset the risk of potential indirect impacts that could not be accounted for in the 1D HEC-RAS model, and to avoid and/or mitigate for any potential impact¹, parallel drainage canals were designed for the 18.27 mile levee of the recommended plan. These canals (one located on either side of the levee alignment) and six gated water control structures through the levee were designed to operate by gravity drainage. Pump stations would only be operated during storm events that result in high exterior water levels, during which the water control structures would be closed. It was estimated that pump operation and water control structure closure would occur, on average, for 1.7 storm events per year which equates to the closure of water control structures on average 8.5 days per year. Consequently, hydrologic connectivity/tidal interchange would be maintained between the wetlands within the 47 square mile levee-enclosed area and the surrounding swamps and Lakes Maurepas and Pontchartrain at all times except during the closing of the gates for storm events.

A HEC-RAS/HMS model, which specializes in rainfall movement and drainage, was performed on Alternative C during feasibility level of design. The results from the HEC-RAS/HMS model were used to size the pump stations and gated structures to eliminate potential interior rainfall flooding impacts during the closing of the gates for storm events. The majority of drainage in the study area is confined to these major canals and waterways.

Based on both the 1D HEC-RAS and HEC-RAS/HMS modeling data, the six proposed gated water control structures were appropriately sized and strategically placed along Alternative C in areas where gravity drainage through canals already exists (e.g. Hope Canal, Reserve Relief Canal, Mississippi Bayou, etc.) to maximize hydrologic connectivity/tidal interchange within the system. As noted above in this section, canals on either side of the levee system have been incorporated into the design of the system to further facilitate hydrologic connectivity/tidal interchange between the flood and protected side of the levee. Generally speaking, if any of the six proposed water control structures in Alternative C were to be removed, there could be a greater loss of hydrologic connectivity/tidal interchange within the enclosed wetlands since existing drainage canals would be closed.

To ensure that Alternative C does not impact hydrologic connectivity/tidal interchange more than anticipated, a 2D model which specializes in water circulation within a system will be run during PED to further validate the findings of the 1D HEC-RAS model and the rainfall model that was conducted to appropriately size the pump stations and drainage structures for Alternative C. The 2D model will determine

¹ Due to the risk of potential indirect impacts that could not be accounted for in the 1D HEC-RAS model as outlined above, and the delay in removing water from the area the HET included impacts to two values in the WVA analysis: V2 (stand maturity) and V3 (water regime). This information is included in Appendix A, Annex R (WVA Analysis).



if the six water control structures, as currently sized and located, are sufficient to maintain current hydrologic connectivity/tidal interchange. A 2D model is the most appropriate model that contains the level of detail required in order to give a “construction ready” accurate design of the control structures. It is feasible to modify these structures as appropriate during PED. This could result in enlargement, shrinkage, or small scale change in location to maximize efficiency of the tidal regime.

Figure 4-1 displays the with- and without-project water elevations for both the exterior and interior sides of the levee system. Flows into and out of the system (not including rainfall) would also be similar to future without-project conditions, but there could be a time lag under the future with-project conditions.

Figure 4-2 displays Alternative D modeling simulation flows during the month of May for Area 5 near the Bonnet Carré Spillway. For this area, there was roughly 75% the amount of interchange over the same time period for with-project versus without-project. In addition, on average, there was a 10-minute lag in the timing of the flows. This time lag would have little, if any, indirect impacts on flows or water elevations.

To ensure that the current design assures tidal connectivity, a 2D model which specializes in water circulation within a system will be run during PED to further validate the findings of the 1D HEC-RAS model.

The structural component of the Recommended Plan has the potential to increase stages to the areas exterior to the levee. These areas include the east bank of St. James Parish and the Gonzales and French Settlement areas in Ascension Parish. Based on advanced circulation modeling (ADCIRC) studies, induced flooding in the study area is minimal (see section 3.9.4). Storm surge modeling of the with-project conditions (those conditions with the structural component of the Recommended Plan in place) which was performed during feasibility found increased stages during a storm event that ranged between 0.1 and 0.2 feet of water. These elevated water stages were observed between the 50-500 year events. No induced flooding was observed in storm surge events between the 1-25 year events. There is a margin of error in both the economic model and the storm surge modeling (ADCIRC) which is recognized by team hydrologists and economists. The ADCIRC modeling will be refined during preconstruction engineering and design to determine whether or not there will be induced flooding and to precisely estimate its magnitude.

Alternative A

Direct and Indirect Impacts: Impacts for structural measures would be similar to the Recommended Plan, except they would occur over a smaller area (38 square miles enclosed area). Alternative A has the potential to increase flood stages in the immediate areas exterior to the levee. However the affected area would be of a smaller footprint than the influence area of the Recommended Plan. Direct and indirect impacts of localized storm surge risk reduction measures would be the same as those identified for the Recommended Plan.

Alternative D

Direct Impacts: Impacts would be similar to the Recommended Plan except over a much larger area (160 square miles) including the areas with the greatest human development within St. Charles and St. James and St. John the Baptist Parishes. There would be no difference due to Maximum Width (MaxW)² or Minimum Width (MinW) variation of this alternative on this resource. The western-most portion of the Alternative D levee alignment would extend outside of the authorized project area into Ascension Parish to

² Because of the lack of detail as it relates to the required width of the Alternative D levee as it extends to the west, estimates were developed for two variations of Alternative D: Maximum Width (MaxW) and Minimum Width (MinW). Estimates for both variations were developed to capture any change in potential impacts that may result from an increase in Alternative D's footprint brought on by an increase in levee width. The Maximum Width is the same levee width used for the final feasibility designed TSP. The Minimum Width uses the width identified for the final feasibility designed TSP for that portion of the levee where the TSP overlaps with Alignment D and for the remaining 19.74 miles, the original width estimates reported in the Draft Report. Due to the fact that the Recommended Plan -Alternative C (Recommended Plan) and Alternative A overlap for approximately 6 miles and at the greatest distance is only separated by approximately 1.25 miles. The width for Alternative C was used for all of Alternative A. This assumption has a low risk.



tie into an existing non-Federal levee. This alternative would directly impact flow and water levels in the interior (protected side) and exterior during rainfall and hurricane events. Interior water stages and flows would likely decrease for hurricane events, while being similar for rainfall events (assuming that the drainage structures or pumps are operating).

Indirect Impacts: Impacts would be similar to the Recommended Plan, except over a larger area (160 square mile enclosed area) and with the following exception: Alternative D would have the potential to increase stages to areas exterior to the proposed levee alignment. In the case of Alternative D, these areas include Ascension and Livingston Parishes. Due to the larger area being taken out of the flood plain, the probable affected area could be much larger than the influence area of the Recommended Plan.

4.1.2 Sedimentation and Erosion

Recommended Plan - Alternative C

Direct and Indirect Impacts: Implementing the proposed action would require approximately 9,000,000 cubic yards of borrow material for the structural levees and the berms. However, best management practices would be used to avoid, minimize and reduce potential sedimentation and erosion impacts during borrow excavation. Construction of levees, earthwork fill, placement of geotextile, T-walls, storm damage gates, drainage gates, sheetpile, riprap, gates and pumping stations would also utilize best construction management practices to avoid, minimize and reduce potential erosion and sedimentation into adjacent wetlands. These impacts would generally be minor and short-term, lasting only during construction of the proposed project features. Indirect impacts would include significant reduction of erosion and sedimentation associated with storm events.

The placement of structures within waterways intersecting the levee alignment has the potential to create a sedimentation/erosion maintenance issue directly upstream and downstream of the structure. However, these structures would be designed and scour protection would be placed to minimize sedimentation/erosion issues. Several pumping stations would also be placed along the waterways that would intersect the levee alignment. These pump stations have the potential to cause severe erosion in the vicinity of the suction and discharge areas. The pump stations would be designed and scour protection would be placed to minimize sedimentation/erosion issues. Despite best efforts, sedimentation/erosion issues may still exist. The proposed action has the potential to decrease tidal interchange velocities throughout the area resulting in increased sedimentation within waterways of both the interior and exterior of the proposed levee alignment.

Alternative A

Direct and Indirect: Impacts would be similar to the Recommended Plan except over a smaller area. Approximately 10,100,000 cubic yards of borrow would be needed.

Alternative D

Direct and Indirect: Impacts would be similar to the Recommended Plan except over a larger area. Approximately 13,800,000 and 12,100,000 cubic yards of borrow would be needed for the MaxW and MinW, respectively.

4.1.3 Water Quality and Salinity

Recommended Plan - Alternative C

Direct and Indirect Impacts: Some wetland and open water areas (see section 4.3.1 for details) would be converted into upland habitat for construction of hurricane risk reduction features and would no longer provide water quality benefits. Because fill and construction materials are anticipated to be free of contaminants, discharge of these materials into existing adjacent waters is not expected to result in adverse effects to aquatic organisms. Construction impacts to runoff would be minimized through implementation of a Stormwater Pollution Prevention Plan (SWPPP) (USEPA 2012). Indirect impacts include water exchange between the flood and protected side of the levee system which could lead to localized areas of stagnation and reduced salinity on the protected side of the levee and local areas of increased salinity on the flood side of



the levee system. Additional development in areas behind the levee alignment could lead to additional point and nonpoint discharges within these areas. Structure operation is expected to impact biogeochemical cycling for wetlands within the proposed alignment. There would be brief indirect impacts during the construction of the localized storm surge risk reduction measures to the surrounding open water due to runoff from the construction of the berms and flap gates. There would be no impact on salinity since the material that is being brought in is not expected to have a high salt concentration. See Water Quality Analysis at Appendix A, Annex M for more details.

Alternative A

Direct and Indirect: The alignment of this alternative would minimize further impoundment of wetlands (3,653 acres as compared to 8,521 acres for the Recommended Plan); hence, water quality impacts would be expected to be similar in nature, but lesser in extent, than impacts associated with the Recommended Plan.

Alternative D

Direct and Indirect: This alternative encloses the largest area by a significant margin (56,677 acres) while also having the greatest amount of new levee construction. Water quality impacts associated with this alternative would be expected to be similar in nature but greater in extent than impacts associated with the Recommended Plan. The MaxW variation would have a greater impact on wetlands resulting in a greater loss of water quality filtering by those lost wetlands. .

4.2 HUMAN ENVIRONMENT

4.2.1 Population and Housing

Recommended Plan - Alternative C

Direct and Indirect Impacts: Structural measures would have no direct impacts to population and housing. The localized storm surge risk reduction measure of elevating 14 residential structures would cause residents temporary inconveniences related to relocating to a temporary residence. The indirect impacts of raising structures include a reduced ease of access to structures, as some residents would have to approach the entrances to their homes by way of a stairway, ramp, or lift. Indirect impacts for the structural and localized storm surge risk reduction features include reduced risk of damage from hurricane and tropical storm surge events. This would potentially enhance the stability and sustainability of population and housing resources located behind the levee and berm alignments. It is anticipated that local parish building codes would place restrictions requiring the elevation of future construction in the area.

Alternative A

Direct and Indirect Impacts: Impacts would be similar to the Recommended Plan, except construction of the levee would be closer to development in Alternative A, thereby creating a greater chance of temporarily decreasing property values due to added traffic congestion, noise and dust during the construction..

Alternative D

Direct and Indirect Impacts: Impacts would be the same as the Recommended Plan, except localized storm surge risk reduction measures would not be included. There would be no difference due to MaxW or MinW variation of this alternative on this resource.

4.2.2 Employment, Business and Industrial Activity (including Agriculture)

Recommended Plan - Alternative C

Direct and Indirect Impacts: Proposed structural measures would cause the a swamp tours temporary loss of access to the adjacent waterway until construction of boat access to the waterway is restored following construction of this reach of the project. The localized storm surge risk reduction measure of flood proofing non-residential structures could temporarily interrupt business operations, although it is possible these businesses could continue operating during the retrofitting process. Indirect impacts for both the structural and localized storm surge risk reduction features include reduced risk of damages from hurricane and tropical storm surge events. These risk reduction measures would allow businesses and industries to resume normal



operations in a shorter period of time following a storm event. It is anticipated that local parish building codes would place restrictions on the elevation of future construction in the area. In contrast to the potential adverse effects to the St. James Parish area described above, the St. Charles and St. John the Baptist Parishes areas would generally benefit from implementation of the hurricane and storm surge damage risk reduction measures which would allow these businesses, industries and agricultural operations to continue to operate during minor storm events not requiring evacuation.

Alternative A

Direct and Indirect Impacts: Impacts would be the same as the Recommended Plan.

Alternative D

Direct and Indirect Impacts: Impacts would be the same as the Recommended Plan except all three parishes would be behind the levee alignment allowing for continued operation of businesses, industries and agriculture in St. James Parish during a storm minor surge event not requiring evacuation. There would be no difference due to MaxW or MinW variation of this alternative on this resource.

4.2.3 Public Facilities and Services

Recommended Plan - Alternative C

Direct and Indirect Impacts: Structural measures would not directly impact public facilities or services. The localized storm surge risk reduction measure of flood proofing public facilities could temporarily interrupt these services and inconvenience users until the retrofitting process has been completed. Indirect impacts for both the structural and localized storm surge risk reduction features would include reduced risk of damage from hurricane storm surge for public facilities and services.

Alternative A

Direct and Indirect Impacts: Impacts would be the same as the Recommended Plan.

Alternative D

Direct and Indirect Impacts: Impacts would be the same as the Recommended Plan except for the absence of the indirect impacts associated with localized storm surge risk reduction measures in the Gramercy/Lutcher area. There would be no difference due to MaxW or MinW variation of this alternative on this resource.

4.2.4 Transportation

Recommended Plan - Alternative C

Direct and Indirect Impacts: There would be no significant direct impacts. Rather, there would be minor temporary impacts in the form of increased vehicular congestion along roads, highways and streets during construction which cease following completion of construction activities. There would also be a degradation of the transportation infrastructure, primarily local roads and highways, as a result of the wear and tear from transporting construction materials. Indirect impacts would include a lower risk of storm damage-related damages to the transportation infrastructure for areas behind the proposed levee alignment, inside the polders and south of the highways where flap gates are put in. Because the Recommended Plan does not reduce risk to those sections of highway previously inundated during tropical storm/surge events, there would be no change in accessing the area during or directly after a storm event that required evacuation compared to the no action alternative.

Alternative A

Direct and Indirect Impacts: Impacts would be the same as the Recommended Plan.

Alternative D

Direct and Indirect Impacts: Direct impacts would be similar to the Recommended Plan, except construction impacts, such as traffic congestion and deterioration of the transportation infrastructure, could affect a total of 28 miles of roads. Indirect impacts would be similar to the Recommended Plan, except risk reduction from



storm surge events to transportation infrastructure would extend into the western portion of the project area. This alternative could reduce the risk of inundation to the ground level section of I-10 in the western portion of the area which could improve access for emergency responders and prevent delays of local and regional residents returning to residences after storm events. There would be no difference due to MaxW or MinW variation of this alternative on this resource.

4.2.5 Community and Regional Growth

Recommended Plan - Alternative C

Direct and Indirect Impacts: There would be no direct impacts from the structural or non-structural measures. Indirect impacts for both the structural and localized storm surge risk reduction features of the alternative include reduced hurricane storm damage risk reduction for communities thereby contributing to potential growth opportunities for communities in the three-parish area. The proposed action could enable community growth to occur as the lower incidence of storm surge damage allows communities to focus more on community-building activities rather than on preparing for and recovering from storm surge events.

Alternative A

Direct and Indirect Impacts: Impacts would be the same as the Recommended Plan.

Alternative D

Direct and Indirect Impacts: Direct and indirect impacts would be similar to the Recommended Plan. There would be no difference due to MaxW or MinW variation of this alternative on this resource.

4.2.6 Tax Revenues and Property Values

Recommended Plan - Alternative C

Direct and Indirect Impacts: Property values near levee and localized storm surge risk reduction measure construction sites may decrease temporarily due to added traffic congestion and construction noise and dust. These impacts would be temporary and minor, lasting only during construction. It is unknown at this time if elevating structures would have any effects on property values. Currently, there are 14 residential being considered for elevating and 9 non-residential structures being considered for flood proofing. Indirect impacts could include increases in tax revenues and property values due to the increased hurricane storm damage risk reduction for residential properties and businesses.

Alternative A

Direct and Indirect Impacts: Impacts would be the same as the Recommended Plan. Construction of the levee would be closer to development than the Recommended Plan, thereby creating a greater chance of temporarily decreasing property values due to added traffic congestion, noise and dust during the construction.

Alternative D

Direct and Indirect Impacts: Direct impacts would include structural hurricane and storm surge damage risk reduction affecting tax revenues and property values not only for the St. Charles and St. John the Baptist Parishes, but also St. James Parish. Indirect impacts would be similar to the Recommended Plan except over a three-parish area. But there would be no impact due to the localized storm surge risk reduction measures. There would be no difference due to MaxW or MinW variation of this alternative on this resource.

4.2.7 Community Cohesion

Recommended Plan - Alternative C

Direct and Indirect Impacts: There would be no direct impacts from the structural measures. However, if residential structures are elevated then the residents would be temporarily relocated and community cohesion would be disrupted during the time the structures are being elevated. Currently, there are 14 residential structures being considered for elevating and 9 non-residential structures for flood proofing. Indirect impacts for both the structural and localized storm surge risk reduction features include reduced storm damage risk



for communities thus preserving the spatial patterns of social interaction and maintaining community cohesion.

Alternative A

Direct and Indirect Impacts: Impacts would be the same as the Recommended Plan.

Alternative D

Direct and Indirect Impacts: Direct impacts would include structural hurricane and storm surge damage risk reduction for the St. Charles, St. John the Baptist and St. James Parishes. Direct and indirect impacts associated with localized storm surge risk reduction measures would not be present under this alternative. There would be no difference due to MaxW or MinW variation of this alternative on this resource.

4.2.8 Environmental Justice

Recommended Plan - Alternative C

Direct and Indirect Impacts: The construction of the levee may have minimal short term impacts to residences located behind the levee but these impacts would be the same regardless of race or income thereby eliminating any Environmental Justice concerns in relation to those communities located behind the levee alignment.

There are two components of the residential localized storm surge risk reduction plan that provide hurricane/tropical storm risk reduction to residents in St. James Parish: 1) Berms constructed around groups of residential structures and 2) elevation of a limited number of residential structures.³ Details of the residential localized storm surge risk reduction features can be found in Section 5.1.

Construction of the first component, the berms in St. James Parish, will provide a similar level of risk reduction to residents as will the structural alignment in St. John the Baptist, in year 2020. In the future, the level of risk reduction provided by the localized storm surge risk reduction measures would depend on the actual rate of RSLR. Without any improvements (i.e. lifts), the level of risk reduction in year 2070 is estimated to fall between the 25 yr and 50 yr probability storm surge stages based on the intermediate RSLR scenario. This lower level of risk reduction may allow flooding to occur behind the berm in later years. Due to RSLR, there could be an impact to those homes in the localized storm surge risk reduction area in St. James Parish that would not occur to homes protected by the structural alignment.

Implementation of the localized storm surge risk reduction component that constructs a berm around groups of residential structures could impact the following four communities in St. James Parish: Lucher, Gramercy, Grand Point and Convent. These communities are identified as the “Project Impact Area.” Two of these are EJ communities (Lucher and Convent). Because there are EJ communities in the Project Impact Area, a determination must be made if these impacts are disproportionate to minority or low-income residents.

Table 4-1 shows the white and minority population of the 3-parish area and of the Project Impact Area. Approximately 9% of the 3-parish area white population lives in the Project Impact Area while 8% of the 3-parish area minority residents live in the Project Impact Area. Additionally, only 9% of the 3-parish area low-income population lives in the Project Impact Area.

As illustrated in the below table, the percent of the white and minority population located within the Project Impact Area are nearly equal. As also reflected in the below table, only a small percentage of the 3-parish area low-income households are located in the Project Impact Area. Therefore, the project would not result in a disproportionate adverse impact to minority and/or low-income communities per 2010 U.S. Census information and requirements of E.O. 12898.

³ Localized storm surge risk reduction measures that address non-residential structures are not addressed by this section of the report.



Table 4-1: Relationship between the Project Impact Area and the 3-Parish Area for EJ Analysis

Population	3-Parish Area	Project Impact Area*	Percent in 3-Parish Area	Percent in Project Impact Area
Total	120,806	10,356	100%	9%
White	62,631	5,542	52%	9%
Minority**	58,175	4,814	48%	8%
Low Income Population	17,063	1,486	14%	9%
* Project Impact Area includes population in Lusher, Gramercy, Convent and Grand Point all within St. James Parish.				
**Minority includes non-Hispanic black and other non-white races and Hispanics.				

The elevation of individual residential structures, the second component of the residential localized storm surge risk reduction plan, also takes place in St. James Parish and would provide the same level of risk reduction as the structural alignment for the Project in St. John the Baptist Parish. The overall costs of structure elevation would not be borne by any single individual (minority or low-income) nor the community; rather, these costs would be part of the proposed project costs. There are however costs associated with temporary relocation while construction occurs which may include hotel, meals, and incidentals. These costs can present a temporary burden to low-income residents. However, only 12% of households in Block Group 3 of Census Tract 40400 and Block Group 1 of Tract 40300 have incomes below the poverty level. Additionally, 16% of the population in Census Tract 40400, blocks 3005, 3007, 3014, 3018, 3022 and Census Tract 40300, blocks 1026 and 1058 are minority. These specific Census blocks examined are where the 14 structures identified for elevation would occur. Therefore, the proposed structure elevations would not cause a disproportionate adverse impact to minority and/or low-income residents.

Implementation of Alternative C would not have a disproportionate adverse impact to minority and/or low-income residents as it would provide additional benefits to safety, life, health and properties of all residents and businesses within the study area regardless of race or income level by reducing the overall level of flood risk by the end of the period of analysis.

Alternative A

Direct and Indirect Impacts: Impacts would be the same as the Recommended Plan.

Alternative D

Direct and Indirect Impacts: Alternative D extends structural measures for hurricane and storm damage risk reduction to all populations located within the area removing any impacts associated with the localized storm surge risk reduction measures. There would be no difference due to MaxW or MinW variation of this alternative on this resource.

4.3 NATURAL ENVIRONMENT

4.3.1 Soils, Water bottoms and Prime and Unique Farmlands

Recommended Plan - Alternative C

Direct Impacts: Due to the levee construction a total of 1,198 acres, would be converted to levee, including 1,176 acres of primarily hydric soils of Cancienne and Fausse soils in St. Charles Parish; and Cancienne and Carville, Barbary, Schreiber and Gramercy soils in St. John the Baptist Parish.

Approximately 14.8 acres of water bottoms in canals such as Reserve Flood Relief Canal and waterways such as the Mississippi Bayou would also be impacted. A total of approximately 128.2 acres of land classified as prime farmlands would be converted to nonagricultural use. Project impacts would be related to the construction of levee earthwork fill, geotextile, T-walls, storm damage gates, drainage gates, sheetpile, riprap, gates and pumping stations. The remaining project-induced impacts would be to existing developed areas such as highways and pipeline rights-of-way. The USACE has coordinated these potential impacts with the



Natural Resources Conservation Service (NRCS) (Appendix A, Annex E) and determined that the proposed conversion would be consistent with the Farmland Protection Policy Act and the USACE's internal policies. It is anticipated that the Bonnet Carré government furnished borrow site has enough borrow material for the entire proposed action.

The proposed localized storm surge risk reduction plan (polders) would result in a direct impact to approximately 10 acres of soils classified as prime farmland. There would be no impacts to water bottoms (Sportsman Pond) resulting from the construction of Polder 1 (Gramercy Berm).

Indirect Impacts: Up to approximately 8,432 acres of hydric soils could be affected due to enclosing the area within the levee and pump system. The levee and pump system would be a gravity drainage system with pumps operated only during hurricane/tropical storm surge events of approximately 1.7 storm events per year and would be closed for approximately 8.5 days per year. Consequently, hydrologic connectivity would be generally maintained with the surrounding swamps and Lakes Maurepas and Pontchartrain, except during the closing of the system for hurricane/tropical storm surge events. Preliminary hydrologic modeling (not including rainfall) indicates that future with-project daily water stages on the protected side would be similar to future without-project conditions. In addition, future with-project flows into and out of the protected system (not including rainfall) would also be similar to future without project conditions, but there could be a brief time lag of approximately ten minutes (Section 4.1.1). The proposed action is not anticipated to convert any existing hydric or non-hydric soils, to a different soil type. Indirect impacts to soils from the localized storm surge risk reduction measures would be minimal as floodgates and pumps would be installed to allow existing drainage to continue when not under surge events, and to remove rainwater during storm events.

Alternative A

Direct and Indirect Impacts: Direct impacts would be similar to the Recommended Plan with the following exceptions: a total footprint of 1,338 acres and impacts of levee/structures construction to 7.8 acres of water bottoms. Additionally, approximately 53.4 acres of land classified as prime farmlands would be converted to nonagricultural use. Indirect impacts would be similar to the Recommended Plan except Alternative A could indirectly affect up to 3,564 acres. The impacts of the localized storm surge risk reduction measures would be the same as the Recommended Plan.

Alternative D

Direct and Indirect Impacts: Direct impacts would be similar to the Recommended Plan with the following exceptions: Alternative D, with a total footprint of 1,836 and 1,611 acres for the MaxW and MinW respectively, would directly impact approximately 1,115 acres of primarily hydric soils of Cancienne and Fausse soils in St. Charles Parish; Cancienne and Carville, Barbary, Schriever and Gamercy soil associations in St. John the Baptist Parish; and Barbary soils in Ascension and St. James Parishes. Alternative D would also directly impact approximately 17.5 acres of water bottoms, including the Blind River and Mississippi Bayou. No prime or unique farmlands would be impacted. Indirect impacts would be similar to the Recommended Plan except Alternative D could indirectly affect up to 56,228 acres.

4.3.2 Vegetation, Wildlife and Fish Habitat Impacts

As discussed in Section 3.9.5, WVA swamp and BLH models were run for the Recommended Plan. AAHU estimates developed for both Alternatives A and D are based on assumptions made during the running of the Swamp WVAs for Alternative C. No new data was collected specific to Alternatives A and D. The WVA models operate under the assumption that optimal conditions for fish and wildlife habitat within a given coastal wetland type can be characterized, and that existing or predicted conditions can be compared to that optimum to provide an index of habitat quality. Habitat quality is estimated and expressed through the use of a mathematical model developed specifically for each wetland type. Each model consists of: 1) a list of variables that are considered important in characterizing fish and wildlife habitat; 2) a Suitability Index graph for each variable, which defines the assumed relationship between habitat quality (Suitability Index) and different variable values; and 3) a mathematical formula that combines the Suitability Indices for each variable



into a single value for wetland habitat quality, termed the Habitat Suitability Index (HSI). The WVA models assess the suitability of each habitat type for providing resting, foraging, breeding, and nursery habitat to a diverse assemblage of fish and wildlife species. This standardized, multi-species, habitat-based methodology facilitates the assessment of project-induced impacts on fish and wildlife resources.

The WVA Swamp model consists of four variables: V1) stand structure; V2) stand maturity; V3) water regime; and V4) mean high salinity during the growing season. When the interagency Habitat Evaluation Team (HET) prepared the WVAs for Alternative C they decided that there would be some impact to both the V1 and V2 for the future with project condition if the water levels inside the levees were held for a longer duration or at a higher level. The other variables would remain the same for both the future without and future with project condition. Alternative C has been designed in a manner to eliminate hydraulic impacts to the enclosed swamp and this design has been verified with the 1D HEC-RAS hydraulic modeling (See Engineering Appendix, Interior H&H). Based on best professional judgment and experience in the vicinity, the HET assumed that placement of the levee would result in a reduction in efficiency of drainage on the protected side thereby affecting water quality and increasing impoundment. The HET assumed that these impacts may not have been adequately captured in the H&H modeling effort or in its margin of error because rainfall had not been included in the model. Based on these assumptions, stand structure (V1) was reduced by 1 class level from the future without project condition to the future with project condition. Maturity (V2) stand data was collected from the project area for baseline estimates. Projections were processed through the WVA Site-Ingrowth spreadsheets that incorporated RSLR into the growth factor regression. The HET took the future without project growth rate numbers and reduced them by -0.2 to account for the expected change in efficiency of drainage for the future with project condition. The sections below presents the results of these changes.

4.3.2.1 Vegetation Resources

Recommended Plan - Alternative C

Direct Impacts: The Recommended Plan would directly impact a total of approximately 1,114 acres of swamp along the reach of the alignment located north of US-61, and approximately 12 acres of dry and/or wet BLH located along the reach of the alignment located south of US-61 (Figure 4-3). Direct impacts from the localized storm surge risk reduction measures would be the conversion of about 1 acre of swamp habitat bordering residential property in St. James Parish into berm habitat. Approximately 0.29 acres of forested wetlands would be impacted by the Gramercy berm; and 0.81 acres impacted by construction of the Grand Point North berm. The certified Swamp and BLH Wetland Value Assessment (WVA) Models were run to determine the impact due to this alternative. Details on the certification, assumption made during for the WVA runs and the actual model runs can be found in Appendix A, Annex R. The results of the WVAs indicate that 595.6 and 95.5 AAHUs of swamp and BLH habitat, respectively, would require mitigation due to direct impacts.

Indirect Impacts: The Recommended Plan could potentially indirectly impact up to approximately 8,432 acres (494.5 AAHUs) of primarily forested wetlands/swamp habitats and 89 acres (3.1 AAHUs) of BLH used by fish and wildlife for shelter, nesting, feeding, roosting, cover, nursery and other life requirements. This would include cypress-tupelo swamp, swamp milkweed, floating antler fern and rooted spike-rush (LDWF 2013), listed species and rare, unique or imperiled vegetative communities in the project area. However, preliminary hydrologic modeling indicates that the project design would have minimal changes to flows or stages on either the protected or unprotected sides. To accomplish this, the proposed levee system designs would include culverts with sluice gates joining directly with each of the existing culverts under I-10. Similarly, culverts would be included within the levee system along those levee reaches presently open to the surrounding wetlands system in order to retain hydrologic connectivity between the protected and unprotected areas. These structures would only be closed on average for 1.7 storm events annually, or about 8.5 days annually.



Additional indirect impacts would be the potential prevention of saltwater intrusion into the levee-enclosed system when structures are closed for hurricane/tropical storm surge events. Gates, like those along the Reserve Relief Canal, and levee culverts would be closed for hurricane/tropical storm surge events on average frequency of about 1.7 times per year; which would result in the closure of the levee system for an average duration of about 8.5 days per year. Closure of the levee system during these storm surge events would reduce minor salt water intrusion into wetland habitats enclosed by the levee system. This could provide some reduction of the potential ecological stresses associated with saltwater intrusion and could also help reduce the conversion of existing forested wetlands and swamps to marsh and open water habitats.

The total direct and indirect impacts that would require mitigation is 1,188.7 AAHUs.

Alternative A⁴

Direct Impacts: Direct impacts would be similar to the Recommended Plan except 1,389 acres (estimated 747.9 AAHUs) of forested wetlands and swamp, and 123 acres (95.5 AAHUs⁵) of BLH would be impacted.

Indirect Impacts: Indirect impacts would be similar to the Recommended Plan except 3,564 acres (estimated 747.6 AAHUs) of forested wetlands and swamp habitat and 89 acres (3.1 AAHUs) of BLH would be impacted.

The total estimated direct and indirect impacts that would require mitigation under Alternative A is 1,038.0 AAHUs – an estimated 150.7 AAHUs less than the Recommended Plan.

Alternative D⁶

Direct Impacts: Direct impacts would be similar in nature but greater in extent to those reported in connection with the Recommended Plan. An estimated 1,951 acres (estimated 1,032.4 AAHUs) for MaxW and 1,712 acres (estimated 905.88 AAHUs) for MinW of forested wetlands and swamp could be directly impacted. There would be on direct impacts to BLH.

Indirect Impacts: Indirect impacts would be similar in nature but greater in extent to those reported in connection with the Recommended Plan. Under both the MaxW and MinW scenarios, up to 56,588 acres (estimated 2,235.8 AAHUs) of swamp and 89 acres (3.1 AAHUs) of BLH could be impacted.

The total estimated direct and indirect impacts that would require mitigation under Alternative D is 3,268.2 AAHUs and 2,867.69 AAHUs for the MaxW and MinW, respectively – an estimated 2,079.5 AAHUs and 1,678.99 AAHUs greater than those reported in connection with the Recommended Plan.

4.3.2.2 Wildlife Resources

Recommended Plan - Alternative C

Direct and Indirect Impacts: Approximately 9,758 acres of wildlife habitat would be directly or indirectly impacted. During construction any wildlife present would relocate to avoid the construction but would quickly return to the area after construction ends. Wildlife access into and out of the levee-enclosed system would not be significantly impacted as most wildlife are highly mobile. For example, quadrupeds such as deer, bobcats, bear and rabbits would be able to cross the levees to access habitat on either side of the alignment. However aquatic wildlife such as manatee cannot traverse the levee, while other semi aquatic wildlife such as turtle, alligators, otters, frogs, etc may choose not to traverse the levee even though they may be capable of it.

⁴ AAHUs for both Alternative A and D are estimates based on assumptions made during the running of the swamp WVAs for Alternative C. No new data (WVAs) was collected to determine AAHUs specific to Alternatives A and D. See section 3.9.5 for further discussion.

⁵ The tracts of land where BLH habitat is found are impacted in same manner by all three alternatives. Therefore the BLH WVA for Alternative C is also accurate for Alternative A and Alternative D.

⁶ AAHUs for both Alternative A and D are estimates based on assumptions made during the running of the swamp WVAs for Alternative C. No new data (WVAs) was collected to determine AAHUs specific to Alternatives A and D.



Various structures are designed into the system to allow for water exchange during the majority of the year except during hurricane/tropical storms. As noted, aquatic wildlife would face temporary limits to transit between both sides of the alignment when structures are closed to block storm surge. However, restriction from transiting between both sides of the structure would be temporary and would occur, on average, only an estimated 8.5 days per year due to closure of the levee system during hurricane/tropical storm surge events. Closure of the levee system during these storm surge events would also reduce some degree of salt water intrusion into wetland habitats enclosed by the levee system. This could provide some reduction of the potential ecological stresses associated with saltwater intrusion and could also help reduce the conversion of existing forested wetlands and swamps wildlife habitat to marsh and open water habitats thereby protecting enclosed cypress-tupelo swamp for continued wildlife use. This would be especially important as RSLR is projected to increase.

Avian species would lose forested habitat along the alignment. However this habitat would be replaced at mitigation sites. Some wildlife may avoid the open landscape of the levee corridor while others could be attracted to the area for hunting or to use it for transition to other parts of the study area.

Alternative A

Direct and Indirect Impacts: Direct impacts would be similar to the Recommended Plan except 5,174 acres of wildlife habitat would be impacted. This represents a 47% reduction in the number of acres impacted when compared to the Recommended Plan but only a 13% reduction when comparing the impacts in habitat value (AAHUs). This is due to the fact that 100% of the direct impact acres (swamp converted to levee) do not have habitat value using the WVA models. Since there are less enclosed wetlands there would less area with restricted access to aquatic wildlife.

Alternative D

Direct and Indirect Impacts: Direct impacts would be similar in nature to the Recommended Plan but greater in extent with an estimated total of 58,628 acres of wildlife habitat impacted. This represents a 501% increase in the number of acres impacted and a 175% increase when comparing the impacts in habitat value (AAHUs) for the both the MaxW and MinW. Because Alternative D encloses a larger area there would be a greater number of acres with restricted aquatic wildlife access.

4.3.2.3 Aquatic and Fisheries Resources

Recommended Plan - Alternative C

Direct and Indirect Impacts: Approximately 1,114 acres of existing benthos swamp habitat would be converted into upland grass covered (levee) habitat. Sessile organisms would be buried during construction. Mobile species of fish, shellfish and other aquatic resources would either avoid the area during construction (fish) or be moved out of the way due to water displacement (plankton). Up to 8,432 acres of forested wetland and swamp habitats utilized by aquatic and fishery resources could be indirectly impacted. However, preliminary hydrologic modeling indicates that the project design would have minimal changes to flows or stages on either the protected or unprotected sides. The WVA for this project shows an estimated 34% reduction in the overall habitat suitability due to indirect impacts of the levee over the project life.

Aquatic organism access into and out of the proposed action area would be impacted; additional culverts may deter some species from swimming through those structures. Aquatic species would be temporarily restricted from entering the proposed action area on average about 8.5 days per year due to closing gates and culverts in preparation for storm surge. This impact could be significant for the catadromous American eel that needs the fresh water areas for development and access to the ocean for breeding. If the closures occur, when the elvers stage enter the swamps there would be a recruitment age class loss. For marine species the impact would not be significant because their movement into the area is less dependent on tidal action and stage of development. Fresh water species would breed in the enclosed area for the most part and would not be indirectly impacted by the closure.



Approximately 0.17 acres of existing drainage canal bottom would be directly converted into upland grass covered (berm) habitat another 0.02 acres (4 locations) would be converted to a berm with culverts and flap gates due to the localized storm surge risk reduction measures. Sessile organisms would be buried during construction. Mobile species of fish, shellfish and other aquatic resources would either avoid the area during construction (fish) or be moved out of the way due to water displacement (plankton). The operation of the 150 flap gates would result in a repetitive temporarily indirect impact on aquatic organisms. Species would be restricted from entering the proposed action area on average about 8.5 days per year due to closing gates in connection with storm surge events.

Alternative A

Direct and Indirect Impacts: Direct impacts would be similar to the Recommended Plan with the following exceptions: approximately 1,398 acres of benthos would be directly impacted due to the longer levee alignment representing an estimated 25% increase in impacts over those identified in connection with the Recommended Plan. Indirect impacts would be similar to the Recommended Plan except Alternative A would enclose approximately 3,564 acres of aquatic habitat; hence, there would likely be a less significant impact on the American eels – an estimated 58% reduction. The impact from the localized storm surge risk reduction plan would be the same as the Recommended Plan.

Alternative D

Direct and Indirect Impacts: Direct impacts would be greater than the Recommended Plan. Under the MaxW scenario, approximately 1,951 acres of benthos would be directly impacted – an estimated 75% increase over those reported in connection with the Recommended Plan. Under the MinW scenario, approximately 1,712 acres of benthos would be directly impacted – an estimated 54% increase over those reported in connection with the Recommended Plan. Indirect impacts would also be greater than those reported for the Recommended Plan. Approximately 56,588 acres of aquatic habitats would be enclosed in the levee system; representing a 571% increase in impacts on American eels under the MaxW and MinW scenario.

4.3.3 Essential Fish Habitat (EFH)

Recommended Plan - Alternative C

Direct and Indirect Impacts: the Recommended Plan would have no direct or indirect impacts on EFH since no EFH intersects the structural or localized storm surge risk reduction areas or the proposed enclosed area in the near term (Figure 2-7). Closure of the levee system during hurricane/tropical storm surge events would reduce minor salt water intrusion into wetland habitats in the proposed levee system. This could provide some reduction of the potential ecological stresses associated with saltwater intrusion and could also help reduce the conversion of existing forested wetlands and swamps to marsh and open water habitats (EFH).

Alternative A

Direct and Indirect Impacts: Impacts would be similar to the Recommended Plan.

Alternative D

Direct and Indirect Impacts: There would be no direct impact to white shrimp EFH. There would be direct impacts to red drum EFH where the gate on Blind River is built. The soft bottom habitat, EFH red drum habitat, in the footprint would be permanently removed from use. Red drum EFH areas located within the construction turbidity plume may not be usable during construction. However, this impact would be temporary. The EFH area of Blind River inside the proposed levee system could be slightly less accessible by red fish after the levee structure is in place. However, the intent of the tentative levee design is to allow for existing flows and cross sections and should not hinder red fish access. There would be no difference due to MaxW or MinW variation of this alternative on this resource.



4.3.4 Threatened and Endangered Species

Recommended Plan - Alternative C

Direct and Indirect Impacts: Based on review of existing data and preliminary field surveys, the USACE finds that implementation of the proposed action would have no effects on any known listed species or their critical habitat, bald eagles or colonial nesting waterbirds. The Recommended Plan would directly impact (destroy) the following acres of habitats potentially utilized by the bald eagle and colonial nesting waterbirds: a total of 1,237 acres primarily swamp habitats and BLH. Other, adjacent forested wetlands and swamp habitats are available for use by listed species, the Bald Eagle and colonial nesting waterbirds. The Recommended Plan could potentially indirectly degrade up to approximately 8,521 acres of swamp and BLH habitats potentially utilized by the bald eagle and colonial nesting waterbirds. However, preliminary hydrologic modeling indicates that the project design would have minimal changes to flows or stages on either the protected or unprotected sides.

Access into and out of the project area would not be significantly impacted for the bald eagle or colonial nesting waterbirds. Gulf sturgeon and the West Indian Manatee would be temporarily restricted from entering the proposed action area on average about 8.5 days per year due to closing gates and culverts in connection with storm surge events.

To deter colonial nesting water birds from establishing active nesting colonies in the construction areas, a Nesting Prevention Plan would be developed, in coordination with the USFWS and LDWF. If measures to prevent colonial nesting bird populations are not successful in the area, construction-related activities that would occur within 1,000 feet of a colony could be restricted to the non-nesting period, which in this region generally extends from September 1 to February 15, depending on the species present. This restriction would likely pose significant problems to construction activity schedules. If wading bird nesting colonies become established in the area, the 1,000 foot buffer must be maintained unless coordination with the USFWS indicates that the buffer zone may be reduced based on the species present or an agreement is reached with USFWS that allows a modified process to be adopted.

There are existing bald eagle nests in the area; however, based on information provided by USFWS, all nests are beyond 1,500 feet from the proposed project alignments. Two potentially active waterbird rookeries exist within 1,000 feet of the proposed alignments. Before construction, the USFWS and USACE will survey the area to confirm if the rookeries are active or not. USFWS guidelines would be utilized during construction to avoid any impacts to above described species, if encountered.

Alternative A

Direct and Indirect Impacts: Direct impacts would be similar to the Recommended Plan except an estimated total 1,521 acres of swamp and BLH habitat will be directly impacted (destroyed). Other, adjacent forested wetlands and swamp habitats are available for use by the bald eagle and colonial nesting waterbirds. Indirect impacts would be similar to the Recommended Plan except up to 3,654 acres of swamp and BLH could potentially be indirectly impacted. The implementation of Alternative A would have no effect on any listed species or their critical habitat, bald eagles or colonial nesting waterbirds.

Alternative D

Direct and Indirect Impacts: Direct impacts would be similar to the Recommended Plan except an estimated 1,951 acres of swamp and BLH utilized by the bald eagle and colonial nesting waterbirds would be directly impacted and an estimated 56,679 acres of swamp and BLH would be indirectly impacted by the MaxW. Under the MinW scenario, direct and indirect impacts would be 1,712 acres and 56,679 acres, respectively. The implementation of Alternative D would have no effect on any listed species or their critical habitat, bald eagles or colonial nesting waterbirds.



4.3.5 Cultural and Historic Resources

Recommended Plan - Alternative C

Direct and Indirect Impacts: With a total footprint of 1,198 acres, the Recommended Plan has a chance to directly affect any recorded cultural resources or an unrecorded cultural resource that may exist within its footprint, or its borrow source or mitigation areas. Site 16SJB68 is located at the western end of the Recommended Plan, and would require further investigation as to whether it may be adversely affected by construction of the Recommended Plan. There are no other currently recorded cultural resources within the Recommended Plan footprint. A large portion of the Recommended Plan footprint has been surveyed via inclusion in cultural resource surveys for other purposes with no cultural resources recorded or expected. Regardless, portions of the Recommended Plan, especially those closest to waterways, do retain likelihood to contain unrecorded cultural resources that could be damaged by the construction of the Recommended Plan. Indirect impacts of the Recommended Plan would not be expected to be substantial. Known or unknown cultural resources on either side of the alignment could suffer indirect impacts via hurricane/tropical storm surge damage events. A Programmatic Agreement among the United States Army Corps of Engineers, the Louisiana State Historic Preservation Officer, and the Advisory Council on Historic Preservation was executed and can be found in Appendix A, Annex F. Compliance with this Programmatic Agreement will be achieved during preconstruction engineering and design (PED).

Alternative A

Direct and Indirect Impacts: Direct impacts would be similar to the Recommended Plan. Site 16SJB68 overlaps the western edge of Alignment A, and would require testing to determine if adverse impacts may occur to the resource by construction of Alternative A. There are no other currently recorded cultural resources within the Alternative A footprint. An alignment similar to Alignment A was surveyed for cultural resources in 2003 and found no cultural resources. Previously unsurveyed areas of Alignment A will need to be examined for potential cultural resources before construction.

Alternative D

Direct and Indirect Impacts: Direct impacts would be similar in nature to the Recommended Plan but potentially greater in extent as Alternative D has a footprint of 1,836 acres under the MaxW scenario and 1,611 acres under the MinW scenario, which increases the risk of both direct and indirect impacts to unknown cultural resources. Alternative D does not directly intersect any recorded and known cultural resources. There are cultural resources recorded in close proximity. Alternative D crosses many natural waterways considered high potential areas for cultural resources.

4.3.6 Aesthetics and Visual Resources

Recommended Plan - Alternative C

Direct Impacts: the Recommended Plan footprint is wider than Alternatives D MinW giving it a wider direct area of effect. Even with this wider footprint, direct impacts to visual resources would be minimal in residential and agricultural areas. Much of the levee system would be in areas that are screened by deep forest and swamp, or are remote and have minimal access. Residential areas near the levee construction may see increases in dust and noise levels during construction. This is a temporary impact and conditions should return to preconstruction levels after completion of the project. View sheds from I-10 may also be altered near the intersection with I-55 and further west where the proposed levee crosses under the interstate. Where once a natural landscape of water, marsh, or swamp could be seen, a green topped levee with a wide footprint and storm damage walls would now be seen. The proposed levee system intersects and crosses the Maurepas Swamp WMA boundaries. In those areas, access for recreation will be limited.

Indirect Impacts: The River Road Scenic Byway may see temporary impacts due to truck traffic and construction vehicles, but impacts would be minimal. Construction of the proposed levee system would most likely require a storm damage control gate or other structure across US-61. This could reduce the visual quality of the drive along the Byway. The affected area of wetlands south of the proposed levee system could be approximately



8,521 acres which could change the landscape of the region due to water channel and drainage way closures or redirections.

Alternative A

Direct and Indirect Impacts: Direct impacts to the visual resources would be similar to those described under the Recommended Plan except the footprint of Alternative A is longer than that of the Recommended Plan. Indirect impacts to the visual resources would be similar to those described under the Recommended Plan. The affected wetlands would be much less than the Recommended Plan with only 3,654 acres of potential impacts.

Alternative D

Direct and Indirect Impacts: Direct and indirect impacts to resources would be similar to those for the Recommended Plan with the exception of the Blind River, a designated Wild and Scenic River, longer levee and potential impacts to 56,679 acres of wetlands.

4.3.7 Recreation Resources

Recommended Plan - Alternative C

Direct Impacts: Approximately four miles of the levee is within the Maurepas Swamp WMA. Depending on levee designs, the WMA may be less accessible by land and water to recreation users. The LDWF boat launches at the Hope Canal and Reserve Relief Canal, a swamp tour, the I-55 launch and the I-10 launch; and a recreational camp are on protect side of the levee alignment. Localized storm surge risk reduction measures impacts would not include effects on outdoor facilities such as golf courses, swimming pools, tennis courts, boat launches, playgrounds, or ball fields. Facilities that are raised would benefit from the added risk reduction. Boat access from the Reserve Relief Boat Launch via the Reserve Relief Canal to the Maurepas Swamp WMA would be temporarily blocked during construction. Post construction, access would be via a gate that would accommodate recreational use of the canal. Access impacts to Montz Canal, near the swamp tour would be mitigated through appropriate measure if necessary. The Hope Canal boat launch would be closed during construction and permanently relocated north of its current location along the Hope Canal and road access will be provided over the levee.

Indirect Impacts: Recreationists may have less access to Maurepas Swamp WMA during construction. People with recreational camps may not be able to access their camps temporarily. Access to Grand Point Canal Boat Launch via State Route 642 will remain available during and after polder construction.

Alternative A

Direct and Indirect Impacts: Direct impacts would be similar to the Recommended Plan with the following exceptions. The LDWF Hope Canal boat launch 0.2 mile north of Alternative A would not be impacted. There would be impacts to waterway access to the Hope Canal rather than the launch itself. The levee alignment crosses the access road to a recreational camp and would block access to it temporarily. Indirect impacts would be similar to the Recommended Plan.

Alternative D

Direct and Indirect Impacts: Direct impacts would be similar to the Recommended Plan except there would be an additional 16 miles of levee alignment impacts to the Maurepas Swamp WMA. This alternative would impact waterway access to the Hope Canal rather than the launch itself. Additionally, the alignment would block water access to the St. James Boat Club and the US-61 boat launch. Indirect impacts would be similar to the Recommended Plan.



4.3.8 Noise

Recommended Plan - Alternative C

Direct and Indirect Impacts: There would be temporary and localized increased noise levels related to construction. Most of the alignment is remote and unpopulated so noise would not affect any nearby communities. The area south of US-61 and in the general vicinity of the I-10/I-55 intersection is populated and may be impacted by construction noise. After construction, noise levels would return to pre-construction conditions. Construction equipment is limited in the level of noise that can be emitted. Institutional recognition of noise, such as the regulations for Occupational Noise Exposure (29 CFR §1910.95) under the Occupational Safety and Health Act of 1970, as amended, would continue. This mandates that noise levels emitted from construction equipment be below 90 dB for exposures of eight hours per day or more. Noise may cause some temporary and minor annoyance to residents adjacent to the proposed alignment south of US-61 and business customers and workers (e.g., Shell gasoline station and casino) near the intersection of I-10/I-55. However, the Occupational Noise Exposure (29 CFR §1910.95) under the Occupational Safety and Health Act of 1970, as amended, would continue. Local fish and wildlife species may relocate during construction. Noise effects are expected to be localized, temporary and minor. Administrative and/or engineering controls, determining and implementing appropriate buffer zones, and implementing construction activity windows, shall address these issues.

No permanent noise impacts would occur as a result of localized storm surge risk reduction measures and all noise emissions would be relatively short-term, lasting only as long as construction activities. The initial construction would be from 2016-2020 (4 years). The construction would also be phased starting in one location and moving to the next so the entire area would not be under construction at the same time. Table 4-2 presents noise emissions for construction equipment expected to be used during the construction activities. Anticipated sound levels at 50 ft would range from 76 dBA to 91 dBA based on data from the Federal Highway Administration (FHWA) (2007).

Table 4-2: Sensitive noise receptors within 1000 ft impacted from project construction							
Project Construction	Noise Work Hours		Number of Sensitive Noise Receptors				
	Construction Contract Permissible Hours	Noise Ordinance - maximum permissible sound levels	Single-Family Homes	Apartment Buildings	Churches	Schools	Hospitals
<i>Ascension Parish</i>							
Maurepas Swamp Mitigation	10 hr/day, 6 days/week	6:00 am - 9:00 pm 65 dBA.	21	0	0	0	0
<i>St Charles Parish</i>							
Structural Features and Bonnet Carré mitigation area	10 hr/day, 6 days/week	7:00 am - 10:00 pm are 60 dBA for residential areas and 65 dBA for	0	0	0	0	0



Table 4-2: Sensitive noise receptors within 1000 ft impacted from project construction							
Project Construction	Noise Work Hours		Number of Sensitive Noise Receptors				
	Construction Contract Permissible Hours	Noise Ordinance - maximum permissible sound levels	Single-Family Homes	Apartment Buildings	Churches	Schools	Hospitals
		commercial areas.					
<i>St. John the Baptist Parish</i>							
Structural Features	10 hr/day, 6 days/week	7:00 am - 10:00 pm are 70 dBA for residential areas and 75 dBA for business & commercial areas.	197	5	0	0	0
<i>St. James Parish</i>							
	10 hr/day, 6 days/week	No specific ordinances regarding construction noise.	789	6	1	1	0
<i>Livingston Parish</i>							
Blind River Mitigation area	10 hr/day, 6 days/week	6:00 am - 11:00 pm 85 dBA for all areas.	4	0	0	0	0
Total			1023	11	1	1	0

The majority of the localized storm surge risk reduction system construction would not require the use of pile drivers or vibratory hammers, however it would use earth-moving construction equipment, which produces noise emissions of 81 dBA. The noise model projected that noise levels of 81 dBA were required to travel 300 ft before they attenuated to acceptable levels of 65 dBA. To achieve an attenuation of 81 dBA to a normally unacceptable level of 75 dBA, the distance from the noise source to the receptor was 100 ft.



A number of sensitive noise receptors were located within 1,000 ft of the construction sites. Aerial photography was used to determine the number of sensitive noise receptors within the 1,000 ft zones. Table 4-2 summarizes the total sensitive receptors with 1000 ft, segregated by parish that would be temporarily impacted during construction of the projects.

A number of parks and recreational areas are located near the projects, including the WMA, and these areas have the potential to experience increased noise emissions.

Impacts on the ambient noise environment resulting from the construction would be minor and short-term. Approximately, 697 single-family homes, 6 apartment buildings, 1 church and 1 school are located within 1,000 ft from the edge of the project corridors. These sensitive noise receptors could experience noise emissions greater than 65 dBA, which are normally unacceptable (HUD 1984). Construction work could occur as long as 10 hours a day, 6 days a week. However, no local noise ordinances would be exceeded. Administrative and/or engineering controls, determining and implementing appropriate buffer zones, and implementing construction activity windows, shall address these issues.

Alternative A

Direct and Indirect Impacts: Direct and, indirect impacts would be similar to the Recommended Plan except over a greater area because the alignment is closer to the developed area. Sixty-five additional homes would have minor and short-term impacts on ambient noise during construction. There is a potential for the background noise scape to change if pump stations are located near residential areas.

Alternative D

Direct and Indirect Impacts: Impacts would be similar to the Recommended Plan except there would be no impacts to residents south of the I-10 or US Highway 61; and there would be greater temporary and minor impacts to fish and wildlife resources along the longer alignment.

4.4 CUMULATIVE EFFECTS

Cumulative effects are defined in 40 CFR 1508.7 as those effects that result from:

...the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Cumulative environmental effects for the proposed project were assessed in accordance with guidance provided by the President's Council on Environmental Quality (CEQ).

4.4.1 Methodology

A six-step process was followed to assess cumulative effects on resources affected by the Updated Plan. The first step was to identify which resources to consider in this analysis. All impacts on affected resources can be called cumulative. However, according to CEQ guidance, "the role of the analyst is to narrow the focus of the cumulative effects analysis to important issues of national, regional, or local significance" (CEQ, 1997, p. 12).

The temporal boundaries for the assessment were established as follows:

- Past: Starting in the early 1800's the French and Spanish required riparian landowners to levee the river frontage of their lands, when logging decimated the cypress swamps, railroad corridor were construction. The Flood Control Act of 1928, when flood control projects of the Mississippi River and its tributaries were first authorized. Since that time, oil gas and mineral exploration and production measures such as pipelines, construction of I-10 and I-55, area levees and pump systems, drainage canals, and access canals have altered the hydrology of the project area.



- Present: 2020, when the construction impacts would begin.
- 2060, when construction of project features is expected to be completed.
- Future: 2020 to 2070.

The next steps of the cumulative effects analysis included:

- Defining the study area for each resource.
- Describing the historical context and existing condition of each resource. Descriptions of affected resources are summarized in more detail in Chapter 2.0 of this report.
- Summarizing the direct and indirect effects of the Action Alternatives on each identified resource. Environmental effects of the Action Alternatives are presented in more detail in sections 4.1 to 4.3 of this report.
- Identifying the accumulated effects on each resource from the Action Alternatives and other past, present, and reasonably foreseeable actions.
- Summarizing the magnitude of the cumulative effects of the projects and actions on the affected resources.

The information derived from these steps of the cumulative effect assessment is presented below for each resource. A summary of the cumulative effects analysis is provided in Table 4-3.

4.4.2 Study Area

The study area is defined in Section 1.1 of this report.

4.4.3 Past, Present, and Reasonably Foreseeable Future Actions

Descriptions of past, present, and reasonably foreseeable future projects related to the study area and the proposed project are located below in Table 4-3.

Table 4-3. Descriptions of past, present, and reasonably foreseeable future projects.

ID	Past/Present/Reasonably Foreseeable Future Action (RFFA)	Description
Local Drainage Improvements	Past/Present/RFFA	Parishes in the study area will continue to make improvements to their existing drainage systems. These actions may include dredging or clearing and snagging of drainage canals. In some areas, it may include enlarging drainage features, culverts, or pump stations for areas under forced drainage.
I-10 Improvements	Past/Present/RFFA	The LaDOTD, in conjunction with the Federal Highway Administration, continues to make improvements and repairs to the I-10/I-55 system. This would include minor improvements to address flooding and also in the future include an enhanced commercial interstate access into St. John the Baptist Parish, Louisiana.
Local Housing Developments	Past/Present/RFFA	Population and housing are expected to follow trends in the local, regional, and national economies. An increase of 33,000 residents and approximately 11,000 residential structures are projected in the study area over the course of the planning horizon.
Local Farming Activities	Past/Present/RFFA	Large areas of the WSLP study area are devoted to agriculture production such as sugarcane, soybeans, and a highly specialized crop called Perique tobacco. The main crop is sugarcane, but the acres planted between sugarcane and other crops vary each year based on the pricing demands.



ID	Past/Present/Reasonably Foreseeable Future Action (RFFA)	Description
Commercial and Industrial Developments (Expansion of chemical plants and port facilities)	Past/Present/RFFA	The study area and region includes numerous existing commercial and industrial facilities supporting the oil and gas infrastructure in Louisiana. Growth in business and industrial activity is expected to follow economic trends in the local, regional, and national economies.
Local Infrastructure Improvements	Past/Present/RFFA	The study area includes multiple power lines, pipelines and pipeline/power line right of ways. Historically, the supporting infrastructure has been expanded to support the growing commercial and industrial developments of the study area. Most of these expansions will be constructed within the existing right of ways or immediately adjacent to the existing right of ways in existing pipeline corridors.
Greater New Orleans Hurricane & Storm Damage Risk Reduction System	Past/Present/RFFA	The USACE, in conjunction with local non-federal partners, will continue to make improvements to the existing levee systems in the Pontchartrain Basin. This includes the construction of new levees/floodwalls or elevating existing levees or structures to address changes in the RSLR.
Mississippi River and Tributaries project (MR&T)	Past/Present/RFFA	The southern boundary of the WSLP study area is bound by the MR&T levee system. The levee is part of a comprehensive river management program authorized through the Flood Control Act of 1928. The levees were constructed by the Federal Government. Major maintenance is performed by the Federal Government, with minor maintenance being performed by the non-Federal Sponsor.. Periodic inspections of maintenance are conducted to ensure that the levees are maintained in good condition for their proper functioning in the flood control plan. Improvements are made to the system based on these inspections. This could consist of elevating existing levees or structures to address changing flow conditions.
Bonnet Carré Spillway	Past/Present/RFFA	The Bonnet Carré Spillway is the southernmost floodway in the MR&T system. Located in St. Charles Parish, Louisiana, the spillway reduces risk for New Orleans and other downstream communities during major floods on the Mississippi River. This risk reduction is accomplished by diverting a portion of the floodwaters into Lake Pontchartrain and then into the Gulf of Mexico, bypassing New Orleans. Outside of flood events, the spillway developed into an extensively used outdoor recreation area with approximately 400,000 visitors per year.
St. Charles Parish Hurricane Protection Levee Shoreline Enhancement and LaBranche Wetlands Restoration	Past/Present/RFFA	The project's overall objective is to protect northern St. Charles Parish by stabilizing the Lake Pontchartrain shoreline from further erosion, enhancing the shoreline where possible, and restoring the LaBranche Wetlands to provide an integrated system of multiple lines of defense.
Mississippi River Gulf Outlet (MRGO) Navigation Channel Closure	Present	Work included the construction of a rock closure structure across the MRGO channel at Bayou La Loutre. The project feature was then turned over to the Louisiana Coastal Protection and Restoration Authority for long-term operation, maintenance, repair, rehabilitation, and replacement responsibilities.



ID	Past/Present/Reasonably Foreseeable Future Action (RFFA)	Description
MRGO Ecosystem Restoration Plan Feasibility Study	Present/ RFFA	The purpose of the study is to restore the areas affected by the construction and operation of the MRGO channel through systematic ecosystem restoration efforts. The study considers several restoration measures to restore the ecosystem, including those that reduce or prevent damages from storm surge. At this time, there is no non-federal cost share sponsor.
Small Diversion at Convent/Blind River	RFFA	The objective of this diversion is to provide additional freshwater, nutrients and fine sediment from the Mississippi River into Maurepas Swamp and its surrounding areas. The project would be entirely within the WSLP study area
Amite River Diversion Canal Modification	RFFA	This project will construct gaps in the existing dredged material banks of the Amite River Diversion Canal to allow floodwaters to introduce additional nutrients and sediment into western Maurepas Swamp.
River Reintroduction into Maurepas Swamp (PO-29)	RFFA	The project would divert Mississippi River water to the Maurepas Swamp through Hope Canal. Construction of this project has transitioned for independent implementation by the State of Louisiana.
Amite River and Tributaries, Bayou Manchac Project	RFFA	The study area is located in southeastern Louisiana and encompasses portions of Ascension, Iberville, and East Baton Rouge Parishes. The proposed actions include several alternatives that would reduce the flood stages provide ecosystem restoration benefits as an ancillary benefit.
Bayou Conway & Panama Canal Drainage Improvement Project Ascension Parish and St. James Parish	RFFA	The purpose of the Bayou Conway and Panama Canal Drainage Improvement Project is to provide a reduction in the risk of flooding for the drainage basin that includes the area near the boundary between Ascension and St. James Parishes. The study determined the existing conditions within the basin based on varying downstream conditions and proposed necessary improvements to the channels to reduce the risk of flooding within the watershed. Currently, permits are being sought to begin the snagging and clearing of the channels to facilitate the drainage improvements. The next phase of work will be to begin the implementation of the proposed channel enlargement and improvements.
Laurel Ridge Levee Extension, Ascension Parish	RFFA	The Laurel Ridge Levee Extension Project consists of extending the existing Laurel Ridge Levee northward to protect additional properties along/within the Amite River floodplain from backwater flooding and high waters on the Amite River.

4.4.4 Existing Conditions

Existing conditions for each resource are described in Section 2.0, Affected Environment.

4.4.5 Direct, Indirect, and Cumulative Impacts

The cumulative effects on each of the resources considered and for each alternative are discussed in Table 4-4.

Table 4-4. Cumulative effects of key significant resources

Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts Recommended Plan Alternative C	Cumulative Impacts Alternative A	Cumulative Impacts Alternative D
Hydrology– Flow and Water Levels	Louisiana (LA): Flows and water levels respond to and are impacted by natural conditions and man-made conditions. Study Area (SA): Decreased flows into and out of the swamp located within the SA due to construction of dredged material berms in connection with ARDC.	LA: Increased flows and water levels associated with increased runoff due to increasing urbanization and wetland loss. Rate of RSLR increasing over historic conditions. SA: Decreased flows into and out of the swamp due to dredged material berms along ARDC. Increased runoff due to increased urbanization of the Pontchartrain Basin.	LA: Increased flows and water levels associated with increase urbanization and associated runoff and increased wetland loss. Rate of RSLR increasing over historic conditions. SA: Decreased flows into and out of the swamp due to dredged material berms along ARDC. The State of Louisiana and Livingston Parish both have Coastal Impact Assistance Plan (CIAP) projects planned that would increase flows and sediment into the Maurepas swamp by breaching the berms along ARDC. Increased water levels due to continuation of coastal wetland loss, and increased runoff due to increased urbanization of the Pontchartrain Basin.	Cumulative impacts would include the incremental direct and indirect effects on flows and water levels attributable to the proposed action in addition to the direct and indirect impacts to flows and water levels attributable to other past, present, and reasonably foreseeable future actions including previous, existing and authorized levee systems in the Pontchartrain Basin, the state and the nation. Impacts associated with the Pontchartrain Basin levee systems, as reported in the USACE November 2012 preliminary report titled “Hurricane Isaac With and Without 100-year HSDRRS Evaluation” and the “Comprehensive Environmental Document, Phase I, Greater New Orleans HSDRRS”, (USACE 2013) include impacts to flows and water levels associated with approximately 217 miles of levees systems within the existing New Orleans HSDRRS; approximately 1,115 acres of recently constructed portions of the West Bank and Vicinity HSDRRS system; additionally the 142-mile long MR&T levee system and the 18-mile long non-Federal levee from Caernarvon to White Ditch; as well as potential impacts of projects approved for construction. The state levee systems include approximately 3,122 miles of levee. Impacts associated with these levee systems are in addition to the increased flows and water levels associated with urban runoff from increased urbanization and increasing wetland loss arising from natural (i.e., SLR-related) and man-made conditions. Approximately 100,000 miles of levees exist throughout the nation (ASCE 2013). There would not be a significant cumulative change in water flows or levels due to impacts associated with this project since there are only minor effects due to this project.	Cumulative impacts associated with structural measures would be similar to those reported for the Recommended Plan, except impacts to protected-side wetlands would occur over a smaller area (6 square miles enclosed area as compared to 15 square miles under the Recommended Plan). Alternative A has the potential to increase flood stages in the immediate areas exterior to the levee.	Cumulative impacts would be similar to those reported in connection with the Recommended Plan except impacts to the protected side wetlands would occur over a significantly larger area (79 square mile enclosed area as compared to 15 square miles under the Recommended Plan). Alternative D would also have a higher potential to increase stages to communities located outside of and in the vicinity of the proposed levee alignment. This higher water level would be significant to the residents where induced flooding would occur but would not be significant on a state level.
Hydrology– Sedimentation and Erosion	LA & SA: Sediment delivery by crevasses ended after Flood Control Act of 1928. SA: Decreased redistribution of sediments into and out of the swamp due to dredged material berms associated with construction of ARDC which cut off the swamp from Amite River -- the primary source of sediments.	LA & SA: Inflow of suspended sediments by Mississippi River limited by construction of levees. SA: Decreased redistribution of sediments into and out of the swamp due to dredged material berms along ARDC.	LA: Sediment supply would not offset coastal land loss. Sediments would continue to be transported from terrestrial areas into Lakes Maurepas and Pontchartrain. SA: Storms cause some redistribution of sediments to and from the swamp and surrounding water, but the ARDC dredged material berm would continue to block exchange and therefore sedimentation. The swamp would continue to deteriorate due to this impoundment and lack of sediment supply. Natural and man-made levees would continue to subside and organic soils would not maintain elevations due to subsidence, decreased plant productivity, and wave erosion (USACE 2004). The State of Louisiana and Livingston Parish both have CIAP projects planned that would increase flows and sediment into the Maurepas swamp by breaching the berms along ARDC.	Cumulative impacts would include the incremental direct and indirect effects on hydrology as it relates to sedimentation and erosion attributable to both the construction of and operation of the proposed action (see Section 4.1.2) in addition to the direct and indirect impacts attributable to other past, present, and reasonably foreseeable future actions including previous, existing and authorized levee systems in the Pontchartrain Basin, the state and the nation. And the beneficial impact of the two proposed CIAP projects. This project would result in a significant reduction of erosion and sedimentation associated with storm events. The proposed action has the potential to decrease tidal interchange velocities throughout the area resulting in increased sedimentation within waterways of both the interior and exterior of the proposed levee alignment. There would not be a significant cumulative change in sedimentation and erosion due to this project.	Impacts would be similar to the Recommended Plan except over a smaller area.	Impacts would be similar to the Recommended Plan except they would occur over a larger area. These impacts would not rise to the level of significant.

Table 4-4. Cumulative effects of key significant resources

Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts Recommended Plan Alternative C	Cumulative Impacts Alternative A	Cumulative Impacts Alternative D
Water Quality and Salinity	LA & SA: Clean Water Act of 1977, NEPA of 1969, Coastal Zone Management Act, and Estuary Protection Act and institutional recognition to restore and protect water bodies, especially with respect to point sources. Non-point sources still unregulated. LA: Increase in salinity levels inland due to salt water intrusion, due in part to wetlands loss. SA: Human developments along the ARDC, Amite and Blind Rivers and on ridges begin to adversely impact water quality. The ARDC northeast of Sorrento is listed as impaired for mercury. Construction of ARDC results in impounding storm driven higher salinity waters within SA and causes it to absorb into the substrate resulting in degradation of freshwater swamp ecosystem.	LA & SA: Continued institutional recognition. Increasing human populations, agriculture and industrialization result in increased potential for water quality problems. LA: Increase in salinity levels inland due to salt water intrusion from wetlands loss and reduction in freshwater inflow. SA: Human developments result in wastewater and polluted runoff from nearby urban areas; continued conversion of swamp habitat to marsh and open water reduces natural filtration of water. Continued impounding of higher salinity waters causing it to absorb into the substrate resulting in degradation of freshwater swamp ecosystem. Recent closure of MRGO has reduced Salt water entering Lake Ponchartrain.	LA & SA: Continued institutional recognition. Federal and state water quality programs – may address land use practices in the Mississippi River basin and could impact the area water quality. Increasing human populations and industrialization result in increased potential for water quality problems. LA: Increase in salinity levels inland due to salt water intrusion from wetlands loss and reductions in freshwater inflow. Salinities may also increase due to impacts from relative sea level rise. SA: Conversion of 18,204 acres of swamp to marsh and open water reduces natural filtration of water by swamp vegetation; continued discharge of untreated stormwater runoff from nearby populated areas. Continued impoundment and lack of hydrologic connections result in longer residence time of higher salinity water resulting in absorption of salinity into swamp soils continuing the degradation of freshwater swamp and BLH vegetation. But lower salinity trends in Lake Ponchartrain may reduce this effect.	LA & SA: There exists a continued institutional recognition while at the same time increasing human populations and industrialization that increase the potential for water quality problems. LA: Increase in salinity levels inland due to salt water intrusion from wetlands loss and reductions in freshwater inflow. Salinities may also increase due to impacts from RSLR. Cumulative impacts would be the incremental direct and indirect impacts to water quality and salinity of implementing and operating the proposed Recommended Plan in addition to the direct and indirect impacts attributable to other past, present, and reasonably foreseeable future actions including other existing and authorized levee systems in the Pontchartrain Basin, the state and the nation. The proposed project, combined with other projects and activities in the area could cumulatively impact water quality. Additionally, the combination of the proposed project and the planned diversion projects in the study area could complicate water quality and hydrology, particularly for the protected side of the proposed alignment, leading to changes in wetlands biogeochemistry and water quality function. The continued freshening trend in Lake Pontchartrain would reduce the chance for any negative salinity effects of this project during periods that the system is open. During storm events salinity driven by the surge would be prevented from entering the system. There would not be a significant cumulative change in water quality or salinity due to the addition of this project.	Water quality impacts would be expected to be similar in nature, but less than impacts associated with the Recommended Plan due to the fewer enclosed wetlands.	Water quality impacts associated with this alternative would be expected to be similar in nature but greater than impacts associated with the Recommended Plan.
Socioeconomic and Human Resources – Population and Housing	LA: Hurricanes Katrina and Rita adversely affected populations throughout the state. SA: Development along the ARDC, Amite and Blind Rivers and on ridges. Populations within Ascension and Livingston Parishes increasing.	LA: Slight decrease (-3.9%) in population from 2000-2007. SA: Development along the ARDC, Amite and Blind Rivers and on ridges. Populations within Ascension and Livingston Parishes have been increasing. Population increases between 2000 and 2010 are likely the result of population influx after Hurricane Katrina (2005). The three parish total population in 2010 was 120,806 residents. The 2012 population in the three parishes declined to 119,161 (U.S. Census 2013) due mainly to Hurricane Isaac impacts.	LA: Increasing populations in Louisiana. SA: An increase of 33,000 residents and approximately 11,000 residential structures are projected. In the absence of storm surge damage risk management measures population and housing could be adversely affected.	LA: Increasing populations worldwide. Populations and housing within the SA would continue to increase. Storm surge damage risk management measures would benefit population and housing. There would not be a significant cumulative change in population and housing on the state level. There may be some adjustment in location in housing to be in the protected area. Housing outside would be built at a higher elevation.	Impacts would be the same as the Recommended Plan.	Impacts would be the similar to the Recommended Plan except there would be fewer new homes elevated.

Table 4-4. Cumulative effects of key significant resources

Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts Recommended Plan Alternative C	Cumulative Impacts Alternative A	Cumulative Impacts Alternative D
Socioeconomic and Human Resources - Employment, Business and Industrial Activity (including Agriculture)	LA: Slight increase in employment in Louisiana. Hurricanes Katrina and Rita had an adverse effect on employment and personal income. Rebuilding efforts provide some new job opportunities. Increasing population growth and supporting infrastructure in the form of roads, bridges, pipelines, homes, and businesses. Agriculture is important to the economy of the US and coastal Louisiana. Important crops include sugar cane, rice, and soybeans. SA: Total employment in SA increasing. Businesses are generally retail stores and restaurants. Approximately 10 percent of the area (23,800 acres) is devoted to agriculture, and about half of these acres are sugar cane crops	LA: Increasing population growth and employment and personal income opportunities. Economic activity related to wetland resources would be adversely affected by the depletion of these resources. Increasing population growth and supporting businesses and industry development contributes to degradation and loss of coastal and other wetlands. SA: Businesses are generally retail stores and restaurants. Agriculture is important to the economy of the US and coastal Louisiana. Important crops include sugar cane, rice, and soybeans. Development along the ARDC, Amite and Blind Rivers and on ridges as well as conversion of farmland. Employment and income resources are primarily retail, eating and drinking establishments. Total employment in SA increasing.	LA: Increasing population growth and employment and personal income opportunities. Economic activity related to wetland resources would be adversely affected by the depletion of these resources. Degradation and loss of wetlands would contribute to potential losses of businesses. Agriculture would continue to be important to the economy of the US and coastal Louisiana. SA: Total employment in SA expected to increase. Wetland land loss would potentially threaten businesses in the study area. Agricultural lands, primarily livestock pastures, within the study area would continue to be used and may be adversely impacted by habitat conversion and land loss. There would be a potential for the temporary interruption or permanent displacement of employment, business, and industrial activity as businesses temporarily or permanently relocate to areas with less storm damage risk.	LA: Increasing human populations lead to competition for employment and income. Economic activity related to wetland resources would be adversely affected by the depletion of these resources. Continued population growth and supporting business and industry development contributes to degradation and loss of coastal and other wetlands, which contributes to potential loss of businesses. Continued importance of agriculture to the economy of the US and coastal Louisiana. Agricultural lands may be adversely impacted by habitat conversion and land loss. There may be some adjustment in location of business and industry in order to be located in the protected area. New Business and industry would be built at a higher elevation or with flood proofing as part of the design. There would not, however, be a significant cumulative change in resource on the state level.	Cumulative impacts would be the same as those reported in connection with the Recommended Plan.	Cumulative impacts would be similar to those reported in connection with the Recommended Plan except all three parishes would be located behind the levee alignment allowing for continued operation of businesses, industries and agriculture in St. James Parish during a minor storm surge events.
Socioeconomic and Human Resources- Public Facilities and Services	LA: Increasing population growth increases public facilities and services issues. SA: Public facilities and services generally serve residents and recreational visitors.	LA: Increasing population growth increases public facilities and services issues. SA: Public facilities and services generally serve residents and recreational visitors. A total of 402 public and quasi-public buildings were in the three-parish area in 2012.	LA: Increasing population growth increases public facilities and services issues. SA: Wetland land loss potentially threatens public facilities and services and increases maintenance. Several of the current subdivisions would expand, creating additional needs for public facilities and services. An additional 165 such facilities are projected by 2070.	LA: Continued population growth increases public facilities and services issues. There may be some adjustment in location of these facilities to be in the protected area. New public facilities outside the levees would be built at a higher elevation or with flood proofing as part of the design. There would not be a significant cumulative change in resource on the state level.	Impacts would be the same as the Recommended Plan.	Facilities would not need to relocate in order to be behind the levee nor would they be built at a higher elevation with flood proofing as part of the design as all three parishes are located behind the levee under Alternative D .
Socioeconomic and Human Resources- Traffic and Transportation	LA: Increasing population growth increases traffic and transportation issues. SA: State and local roads traverse the study area. Traffic is generally confined to residents and recreational visitors.	LA: Increasing population growth increases traffic and transportation issues. SA: State and local roads traverse the study area. Traffic is generally confined to residents and recreational visitors.	LA: Continued population growth increases traffic and transportation issues SA: Several of the current subdivisions would expand, creating additional roads, bridges, and traffic.	LA: Continued population growth increases traffic and transportation issues. There would not be a significant cumulative change in traffic and transportation on a state level.	Impacts would be the same as the Recommended Plan.	Impacts would be similar to the Recommended Plan, except storm surge risk reduction to the transportation infrastructure would extend into the western portion of the project area.

Table 4-4. Cumulative effects of key significant resources

Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts Recommended Plan Alternative C	Cumulative Impacts Alternative A	Cumulative Impacts Alternative D
Socioeconomic and Human Resources–Community and Regional Growth	LA & SA: Increasing population growth increases community and regional growth.	LA & SA: Increasing population growth increases community and regional growth.	LA: Increasing population growth increases community and regional growth. SA: Additional increases in community and regional growth would be sustained through the filling of lots in the existing and proposed subdivisions. Higher potential for less community and regional growth due to increasing risk of damage from hurricane/tropical storm surge events	LA: Continued population growth increases community and regional growth. There would not be a significant cumulative change in community and regional growth. The location of that growth could be concentrated in areas of higher protection.	Impacts would be the same as the Recommended Plan.	Impacts would be similar to the Recommended Plan, except localized storm surge risk reduction measures would not be necessary in the Gramercy/Lutcher area.
Socioeconomic and Human Resources–Tax Revenue and Property Values	LA & SA: Increasing population growth increases tax revenue and property values.	LA & SA: Increasing population growth increases tax revenue and property values.	LA: Increasing population growth increases tax revenue and property values. SA: Additional increases in property values and tax revenues would be sustained through the filling of lots in the existing and proposed subdivisions. However, without storm surge damage risk reduction measures, the economic stability, tax revenues and property values could be adversely affected.	LA: Continued population growth increases tax revenue and property values. There would not be a significant cumulative change in tax revenues and property values. The location of that growth could be concentrated in areas of higher protection.	Impacts would be the same as the Recommended Plan.	Impacts would be the same as the Recommended Plan.
Socioeconomic and Human Resources–Community Cohesion	LA & SA: Community cohesion is affected by infrastructure development and community development. LA: Hurricanes Katrina and Rita adversely affected community cohesion in southern portions of the state. SA: The SA is populated along the Mississippi River, ARDC, Amite and Blind Rivers, and on ridges.	LA & SA: Community cohesion is affected by infrastructure development and community development. LA: Hurricanes Katrina and Rita adversely affected community cohesion in southern portions of the state.	LA & SA: Community cohesion would continue to be affected by infrastructure development and community development. SA: Several of the current subdivisions would expand. The increased risk of damage to residential and non-residential structures and the resulting temporary and/or permanent relocation of populations would negatively affect the community cohesion in many communities. Community cohesion may be reduced if residents and businesses relocate to lower-risk areas.	LA: Increasing populations worldwide. Increasing opportunity for infrastructure development and community cohesion development. There would not be a significant cumulative change in community cohesion; this alternative would help to maintain the existing level. Some communities may be affected by residents and businesses relocate to lower-risk areas. There are no adverse cumulative impacts to the Human Environment resources; there are positive cumulative effects for community sustainability and resiliency that accrue to the metropolitan area as a whole attributable to an expansion of a regional flood risk reduction system.	Impacts would be the same as the Recommended Plan.	Impacts would be similar to the Recommended Plan. There would be less movement of residents and businesses.

Table 4-4. Cumulative effects of key significant resources

Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts Recommended Plan Alternative C	Cumulative Impacts Alternative A	Cumulative Impacts Alternative D
Socioeconomic and Human Resources – Environmental Justice	US: Institutional recognition via Executive Order 12898. LA: Hurricanes Katrina and Rita adversely affected Environmental Justice resources in the state. SA: St. James and St. John the Baptist Parishes have majority minority populations. The communities of Lusher and Convent (in St. James Parish), and Reserve, Laplace and Garyville (in St. John the Baptist Parish) were identified as having majority minority populations, and therefore are identified as areas of potential EJ concerns.	LA: Continued institutional recognition; increasing Environmental Justice resources as a result of increase in population and decrease in economic output from 2000-2009. SA: Environmental Justice resources within study area appear stable.	LA: Continued institutional recognition; potential increase in Environmental Justice resources as a result of continued economic recession. SA: There may be further construction and an increase in the population. Environmental Justice resources may increase; these resources would likely remain unchanged. People living and working in the area, irrespective of race or income, would be impacted by storm surge events in the future without project condition.	LA: Increasing populations worldwide. Increasing opportunity for the development of minority communities and the expansion of low-income populations worldwide. Assessment of cumulative impacts would include an assessment of any historical storm impacts to low lying elevations and communities in the project area as well as any measures or projects constructed by local, county, and State agencies as a result of past storm events. Past construction efforts may need to be reassessed at the local, parish or state level after construction of the proposed action. Cumulative impacts would include the incremental direct and indirect impacts of implementing storm damage risk reduction measures in the area plus the direct and indirect impacts on minority and low income populations from other activities in the area including hurricane storm damage risk management projects within the Pontchartrain Basin. Potential construction impacts resulting from the proposed action would be temporary in nature and would impact all communities regardless of race or poverty level, equally. Specific construction impacts such as air quality are discussed in this document and appropriate guidelines will be implemented to reduce impacts to all residents. These and future activities would provide communities in the vicinity with increased flood risk reduction benefits regardless of race or income level. There would be no cumulative environmental justice-related impacts.	Impacts would be the same as the Recommended Plan.	Impacts would be the same as the Recommended Plan.
Soil and Waterbottoms- Soils, Water Bottoms and Prime and Unique Farmlands	LA: Louisiana coastal land loss of over 1.22 million acres since 1956. SA: Loss of 1,600 acres in Amite/Blind River mapping unit between 1932 and 1990 (LCWCRTF and WCRA, 1999). LA & SA: Water bottoms develop in response to natural and man-made conditions. Approximately 44,672 acres, or 24.2 percent, of the study area meet the soil requirements for prime farmland (NRCS 2013).	LA: Continued land loss of over 25 square miles per year increasing the acreage of shallow open water and water bottoms. SA: Continued land loss due to natural and human-induced causes. Barbary, Fausse, and Maurepas soils are primarily affected. Prime farmlands could be converted to other uses.	SA: Shoreline erosion and land loss persist resulting in the loss of soil resources. Over 50-year period of analysis; projected conversion of 18,204 acres of swamp soils to fresh marsh and open water. Barbary, Fausse, and Maurepas soils would primarily be affected. Prime farmlands could be converted to other uses, including new development.	LA: Continued institutional recognition and programs for soil conservation to reduce soil losses. Increased acreage of shallow water bottoms in response to wetland loss SA: There would be adverse cumulative impacts from the non-structural plan to soils, water bottoms, and prime and unique farmlands, urban growth and natural processes would also continue to contribute to impacts to soils and water bottoms and to the loss of prime and unique farmlands. 1,176 acres of direct impacts and up to 8,432 acres of minor indirect impacts on soil resources and water bottoms; about 128.2 acres of farmlands converted to non-agricultural use. The water bottoms are part of the unavoidable impacts and will be mitigated for through compensatory mitigation measures. There would not be a significant cumulative change in these resources due to the construction of this project.	Impacts would be the same as the Recommended Plan with the following exceptions: there would be an incremental total of about 1,338 acres of direct impacts and up to 3,564 acres of indirect impacts on soil resources and water bottoms; about 53.4 acres of farmlands converted to non-agricultural use.	Cumulative impacts would be similar to the Recommended Plan with the following exceptions: incremental direct impacts of approximately 1,115 acres of soil resources and 17.5 acres of water bottoms.

Table 4-4. Cumulative effects of key significant resources

Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts Recommended Plan Alternative C	Cumulative Impacts Alternative A	Cumulative Impacts Alternative D
Vegetation	LA & SA: Natural processes form coastal vegetation resources. SA: Upland habitat is primarily limited to the agricultural, while wetlands in the area are primarily BLH and swamp. Since 1932, more than 66,000 acres of wetlands have converted to water in the Pontchartrain Basin--over 22 percent of the marsh that existed in 1932 (source: The Pontchartrain Basin accessed March 28, 2014). Louisiana's 3 million acres of wetlands are lost at the rate of about 75 square kilometers annually (http://pubs.usgs.gov/fs/la-wetlands/ accessed March 25, 2014. According to the USGS (http://www.npwrc.usgs.gov/resource/wetlands/uswetlan/century.htm accessed March 28, 2014) natural wetlands of this country are estimated at 127 million acres.	LA & SA: Deterioration and loss of wetlands over 25 square miles per year.	LA & SA: Continued deterioration and loss of vegetated acreage due to natural and human-induced processes. SA: The swamp would convert to freshwater marsh, which in turn would convert to open water. Undeveloped vegetated lands, including wetlands, would continue to be lost to development.	LA: Continued deterioration and loss of vegetated wetland habitat due to natural and human-induced processes. The primary vegetation impacts from this project would be the direct and indirect impacts of implementing and operating the Recommended Plan on wetlands. (See Section 4.3.2 for a detailed discussion of these impacts). The project would be designed to mitigate for these impacts thereby reducing them to the greatest extent practicable. Unavoidable impacts will be mitigated for through compensatory mitigation measures. As such, any incremental direct and indirect impacts of implementing the Recommended Plan when added to the direct and indirect impacts attributable to other past, present, and reasonably foreseeable future actions including other existing and authorized levee systems in the Pontchartrain Basin, the state and the nation would not result in a significant cumulative change in these resources.	Cumulative impacts would be similar to those reported in connection with the Recommended Plan, but with less mitigation requirements.	Cumulative impacts would be similar to those reported in connection with the Recommended Plan, but with greater mitigation requirements.
Wildlife Resources	LA & SA: Wetland dependent wildlife populations respond primarily to natural population-regulating mechanisms. SA: The bald eagle was removed from the endangered species list in 2007. The Southeast United States Regional Waterbird Conservation Plan was completed in 2006.	LA & SA: Continued nationwide degradation and loss of wetlands leads to decline of wetland-dependent wildlife populations. SA: Continued swamp degradation and conversion to marsh and open water leads to increased competition between local wetland-dependent wildlife populations, displacement to other more suitable swamp wetland areas, and localized decline in wetland-dependent wildlife population. Bald eagle populations in the area are steady. Habitats for wading birds in the area are declining due to swamp degradation.	LA and SA: Nationwide degradation and loss of swamp habitat continues to adversely impact wetland-dependent wildlife populations. SA: Conversion of swamp vegetation to fresh marsh and open water habitat results in continued decline in quality of and availability of swamp wildlife habitat. Conversion of swamp to open water will adversely affect populations of bald eagle and colonial nesting wading birds due to decreased nesting habitat and decreased food availability.	Continued nationwide loss of vegetated wetlands continues to adversely impact wetland-dependent wildlife populations. The potential direct and indirect impact to vegetated wetlands represents the primary wildlife-related impact associated with the Recommended Plan. Because the project would be designed to mitigate for these impacts and because unavoidable impacts will be mitigated for through compensatory mitigation measures, any incremental direct and indirect impacts to wildlife resources associated with implementing the Recommended Plan, when added to the direct and indirect impacts attributable to other past, present, and reasonably foreseeable future actions in the Pontchartrain Basin, the state and the nation, would not result in a significant cumulative change in these resources.	Cumulative impacts would be similar to those reported in connection with the Recommended Plan, but with less mitigation requirements.	Cumulative impacts would be similar to those reported in connection with the Recommended Plan but with greater mitigation requirements.

Table 4-4. Cumulative effects of key significant resources

Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts Recommended Plan Alternative C	Cumulative Impacts Alternative A	Cumulative Impacts Alternative D
Aquatic and Fishery Resources	LA: Reduction in fisheries habitat, increased catches, gear improvement, catch regulations, Magnuson-Stevens Fishery Conservation and Management Act and amendments, formation of NMFS and LDWF. About 90% of the world's seafood resources have been depleted in the past century; 38% of the depleted species have declined by more than 90%; 7% of the species of fish studied by researchers have become extinct (Worm et al., 2006).	LA: Aquatic and fisheries populations in LA are shifting towards more saline-oriented species as land loss and saltwater intrusion into interior regions continues. SA: There are aquatic and fisheries species changes associated with conversion of swamp habitat to freshwater marsh and open water.	LA: Aquatic and fisheries populations in LA are shifting towards more saline-oriented species as land loss and saltwater intrusion into interior regions continues. LA & SA: Conversion of swamp to fresh marsh and open water may shift populations, but there are no direct adverse impacts.	LA: Continued institutional recognition. Continued nationwide loss of vegetated wetlands continues to adversely impact aquatic species. Aquatic organism access into and out of the proposed action area would be impacted; additional culverts may deter some species from swimming through those structures. This impact would be most significant for the catadromous American eel that needs the fresh water areas for development and access to the ocean for breeding. If the closures occur, when the elvers stage enter the swamps there would be a recruitment age class loss. Aquatic habitat that is affected by this project is being mitigated for. All this mitigation will occur on the flood side of the levee. As such, any incremental direct and indirect impacts to aquatic and fisheries resources associated with implementing the Recommended Plan, when added to the direct and indirect impacts attributable to other past, present, and reasonably foreseeable future actions in the Pontchartrain Basin, the state and the nation, would not result in a significant cumulative change in these resources.	Cumulative impacts would be similar to those reported in connection with the Recommended Plan.	Cumulative impacts would be similar to those reported in connection with the Recommended Plan.
Essential Fish Habitat (EFH)	US and LA: General decrease in quality of EFH beginning in the mid-1990s. Institutional recognition of decline in EFH quality; passage of Magnuson-Stevens Fishery Conservation and Management Act, as amended. SA: Blind River and various bayous and canals in the Maurepas Swamp provide EFH.	US and LA: Continued institutional recognition; continued wetland loss and decline in quality of EFH. SA: Blind River and various bayous and canals in the Maurepas Swamp provide EFH.	US and LA: Continued institutional recognition; continued wetland loss and decline in quality of EFH. SA: Blind River and various bayous and canals in the Maurepas Swamp provide EFH.	US and LA: Continued institutional recognition; continued wetland loss and decline in quality of EFH. There is no EFH in the levee alignment or the area enclosed by the levee. Therefore there is no cumulative effect on EFH due to this project at this time.	Same as the Recommended Plan.	This Alternative does directly and indirectly impact EFH. Because the structure is being designed to minimize any such impacts, however, these impacts would not cause a significant cumulative impact in EFH.
Threatened and Endangered Species	LA & SA: Institutional recognition of importance of wetlands decline in listed species via the Endangered Species Act (ESA). Decrease in some animal and plant populations and their critical habitat including loss of wetlands.	LA & SA: Continued institutional recognition of decline in listed species; continued loss of wetlands that are critical habitat to many listed species. SA: Degradation and loss of important fish and wildlife habitats for shelter, nesting, feeding, roosting, cover, nursery, and other life requirements.	LA & SA: Continued institutional recognition of decline in listed species; continued loss of wetlands. SA: Conversion of 18,204 acres of swamp habitat to fragmented and degraded fresh marsh and open water habitats; any listed species that may be presently utilizing the habitats would likely not be impacted.	US and LA: Continued institutional recognition of decline in listed species; continued loss of wetlands. Based on review of existing data and preliminary field surveys, the USACE finds that implementation of the proposed action would have no effects on any known listed species or their critical habitat. Gulf sturgeon and the West Indian Manatee would be temporarily restricted from entering the proposed action area on average about 8.5 days per year due to closing gates and culverts in preparation for storm surge events. Therefore there is no cumulative effect on T&E species due to this project.	Same as the Recommended Plan.	Same as the Recommended Plan.
Cultural and Historic Resources	US, LA, & SA: Institutional recognition via the National Historic Preservation Act (and others). Historic and cultural resources subjected to natural processes and man-made actions.	US, LA, & SA: Continued institutional recognition. Human activities as well as natural processes can potentially destroy historic and natural resources. The loss of land threatens the existence and integrity of these resources.	US, LA, & SA: Continued institutional recognition. Potential loss of resources due to natural and human causes. SA: The loss of land within the SA threatens the existence and integrity of resources that may exist within the SA.	US & LA: Potential loss of resources due to natural and human causes. SA: the Recommended Plan has a chance to directly and indirectly affect any recorded or unrecorded cultural resource that may exist within the footprint of the project, the project's borrow source or the project's mitigation areas, or within any area identified as an area of potential effects (APE). A programmatic agreement (PA) is in place to govern future investigations and activities. In accordance with the PA, to the extent any adverse effect to identified cultural resources cannot be avoided, such impacts will be mitigated.	Cumulative impacts would be similar to those reported in connection with the Recommended Plan.	Given the longer levee alignment, there is an increased risk of discovery of unrecorded cultural resources. Cumulative impacts would be similar to those reported in connection with the Recommended Plan.

Table 4-4. Cumulative effects of key significant resources

Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts Recommended Plan Alternative C	Cumulative Impacts Alternative A	Cumulative Impacts Alternative D
Aesthetics	US, LA, & SA: Technical recognition via 1988 USACE Visual Resources Assessment Procedure. Institutional recognition via Wild and Scenic Rivers Act, Louisiana Scenic Rivers Act, Scenic Byways and others. LA & SA: Aesthetic resources negatively impacted by hurricanes Katrina, Rita, Gustav, and Ike. Blind River is a designated Scenic River.	US, LA, & SA: Continued institutional recognition. Visual resources have been destroyed, enhanced, or preserved by human activities and natural processes. LA & SA: Continued wetland loss may have an adverse effect on the visual complexity of the bayous and swamps.	US, LA, & SA: Continued institutional recognition. Continued human population growth and development and other human activities have the potential to destroy, enhance or preserve visual resources. SA: Erosion and land loss could result in the loss of vegetation that may provide a visually complex environment and desirable views and reduce opportunities for viewing wildlife.	US & LA: Continued human population growth and development and other human activities have the potential to destroy, enhance or preserve visual resources. Hydrologic units and drainage throughout the area of effect would be changed due to the introduction or enlargement of a large levee system to the area. Existing canals and channels would not be altered and only closed on a limited basis, there by not changing water flows or altering the landscape. There would be no significant cumulative effect due to this project	The cumulative impacts to resources would be similar to those for the Recommended Plan with the exception of the longer levee.	The cumulative impacts to resources would be similar to those for the Recommended Plan with the exception of the Blind River, a designated Wild and Scenic River, and the longer levee.
Recreational	LA & SA: Recreational resources not an issue. Institutional recognition via Federal Water Project Recreation Act, Land and Water Conservation Act, and National Wildlife Refuge System Acts. SA: Recreation activities in SA centered on natural resources. A portion of Maurepas Swamp WMA is present.	LA: Continued institutional recognition. Increased recreational activities impact national and state wetlands. SA: Recreation activities centered on natural resources. Continued conversion of marsh and swamp to open water resulting in decreasing recreational opportunities.	LA & SA: Continued institutional recognition. Potential loss of recreational resource base due to continued swamp and freshwater marsh degradation and loss. Recreational infrastructure would remain vulnerable to surges. Parks, boat launches, and golf courses could be damaged.	LA: Continued loss of recreational resource base due to continuing coastal and wetland degradation and loss. SA: Area diversion projects (LCA CBRD and the Maurepas Diversions) would provide fresh water and improve wetlands. The WSLP project could decrease salt water intrusion resulting from hurricane/tropical storm surge events, which would improve fish and wildlife habitat and increase opportunities for fresh water fishing and hunting. As levees are built, recreational access through canals and bayous would decrease, but recreational infrastructure would realize a reduction in risk of damage from hurricane/tropical storm surge events. There would be no significant impact to recreation with the addition of this project.	Cumulative impacts would be similar to the Recommended Plan.	Cumulative impacts would be similar to the Recommended Plan; however this alternative would limit recreational access to the Maurepas Swamp WMA to a greater extent because of the greater length of the alignment.
Noise	LA & SA: Institutional recognition via Noise Control Act of 1972. SA: Noise pollution sources are development along the ARDC, Amite, and Blind Rivers, on ridges, and boat traffic on ARDC, Amite and Blind Rivers. Noise is not yet an issue. Near developed areas, automobile and train traffic, and to a lesser extent air traffic, contribute to the background noise levels.	LA and SA: Continued institutional recognition; continued human population growth and development cause some noise pollution. SA: Ambient noise from boats and airboats on ARDC, Amite and Blind Rivers, and other human activities may cause some minimal and temporary disturbances.	LA and SA: Continued institutional recognition; continued human population growth and development would cause some noise pollution. SA: Ambient noise from boats and airboats on ARDC, Amite and Blind Rivers, and other human activities continue to cause some minimal and temporary disturbances.	LA: Continued institutional recognition; continued human population growth and development would cause some noise pollution. Any cumulative impacts would be temporary and minor in nature. Therefore there would be no significant cumulative impact to noise due to the addition of this project.	Cumulative impacts would be similar to the Recommended Plan.	Cumulative impacts would be similar to the Recommended Plan except there would be no impacts to residents south of the I-10 or US Highway 61; and there would be greater temporary and minor impacts to fish and wildlife resources along the longer alignment.

*Includes Spatial/Geographic Extent (Continental United States [US], Louisiana [LA], and Study Area [SA]), and Temporal (Past, Present, and Future with the No-Action Alternative). This cumulative impact analysis follows the 11-step process described in the 1997 report by the Council on Environmental Quality entitled "Considering Cumulative Effect Under the National Environmental Policy Act".



4.5 Mitigation Requirements Associated with the Recommended Plan

Mitigation planning is an 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 bottomland hardwood and swamp habitat would occur and would be offset through compensatory mitigation. A mitigation plan was further developed in the feasibility level design of the recommended plan. The mitigation plan objective is to restore swamp and BLH habitat to fully compensate for project-related impacts. WVA models were run on the recommended plan to determine the functions and values of impacted habitats. These results are expressed in AAHUs in Table 4-5. The models predict that approximately 1,189 AAHUs would be lost due to direct and indirect impacts over the 50-year period of analysis. This impact set the mitigation requirement that must be delivered by the mitigation plan. Table 4-6 lists the mitigation measures to compensate for the impacts. These measures are the result of Cost Effectiveness and Incremental Cost Analyses which can be found in Appendix A, Annex S. For more details on the Mitigation plan see Appendix A, Annex K. Impacts related to resources mitigation actions are described below. All mitigation areas of WSLP are being coordinated for Section 106 compliance via a Programmatic Agreement. Compliance with the Section 106 Programmatic Agreement will be achieved during PED.

Table 4-5: Impacts to swamp and BLH

Habitat	Direct Impacts		Indirect Impacts		Total Impacts ⁷	
	Acres	AAHU	Acres	AAHU	Acres	AAHU
Swamp ⁸	1,112	595	8,432	495	9,545	1,090
Bottomland Hardwood	124	96	89	3	213	99
Total	1,236	691	8,521	498	9757	1,189

Table 4-6: Restored swamp and BLH

Mitigation Project ID*	Proposed Components	Acres	Net Gain AAHU ⁹
BLH1	Bonnet Carré Bottomland Hardwood Restoration	156	99
SWMP1	Swamp Mitigation Bank Credit Purchase	38-14 ¹⁰	72
SWMP2	Blind River Swamp Restoration	1,040	339
SWMP3	Bonnet Carré Swamp Restoration	310	121
SWMP4	Maurepas Crawfish Ponds Restoration	1,161	407
SWMP6	Lutcher Polder Farmlands Swamp Restoration	348	151
TOTAL		3,053	1,189

*SWMP5 (Milton Island Swamp Restoration) was removed from the plan. The 131 AAHUs from that site will be accomplished by expanding the acres at SWMP6.

4.5.1 Bonnet Carré Bottomland Hardwood Restoration (BLH1)

The BLH1 would restore BLH forests with dredged material from the levee ROW and would include tree plantings. *This project was assessed in the [PIER 36 LPV HSDRRS Mitigation report and is incorporated by reference. Unless discussed below, see PIER 36 for details.](#)* The borrow material is coming from the levee alignment parallel drainage canals. General impacts related to the parallel drainage canals can be found in the sections above.

⁷ Figures are rounded up.

⁸ Includes 1.1 acres of impacts from localized storm surge risk reduction measures.

⁹ Required acre and AAHUs amounts are rounded up.

¹⁰ Acres are dependent on the final selected mitigation bank credit purchase



4.5.1.1 BLH1 Impacts to Water Quality and Salinity

Affected Environment

The affected Environment can be found in the [PIER 36](#) LPV HSDRRS Mitigation report and is incorporated by reference.

Environmental Consequences

Placement of dredged material for the proposed BLH1 project, is expected to result in some temporary changes in water chemistry for adjacent waters, such as lowered dissolved oxygen, elevated biochemical oxygen demand, elevated turbidity, and elevated nutrients, and oxidation of reduced metals species. Following construction activities, impacts of dredged and graded material on water quality would dissipate. Indirect water quality impacts of the proposed mitigation projects would largely be relegated to within the project footprints, and would likely relate to changes in biogeochemical cycling from establishment of swamp and bottomland hardwood forest habitat in existing agricultural lands, open water areas, and low quality wetlands areas. There should be no changes to salinity due to this project. For the BLH1 projects, because of the small footprint of the proposed projects and their relative isolation from major waterbodies, cumulative water quality impacts in synergy with other projects and activities in the area would generally be minor. In the case of an opening of the Bonnet Carré Spillway (part of the MR&T Flood Risk Reduction System), water quality conditions within the footprint of these mitigation projects would largely be temporarily supplanted by those of the Mississippi River. In addition, if mitigation sites are not sufficiently established in the event of a significant spillway opening, it is possible that the sites would be eroded, thus eliminating any water quality functions and characteristics associated with the mitigation projects.

4.5.1.2 BLH1 Impacts to Natural Environment

4.5.1.2.1 Soils, Water Bottoms and Prime and Unique Farmlands

Affected Environment

The Bonnet Carré Spillway consists almost entirely of frequently flooded Cancienne and Carville (CR) soils. There are no identified prime and unique farmlands in the Bonnet Carré Spillway BLH restoration area. Please see section 3.2.5.1.2 of the Final PIER 36 for more details on the existing conditions within the Bonnet Carré Spillway.

Environmental Consequences

The proposed BLH restoration would result in the filling of 156 acres of open shallow water bottoms with dredged material. The area is frequently flooded during the high water events on the Mississippi River. The area is frequently excavated to acquire borrow, and soils have been impacted from these events. There would be no direct, indirect, or cumulative impacts to prime and unique farmlands, as none are present in the Bonnet Carré Spillway. See Section 5 of the Final PIER 36 for more details regarding direct, indirect, and cumulative impacts within the Bonnet Carré Spillway resulting from proposed restoration projects.

4.5.1.2.2 Vegetation Resources

Affected Environment

The site is a severely disturbed area that has been cleared and excavated to acquire borrow material. These activities have drastically altered normal topography, creating both depressions and ridges and have cleared prior wetland forests. The mitigation site consists of shallow inundated borrow pits which are segmented by disturbed scrub-shrub and perennial herb ridges including: black willow, carpetweed, southern waterhemp, pigweed, mock bishopweed, ragweed, asters, spiny thistle, yankeeweed, goldenrod, cocklebur, peppergrass, morning glories, woolly croton, coffeeweed, clovers, ironweed, evening primroses, wood sorrel, bushy beardgrass, Bermuda grass, Dallis grass, smartweeds, buttercups, bedstraw, vervain, peppervine, and numerous grasses, rushes and sedges. Shallow water canals and ponds are filled with aquatic vegetation, while deeper canals and ponds exhibit open water. Emergent, floating and submersed plants in these water bodies include water hyacinth, delta duck potato, duckweeds, alligator weed, water pennywort, mosquito fern, sedges and rushes, *Cyperus* spp., *Juncus* spp., floating water primrose and pickerelweed. Invasive species in the area



include: alligator weed, Chinese tallow tree, Johnson grass, and water hyacinth. Invasive and nuisance plant species, particularly black willow, have colonized these areas. See Figure K-1 in the Mitigation Plan document in Appendix A, Annex K for an area map and details of the mitigation features. Please see section 3.2.5.4.2 of the Final PIER 36 for more details on the placement area.

Environmental Consequences

Direct impacts would be creating 156 acres of BLH using beneficial placement of dredged material and tree plantings. See Figure K-1 in the Mitigation Plan document (Annex K) in Appendix A for a map of the area and details of the mitigation features. Primary impacts include: clearing and grubbing before fill placement; plant with native BLH canopy and mid-story species after grading; install invasive/nuisance plants control, including installation of nutria guards to protect trees against herbivory. Locally positive cumulative impacts would be the aggregate of impacts of converting lower quality fragmented scrub shrub habitats to higher quality swamp habitats resulting from implementing the proposed mitigation action in combination with other ongoing actions and actions within the reasonably foreseeable future including the following. On a larger scale the mitigation would not provide a benefit because it is required to compensate for impacts from the structural component of this project. Considering the historic human population growth and expansion throughout Louisiana and the nation, it is likely that existing low quality habitat lands would continue to be converted to multiple uses, especially for human habitations and structures.

4.5.1.2.3 Wildlife

Affected Environment

Please see wildlife section of the Final PIER 36 for more details on the placement area.

Environmental Consequences

The impacts would be similar to those discussed in the Final PIER 36 except approximately 156 acres of wildlife habitat would be converted from ponds to BLH. Approximately 3,015 acres of forested habitat (BLH and Swamp) would be restored or enhanced by mitigation measures in this project. This project, when added to other past, present, and reasonably foreseeable ecosystem restoration and mitigation projects in the basin would help retard the loss of wetlands and overall decline of wildlife species within local area and would be beneficial to preserve the species bio-diversity. On a larger scale the mitigation would not provide a benefit because it is required to compensate for impacts from the structural component of this project.

4.5.1.2.4 Aquatic and Fisheries Resources

Affected Environment

The Bonnet Carré Spillway offers areas for freshwater and saltwater fishing, and at times anglers are able to catch sunfish, bass, spotted/speckled trout, and red drum (redfish) from the same area. Please see section 3.2.5.4.2 of the Final PIER 36 for more details on the placement area.

Environmental Consequences

Please see section 3.2.5.4.2 of the Final PIER 36 for more details on the impacts to the placement area.

4.5.1.2.5 Essential Fish Habitat (EFH)

Affected Environment

The BLH-Wet restoration and borrow area has limited tidal connections and is not considered EFH.

Environmental Consequences

There are no direct, indirect or cumulative impacts to EFH due to the Bonnet Carré BLH Restoration.

4.5.1.2.6 Threatened and Endangered Species

Affected Environment



Please see Threatened and Endangered Species section of the Final PIER 36 for more details on the placement area.

Environmental Consequences

The impacts would be similar to those discussed in the Final PIER 36 except approximately 156 acres of open water habitat would be converted to BLH. This conversion would offer more suitable nesting grounds for bald eagles. A total of approximately 3,912 acres of forested habitat would be restored or enhanced by mitigation measures for HSDRRS and the selected project. Locally positive cumulative impacts would help retard the loss of wetlands and overall decline of habitat available for use by Threatened and Endangered Species, bald eagles and colonial nesting waterbirds. On a larger scale, the mitigation would not provide a benefit because it is required to compensate for impacts from the structural component of this project.

4.5.1.2.7 Recreation Resources

Affected Environment

The affected environment is described in Final PIER 36 Bonnet Carré Spillway BLH Restoration 3.3.5.7.2.

Environmental Consequences

The Bonnet Carré mitigation site shares a boundary with All Terrain Vehicle (ATV) area 2 in the Bonnet Carré Spillway. The ATV area has been closed for 3 years with no immediate plans to re-open. No impact is expected to the ATV area. Recreational use (water fowl and big game hunting, fishing, crawfishing, and crabbing) would be displaced during construction and approximately 5 years thereafter or until the plantings take hold, whichever is greater. There is the occasional use of the area by trail runners and an annual adventure race. These activities would be displaced during construction. The proposed swamp habitat could provide opportunities for limited fishing, hunting, and bird watching.

4.5.1.2.8 Noise Resources

Affected Environment

There are many different noise sources throughout the area including commercial and recreational boats, and other recreational vehicles; automobiles and trucks, and all terrain vehicles; aircraft; machinery and motors; and industry-related noise. The noise ordinance for St. Charles Parish allows for the maximum permissible sound levels during the hours of 7:00 am to 10:00 pm are 60 dBA for residential areas and 65 dBA for commercial areas ([St. Charles Parish, Louisiana, Code of Ordinances](#)). Noise levels surrounding St. Charles varies depending on the time of day and climatic conditions. Near the mitigation area in the Bonnet Carré Spillway automobile and train traffic, and to a lesser extent air traffic, contribute to the background noise levels. The Bonnet Carré Spillway mitigation area is located on public lands and recreation areas within the spillway could contain sensitive noise receptors where serenity and quiet are an important public resource.

Environmental Consequences

No permanent noise impacts would occur as a result of the mitigation measures and all noise emissions would be relatively short-term, lasting only as long as construction activities. The initial construction would be approximately 12 months. The construction would also be phased starting in one location and moving to the next so the entire area would not be under construction at the same time. Using aerial photography there are no resident sensitive noise receptors in the area. However, individuals recreating within 1000 ft of the mitigation area could be temporarily impacted by the noise of construction. Cumulative impacts would be similar to the structural component for Alternative C but less because future levee lifts are not required for the mitigation component of this project.



4.5.2 Bonnet Carré Spillway Swamp Restoration (SWMP3)

The SWMP3 would restore swamp with dredged material from the levee ROW and would include tree plantings. *This project was assessed in the [PIER 36 LPV HSDRRS Mitigation NEPA document](#) and is hereby incorporated by reference. Unless discussed below, see PIER 36 for details.* The Affected Environment and Environmental Consequences for most resources are the same as for Bonnet Carré BLH except where described below. The borrow material is coming from the levee alignment and the existing conditions are described in section 2.3 and 2.4 of this document.

4.5.2.1 SWMP3 Impacts to Water Quality and Salinity

The direct indirect and cumulative impacts are the similar as BLH1 above, but vary with the acres of impact.

4.5.2.2 SWMP3 Impacts to Natural Environment

4.5.2.2.1 Vegetation Resources

Environmental Consequences

Direct impacts would be creating 310 acres of swamp using beneficial placement of dredged material and tree plantings. See Figure K-1 in the Mitigation Plan document (Annex K) in Appendix A for a map of the area and details of the mitigation features. Primary impacts include: clearing and grubbing before fill placement; plant with native swamp canopy and mid-story species after grading; install invasive/nuisance plants control, including installation of nutria guards to protect trees against herbivory. Cumulative impacts would be the aggregate of impacts of converting lower quality fragmented scrub shrub habitats to higher quality swamp habitats resulting from implementing the proposed mitigation action in combination with other ongoing actions and actions within the reasonably foreseeable future. The conversion of 310 acres of low quality fragmented scrub shrub habitat from the mitigation site would be in addition to conversion of similar low quality habitats throughout Louisiana and the nation. Considering the historic human population growth and expansion throughout Louisiana and the nation, it is likely that existing low quality lands will continue to be converted to multiple uses, especially for human habitations and structures.

4.5.2.2.2 Wildlife

Environmental Consequences

Impacts would be similar to those discussed in BLH1 except approximately 310 acres of wildlife habitat would be converted.

4.5.2.2.3 Aquatic and Fisheries Resources

Environmental Consequences

The proposed Swamp restoration would result in the filling of 310 acres of open shallow water bottoms with dredged material; otherwise, it is the same as BLH1 above.

4.5.2.2.4 Threatened and Endangered Species

Environmental Consequences

Impacts would be similar to those discussed in Bonnet Carré Spillway BLH Restoration except approximately 310 acres of open water would be converted to swamp habitat which is more suitable nesting grounds for bald eagles and colonial nesting waterbirds.

4.5.3 Purchasing Mitigation Bank credits for swamp habitat (SWMP1)

Affected Environment for all Resources

Various mitigation banks within the LPV coastal zone basin may be capable of supplying enough credits to meet some of the swamp mitigation requirements. Since the bank that may ultimately be selected to provide the necessary mitigation credits is unknown, the existing conditions present at the bank site are similarly unknown. Existing bank habitat quality varies depending on the success criteria met, as specified in the bank's Mitigation Banking Instrument (MBI). Typically, as mitigation success criteria are met and the quality of the habitat increases within the bank, more credits are released for purchase.



Environmental Consequences for all Resources

Direct, indirect and cumulative impacts of the No Action Alternative regarding the various mitigation banks within the Lake Pontchartrain and Vicinity (LPV) coastal zone have been documented in the respective mitigation bank NEPA documents. Since the bank that may ultimately be selected to provide the necessary mitigation credits is unknown, the environmental consequences for a specific bank site are similarly unknown.

5.3.4 Blind River Swamp Restoration (SWMP2)

The SWMP2 would restore swamp with tree plantings in an area where the hydrologic connection has been restored. *This project was assessed in the [LCA Amite Report](#) and is hereby incorporated by reference. Unless discussed below, see the LCA Amite Report for details.*

4.5.3.1 SWMP2 Impacts to Natural Environment

4.5.3.1.1 Soils, Water Bottoms, and Prime and Unique Farmlands

Affected Environment

Soils in the Blind River Diversion Canal Swamp restoration area are Barbary (BA) and Maurepas (MA) muck. There are no identified prime and unique farmlands in the Blind River Diversion Canal Swamp restoration area. Please see section 4.2.1 of the LCA Amite Report for more details on the placement area.

Environmental Consequences

Direct and indirect impacts to soil and water bottoms would result from construction associated with the swamp restoration project. A net total of 1,040 acres of wetland soils would be hydrologically restored and nourished. No prime and unique farmlands would be impacted by the proposed restoration project, as none are identified. This project when added to other past, present, and reasonably foreseeable ecosystem restoration and mitigation projects in the basin would help retard the overall loss of wetlands within the basin and, when combined with other mitigation projects, would offset the habitat losses caused by other development and natural processes in the basin. Please see section 5.1.1.3 of the LCA Amite Report for more detail on environmental consequences associated with proposed restoration projects in the placement area.

4.5.3.1.2 Vegetation Resources

Affected Environment

Please see section 4.2.6 of the final EIS for the LCA Amite River Diversion Canal Modification (ARDC) project for a description of the affected environment. Forested wetlands, consisting primarily of bald cypress-tupelo swamp, have presently converted into marsh and shallow open water in the planting area. The site would likely convert to open water within less than 50 years.

Environmental Consequences

Please see section 5.62 of the LCA ARDC final EIS for a description of the direct, indirect and cumulative impacts of the environmental consequences of restoring this site which are incorporated herein by reference consistent with CFR 40 1502.21. This project is dependent on construction of the Livingston Parish CIAP project. See Figure K-2 in the Mitigation Plan document (Annex K) in Appendix A for a map of the area and mitigation details. Direct impacts of restoring and planting native swamp canopy and mid-story species on 1,040 acres of deteriorating fragmented swamp; installing nutria guards on all planted trees to protect against herbivore tree loss. Indirect impacts include restoration of 1,040 acres of degrading swamp habitat to higher quality swamp habitat. Cumulative impacts consist of an aggregate of impacts to swamp resources resulting from implementing the restoration of 1,040 acres by the proposed mitigation action in combination with other ongoing actions and actions within the reasonably foreseeable future including: continued coastwide degradation and loss of swamp habitat due to sea level change and other natural factors; implementation of swamp restoration projects in Louisiana by the LCA program and the CWPPRA programs; implementation of swamp restoration features within the Louisiana State Master Plan; implementation of the LCA Small Diversion at Convent/Blind River and the Maurepas Diversion projects; local city and parish swamp degradation and restoration efforts; construction of other hurricane and storm damage risk reduction



projects; road construction; and other human encroachment. These would be in addition to similar activities nationwide.

4.5.3.1.3 Wildlife

Environmental Consequences

Direct and Indirect Impacts: Impacts would be similar to those discussed in the LCA Amite Report except that 1,040 acres of forested wetlands habitat would be restored. The cumulative impacts would be the same as those identified for BLH1.

4.5.3.1.4 Aquatic and Fisheries Resources

Environmental Consequences

Planting vegetation on 1,040 acres would be conducted by hand and would have limited to no direct impacts on aquatic species. The swamp is flooded for a short while every three to five years and aquatic species access is limited to those times. The flooding would contribute to the improved health of the freshwater swamp system and indirectly would benefit aquatic species that use the swamp. There would be a local positive cumulative impact to the area when this is added to the benefits provided by the Livingston Parish CIAP project (the hydraulic modification portion of alternative 39 from the LCA Amite Report) and the State's Amite Restoration project (alternative 33 from the LCA Amite report). On a larger scale the planting would not provide a benefit because it is required to compensate for impacts from the structural component of this Project.

4.5.3.1.5 Essential Fish Habitat (EFH)

Affected Environment

Blind River swamp mitigation site is not classified as EFH in the GIS database layers provided by the NOAA National Marine Fisheries Service website.

Environmental Consequences

There is no direct, indirect or cumulative impact to EFH at this site.

4.5.3.1.6 Threatened and Endangered Species

Environmental Consequences

Direct and Indirect Impacts: Impacts would be similar to those discussed in the LCA Amite Report except that 1,040 acres of forested wetlands habitat would be restored and available for use by bald eagles and colonial nesting waterbirds. *Cumulative Impacts:* Same as Bonnet Carré Spillway BLH Restoration

4.5.3.1.7 Aesthetics and Visual Resources

Affected Environment

The Blind River Mitigation sites are located north of the Maurepas Swamp WMA boundary, along the Amite River Diversion Canal. The area is remote and user activity (fishing, hunting, and other water traffic) is extremely low. See section 4.2.13 of the LCA Amite Report for more details on the affected environment.

Environmental Consequences

The Blind River Mitigation sites are located north of the Maurepas Swamp WMA boundary, along the Amite River Diversion Canal, with little user activity other than that associated with recreational uses. Direct and indirect impacts are negligible. For more information, see the LCA Amite Report, section 5.13.

4.5.3.1.8 Resource: Recreation

Affected Environment - The site is in the Maurepas Swamp WMA adjacent to the National Scenic Blind River. Recreation within the project area includes hunting (deer, small game, waterfowl), fishing, and boating.

Environmental Consequences

During project construction recreation users would be temporarily displaced. If construction occurs during hunting season (October – February), safety issues and disturbance to WMA users is expected. Best



management practices would be employed. No impact to recreation users of Blind River is expected. There is a vegetation buffer between the project and river to minimize visual impacts for those travelling on the river.

4.5.3.1.9 Noise

Affected Environment

There are many different noise sources throughout the area including commercial and recreational boats, and other recreational vehicles; automobiles and trucks, and all terrain vehicles; aircraft; machinery and motors; and industry-related noise. The maximum permissible sound levels for Livingston Parish during the hours of 6:00 am and 11:00 pm are 85 dBA ([Livingston Parish Council, Louisiana, Code of Ordinances](#)). Noise levels surrounding Livingston Parish vary depending on the time of day and climatic conditions. Near the Blind River mitigation area automobile and train traffic, and to a lesser extent air traffic, contribute to the background noise levels.

Environmental Consequences

No permanent noise impacts would occur as a result of Blind River mitigation measures, and all noise emissions would be relatively short-term, lasting only as long as construction activities. The initial construction would be approximately 12 months. The construction would be phased starting in one location and moving to the next so the entire area would not be under construction at the same time. Table 4-2 presents noise emissions for construction equipment expected to be used during the construction activities. Anticipated sound levels at 50 ft would range from 76 dBA to 82 dBA based on data from the FHWA (2007).

Noise levels may result in wildlife avoiding the area during construction. Residences could experience higher than ambient noise levels during construction, however these levels would be temporary during the period of construction and would be limited to daylight hours and are below the noise ordinances for Livingston parish.

Aerial photos were used to determine the number of sensitive noise receptors within the 1,000 ft zones. Table 4-2 summarizes the total sensitive receptors with 1000 ft, segregated by parish that would be temporarily impacted during construction of the projects. Impacts on the ambient noise environment resulting from the construction would be minor and short-term. Approximately, 4 single-family homes are located within 1,000 ft from the edge of the project corridors. These sensitive noise receptors could experience noise emissions greater than 65 dBA, which are normally unacceptable (HUD 1984). Construction work could occur as long as 10 hours a day, 6 days a week. However, these noise levels are below the Livingston Parish maximum acceptable level of 85 dBA. Noise emissions created during construction activities would be temporary; therefore, long-term impacts are negligible. Construction of this project is not anticipated to add significantly to the cumulative effect of noise in the project areas as the construction activities would be temporary, restricted to daylight hours and encourage the avoidance of the project area by wildlife only during the period of construction. Cumulative impacts would be similar to the structural component for Alternative C but less because future levee lifts are not required for the mitigation component of this project.

4.5.4 Maurepas Crawfish Ponds Swamp Restoration (SWMP4)

The SWMP4 would restore swamp by degrading dikes of crawfish ponds and restoring hydrologic connections and would include tree plantings.

4.5.4.1 SWMP4 Impacts to Water Quality and Salinity

The direct and indirect impacts are similar as BLH1 above, but vary because of the acres of impact. Cumulative impacts: Local development may affect quality of created swamp. Local runoff in these areas from urban areas and agricultural lands (primarily utilized for sugarcane) may contain elevated levels of metals, nutrients, pesticides, and other organic contaminants capable of being assimilated by and augmenting these created wetlands (e.g., see Demcheck et al. 2004, Southwick et al. 2002). Future development in areas adjacent to these mitigation sites could enhance runoff quality.



4.5.4.2 SWMP4 Impacts to Natural Environment

4.5.4.2.1 Soils, Water Bottoms, and Prime and Unique Farmlands

Affected Environment

The Maurepas Crawfish Ponds Swamp restoration area consists entirely of Schriever clay. The restoration areas are approximately 300 acres of crawfish ponds. There are no identified prime and unique farmlands in the restoration area.

Environmental Consequences

Direct and indirect impacts to soil and water bottoms would result from construction activities associated with the swamp restoration project. A net total of 1,161 acres of wetland soils would be hydrologically restored and nourished. Approximately 78 acres of shallow water bottoms would be directly impacted. No prime and unique farmlands would be impacted by the proposed restoration project, as none are identified.

4.5.4.2.2 Vegetation Resources

Affected Environment

This 1,161-acre area is presently characterized as shallow water ponds interspersed with canals and natural bayous. There are also fallow or drained ponding areas which have an overgrowth of scrub shrub, primarily willow. Around 1950, the practice of re-flooding rice fields after harvest became commonplace as a method to produce crawfish for harvest during the autumn, winter and early spring. This practice of crawfish 'farming' eventually spread to impounded woodlands and marshland as well. By the mid-1960s, acreage had increased to approximately 10,000 acres of managed crawfish ponds. At this point, an industry based on peeling crawfish became established, which in turn fueled further expansion of both crawfish farming and wild harvests. Acreage continued to increase, from approximately 44,000 acres in the mid-1970s to roughly 182,000 acres in 2012 (source: http://www.agmrc.org/commodities_products/aquaculture/crawfish-profile/ accessed March 28, 2014).

Environmental Consequences

Direct impacts would be conversion of 1,161 acres of existing crawfish ponds to swamp through land grading, especially removal of water management levees to create uniform elevations and open exchange of water with adjacent swamps; clearing and grubbing; invasive/nuisance plants control including installation of nutria guards to protect trees against herbivory; and planting with native swamp canopy and mid-story species after grading. See Figure K-3 in the Mitigation Plan document (Annex K) in Appendix A for a map of the area and mitigation project details. Cumulative impacts would be the aggregate of impacts to crawfish pond resources resulting from implementing the proposed mitigation action in combination with other ongoing actions and actions within the reasonably foreseeable future including the following. The loss of 1,161 acres crawfish ponds out of the Louisiana state-wide 182,000 acres would be a loss of about 0.6 percent. Considering the historical growth of the crawfish industry in Louisiana it is likely that existing rice and other agricultural lands, as well as woodlands and swamps, would continue to be converted to crawfish ponds to meet ever increasing consumer demands for this product.

4.5.4.2.3 Wildlife

Affected Environment

Depending on water level, and if crawfish are present, crawfish ponds could provide foraging grounds for wading birds, waterfowl, birds of prey, reptiles, amphibians and mammals such as raccoons, rabbits, deer, otter and mice.

Environmental Consequences

Direct Impacts: Some more immobile wildlife species (e.g. mice, rats, and crawfish) may experience demise during construction. Species that utilize agricultural fields when crops are present may be temporarily displaced during by construction activity. However, the creation of high quality swamp habitat greatly outweighs the loss of crawfish ponds that are no longer used for production.



Indirect Impacts: The conversion of 1,161 acres of crawfish ponds to swamp land would provide shelter, nesting and foraging grounds for many animals including the ones listed above.

Cumulative Impacts: Same as Bonnet Carré Spillway BLH Restoration

4.5.4.2.4 Aquatic and Fisheries Resources

Affected Environment

The amount of water in the existing crawfish pond depends on if it is still in production, the season, if the outer dikes have been maintained or in disrepair and dike elevation. If water has been able to flow in naturally the species that can be found would be dominated by fresh water species such as crawfish, sunfish, bowfin, catfish, and bass.

Environmental Consequences

The crawfish ponds would be drained before any construction would begin, most mobile species would swim out of the system therefore they would not be directly impacted. The drying out of the area and the degrading of the internal and external dikes would eliminate any non mobile species. The planting of trees and reconnecting of the area to the adjacent swamps would allow aquatic species to recolonize the area and be a positive impact on the resource. There would be locally positive cumulative impacts on this resource, but on a larger scale the mitigation would not provide a benefit because it is required to compensate for impacts from the structural component of this project.

4.5.4.2.5 Essential Fish Habitat (EFH)

Affected Environment

The existing crawfish ponds presently are not classified as EFH.

Environmental Consequences

There is no direct, indirect or cumulative impact to EFH at this site.

4.5.4.2.6 Threatened and Endangered Species

Affected Environment

No listed species occur in this area. However, crawfish ponds are utilized as foraging grounds by colonial nesting waterbirds and the delisted bald eagle.

Environmental Consequences

Direct Impacts: Based on review of existing data, the USACE finds that this feature would have no effect on listed species or their critical habitat. The construction of swamp habitat would convert foraging grounds to suitable habitat for shelter, nesting and foraging grounds for bald eagles and colonial nesting waterbirds.

Indirect Impacts: There is potential for temporary indirect impacts due to construction activity. These impacts would be the avoidance of the area during construction. The area is surrounded by suitable foraging habitat; therefore it is assumed that any birds utilizing the ponds would simply forage elsewhere. *Cumulative Impacts:* Same as those identified in connection with Bonnet Carré Spillway BLH1 Restoration.

4.5.4.2.7 Aesthetics and Visual Resources

Affected Environment

The Maurepas Crawfish Ponds Mitigation sites are split into three areas. The first is located just west of Sorrento adjacent to US-61. The landscape of the area is currently made up of crisscrossing small canals, open water ponds and abundant vegetation surrounding the crawfish ponds. Land use in the area is primarily agricultural and undeveloped rural lands. Access to the first site can be had via US-61 and Texaco road. Visual accessibility is abundant for approximately 1.5 miles along the Highway 61 corridor. User activity in the area is moderate with typical industrial and commercial highway traffic between two major cities (New Orleans and Baton Rouge), and tourist traffic along the Great River Road (US- 61).



The second mitigation site is located just north of the intersection between Hwy 70 and Hwy 3125. Water resources are less substantial here. The landscape of the area is similar to that mentioned at the first site, with agricultural and undeveloped rural lands surrounding the project site. User activity is lower here and primarily relegated to farm traffic.

The third mitigation site is located at the southwestern corner of the West Maurepas Swamp WMA boundary, near the intersection of Hwy 3214 and Hwy 3125. The landscape, water resources, and land uses are similar to that mentioned under sites 1 and 2. User activity is similar to that mentioned under site 2.

Environmental Consequences

The Maurepas Crawfish Ponds Mitigation sites have relatively high visibility and could be considered institutionally significant due to their proximity to the Maurepas Swamp WMA. The conversion of the open water crawfish ponds into swamp would drastically improve scenic quality in the area and improve view sheds, especially along US-61. Technical design criteria would be satisfied with the conversion of open water into a tree filled landscape. Direct impacts would therefore be considerably to the positive and noticeable to daily users. On the downside, user activity would see temporary interruptions during construction of the mitigation features due to vehicles moving in and out of the area. However; it is important to note that after completion of the project, the area would return to normal.

4.5.4.2.8 Recreation

Affected Environment

There is no recreation occurring within the commercial ponds.

Environmental Consequences

There is no impact to recreation resources.

4.5.4.2.9 Noise

Affected Environment

There are many different noise sources throughout the area including commercial and recreational boats, and other recreational vehicles; automobiles and trucks, and all terrain vehicles; aircraft; machinery and motors; and industry-related noise. The maximum permissible sound levels for Ascension Parish are 75 dBA during the hours of 6:00 am and 9:00 pm (<http://library.municode.com/index.aspx?clientId=10989>). St. James Parish does not have any specific ordinances regarding construction noise. Noise levels surrounding Ascension and St. James Parishes vary depending on the time of day and climatic conditions. Near the localized storm surge risk reduction system in St. James Parish, automobile and train traffic, and to a lesser extent air traffic, contribute to the background noise levels.

A number of parks and the Maurepas WMA are located adjacent to or near the Maurepas Swamp Crawfish Pond mitigation areas. These public lands are sensitive noise receptors where serenity and quiet are an important public resource. The areas with the greatest number of sensitive noise receptors, such as residential homes and apartments, schools, churches, and parks are also located in St. James and to some extent in Ascension Parish. They are located along Hwy 3125 and Hwy 61 (Airline Hwy).

Environmental Consequences

Direct, Indirect and Cumulative Impacts: No permanent noise impacts would occur as a result of localized storm surge risk reduction measures and all noise emissions would be relatively short-term, ending after construction. The initial construction would be approximately 12 months. The construction would also be phased starting in one location and moving to the next so the entire area would not be under construction at the same time. Table 4-2 presents noise emissions for construction equipment expected to be used during the construction activities. Anticipated sound levels at 50 ft would range from 76 dBA to 82 dBA based on data from the FHWA (2007).

The majority of mitigation construction would require the use of earth-moving equipment, which produces



noise emissions of 81 dBA. The noise model projected that noise levels of 81 dBA were required to travel 300 ft before they attenuate to acceptable levels of 65 dBA. To achieve an attenuation of 81 dBA to a normally unacceptable level of 75 dBA, the distance from the noise source to the receptor was 100 ft.

Aerial photography was used to determine the number of sensitive noise receptors within the 1,000 ft zones. Table 4-2 summarizes the total sensitive receptors with 1000 ft, segregated by parish that would be temporarily impacted during construction of the projects. A number of parks and recreational areas are located near the projects, including the Maurepas WMA, and these areas have the potential to experience increased noise emissions.

Impacts on the ambient noise environment resulting from the construction would be minor and short-term. Approximately, 31 single-family homes (10 in St. James Parish and 21 in Ascension Parish) are located within 1,000 ft from the edge of the project corridors. These sensitive noise receptors could experience noise emissions greater than 65 dBA, which are normally unacceptable (HUD 1984). Construction work could occur as long as 10 hours a day, 6 days a week. In Ascension Parish residential areas where the noise ordinances could be exceeded temporarily, the contractor would be required to utilize best management practices such as utilizing noise barriers to reduce noise impacts or obtain permission from local authorities to temporarily exceed maximum permissible sound levels. Cumulative impacts would be similar to the structural component for Alternative C but less because future levee lifts are not required for the localized storm surge risk reduction component of this project.

4.5.5 Lutcher Polder Farmlands Swamp Restoration (SWMP6)

The SWMP6 would restore swamp by degrading farmfields and restoring hydrologic connections and would include tree plantings.

4.5.5.1 SWMP6 Impacts to Water Quality and Salinity

The direct and indirect impacts are similar to those identified in BLH1 above, but vary because of the acres of impact. Cumulative impacts: Same as the modification of the SWMP4 above.

4.5.5.2 SWMP6 Impacts to Natural Environment

4.5.5.2.1 Soils, Water Bottoms, and Prime and Unique Farmlands

Affected Environment

The Lutcher Polder Farmlands Swamp Restoration area is comprised of active agriculture lands. The area consists of Cancienne (CmA) and Gramercy (GrA) soils, both of which are classified as prime farmlands.

Environmental Consequences

Direct and indirect impacts to soils would result from construction activities associated with the swamp restoration project. A net total of 348 acres of prime farmland soils would be directly impacted and converted to non-agricultural use. This project when added to other past, present, and reasonably foreseeable ecosystem restoration and mitigation projects in the basin would help retard the overall loss of wetlands within the basin and, when combined with other mitigation projects, would offset the habitat losses caused by other development in the basin.

4.5.5.2.2 Vegetation Resources

Affected Environment

This 348-acre area is presently characterized as agricultural land with a portion of fallow acres.

Environmental Consequences

Direct impacts include the conversion of 348 acres of existing agricultural fields to swamp habitats by clearing and grubbing woody vegetation within the sites before grading, including mechanized removal of invasive



and nuisance plant species. Thereafter, the mitigation plan provides that the Project will plant 348 acres with native swamp canopy and midstory species and install nutria guards on all planted trees to protect against herbivore tree loss. The loss of 348 acres of agricultural lands primarily for sugar cane, compared to the Louisiana state-wide 439,256 acres in sugar cane production in 23 Louisiana parishes during 2013 (source: <http://www.lsuagcenter.com/agsummary/narrative> accessed March 28, 2014) is a loss of .08 percent. Considering the historical growth and expansion of agricultural endeavors in Louisiana and the Nation, it is likely that conversion of existing agricultural lands for mitigation purposes would be offset by agricultural encroachment and conversion of woodlands and marshlands to agricultural fields to meet increasing consumer demands for sugar and other agricultural crops.

4.5.5.2.3 Wildlife

Affected Environment

Agricultural land provides foraging grounds for various species of birds such as sparrow, crows, song birds and birds of prey. Mammals such as skunks, rabbits, armadillo, raccoons, mice and deer may utilize this habitat as well. Snakes and other reptiles could use agricultural lands for nesting and foraging.

Environmental Consequences

Direct Impacts: Some more immobile wildlife species (e.g. mice, rats) may experience demise during construction. Species that utilize agricultural fields when crops are present may be temporarily displaced during construction activity. However, the creation of high quality swamp habitat greatly outweighs the loss of agricultural fields that are periodically used for crop production.

Indirect Impacts: The conversion of 348 acres of agricultural land to swamp would provide shelter and nesting grounds for many animals including the ones listed above. It would also attract some species of colonial nesting waterbirds. *Cumulative Impacts:* Same as those identified in connection with Bonnet Carré Spillway BLH1 Restoration.

4.5.5.2.4 Aquatic and Fisheries Resources

Affected Environment

The existing agricultural fields presently do not provide fisheries or aquatic resources.

Environmental Consequences

There is no direct, indirect negative impact to aquatic and fisheries resources at this mitigation site. The planting of trees and reconnecting of the area to the adjacent swamps would allow aquatic species to recolonize the area and be a positive impact on the resource. There would be locally positive cumulative impacts on this resource, but on a larger scale the mitigation would not provide a benefit because it is required to compensate for impacts from the structural component of this project.

4.5.5.2.5 Essential Fish Habitat (EFH)

Affected Environment

The existing agricultural fields presently are not classified as EFH.

Environmental Consequences

There is no direct, Indirect or Cumulative impact to EFH at this site.

4.5.5.2.6 Threatened and Endangered Species

Affected Environment

No listed species occur in the area. However, this habitat type does offer potential utilization by the Sprague's pipit. The Sprague's pipit, is a candidate species for federal listing as threatened or endangered. It winters in Louisiana, arriving from northern breeding grounds in September and remaining until April. Sprague's pipit exhibits a strong preference for open grassland (i.e., native prairie) with native grasses of intermediate height and thickness, and it avoids areas with too much shrub encroachment. This species is a ground feeder and forages mainly on insects but occasionally eats seeds (personal communication USFWS Brigette Firmin).



Environmental Consequences

Direct Impacts: Impacts would be the conversion of 348 acres of suitable habitat, for use by the wintering Sprague's pipit, to unsuitable habitat. If any of these birds are present they would be forced to permanently relocate. The USACE will consult with USFWS when the species is listed.

Indirect Impacts: Indirect impacts would be the benefit of 348 additional acres locally of swamp habitat available for use by bald eagles and colonial nesting waterbirds.

Cumulative Impacts: Same as those identified in connection with Bonnet Carré Spillway BLH1 Restoration.

4.5.5.2.7 Aesthetics and Visual Resources

Affected Environment

The Lutcher Polder Farmland Mitigation site is located approximately 1 mile from the southern boundary of the West Maurepas WMA, and approximately 2 miles northeast of the community of Hester. The site and its surrounding area are primarily made up of agricultural lands mixed with low density residential; with dense forestation located to the Northwest towards Maurepas Swamp WMA. User access can be had from Hwy 3125 and Hwy 642 where traffic and user activity are relatively low and relegated to agricultural and some minor commuter purposes.

Environmental Consequences

The Lutcher Polder Farmland Mitigation site has relatively high visibility and public significance to the residents living adjacent to the area. The conversion of the open water into swamp would drastically improve scenic quality in the area and improve view sheds. Technical design criteria would be satisfied with the conversion of open water into a tree filled and vegetated landscape. Direct impacts would therefore be considerably to the positive and noticeable to daily users.

On the downside, user activity would see temporary interruptions during construction of the mitigation features due to vehicles moving in and out of the area. However; it is important to note that after completion of the project, the area would return to normal.

Cumulative Impacts:

Area diversion projects (LCA CBRD and the Maurepas Diversions) would provide fresh water and improve wetlands. Wetlands contribute to the visual quality of an area, especially where open water areas are abundant. Wetlands, swamps and forested lands break up the view shed providing variety, color, texture and repetition in an appealing manner. These elements satisfy the needs of technical significance and increase the value of the view sheds in the public's eye.

Of 33 USACE HDSRRS projects (IER 1-33), minimal impacts to visual resources were found for projects in the St. Charles, Chalmette Loop, Belle Chasse, and Gretna-Algiers area. Minor impacts to visual resources occurred in Jefferson East, Orleans East, New Orleans East, Harvey Westwego, and Lake Cataouatche. Impacts were typically associated with land and water access where project areas were remote and well out of the public view shed. In other cases, levees and flood protection measures were already in place and a part of the existing view shed, which created minimal impacts. More considerable impacts were associated with flood wall construction and flood gate construction in areas that previously did have features such as these. Some positive impacts were found among the various borrow IERs, where flat open areas were broken up with the addition of borrow ponds.

Cumulatively, the above environmental documents identify minor adverse impacts to visual resources with *nducthe* the potential of enhanced habitat that may positively impact visual resources in the future.

4.5.5.2.8 Recreation

Affected Environment

There is no recreation occurring within the project area that is currently being used for agriculture.



Environmental Consequences

There is no impact to recreation resources.

4.5.5.2.9 Noise

Affected Environment

There are many different noise sources throughout the area including commercial and recreational boats, and other recreational vehicles; automobiles and trucks, and all terrain vehicles; aircraft; machinery and motors; and industry-related noise. The maximum permissible sound levels for Ascension Parish are 75 dBA during the hours of 6:00 am and 9:00 pm (<http://library.municode.com/index.aspx?clientId=10989>). St. James Parish does not have any specific ordinances regarding construction noise. Noise levels surrounding Ascension and St. James Parishes vary depending on the time of day and climatic conditions. Near the localized storm surge risk reduction system in St. James Parish automobile and train traffic, and to a lesser extent air traffic, contribute to the background noise levels.

A number of parks and the Maurepas Wildlife Management Area are located adjacent to or near the Maurepas Swamp Crawfish Pond mitigation areas. These public lands are sensitive noise receptors where serenity and quiet are an important public resource. The areas with the greatest number of sensitive noise receptors, such as residential homes and apartments, schools, churches, and parks are also located in St. James and to some extent in Ascension Parish. They are located along Hwy 3125 and Hwy 61 (Airline Hwy).

Environmental Consequences

Direct, Indirect and Cumulative Impacts: No permanent noise impacts would occur as a result of localized storm surge risk reduction measures and all noise emissions would be relatively short-term, lasting only as long as construction activities. The initial construction would be approximately 12 months. The construction would be phased starting in one location and moving to the next so the entire area would not be under construction at the same time. Table 4-2 presents noise emissions for construction equipment expected to be used. Anticipated sound levels at 50 ft would range from 76 dBA to 82 dBA based on data from the FHWA (2007).

The majority of the mitigation construction would require the use of earth-moving equipment, which produces noise emissions of 81 dBA. The noise model projected that noise levels of 81 dBA were required to travel 300 ft before they attenuated to acceptable levels of 65 dBA. To achieve an attenuation of 81 dBA to a normally unacceptable level of 75 dBA, the distance from the noise source to the receptor was 100 ft.

Aerial photos were used to determine the number of sensitive noise receptors within the 1,000 ft zones. Table 4-2 summarizes the total sensitive receptors within 1,000 ft, by parish, that would be temporarily impacted during construction. A number of parks and recreational areas are located near the projects, including the Maurepas Wildlife Management Area. These areas have the potential to experience increased noise emissions.

Impacts on the ambient noise environment resulting from the construction would be minor and short-term. Approximately, 31 single-family homes (10 in St. James Parish and 21 in Ascension Parish) are located within 1,000 ft from the edge of the project corridors. These sensitive noise receptors could experience noise emissions greater than 65 dBA, which are normally unacceptable (HUD 1984). Construction work could occur as long as 10 hours a day, 6 days a week. In Ascension Parish residential areas where the noise ordinances could be exceeded temporarily, the contractor would be required to utilize best management practices such as utilizing noise barriers to reduce noise impacts or obtain permission from local authorities to temporarily exceed maximum permissible sound levels. Cumulative impacts would be similar to the structural component for Alternative C but less because future levee lifts are not required for the localized storm surge risk reduction component of this project.



5.0 RECOMMENDED PLAN (PREVIOUSLY TENTATIVELY SELECTED PLAN)

Alternative C is the Recommended Plan. As discussed in Chapter 3, after the TSP was verified, the team developed feasibility-level designs for the Recommended Plan. Investigations included detailed cost estimates, benefits, impacts, and implementation requirements. Below is a summary project description of the Recommended Plan. Additional details on the plan are found in the technical appendices.

5.1 Description of the Recommended Plan

The Recommended Plan includes the construction of an 18.27-mile levee system around the communities of Montz, Laplace, Reserve and Garyville. The plan also includes the construction of localized storm surge risk reduction measures in St. James Parish. An overview of the entire risk reduction system is shown on Figure 5-1.

Levee System

The levee system would begin at the upper guide levee of the Bonnet Carré Spillway, north of an underground utility pipeline right of way and US-61. The levee would head northwest paralleling the pipeline right of way and pass under I-10. Past I-10 the levee would enclose the I-10 and I-55 interchange and cross US-51. It would then track north of I-10 and a pipeline transmission corridor. Past the Belle Terre/I-10 exit, the levee would pass back under I-10 and parallel the pipeline corridor through wetlands until it crosses Hope Canal. The levee would then turn south; cross the pipeline transmission corridor and then extend to the MRL.

The levee system would reduce the risk of flooding for over 7,000 structures and four miles of I-10 located in the system. Inclusion of this segment of I-10 could allow for an earlier re-entry route for residents and emergency responders in southeast Louisiana, including residents in the New Orleans metropolitan area.

The construction of the structural component of the project, hereafter referred to as the “levee system”, would be based on a 1% probability storm level of risk reduction and a 2020 intermediate RSLR condition. In order to maintain the 1% probability storm level of risk reduction system over the period of evaluation (50 years) the levee system would include future levee lifts based on the 2070 intermediate RSLR conditions. For example, at the starting point of the upper guide levee of the Bonnet Carré Spillway the levee would be constructed to a top of levee elevation of 15' NAVD 88 in 2020. In the future, the levee at this point would be lifted to a final elevation of 19.5' NAVD 88 based on the 2070 intermediate RSLR conditions. This is the highest elevation point of the constructed levee system. The levee would start at this height and taper down to a final top levee elevation of 8.5' NAVD 88 near the MRL. The final 2070 top levee elevation near the MRL would be 16' NAVD 88.

The system would consist of earthen levees, floodwalls (T-Walls), floodgates, drainage canals, a flood-side ditch for hydraulic connectivity for wetlands north and south of the system, drainage structures and pump stations along the alignment, and mitigation measures (Figure 5-2). Structures through the levee would be built to the 2070 intermediate RSLR condition, to prevent costly future retrofits required for anticipated changing sea levels.

Starting at the upper guide levee of the Bonnet Carré Spillway and heading west along levee the project would construct a 646 linear foot (hereafter “LF”) T-Wall to pass under the existing I-10 overpass. Past this point, 1,100 cubic feet per second (cfs) pump station with three 68" outfalls would be built at Montz Canal, which is very near the I-55 northbound entrance ramp. The pump station, when the system is closed, would mainly remove rainwater flows from the Woodland, the River Forest, and the Prescott Canals. A 267 LF T-Wall and two 6' x 18' x 27' gated drainage structures would also be constructed at this location. This location and all





locations with pump stations or drainage structures would be connected to a flood side ditch and a protected side canal that would parallel the entire levee length. The canals would be used to maintain the existing connection between swamps located inside and outside of the levee system. The protected side canal would also serve as a redundancy connection if one of the pump stations failed during an event.

Past the Montz Canal, at the location of US-51, a 188 LF gated structure would be placed through the levee. Directly west of US-51, a 247 LF T-Wall would cross under I-55. The levee would continue to the west until the levee intercepts the first pipeline crossings near Vicknair Canal. Two sections of T-Walls would be used for these pipeline crossing, a 550 LF T-Wall, and a 623 LF T-Wall. Half of the 35 required pipeline relocations would be at these two locations. For purposes of this report, it is expected that all of the pipeline relocations would be compensable. Relocations are expected to take place in the proposed levee right of way (ROW) or existing pipeline ROW. Determination of the compensability of these relocations will be determined during the engineering and design phase of this project if it is authorized.

Continuing west, the levee would then cross Ridgefield Canal. Ridgefield Canal is located between the I-10 Louisiana Department of Transportation and Development (LaDOTD) weigh station and the I-10/LA 3188 exit. A 200 cfs pump station with three 30" outfalls would be built at Ridgefield Canal. The pump station, when the system is closed, would mainly remove rainfall flows from Laplace Plantation, Perriloux, Ridgefield, Tebo and Vicknair canals. A 244 LF T-Wall and with two 6' x 18' x 267' gated drainage structures would also be constructed at this location.

West of the Ridgefield Canal, a 100 LF floodgate would be constructed at the location of the Perriloux Canal to allow rainfall flows to flow through the levee when the system is not closed.

West of the I-10/LA 3188 exit, a 247 LF T-Wall would be constructed to cross back under I-10. The levee would continue to parallel the pipeline corridor through wetlands until it reaches Reserve canal. A 400 cfs pump station with three 48" outfalls would be built at this location. The structure at this location would also include two 6' x 20' x 25' drainage structure with a boat bay and 335 LF of T-Walls. Small boats would still be able to pass through the drainage structure when the system is open.

Continuing west, the levee would then cross Mississippi Bayou. A 6' x 10' x 25' drainage structure with a 267 LF T-Wall would be constructed at this location.

The levee would then continue west toward Hope Canal, until it reaches the next major set of pipeline crossings. All of the remaining major pipeline relocations would be at this location. Two sections of T-Walls would be used for these pipeline crossing, a 400 LF T-Wall, and a 300 LF T-Wall. As with the other pipelines, for purposes of this report, it is expected that the pipeline relocations would be compensable. Relocations are expected to take place in the proposed levee ROW or existing pipeline ROW at this location. Determination of the compensability of these relocations will be determined during the engineering and design phase of this project if it is authorized.

The levee would then continue west until it reaches Hope Canal. A 450 c.f.s pump station with three 54" outfalls would be constructed at this location. Currently the design and cost includes a 6' x 20' x 25' drainage structure and a 247 LF T-Wall, but the Hope Canal location is also the same location of the State of Louisiana's proposed River Reintroduction into Maurepas Swamp diversion. The WSLP project has been coordinating activities between the project development teams, but for the purposes of the WSLP feasibility design, we do not consider the diversion project as a future landscape feature, since the State has not identified funding and has filed an incomplete permit application to the USACE for construction of the project. The USACE would continue to monitor the status of the diversion project. The team expects that if the diversion project moves forward it would be constructed on the flood side of the levee and would parallel the levee from Hope Canal to the MRL.

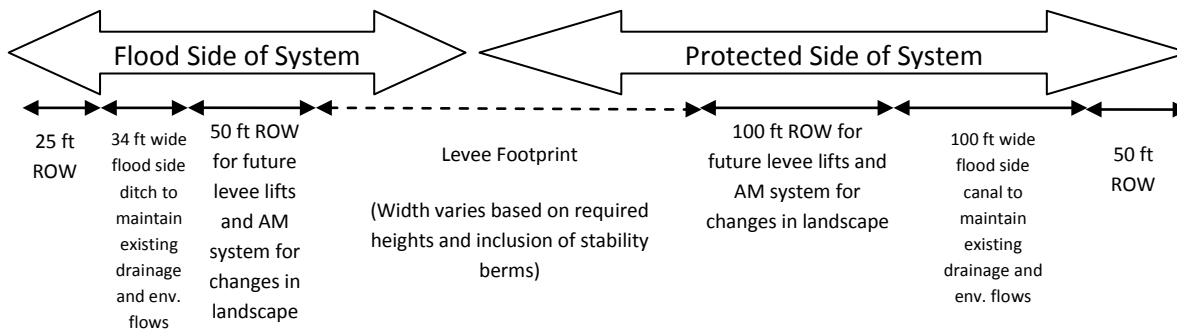


When the levee turns south, past Hope Canal to tie into the MRL, the levee would cross US-61, a pipeline ROW, and two railroad tracks. US-61 would be raised to hump over the levee at the crossing point. The pipeline crossing would include a 301 LF T-Wall, while the two railroad crossings would include a 150 LF gate structure and a 50 LF gate structure.

In all, there would be a total of 5,001 LF of T-Walls, 4 pump stations with associated drainage structures, 2 drainage structures, one gated road crossing, and 2 gated railroad crossings.

4.69 miles of the upper guide levee of the Bonnet Carré Spillway from the spillway control structure to the WSLP tie-in point would be included in the WSLP levee system, but there would be no construction activities associated with this Bonnet Carré levee. Existing levee heights are high enough to prevent 1% probability storm surges from entering the WSLP system during storms. The construction of the WSLP tie-in point would be to set to elevation of 15' NAVD 88 while the current upper guide levee elevation is 15.5' NAVD 88. The upper guide levee heights in the future would be monitored to determine if sections of the Bonnet Carré Spillway levee would need future lifts to prevent overtopping of storm surges into the WSLP system.

All levee right of ways would have the following typical dimensions:



The 50' and 100' right of ways adjacent to the levee footprints would be used for future levee lifts. The levee would be lifted five times over the period of evaluation. The initial construction would be comprised of an initial construction of the base of the levee and a lift that would be used to obtain a 1% probability storm level of risk reduction system in 2020. Additional levee lifts to maintain a 1% probability storm level of risk reduction system would take place in years 2030, 2045, and in 2060.

9,000,000 cubic yards (cy) of compacted and un-compacted fill would be required to create and maintain the levee over the period of evaluation. A portion of the initial fill material, if suitable, would be obtained from the canals and ditch, approximately 1,678,000 cy. Borings indicate that the top 4' of the cross section of these features would not be suitable as levee fill material. The top 4' of material; approximately 1,685,000 cy, would be used beneficially at mitigation plan sites, or disposed of appropriately by the contractor. The remaining fill for the levee, approximately 7,322,000 cy, would be obtained from the Bonnet Carré Spillway.

The levee footprint would vary based on the designed cross section and required top of levee heights by each levee section. The top of the levee would have a 10' wide crown and the protected side of the levee system would be based on a 1:3 side slope, with some reaches including a geotechnical stability berm. 3,400,000 square yards of geotextile fabric would be placed under the levee footprint and approximately 80,000 cy of aggregate limestone would be used to build a road on the levee crown.

The total levee construction ROW would be 1,235 acres. Real estate agreements would be acquired on all features. A perpetual flood protection levee easement would be acquired for the 669 acres of the levee and



floodwall features. A perpetual flood protection levee easement would be acquired for the 33 acres of the T-Walls. For the two canals, a 519 acre perpetual drainage ditch easement would be acquired. For the remaining features, the 4 pump stations would require 9 acres and the 3 gated crossings would require 5 acres to be acquired based on fee, excluding minerals. In addition to the permanent easements, 49 acres of temporary access easements and 12 acres of temporary work area easements would be acquired. These temporary access and work access areas would be on existing roadways or developed areas of the project area and would not be in environmentally sensitive areas.

All of the impacts from the constructed features would be to either swamp habitats or BLH. There would be a direct removal of 1,112 acres of swamp habitats and 123 acres of BLH habitats. Using a WVA under the intermediate sea level scenario the project would be required to mitigate for a direct loss of 595.3 AAHUs of swamp and 95.5 AAHUs of BLH. In addition to the direct removal of acres of habitat due to construction, the project would enclose 8,432 acres of swamp and 89 acres of BLH.

Hydrologic connectivity would be maintained to the extent practicable through water control structures except during closure for hurricanes or tropical storms. When the system is closed, pumps would operate on average for 1.7 storms per year, which equates to a closure of structures on average 8.5 days per year. This expected rate of closure would be the same regardless of the actual rate of RSLR as closure of the system is tied to tropical storm events and the elevation trigger would be adjusted as sea level rises. 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.

As stated above the pumps would only operate on average for 1.7 storms per year, but the NFS has an obligation relating to the operation of the project, specifically pump station capacities, to prevent encroachments that would impact the utility of the project when the pump station is operating. The NFS will be required to comply with flood plain management requirements and ensure that project features such as pump stations would not be impacted by developments in the areas behind the risk reduction system. The pump system designed to match the existing gravity drainage capacity when the system is closed. The NFS would have a responsibility to ensure that this operation of the project features is maintained.

The levee is designed to maintain hydrologic connectivity to the extent practicable. In order to minimize a reduction in efficiency of drainage affecting water quality and increased impoundment on the protected side of the system, the levee design includes drainage structures and canals located on both the flood side and protected side of the levee. In order to mitigate for any impacts caused by the potential delay in water movement, the team developed a WVA that accounts for delays in water movement. Because 366 acres of the total 455 acres of enclosed BLH is already impacted by existing roadways and railroad tracks, the BLH indirect impacts were calculated to total 89 acres. Using a WVA under the intermediate RSLR scenario, the project would have to mitigate for the indirect loss of 494.5 AAHUs of swamp and 3.1 AAHUs of BLH. The project would also be required to mitigate for a direct loss of 595.3 AAHUs of swamp and 95.5 AAHUs of BLH. The total required mitigation for both the direct and indirect impacts from the construction of the risk reduction levee system is 1,188.03 AAHUs.



Localized Storm Surge Risk Reduction Measures

The Recommended Plan includes localized storm surge risk reduction measures for structures in the communities of Gramercy, Lutchet and Grand Point, which are located outside of the proposed levee system (Figure 5-2). These localized storm surge risk reduction measures focused on addressing existing damages in St. James Parish, while still being economically justified and environmentally compliant. See Chapter 3.9 and Appendix E for information concerning plan formulation and design of the localized storm surge risk reduction measures. These measures include berms and flapgates on existing drainage and roadway features. Flood proofing measures (e.g. raising of certain residential structures and construction of smaller berms around certain individual non-residential structures) are limited to a few structures located outside of the larger localized storm surge risk reduction measures. All of the measures focus on providing a risk reduction above the 1% probability storm stages in 2020. The NFS will be required to maintain these features to their initially constructed design height for so long as the project remains authorized. The future level of risk reduction is dependent on the actual rate of RSLR.

Gramercy Area

In the Gramercy and Lutchet area, north of Hwy 3125, a 10,100 LF berm would be built to provide risk reduction to 275 structures, herein referred to as “**Polder 1 (Gramercy Berm)**.” The berm would be constructed to a 6.5' NAVD 88 elevation. The berm in 2020 would provide risk reduction above the 1% probability storm stages. Storm stages in St. James Parish are below +6.5' NAVD 88 elevation in 2020. As discussed in Chapter 3, in the future, the berm's effectiveness depends on the actual rate of RSLR. .

The berm would parallel both sides of Hwy 20, and parallel the railroad track along US-61 (Airline Highway). To the south, the berm would tie into Hwy 3125 to close off the system. Hwy 3125 is key feature for all of the localized storm surge risk reduction features. The entire roadway is above 6.5' NAVD 88 elevation and will be used as a tie in point for the berm. The design of the berm is based on a 4' wide crown and 3:1 side slopes. Using local Light Detection and Ranging (LIDAR) data, it was assumed that the existing ground elevation under the berm would be at an elevation of approximately 4.3' NAVD 88. Using this assumption, the proposed berm would have an average height of 2.2' with an average width of 18' , and require 237,000 cy of compacted fill for construction. The berm would also include two floodgates to allow existing drainage to flow through the berm when not under surge events. A pump system to operate and remove rainwaters during tropical/hurricane storm events will be included in the features. The pump system will be approximately 217 cfs. The berm would be placed in a location so as not to interfere with existing local drainage.

In reviewing the berm footprint there is a risk of affecting approximately 0.29 acres of forested wetlands. Attempts would be made to avoid these areas during construction. Due to the current uncertainty in avoiding these areas, we have included costs for mitigating for these forested wetlands in the total construction cost.

Grand Point Area

In the Grand Point area, north of Hwy 3125, the Recommended Plan includes one berm, “**Polder3 (Grand Point North)**”. Polder3 (Grand Point North) would provide risk reduction to 71 structures. The berm would be a complete ring around the structures in the northern portion of Grand Point, near the Grandpoint Boat Launch. The berm would be 10,400 LF, and would include a 4' wide crown and 3:1 side slopes. The berm would be constructed to a 6.5' NAVD 88 elevation. Initially, in 2020 the berm would provide risk reduction above the 1% probability storm stages. Storm stages St. James Parish are below a 6.5' NAVD 88 elevation in 2020. Future level of risk reduction is dependent on the actual rate of RSLR.

Using local LIDAR data it was assumed that the existing ground elevation under the berm would be approximately 4' NAVD 88. Using this assumption, the proposed berm would have an average height of 2.5' with an average width of 20', and require 286,800 cy of compacted fill for construction. The berm would also



include one floodgate to allow existing drainage to flow through the berm when not under surge events. A pump system to operate and remove rain waters during tropical/hurricane storm events will be included in the features. The pump system will be approximately 140 cfs. The berm would be placed in a location so as not to interfere with existing local drainage. The berm would also be placed very near the edge of the property owners' parcels where feasible. This would minimize the loss of use of any property.

In reviewing the berm footprint there is a risk of affecting approximately 0.81 acres of forested wetlands. Attempts would be made to avoid these areas during construction. Due to the current uncertainty in avoiding these areas, we have included costs for mitigating for these forested wetlands in the total construction cost.

Flood Risk Reduction Under LA Highway 3125

In addition to the berms north of Hwy 3125, the Recommended Plan is to use 13 miles of Hwy 3125 and its existing foundation as a localized storm surge risk reduction feature. Currently the roadway elevation is above 6.5' NAVD 88 in elevation. Currently, the 1% probability storm stages in 2020 flow through the culverts under the roadway in the opposite direction from natural drainage. By closing off the culverts with one-way flap gates and a drainage canal with a floodgate during surge events, the plan would provide risk reduction to 19,500 acres and 4,295 structures south of Hwy 3125. Although there are a limited number of structures that are impacted by the 1% probability storm stages, this closure reduces the risk of a large portion of the parish's critical sugarcane crops from flooding from this type of storm surge event. If the parish in the future makes improvements to Hwy 3125, any additional height added to the entire highway could add to the structures risk reduction level behind the highway. Due to the fact that the roadway is being used as a flood risk reduction feature, the local sponsor will be required to maintain the system's initial level of risk reduction. This includes the berm tie in points to the roadway and 13 miles of the roadway. If the roadway requires maintenance and would be degraded below its original elevation, the work should take place outside of hurricane season. If it is not possible to work outside of hurricane season, interim flood risk measures should be implemented to maintain the original level of risk reduction provided by the roadway.

The Recommended Plan includes 145 flap gate closures, two floodgates and two small berms (Noranda and Uncle Sam). The Noranda berm ties the highway into high ground east of Gramercy. The Uncle Sam berm divides the developed area behind Hwy 3125 from an area that is primarily agricultural land. By dividing these two areas, the local community can focus its reduction efforts in the future. Future improvements could be focused on sections of the highway that have structures behind the highway, approximately 7 miles vs. 13 miles. The area west of the Uncle Sam berm includes an area of 8,175 acres, but only includes one structure that has a first floor elevation below the 1% probability storm stages. The total length of the berms is approximately 645 LF.

Due to the nature of the flooding south of Hwy 3125, it is assumed that the 19,500 acres would have ample storage capacity to hold any rainfall during the surge events. Even if some acres of crops are flooded from rainfall, it would be much less severe than if storm surge was allowed to flow under Hwy 3125.

Remaining Structures in St. James Parish

Eighty structures were evaluated outside of the economically justified and unjustified berms. Only 23 of the 80 structures have a first floor elevation below the 1% probability storm stages in 2020. Based on this evaluation the Recommended Plan includes 14 residential structures that would be raised to the stage associated with the 2070 intermediate RSLR 1% probability storm stages; 4 non-residential structures would be flood proofed to 3 feet above the ground elevation; and smaller berms would be constructed for 5 light industrial/warehouse facilities. The 14 residential structures are being raised to the 2070 height because it is more cost effective to raise a home once.

The incremental first cost for the levee system in the Recommended Plan is \$676,598,000. The incremental first cost for the localized storm surge risk reduction system in the Recommended Plan is \$41,493,000. The total first cost for the Recommended Plan is \$718,091,000.



5.2 Hazardous, Toxic, and Radioactive Waste

The USACE is obligated under Engineer Regulation (ER) 1165-2-132 to assume responsibility for the reasonable identification and evaluation of all Hazardous, Toxic, and Radioactive Waste (HTRW) contamination within the vicinity of proposed actions during the feasibility phase. ER 1165-2-132 identifies that HTRW policy is to avoid the use of project funds for HTRW removal and remediation activities. An ASTM E 1527-05 Phase 1 Environmental Site Assessment, HTRW 14-02 dated February 28, 2014, has been completed for the project area and can be found in Appendix A. The probability of encountering HTRW for the proposed action is low based on the initial site assessment. If no recognized environmental conditions are identified in relation to the project site, the probability of encountering HTRW for this project will be considered low. If a recognized environmental condition is identified in relation to the project site, the U.S. Army Corps of Engineers, New Orleans District would take the necessary measures to avoid the recognized environmental condition so that the probability of encountering or disturbing HTRW would continue to be low. Any further investigations for HTRW that occur after the feasibility phase are the responsibility of the NFS and are subject to a credit against the non-federal proportionate share of total project cost. Any response measures to relocate or mitigate HTRW materials are the sole responsibility of the NFS.

5.3 Adaptive Management & Monitoring (AM&M)

AM&M activities in the mitigation plan address ecological and other uncertainties that could prevent successful implementation of mitigation project measures. The AM&M Plan establishes a framework for decision-making that utilizes monitoring results and other information, as it becomes available, to update project knowledge and adjust mitigation management actions through adaptive management. Integration of AM&M into the mitigation project ensures success under a wide range of conditions and enable implementing corrective actions in cases where monitoring demonstrates that the mitigation project or measures are not achieving ecological success. An AM&M plan was developed and included as part of the mitigation plan. Additional information is located in Appendix A, Annex K.

5.4 Real Estate Requirements Associated with the Recommended Plan

A Real Estate Plan (REP) describing the real estate requirements and costs for the project can be found in Appendix C. The CPRAB will have the responsibility of acquiring all necessary real estate interests for the project and for ensuring that relocation of utilities and facilities are accomplished. The Non Federal contribution of Land, Easements, Rights-Of-Way, Relocation, and Disposal Areas (LERRD) for this project is estimated to be \$26,559,000 which includes the costs associated with acquisition of real estate interests for structural features, non-structural features, and mitigation. In addition, as part of the NFS responsibility to provide LERRDs for the project, the NFS is responsible for 100% the cost of facility and utility relocations which is estimated at a total first cost of \$19,497,000. Because pipelines will be relocated in place, there will be no acquisition of real estate interests required for the proposed relocations for the project. NFS relocation costs are construction costs; these are discussed below in Section 5.5 of this chapter and are also discussed in Section XV of the Real Estate Plan (Appendix C of this report). Administrative Federal costs of acquisition oversight and review of Non Federal Sponsor work products is estimated to be \$1,120,000.

The estimated cost of real estate acquisition for structural features is \$5,481,000. This does not include the cost of real estate required for mitigation, which is discussed below. This estimate includes costs associated with acquisition of real estate rights for the levee/T-Walls/gates, access, staging, drainage canals, and pump stations. These project features impact approximately 34 owners. A standard perpetual Flood Protection Levee easement will be acquired for the construction of levees and floodwalls. A standard Drainage Ditch Easement would be acquired for the areas needed for the conveyance canal. Fee Excluding Minerals (with Restrictions on Use of the Surface) will be acquired for the pump stations. The structural project features impact wetlands, vacant woodlands & agricultural lands. Borrow material for this project would come from the Bonnet Carré Spillway, which is owned in fee by the Federal Government. A standard Temporary Work Area Easement will be acquired for staging areas. A non-material deviation will be made to the standard Road



Easement to revise the rights necessary for a temporary Access Easement to be acquired over existing private roads to allow access to the construction area.

The estimated cost of real estate acquisition for the berm features is \$3,521,000. Approximately 108 landowners may be impacted by these features. The features entail acquisition of real estate interests to construct a berm in two distinct residential locations. The berms will be constructed in the rear of properties in order to minimize impacts. No structures will be impacted by the berms. For these project features, a non-standard Berm Easement will be acquired. This is a non-material deviation from the standard Flood Protection Levee Easement. In addition, a non-standard estate will be acquired for project features which lie within the ROW of Hwy 3125. This is further discussed in Appendix C, Real Estate Plan.

The localized storm surge risk reduction project features also include elevation of 14 residential structures and flood proofing of 9 commercial structures. The estimated administrative cost associated with implementation of the elevation/commercial flood proofing is \$545,000. Property owner participation in the individual localized storm surge risk reduction measures will be completely voluntary. A Flood Proofing Agreement will be executed between the property owner and the Non-Federal Sponsor. It is expected that occupants will need to temporarily relocate from the residence while it is being elevated. Because participation in the elevation of dwellings is voluntary, owner-occupants are not eligible for relocation assistance as indicated in 49 CFR Part 24. No relocation is necessary for flood proofing commercial structures.

Mitigation land will be acquired in Fee, Excluding Minerals (With Restrictions on Use of the Surface). Six sites have been identified for acquisition for mitigation. The sites are located in St. James, Ascension and Livingston Parishes. The properties impacted are currently used for agriculture and recreation; four of the sites in St. James Parish have potential for use as residential and commercial properties. An additional site is within the Bonnet Carré Spillway which is federally owned. As indicated in the 19 September 2006 CECW-P/CECC-G Memorandum, Subject: Cost Sharing for Lands Associated with Fish and Wildlife Mitigation, it is noted that real estate costs for mitigation should be allocated among authorized project purposes and should not be included in real estate costs for lands and damages. This is noted within the Chart of Accounts in Annex C of the Real Estate Plan, and mitigation costs are separated from other real estate costs. The total cost of real estate for mitigation is \$18,132,000.

5.5 Relocations with the Recommended Plan

Levee construction may cause relocations and/or temporary interruptions to pipelines. Relocations are a part of the NFS LERRDs responsibility. The assumption for the Recommended Plan was that a pipeline floodwall would be required wherever a pipeline crossed the levee footprint. The pipeline would cross through a cutoff wall under the pipeline floodwall. It was decided that the existing carrier line would remain in operation while a bypass line would be constructed through a sleeve in the T-wall cutoff piles. When the bypass would be completed and in place, the switch over-tie in with the existing line then would follow along with the removal of the abandoned pipeline. These assumptions are consistent with the screening level assumptions. For the Recommended Plan, it was assumed the pipeline would be relocated for the full right-of-way width of the proposed levee to accommodate the proposed protected side canal and the unprotected side ditch. A pipeline relocation length of 600 feet was used versus the widest right-of-way of 541 feet. Although no determination of compensability was prepared for purposes of this Report, it is expected that all of the pipeline relocations would be compensable. The total costs for relocations are estimated to be \$19,497,000, and are the responsibility of the NFS. Relocation costs include construction costs only, as there are no lands required for relocations. A final determination of compensability for utility/common carrier relocations will be refined during final design.

5.6 Operation and Maintenance, Repair, Rehabilitation and Replacement associated with the Recommended Plan

The purpose of operation and maintenance, repair, rehabilitation and replacement (OMRR&R) is to sustain the constructed project. The total estimated annual OMRR&R cost is \$5,070,000 based on the current



Federal FY2015 Fiscal year discount rate (3.375%). A majority of the annual OMRR&R costs are based upon sustaining the levee system, but also include costs for sustaining the flap gates along Hwy 3125 and maintaining the berms around groups of residential structures. The NFS will be required to maintain these features to their initial constructed design height for so long as the project remains authorized. As stated in section 5.1, the NFS is not obligated to address loss of risk reduction due to RSLR through future berm lifts or highway lifts, but they will still be required to repair, rehabilitation or provide replacement of components associated with the construction of berms and flap gates to maintain the original project benefits. The NFS will also not be obligated to OMRR&R the flood proofing measures that constitute elevation of individual residential structures or construction of small ring berms around individual non-residential or light industry/warehouse structures. After the District Engineer provides notice of construction completion for the project, or functional portion of the project, the CPRAB will commence OMRR&R responsibilities associated with the project.

5.7 Benefit Analysis associated with the Recommended Plan

Project Benefits

Net benefits are based on the following benefit categories: residential and commercial (structure/content/vehicles), and industrial (structures/contents). Costs and benefits for each Recommended Plan are shown in table 5-6. The table provides the final recommendation in both the Federal FY2014 Fiscal year discount rate (3.5%) and the FY2015 discount rate (3.375%).

Table 5-1 Total equivalent annual net benefits by component

(Oct. 2014 Price Level; Discount Rate: 3.5%; \$Millions)				
Component	Equivalent Annual Benefits (EAD)* (Damages Reduced)	Total Annual Costs	Equivalent Annual Net Benefits	Benefit-to-Cost Ratio
Levee System	87.9	32.1	55.7	2.74
Localized Storm Surge Risk Reduction System	5.4	2.4	3.0	2.23
Recommended Plan** (Levee & Localized Storm Surge Risk Reduction System)	97.2	34.6	62.6	2.81
(Oct. 2014 Price Level; Current Discount Rate: 3.375%; \$Millions)				
Recommended Plan** (Levee & Localized Storm Surge Risk Reduction System)	97.8	34.0	63.8	2.88

* Benefits to highways, streets, and debris removal and cleanup were not included in the final evaluation due to the fact that they would only account for a small portion of the total benefits attributable to the project and not affect the plan selection. Individual components were run separately and incorporated risk (Monte Carlo simulations). Due to the randomness associated with risk simulations; EAD totals for each system will not yield the exact same EAD as the Recommended Plan.

** Based on calculations including future development.

5.8 Risk & Uncertainty Analysis associated with the Recommended Plan

Risk and uncertainty are intrinsic in water resources planning and design. This section describes various categories of risk and uncertainty pertinent to the study.

5.8.1 Residual Damages and Residual Risks

Residential, Commercial, and Industrial Damages: With a project in place to reduce hurricane and tropical storm surge damages, not all surge damages will be prevented, only reduced. It is important to provide information on residual damages to demonstrate project performance and communicate the fact that the



project will not eliminate all risks to life and property. In both the levee system and localized storm surge risk reduction system, residual damages can still occur from project exceedance events, rainfall events, and hurricane winds and windblown debris. The study area is still highly susceptible to rainfall flooding, particularly in upland areas where drainage features are restricted by railway or roadway features. As stated in Section 5.1, the recommended 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 or by rainfall events outside of hurricane and tropical storm events.

The Hydrologic Engineering Center Flood Damage Analysis (HEC-FDA) Version 1.2.5a certified model was used to calculate the damages for the without project existing and future conditions. Measurable damage categories from HEC-FDA including residential and non-residential structures and automobiles are accounted for in the residual damages. Table 5-2 shows the equivalent average annual remaining damages provided as output under the HEC-FDA model.

Table 5-2
Equivalent Annual Residual Damages - By Components of Recommended Plan

Component	Total Equivalent Annual Residual Damages¹ (2014 Price Level)
Levee System	
SA 1- SA44C Reaches (behind Alt C Levee System)	\$25,771,167
Localized Storm Surge Risk Reduction System	
Polder 1 (Gramercy Berm)	\$1,100,617
Polder3 (Grand Point North)	\$505,812
Storm Surge Risk Reduction Under LA Highway 3125	\$2,668,102
Remaining Structures in St. James Parish	\$192,919

¹Includes impacts to existing structures for the areas behind the levee system. Note that the values presented in this table are from HEC-FDA outputs and subject to variations in the Economic Appendix due to the assumptions on future development.

The recommended plan would greatly reduce the equivalent annual storm surge damages in areas behind Alternative C. The project is designed to reduce two different levels of hurricane and tropical storm surge damages over the 50-year period of analysis.

The levee system is based on a 1% probability storm level of risk reduction and a 2020 intermediate RSLR condition. Over a 50 year period, the system would be maintained to a 1% probability storm level of risk reduction system with future levee lifts based on the 2070 intermediate RSLR conditions. The levee system will reduce hurricane and tropical storm surge damages by 74 percent to the existing structures behind the levee system over a 50 year period. As stated in section 5.1, the levee system is not authorized to be closed under non-hurricane and tropical storm events. Some damages will still occur from rainfall events and from storms exceeding the systems 1% probability storm level of risk reduction.

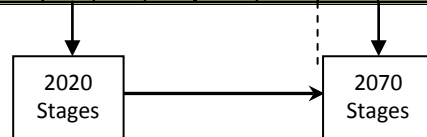
The localized storm surge risk reduction system is based on a 1% probability storm level of risk reduction under the 2020 intermediate RSLR conditions. The NFS will maintain the localized storm surge risk reduction features to their initially constructed design height to maintain initial level of risk reduction, but the



future level of risk reduction is dependent on the actual rate of RSLR. Table 5-3 shows the potential level of change over time based on the intermediate RSLR condition. The table shows the reaches (Sub-Planning in Table 5-3) that are included in this system. The system focuses on reducing storm surge damages below the 1% probability storm stages in 2020. Table 5-3, column “2020 SWL0100YR” shows the surface water level for the 1% frequency storm. The table shows that based on an intermediate RSLR condition, the level of risk reduction would change from the 1% probability storm stages in 2020 to somewhere between a 10% event (2070 SWL0025YR) and 4% event (2070 SWL0050YR) by 2070.

Table 5-3
2020 and 2070 Storm Stages - By Components of Recommended Plan

Sub-Planning				2020 Intermediate Sea Level Rise								2070 Intermediate Sea Level Rise							
SA-Name	Id	Index_Sta	IN_OUT	SWL0001Y	SWL0005Y	SWL0010Y	SWL0025Y	SWL0050Y	SWL0100Y	SWL0200Y	SWL0500Y	SWL0001Y	SWL0005Y	SWL0010Y	SWL0025Y	SWL0050Y	SWL0100Y	SWL0200Y	SWL0500Y
RSA 02	2	104	1	1.2	1.4	3.0	3.9	4.7	5.7	6.6	7.6	3.4	3.6	5.2	6.1	9.7	11.7	13.4	15.3
RSA 24	24	148	1	1.2	1.4	3.0	3.9	4.5	5.4	6.3	7.3	3.4	3.6	5.2	6.1	9.7	11.5	13.4	15.4
RSA 27	27	154	1	1.2	1.4	3.0	3.9	4.6	5.6	6.5	7.5	3.4	3.6	5.2	6.1	9.6	11.6	13.3	15.3
RSA 33	33	166	1	1.2	1.4	3.0	3.9	4.3	5.1	5.9	6.8	3.4	3.6	5.2	6.1	9.9	11.7	13.5	15.6
RSA 34	34	168	1	1.2	1.4	3.0	3.9	4.3	5.1	5.9	6.8	3.4	3.6	5.2	6.1	9.9	11.7	13.5	15.6
RSA 35	35	170	1	1.2	1.4	3.0	3.9	4.3	5.1	5.9	6.8	3.4	3.6	5.2	6.1	9.9	11.7	13.5	15.6
RSA 36	36	172	1	1.2	1.4	3.0	3.9	4.6	5.6	6.5	7.5	3.4	3.6	5.2	6.1	9.6	11.6	13.3	15.3
RSA 41	41	182	1	1.2	1.4	3.0	3.9	4.3	5.1	5.9	6.8	3.4	3.6	5.2	6.1	9.9	11.7	13.5	15.6
RSA 44	44	188	1	1.2	1.4	3.0	3.9	4.5	5.4	6.3	7.3	3.4	3.6	5.2	6.1	9.7	11.5	13.4	15.4
RSA 46	46	192	1	1.2	1.4	3.0	3.9	4.7	5.7	6.6	7.6	3.4	3.6	5.2	6.1	9.7	11.7	13.4	15.3
RSA 54	54	208	1	1.2	1.4	3.0	3.9	4.6	5.6	6.5	7.5	3.4	3.6	5.2	6.1	9.6	11.6	13.3	15.3
RSA 55	55	210	1	1.2	1.4	3.0	3.9	4.5	5.4	6.3	7.3	3.4	3.6	5.2	6.1	9.7	11.5	13.4	15.4
RSA 56	56	212	1	1.2	1.4	3.0	3.9	4.6	5.6	6.5	7.5	3.4	3.6	5.2	6.1	9.6	11.6	13.3	15.3



Although the localized storm surge risk reduction system is based on a limited level of risk reduction, the system would still reduce hurricane and tropical storm surge damages by 55 percent over a 50-year period even with changing sea level rise conditions.

The recommended plan components, when combined, will reduce hurricane and tropical storm surge damages by 73 percent for the existing structures within the risk reduction areas.

Risk to Life and Safety: The main project purpose is to focus on hurricane and tropical storm surge damage reduction. Loss of life is prevented by the existing procedures of evacuating completely well before expected hurricane landfall and thereby removing the residents from harm’s way. The erratic nature and unpredictability of hurricane path and intensity requires early and safe evacuation. This policy should be continued both with and without the storm damage reduction project.



5.8.2 Environmental Factors

Relative Sea Level Rise: There is uncertainty about how much SLR change would occur in the region. Higher than estimated RSLR could cause salt-water intrusion into the freshwater swamp causing significant changes to this habitat. An assessment of RSLR was included in plan formulation and alternatives analysis. The evaluation of RSLR is documented in Appendix B. Calculations based on EC 1165-2-212 determined that the initial WSE at the low, intermediate and high rates of RSLR at 2070 are 1.81 feet, 2.32 feet, and 3.95 feet, respectively. The intermediate RSLR rate was applied.

The use of the intermediate scenario was chosen over the historic and high RSLR scenarios, due to the fact that it is the most likely scenario for the WSLP study area, based on the following information and conclusions.

The application of storm surge damage scenarios were not based on just global SLR, but based on the application of a RSLR scenario for SE Louisiana. Subsidence levels predicted in the study area were incorporated into the storm surge model's initial water level parameter to capture the combined effects of subsidence and local SLR into a single RSLR value. In addition, to account for RSLR in the future conditions, all scenarios in the surge modeling accounted for a potential degradation of vegetation related to SLR and subsidence. The damages are mainly driven by the degradation of vegetation in the landscape, not by just an increase in the SLR. There is actually less than a .6 ft difference between the low and intermediate estimated RSLR at year 2070.

Historical empirical data shows that subsidence and landscape changes will continue to be the driving force in changing storm surge conditions in the future. This driving force would exist under all SLR scenarios. In reviewing surge data points, there are limited differences between the low and intermediate scenarios. Based on the limited differences in stages and the historical documentation of subsidence and landscape changes in Louisiana, the project delivery team felt that the intermediate RSLR scenario was the most likely scenario in the future. The high RSLR scenario was not chosen since it represents the most extreme conditions. Under the FWOP conditions, a majority of the developed portions of the study area are flooded under the high scenario.

Also, the use of intermediate sea level scenario for the final presentation of the expected annual without project damages and benefits with the Recommended Plan, is consistent with other recent NED and National Ecosystem Restoration (NER) projects in SE Louisiana. Final design recommendations for the LCA Study and the Morganza to the Gulf Post Authorization Change Study have all been based on the intermediate sea level scenario and accepted as appropriate by the Agency.

The actual future RSLR could impact the benefits achieved by the Recommended Plan. Because the project was developed using the intermediate RSLR rate, the plan would provide more benefits than anticipated should the low RSLR rate result and less benefits with the high RSLR rate. Investigations under the planning formulation phase of the study showed that if a different RSLR occurs before construction, the project could still be modified and still be shown as justified expenditure to the nation

Storms: Risks associated with the Recommended Plan 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 B).



5.8.3 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 are included in Appendix B. The levee and other features will be constructed to meet USACE standards.

Hydrologic Flows: As discussed in Chapter 3, there is always uncertainty as to whether the levee system would potentially induce flooding. Additional ADCIRC modeling will be performed during PED to determine whether or not there will be induced flooding and to precisely estimate its magnitude. At feasibility level of design, the model uncertainty and inclusion of localized storm surge risk reduction plans adequately address the limited potential for induced damages.

The risk of running the ADCIRC and Steady-State Spectral Wave (STWAVE) models is the assumption that the models appear to provide a specific response on the Recommended Plan 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. Sensitivity discussions are included in Appendix B. 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.

5.8.4 Economic Factors

The HEC-FDA Version 1.2.5a 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 existing conditions (2012), the project base year (2020) and the final year in the period of analysis (2070). 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.

The evaluation incorporated uncertainty surrounding the economic and engineering inputs to generate results that can be used to assess the performance of the Recommended Plan. As presented in Table 48 of the Economic Appendix, there is a greater than a 75 percent chance that the equivalent annual benefits exceeded the annual cost and the benefit-to-cost ratio is greater than one.

5.8.5 Implementation Factors

Subject to project authorization, appropriation and availability of funding, full environmental compliance, and execution of a binding agreement with the non-Federal sponsor, construction is currently scheduled to begin in 2015. The schedule assumes a complete risk reduction system in place by 2020, with additional levee lifts



through 2070 to account for SLR and subsidence impacts. 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 CPRAB, as the non-Federal sponsor, and the Department of the Army will enter into a Project Partnership Agreement (PPA). After the signing of a PPA, the non-Federal sponsor 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 non-Federal sponsor would be fully responsible for OMRR&R of the project or of the completed functional portion of the project.

5.9 Implementation Requirements

5.9.1 Preconstruction Engineering and Design

Detailed design of the WSLP Project will be cost-shared between CPRAB and the USACE contingent upon the execution of a Design Agreement and approval of WIK in accordance with the provisions of ER 1165-2-208. All detailed design will be in accordance with USACE regulations and standards.

5.9.2 Construction and LERRD

Construction would be in accordance with the USACE's regulations and standards. LERRD would be the responsibility of the CPRAB (Appendix C). WIK associated with the construction for both the structural and localized storm surge risk reduction system components of the Project will be negotiated with NFS, contingent upon approval at the Assistant Secretary of the Army for Civil Works (ASACW) or appropriate level in accordance with applicable guidance and regulations.

5.9.3 Cost Sharing

The State of Louisiana, acting through the PLD, is the non-Federal sponsor for the feasibility study. The cost-share during the feasibility phase is 50% Federal and 50% non-Federal. Following the feasibility phase, the CPRAB will be the non-Federal Sponsor for the planning, design, construction, operation, maintenance, repair, replacement and rehabilitation of the project. The cost share for the planning, design and construction of the project will be 65% Federal and 35% non-Federal. The CPRAB must provide all project LERRD required for the project. OMRR&R of the project would be a 100% CPRAB responsibility. A full description of the non-Federal and Federal responsibilities after the feasibility phase of the project is contained in Section 8.2 of this report. The total estimated annual OMRR&R cost is \$5,070,000. Table 5-4 presents the cost apportionment.

Table 5-4: Cost apportionment of the Recommended Plan.

	Total	Federal	Non-Federal
PED	\$7,500,000	\$4,875,000	\$2,625,000
Construction	\$663,415,000	\$460,764,000	\$202,651,000
Pipeline Relocations	\$19,497,000	-	\$19,497,000
Lands, Easements, & ROW	\$27,679,000	\$1,120,000	\$26,559,000
Total First Costs	\$718,091,000	\$466,759,000	\$251,332,000

5.10 Views of the Non-Federal Sponsor

The PLD and the CPRAB support and recognize the importance of hurricane risk reduction in St. Charles, St. John the Baptist and St. James Parishes. A letter of intent from CPRAB indicating their willingness and financial capability has been received. The letter stated the following:



“The 2012 Comprehensive Master Plan for a Sustainable Coast recommended an alignment most similar to Alternative D, as described in the draft Feasibility/EIS dated August 2013. Although Alternative D was not selected by USACE as the preferred alternative, CPRA recognizes that Alternative C does include a portion of the Master Plan alignment from the Bonnet Carré Spillway to the crossing at Interstate 10. The State also supports protection measures to the west of Alternative C and would like the opportunity to investigate solutions for inclusion of these measures in this project. The State of Louisiana continues to support this critical project and looks forward to working with the USACE on timely implementation.”

In the letter, the State of Louisiana also acknowledges the responsibilities of the NFS and will support the role as such for the design, construction, and OMRR&R phases of the recommended project, if authorized. However, since the project is within the jurisdictional boundaries of the PLD which is the delegated local statutory entity with responsibility for flood control and hurricane protection in the project area, the State notes its intent to request that the PLD be included as a co-sponsor for the project.

With regard to LERRDs, CPRAB understood that it is the position of the USACE that the localized storm surge risk reduction portion of the plan for the WSLP Project is voluntary, and the landowners are not considered displaced and will not be eligible for Uniform Relocation Assistance (URA) benefits under Title II, P.L. 91-646, as amended.

This study is supported by the Louisiana Congressional delegation. The USACE has worked with an interagency team and local stakeholders to develop a feasible comprehensive plan to provide hurricane storm surge risk reduction for the area. Construction of the proposed system would immediately allow for improved storm surge risk reduction in the three-parish area, which could potentially reduce life, health and safety risk to residents and interruptions to vital transportation routes.



6.0 ENVIRONMENTAL LAWS & COMPLIANCE (*NEPA Required)

Federal projects must comply with environmental laws, regulations, policies, rules and guidance as identified in Appendix A. The team coordinated with Federal and state resource agencies during planning for both the structural and localized storm surge risk reduction system and the mitigation sites. Compliance is achieved upon review of this report by appropriate agencies and the public, and with the signing of a Record of Decision by the Assistant Secretary of the Army for Civil Works.

6.1 Clean Air Act of 1972 (Air Quality)

The Clean Air Act (CAA) sets goals and standards for the quality and purity of air. It requires the Environmental Protection Agency to set National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. The project area includes two mitigation sites within Ascension and Livingston Parishes which are currently designated as ozone non-attainment status for NAAQS. The Louisiana Department of Environmental Quality is required by the CAA and Louisiana Administrative Code, Title 33 to grant a general conformity determination which is located in Appendix A, Annex O.

6.2 Clean Water Act of 1972 – Section 401 (Water Quality)

The Clean Water Act (CWA) sets and maintains goals and standards for water quality and purity. Section 401 requires a Water Quality Certification from the Louisiana Department of Environmental Quality that a proposed project does not violate established effluent limitations and water quality standards. Section 401 correspondence and compliance is located in Appendix A, Annex A.

6.3 Clean Water Act of 1972 – Section 404(b)(1) (Wetlands)

The USACE administers regulations under Section 404(b)(1) of the CWA, which establishes a program to regulate the discharge of dredged and fill material into waters of the U.S., including wetlands. A signed 404(b)(1) evaluation, public notice and comments are located in Appendix A, Annex A.

6.4 Coastal Zone Management Act of 1972 (Coastal Zone Development)

The Coastal Zone Management Act is a partnership structure allowing states and the Federal government to work together for the protection of U.S. coastal zones from environmentally harmful over-development. A Coastal Zone Consistency Determination and Findings is located in Appendix A, Annex B.

6.5 Endangered Species Act of 1973 (Threatened & Endangered Species)

The Endangered Species Act (ESA) is designed to protect and recover threatened and endangered (T&E) species of fish, wildlife and plants. The USACE has coordinated with the USFWS and the NMFS to ensure the protection of those T&E species under their respective jurisdictions. The USFWS identified in their January 9, 2009 coordination letter two T&E species, the Gulf sturgeon and the West Indian manatee, that are known to occur or occasionally occur in the project area. There are no listed species in the localized storm surge risk reduction or the mitigation project areas. Incorporated by reference are the LCA Amite report and the associated T&E coordination and the Final PIER #36 report. The farm fields offer potential utilization by the Sprague's pipit. The Sprague's pipit, is a candidate species for federal listing as threatened or endangered. It winters in Louisiana, arriving from northern breeding grounds in September and remaining until April. The USACE will consult with USFWS when the species is listed. No plants were identified as being threatened or endangered in any project area or mitigation site. Based on review of existing data and preliminary field surveys, the USACE finds that implementation of the Recommended Plan is not likely to adversely affect any listed species or their critical habitat. ESA coordination with USFWS and NMFS is concluded. See Appendix A, Annex N.

6.6 Bald and Golden Eagle Protection Act of 1940 (Bald Eagles)

The Bald and Golden Eagle Protection Act protects two eagle species. Bald eagles occur or occasionally occur in the project area. Based on review of existing data and preliminary field surveys, the USACE finds that implementation of the Recommended Plan would have no effect on bald eagles.





6.7 Louisiana State Threatened and Endangered Species and Rare and Unique Habitat

The Louisiana Department of Wildlife and Fisheries (LDWF) Louisiana Natural Heritage Program (LNHP) lists T&E species, and rare, unique and imperiled habitats in Louisiana. Based on review of the LNHP online database, for rare or unique cypress-tupelo swamp habitat, bald eagles, alligator snapping turtles, osprey, paddlefish, manatees, swamp milkweed, floating antler fern and rooted spike-rush are found in the project area (LDWF 2013).

6.8 Colonial Nesting Water Birds

The USFWS indicated in a January 9, 2009, coordination letter that the project area supports colonial nesting water birds (e.g., herons, egrets, ibis, night-herons and roseate spoonbills). Based on a review of existing data and preliminary field surveys, the USACE finds that implementation of the Recommended Plan would have no impact on colonial nesting water birds. The best management practices (BMPs) listed in Appendix A, Annex N and USFWS recommendations would be followed in order to avoid impacts. Implementation of the proposed project would require compensatory mitigation for unavoidable project-induced potential impacts to colonial nesting water bird habitat.

6.9 Farmland Protection Policy Act of 1981 (Farmland)

The Farmland Protection Policy Act (FPPA) is intended to minimize the impact of Federal programs on the unnecessary and irreversible conversion of farmland to nonagricultural uses. Projects are subject to requirements if they may irreversibly convert farmland to nonagricultural use and are completed by a Federal agency or with assistance from a Federal agency. In its review of the proposed project the NRCS determined that the Recommended Plan will impact 404 acres of lands classified as prime farmland and that the project will not impact NRCS work in the vicinity. No actions will be taken to avoid impacts to farmland. USACE coordination letters and responses from NRCS are found in Appendix A, Annex E.

6.10 Fish and Wildlife Coordination Act of 1934 (Fish & Wildlife)

The Fish and Wildlife Coordination Act (FWCA) provides authority for USFWS involvement in evaluating impacts to fish and wildlife from proposed water resource development projects. It requires that fish and wildlife resources receive equal consideration to other project features. It requires Federal agencies that construct, license or permit water resource development projects to first consult with the USFWS, NMFS and state resource agencies regarding the impacts on fish and wildlife resources and measures to mitigate these impacts. Section 2(b) requires the USFWS to produce a Coordination Act Report (FWCAR) that details existing fish and wildlife resources in a project area, potential impacts due to a proposed project and recommendations for a project. The final FWCAR dated April 28, 2014 includes the USFWS positions and recommendations. This document, USACE's responses and coordination planning aid letters are found in Appendix A, Annex G.

The USFWS, through coordination efforts, provided a map depicting colonial nesting waterbird (e.g., herons, egrets, ibis, night-herons, and roseate spoonbills) rookeries in the area. Two potentially active rookeries may exist within 1,000 feet of the proposed structural alignment. No rookeries have been identified in the vicinity of the berm alignments or the mitigation sites. USFWS and USACE biologists will survey the area before construction to confirm active rookery locations. If active rookeries exist within 1,000 feet of an alignment, this could be a project constraint. USFWS guidelines would be followed to avoid adverse impacts to birds.

A January 29, 2009, NMFS letter indicates that aquatic and wetland habitats in the area include estuarine emergent wetlands, submerged aquatic vegetation, mud substrates, and an estuarine water column. These habitats provide EFH for white shrimp and red drum. Waterbodies and wetlands provide nursery and foraging habitats for a variety of fish species, some of which may serve as prey for other fish species designated as EFH species (e.g., mackerel, snapper and grouper) and highly migratory fishes (e.g., billfish and sharks). The NMFS letter indicates the area provides foraging and nursery habitat for economically important marine fishery resources including striped mullet, Atlantic croaker, blue crab, and Gulf menhaden. In addition to providing habitat for species with designated EFH, the area is important for Federal and state-managed species. It provides foraging and nursery areas for prey species (gulf menhaden and bay anchovy) (Penland et



al. 2002) eaten by predators, such as sand seatrout, spotted seatrout, catfish and crappie (LDWF 2009, Hastings 2001), and highly migratory species.

As set forth in the FWCAR, the Service Position and Recommendations are:

The Service would prefer to see selection of the least environmentally damaging alternative which is Alternative A. However, we recognize and understand the logic and reasoning for selecting Alternative C, which includes avoidance of the costly relocation of pipelines and utilities and is expected to provide additional storm water storage capacity for exceedence events thus decreasing the flooding potential of nearby developed areas. Construction of Alternative C will result in the direct loss of approximately 1,236 acres (-691 AAHUs) of swamp and BLH and encloses 8,521 acres (-498 AAHUs) of valuable swamp habitat for a total of 9,757 acres (-1189 AAHUs) of direct and indirect acres.

The Service's Mitigation Policy (Federal Register, Volume 46, No. 15, January 23, 1981) identifies four resource categories that are used to ensure that the level of mitigation recommended by Service biologists will be consistent with the fish and wildlife resource values involved. Considering the high value of forested wetlands for fish and wildlife and the relative scarcity of that habitat type on a basin-wide scale, that habitat type is designated as Resource Category 2, the mitigation goal for which is no net loss of in-kind habitat value.

For those features that undergo additional design work during the Pre-construction Engineering and Design phase (PED) the Corps should coordinate that work with the Service and other natural resource agencies in accordance with the FWCA. Funding for such work may also be necessary.

USACE RESPONSE: Concur. The USACE will coordinate additional design work during PED with the USFWS and other Federal and State resource agencies, as well as with the non-Federal Sponsor. Funding for the USFWS to participate in this effort will be provided consistent with the Fish and Wildlife Coordination Act.

We appreciate the Corps' consideration of our recommendations below for the WSLP project. Provided that the below recommendations are included and adequately addressed in the final feasibility report and pending our review of the adaptive management component of the mitigation plan and resolution of any additional recommendations, the Service does not oppose implementation of the TSP.

The Service respectfully requests the following recommendations are implemented concurrently with project implementation:

1. The Service and LDWF recommend that the unavoidable direct and indirect (including hydrologic) impacts (approximately 446 acres and -123 AAHUs of total WMA impacts) to the wetlands within the Maurepas Swamp WMA be mitigated on the WMA lands, specifically by making hydrologic improvements as well as replacement of lost swamp.

a. In the Corps' Blind River Swamp Restoration Project (SWAMP2) mitigation plan it states that the Corps intends to "Verify that the Livingston Parish Coastal Impact Assistance Program (CLAP) project was built, and that those hydraulic modifications when combined with this planting plan will produce the proposed AAHUs." The Service and LDWF recommend the Corps state that if the hydraulic modifications are not made (or only partially made) as part of the proposed CLAP project that the SWAMP2 mitigation will include the hydraulic modifications as a project feature with detailed engineering, adaptive management and monitoring to be developed during the PED phase. The Service and LDWF recognize that since this feature may not be part of the mitigation plan, adaptive management and monitoring plans do not need to be developed at this time.

b. We recommend that the Corps continue coordination on the proposed mitigation with LDWF and the Service throughout further development and design.

USACE RESPONSE: If the hydraulic modifications are not made (or only partially made) as part of the proposed CIAP project USACE will collaborate with the NFS and the resource agencies to develop new mitigation plans. This could include the required the hydraulic modifications to obtain the required AAHUs at the SWAMP2. USACE will continue to coordinate with the USFWS and other Federal and State (LDWF) resource agencies, as well as with the Non-Federal Sponsor.



2. Over 8,000 acres of swamp will be enclosed within the levee of Alternative C. The proposed alternative may alter natural periods of inundation or soil saturation in the impounded wetlands and could prove detrimental to their function and longevity. Therefore, the Service recommends;

a. That because of our concern about the limited number of proposed culvert openings not being adequate to maintain existing water exchange in regard to water depth, delays in water movement, and impacts to water quality; the Corps undertake, if necessary, the installation of additional culverts and/or water control structures in the levee to ensure adequate water exchange while maintaining that all structures should be closed only in advance of tropical storms.

USACE RESPONSE: Feasibility-level modeling indicates that the number of culverts and water control structures would provide adequate water exchange except when the structures are closed in advance of and during tropical storm events. Additional detailed examination of culvert and water control structures design and operations will be conducted during PED. The USACE will coordinate this more detailed design and operational development with the USFWS, other resource agencies and the Non-Federal Sponsor. 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. Any operational changes implemented to address changing RSLR 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.

b. That hydrologic gauges be placed and maintained in appropriate locations to assist in determining future impacts to enclosed swamps. These gauges could be supported or cost-shared through existing activities such as through the US Geological Survey (USGS) or CRMS.

USACE RESPONSE: Determination of number and locations of hydrologic gauges will be developed during PED phase and is part of the overall O&M cost. Gauges will be placed in appropriate locations to monitor the need to open and close the system. USACE does not intend to monitor swamps located on the protected side of the levee as such activity would fall outside of the project purpose and outside of any project authorization. Any unavoidable impacts to these wetlands will be compensated for through construction of various mitigation features within the basin as described in the mitigation plan (see Appendix A, Annex K).

c. To aid in water quality improvements, any pumping stations associated with the project should not discharge directly into canals or other open water bodies, but rather into wetland systems that can assimilate nutrients being discharged.

USACE RESPONSE: All pump station or drainage structure locations will be connected to a flood side ditch and a protected side canal parallel to the entire levee. The canal will maintain existing connection between swamps inside and outside of the levee system. The protected side canal will serve as a redundant connection if a pump station fails.

3. Operational plans for floodgates and water control structures should be developed to maximize the open cross-sectional area for as long as possible. Development of water control structure operation manuals or plans should be done in coordination with the Service and other natural resource agencies.

USACE Response: Operational plans for floodgates and water control structures will be developed before construction to maximize the connectivity between wetlands located inside of the levee system to those located outside of the levee system. More detailed development of floodgate and water control structures will be conducted during the PED phase. During the PED phase and construction Phase, the USACE will continue to coordinate detailed project developments with the USFWS, other resource agencies and the NFS.



4. *The trigger for structure closures would be tropical storm events. Therefore, the project would not close the system more often due to higher day-to-day sea level rise impacts. If the sponsor/operator sees a higher level of sea level rise and starts to see increased soil saturation/flooding in developed areas, they may want to change the operations to close the structures at high tides. A change in operations would be considered a separate project purpose and authorization and would require a new NEPA documentation and/or a permit approval for this operation change. If a change in operation due to RSLR is realized, it is unknown at present, how water levels within the system would be managed so there is a potential for substantial additional indirect impacts to swamp and fish and wildlife resources to occur. If the system is closed more often due to higher RSLR impacts, the Service recommends additional impacts be evaluated and mitigated.*

USACE RESPONSE: Concur, 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. Any operational changes implemented to address changing RSLR conditions or for any other non-project-related purpose would be considered a separate project purpose requiring separate authorization, new NEPA documentation, mitigation and/or permit approvals.

5. *The Service recommends preservation of enclosed wetlands be ensured (in perpetuity) via the purchase of non-development easements and local flood zoning ordinances. Providing perpetual preservation of enclosed wetlands would also guarantee flood storage areas within the levee system.*

a. *If the Corps declares the enclosed wetlands will be used as a flood storage area, the Service recommends that the Corps determine and designate the flood storage area within the levee system that the nonfederal sponsor will be responsible for maintaining.*

USACE RESPONSE: Do not concur. The USACE is not declaring that the enclosed wetlands are flood storage and does not intend to purchase non-developmental easements for preservation of wetlands enclosed by the Recommended Plan. The action is not likely to induce development in the based flood plain due to the fact that a large portion of the base flood plain includes wetland areas. There would still be a significant economic cost to overcome for developing in these areas under both the FWOP and FWP conditions. These wetlands would be subject to existing Federal, State, and local laws and regulations regarding development of wetlands. This would include, but is not limited to; the Section 404 of the Clean Water, Coastal Zone Management Act, as well as local zoning ordinances. Addressing these laws and regulations would likely still be a significant economic cost to overcome for developing in these areas under both the FWOP and FWP conditions.

6. *Alternative C could potentially have impacts to the CWPPRA River Reintroduction into Maurepas Swamp (PO-29) project. The Service recommends close coordinate with the planning objectives and planning team of the restoration project and that any potential impacts to this CWPPRA project be addressed.*

USACE RESPONSE: The River Reintroduction into Maurepas Swamp (PO-29) project is not authorized for construction. The State of Louisiana has applied for a permit to construct the project independently from the Federal CWPPRA project. The PO-29 project is not considered part of the future with or without conditions which would necessitate consideration of WSLP plan impacts on it as the State has yet to identify funding and has not received approval on the final permit(s). However, the team closely coordinated with the CWPPRA team since 2001. This coordination resulted in the consideration and modification of project features which would complement the former CWPPRA project if, and when it were to be constructed in the same manner as proposed under the CWPPRA study efforts. This includes modification of several alternative levee alignments to tie into the proposed Maurepas Swamp diversion guide levee. Should a river reintroduction project into Maurepas Swamp at the former CWPPRA site proceed to implementation, USACE will coordinate the this project's efforts with the planning elements of the entity implementing the river reintroduction project.



7. If it becomes necessary to use borrow sources other than the previously proposed environmentally cleared sites, the Service recommends investigating potential borrow sources based on the map identifying potential borrow areas that are likely to have minimal impacts to fish and wildlife resources that we provided, via a September 9, 2008, letter and based on our priority selection process for borrow material outlined in our August 7, 2006, letter to the Corps regarding the Greater New Orleans Hurricane and Storm Damage Risk Reduction project (Appendix A) should be utilized (please contact Cathy Breaux (504)862-2689 or David Walther (337)291-3122 for more information).

USACE RESPONSE: If necessary, USACE will consider USFWS recommended borrow sites and other available borrow sites likely to have minimal fish and wildlife impacts.

8. The enclosure of wetlands within the proposed levee is necessary to avoid pipeline and utility relocations and to provide for floodwater storage. Full, in-kind compensation (quantified as Average Annual Habitat Units) is recommended for unavoidable direct (levee footprint) adverse impacts and indirect habitat value losses (enclosed wetlands) on forested wetlands associated with levee construction. To help ensure that the proposed mitigation features meet their goals, the Service provides the following recommendations.

a. If applicable, a General Plan should be developed by the Corps, LDWF, and the Service in accordance with Section 3(b) of the Fish and Wildlife Coordination Act for mitigation lands.

USACE RESPONSE: A Mitigation Plan, consistent with the Fish and Wildlife Coordination Act, has been developed and will continue to be coordinated during the PED phase with the USFWS, LDWF and other resource agencies as well as the Non-Federal Sponsor. USACE is not declaring that the enclosed wetlands will be used for flood storage.

b. Continued mitigation planning should be closely coordinated with the Service, LDWF, and other interested natural resource agencies and should include any additional losses identified during future engineering and design studies.

USACE RESPONSE: Any additional losses identified during future engineering and design studies which require mitigation will be coordinated with the USFWS, other resource agencies and the Non-Federal Sponsor. See response to recommendation 7a above.

c. Mitigation measures should be constructed concurrently with the flood damage reduction features that they are mitigating (i.e., mitigation construction should be initiated no later than 18 months after levee construction has begun). Completion of mitigation means that interim success criteria have been achieved.

USACE RESPONSE: Consistent with 33 USCS §2283, the USACE intends to construct mitigation measures concurrent with the construction of risk reduction features. Construction of the mitigation features is anticipated to be initiated no later than 18 months after the construction of the risk reduction feature has begun. Mitigation success criteria have been identified in the mitigation plan Appendix A, Annex K.

d. If mitigation is not implemented concurrent with levee construction, the amount of mitigation needed should be reassessed and adjusted to offset temporal losses of wetlands.

USACE RESPONSE: If unforeseen circumstances result in mitigation not being implemented concurrent with construction of the flood damage reduction features, then USACE will adjust mitigation to offset wetland temporal losses. Such actions would be coordinated with the USFWS, other resource agencies and the Non-Federal Sponsor.

e. The Corps should remain responsible for the required mitigation until the mitigation is demonstrated to be fully compliant with interim success and performance criteria. At a minimum, this should include compliance with the requisite vegetation, elevation, acreage, and dike gapping criteria.



USACE RESPONSE: As soon as the initial construction of a mitigation feature, or of a functional portion of a mitigation feature, is completed by the USACE contractor, the District Commander will provide the non-Federal sponsor with a notice of construction completion (NCC) for that feature or for the functional portion of that feature. Thereafter, the non-Federal sponsor shall be responsible for the operation, maintenance, repair, rehabilitation and replacement (OMRR&R) of the NCC'd mitigation feature or functional portion thereof and all cost of the OMRR&R of the NCC'd features or functional portion will be borne by the non-Federal sponsor. More information is included in Appendix A, Annex K. Once USACE determines that the mitigation has achieved initial success criteria, monitoring will be performed by the Non-Federal Sponsor as part of its OMRR&R obligations. If, after meeting initial success criteria, the mitigation fails to meet its intermediate and/or long-term ecological success criteria, USACE will consult with other agencies and the Non-Federal Sponsor to determine whether operational changes would be sufficient to achieve ecological success criteria. If, instead, structural changes are deemed necessary to achieve ecological success, USACE will implement appropriate adaptive management measures following the contingency plan and subject to cost sharing requirements, availability of funding, and budgetary and other guidance.

f. The acreage restored and/or managed for mitigation purposes, and adjacent affected wetlands, should be monitored over the project life. This monitoring should be used to evaluate project impacts, the effectiveness of the compensatory mitigation measures, and the need for additional mitigation should those measures prove insufficient.

USACE RESPONSE: A full monitoring report with methodology has been developed and can be found in Section 7 of the mitigation plan (Appendix A, Annex K).

9. The Service recommends enough money be set aside for adaptive management to address potential impacts of the enclosed wetlands. The Service, LDWF, and other natural resource agencies should be consulted in the development of plans and specifications for all mitigation features and any monitoring and/or adaptive management plans. In addition, the Service recommends the Monitoring and Adaptive Management Plan, as it is further developed, be provided to the Service, NMFS, and LDWF for review, comment, and input.

USACE RESPONSE: Specific funds are not being set aside for the adaptive management of the enclosed wetlands. Any monitoring or adaptive management activities in the wetlands on the protected side of the levee would exceed the project purpose and would fall outside of the authorization. USACE will implement appropriate adaptive management measures following the contingency plan and subject to cost sharing requirements, availability of funding, and budgetary and other guidance. Funding requirements to address potential uncertainties to mitigation ecological success are included in the Adaptive Management and Monitoring Plan (Appendix A annex K. The USACE will continue to coordinate with the USFWS, other resource agencies and the Non-Federal Sponsor.

10. Alignment C will occur partly within the boundaries of Maurepas Swamp WMA. Please coordinate all activities within the WMA with LDWF. Please contact Mr. Christain Winslow (985-543-4781 or cwinslow@wlf.la.gov) and Mr. Mike Windham at 504-284-5268 or cwindham@wlf.la.gov for more information about appropriate WMA authorizations.

USACE RESPONSE: The USACE has and will continue to coordinate impacts of the Recommended Plan (Alternative C) with the LDWF.

11. Blind River is a Louisiana designated Natural and Scenic River. The Corps must obtain authorization from the LDWF, Scenic Rivers Program prior to initiating any of the proposed activities within or adjacent to the banks of Blind River. Scenic Rivers Coordinator Keith Cascio can be contacted at (318) 343-4045 or kcascio@wlf.la.gov.

USACE RESPONSE: The USACE will coordinate and, if necessary, obtain authorization from the LDWF, Scenic Rivers Program prior to initiating any proposed activities within or adjacent to the banks of the Blind River.



12. *The Corps should coordinate closely with the Service, LDWF, and other fish and wildlife conservation agencies throughout the pre-construction engineering and design phase of project features including levees, floodgates, environmental water control structures, and operation plans to ensure that those features are designed, constructed and operated consistent with wetland restoration purposes and associated fish and wildlife resource needs, and to update and finalize impacts and to develop an adequate mitigation plan.*

USACE RESPONSE: The USACE will continue to coordinate with the USFWS, other resource agencies and the Non-Federal Sponsor throughout the PED phase regarding project feature design, construction and operation with regard to updating and finalizing avoiding, minimizing, reducing and appropriately mitigating for unavoidable project-induced impacts to wetland, fish and wildlife and other significant resources which. Project-induced impacts to significant resources and the measures to mitigate such impacts will be documented in the mitigation plan, and the adaptive management and monitoring plans.

13. *West Indian manatees (*Trichechus manatus*) occasionally enter Lakes Pontchartrain and Maurepas, and associated coastal waters and streams during the summer months (i.e., June through September). During in-water work in areas that potentially support manatees all personnel associated with the project should be instructed about the potential presence of manatees, manatee speed zones, and the need to avoid collisions with and injury to manatees. All personnel should be advised that there are civil and criminal penalties for harming, harassing, or killing manatees which are protected under the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973. Additionally, personnel should be instructed not to attempt to feed or otherwise interact with the animal, although passively taking pictures or video would be acceptable. For more detail on avoiding contact with manatee contact this office. Should a proposed action directly or indirectly affect the West Indian manatee, further consultation with this office will be necessary.*

USACE RESPONSE: Concur. All personnel associated with project in-water work areas will be instructed about the potential presence of manatees; to obey speed zones; and to avoid collisions with manatees; and be advised that there are civil and criminal penalties for harming, harassing, or killing manatees. Personnel will also be instructed not to attempt to feed or otherwise interact with the manatee. The USACE will consult with the USFWS should a proposed action potentially directly or indirectly affect the West Indian manatee.

14. *Avoid adverse impacts to nesting bald eagles and wading bird colonies through careful design project features and timing of construction. The Service and LDWF recommend that a qualified biologist inspect the proposed work site for the presence of undocumented nesting colonies and bald eagles during the nesting season (i.e., September 1 through February 15 for wading bird nesting colonies and October through mid-May for bald eagles).*

USACE RESPONSE: Concur. Project design and construction timing will be further developed, refined and scrutinized to insure there would be no adverse project-induced impacts to bald eagles and wading bird colonies. A qualified biologist will inspect work sites for the presence of undocumented nesting colonies and bald eagles during the nesting season (i.e., September 1 through February 15 for wading bird nesting colonies and October through mid-May for bald eagles).

15. *If proposed project features, including adaptive management features, are changed significantly or are not implemented within one year of the Endangered Species Act consultation letter, we recommend that the Corps reinstate coordination with the Service and NMFS to ensure that the proposed project would not adversely affect any federally listed threatened or endangered species or their critical habitat.*

USACE RESPONSE: To ensure that the proposed project would not adversely affect any federally listed threatened or endangered species or their critical habitats, the USACE will reinstate endangered species coordination with the USFWS and NMFS if proposed project features, including



adaptive management features, are changed significantly or are not implemented within one year of the Endangered Species Act consultation letter.

16. Costs and tasks associated with the Service's involvement in future planning and construction phases should be coordinated with the Service prior to the finalization of the project management plan or similar documents (e.g., decision management plan).

USACE RESPONSE: The USACE will coordinate the costs and tasks associated with the USFWS involvement in future planning and construction phases prior to the finalization of the project management plan or similar documents.

6.11 Magnuson-Stevens Fishery Conservation and Management Act of 1976 and Magnuson-Stevens Act Reauthorization of 2006 (Essential Fish Habitat)

These laws govern marine fisheries management in the U.S. Essential Fish Habitat (EFH) does not intersect the proposed alignment or the enclosed area in the near term. The USACE has determined that the Recommended Plan would have no impacts to EFH.

6.12 Marine Mammal Protection Act of 1972 (Marine Mammals)

The act protects whales, dolphins, sea lions, seals, manatees and other species of marine mammals. The USACE finds the Recommended Plan would have no effect on marine mammals that may occasionally be found in the area. To avoid “takings” of the West Indian manatee and ensure compliance with the law, USACE commits that 1) all construction staff will be educated about the laws and manatees, 2) a search for manatees in work areas would be conducted before construction, and 3) appropriate best management practices to avoid or minimize potential entrapment of manatees during construction would be implemented.

6.13 Migratory Bird Treaty Act of 1918 & Migratory Bird Conservation Act of 1929 (Migratory Birds)

The laws protect migratory birds and their habitat. Many important habitats in the area provide migratory bird shelter, nesting, feeding and roosting habitat. The BMPs listed in Appendix A and USFWS recommendations would be followed to avoid impacts to any protected birds. Implementation of the Recommended Plan will require compensatory mitigation for unavoidable project-induced habitat impacts.

6.14 National Historic Preservation Act of 1966 (Cultural and Historic Resources)

In compliance with Section 106 of the act and 36 CFR Part 800, Federal agencies must take into account the effects of their actions on historic properties and afford the Advisory Council on Historic Properties (ACHP) a reasonable opportunity to comment on such undertakings. Historic properties include any prehistoric or historic district, site, building, structure, or object that is included in, or eligible for inclusion in, the National Register of Historic Places. A Federal agency shall consult with any Indian tribe that attaches religious and cultural significance to such properties. Agencies shall afford the State Historic Preservation Officer (SHPO) and Indian tribes a reasonable opportunity to comment before decisions are made. Section 106 consultation was initiated with the SHPO and Indian tribes on May 3, 2013. USACE has determined that the effects on historic properties cannot be fully determined before plan approval, and in accord with ER 1105-2-100, paragraph C-4(d)(5)(d)(2), USACE has elected to fulfill its obligations under Section 106 of the National Historic Preservation Act of 1966, as amended, through the execution and implementation of a Programmatic Agreement. A copy of the executed Programmatic Agreement for consultation, identification of historic properties, assessment and resolution of adverse effects is included in Appendix A, Annex F.

6.14.1 Tribal Consultation (Tribal Interests)

In partial fulfillment of EO 13175 (“Consultation and Coordination With Indian Tribal Governments”), NEPA, Section 106 of the National Historic Preservation Act and 36 CFR Part 800, consultation was initiated with these Federally-recognized Tribes: Alabama-Coushatta Tribe of Texas, Caddo Nation of Oklahoma, Chitimacha Tribe of Louisiana, Choctaw Nation of Oklahoma, Coushatta Tribe of Louisiana, Jena Band of Choctaw Indians, Mississippi Band of Choctaw Indians, Quapaw Tribe of Oklahoma, Seminole Nation of Oklahoma, Seminole Tribe of Florida and Tunica-Biloxi Tribe of Louisiana. In a May 3, 2013,



letter, USACE summarized the study authority and history, study area and proposed alignment, offering tribes an opportunity to review and comment on the potential to significantly affect protected tribal resources and rights, or Indian lands. The Quapaw Tribe of Oklahoma determined that the undertaking is not within their area of interest and does not wish to comment. Appendix A, Annex F has a copy of the executed Programmatic Agreement for consultation, identification of historic properties, assessment and resolution of adverse effects.

6.15 Resource Conservation and Recovery Act of 1976, as amended by the Hazardous and Solid Waste Amendments of 1984

A Phase I Environmental Site Assessment (ESA) is required for all of the USACE Civil Works Projects, to facilitate early identification and appropriate consideration of potential Hazardous, Toxic, and Radioactive Waste (HTRW) problems. HTRW includes any material listed as a “Hazardous Substance” under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Other regulated contaminants include those substances that are not included under CERCLA but pose a potential health or safety hazard, and are regulated. Examples include, but are not limited to, many industrial wastes, naturally occurring radioactive materials (NORM), many products and wastes associated with the oil and gas industry, herbicides, and pesticides. Engineer Regulation ER 1165-2-132 and Division Regulation DIVR 1165-2-9 established policies for conducting HTRW review for USACE Civil Works Projects.

An ASTM E 1527-05 Phase 1 Environmental Site Assessment (ESA), HTRW 14-02 dated February 28, 2014, is included in Appendix A. The objective of the Phase I Environmental Site Assessment (ESA) is to identify, to the extent feasible pursuant to the process described herein, recognized environmental conditions (REC) in connection with a given property. This assessment revealed several potential RECs (pipelines and oil and gas wells) in connection with the project’s structural and localized storm surge risk reduction sites as well as within five of the seven mitigation areas.

Numerous oil and gas pipelines, oil and gas well-heads (active, inactive, and plugged and abandoned), and oil and gas related facilities were found to be located within or near the footprint of the structural and localized storm surge risk reduction project areas.

No field inspections were conducted at the Blind River, Bonnet Carré Spillway, and the Maurepas Crawfish Ponds locations. A data base search, however, was conducted for the mitigation areas. Several potential RECs (pipelines and oil and gas wells) were identified within five of the six mitigation areas.

Care must be taken to avoid impacts to pipelines or oil and gas wells during construction of all features.

6.16 Wild and Scenic River Act of 1968 (Rivers)

The Wild and Scenic Rivers Act establishes a National Wild and Scenic Rivers System. The Louisiana Scenic Rivers Act recognizes and implements the 1968 Federal law, to preserve, protect and enhance the wilderness qualities, scenic beauties and ecological regimes of rivers and streams. Any construction within 100 feet of a scenic stream requires a scenic streams permit. The Recommended Plan would not impact the Blind River, the only scenic river within the study area.

6.17 Executive Order 11514, Protection and Enhancement of Environmental Quality

EO 11514 directs Federal agencies to "initiate measures needed to direct their policies, plans and programs so as to meet national environmental goals." The Recommended Plan complies with EO 11514.

6.18 Executive Order 11988, Floodplain Management

The order requires a Federal agency, when taking an action, to avoid short- and long-term adverse effects associated with the occupancy and the modification of a floodplain. The agency must avoid direct and indirect support of floodplain development whenever floodplain siting is involved. In addition, the agency must minimize potential harm to or in the floodplain and explain why the action is proposed. Additional floodplain management guidelines for EO 11988 were provided in 1978 by the Water Resources Council.



The wise use of floodplains concept, as described in EO 11988, was incorporated as a life safety consideration in this study. This approach was based on SMART planning study objectives of applying qualitative rather than quantitative analysis; use of existing data/inventory; and professional judgment. In calculating the potentially developable land for the study area, the following areas were excluded:

- Areas that are currently developed were excluded
- Areas that are owned in fee by governments or nonprofit organizations and that are protected for open space purposes were excluded (WMA, Reserve Airport).
- Large industrial sites. Future residential development is not likely to occur because of the proximity.
- Areas with flood depths greater than 3 feet for the FEMA 1% (1/100) ACE base flood event because constructing buildings to meet FEMA floodplain management requirements is assumed to be cost prohibitive. A general assumption of a 6 ft NAVD 88 elevation was used to determine areas with flood depths greater than 3 feet. This is consistent with planning codes where construction has to be above the 6 ft NAVD 88 or above the FEMA 1% (1/100) ACE base flood event depending which one is greater.

Using the criteria and assumptions listed above for determining potentially developable floodplain, maps were prepared and acres calculated for the No Action and the Recommended Plan (Figure 6-1). These maps do not forecast future growth. The areas in green and blue would have limited development due to economic cost factors. There would still be a significant economic cost to overcome for developing in these areas under both the FWOP and FWP conditions. These areas are mainly wetlands and would still flood from rainfall events. As stated in Chapter 5, the levee system would only be closed for storm surge events. Existing local building codes would still required developments to build above the 100 yr stage for rainfall impacts, and with an open levee system, the stage is still going to increase over time because of RSLR impacts. Existing local building codes would require significant amounts of fill material for new developments. These areas would still be in jurisdictional wetland and would required compensatory mitigation for impacting these areas. These two factors and the existing available upland areas for development; at a much lower cost, would limit the development in these areas.

The NED Plan would result in an additional 4,300 acres of potentially developable floodplain over the period of evaluation in St. Charles and St. John the Baptist Parishes, but these same 4,300 acres would be developable under the no action plan, due to the fact that FEMA Floodplain management guidelines do not take into consideration RSLR. These areas would be considered high ground. The federal action would only change the more recent base flood advisory maps (post Katrina) and future flood advisory maps which are based on storm surge impacts. FEMA Floodplain management guidelines would still require updates to the base flood elevations based on changing rainfall impacts and day-to-day tidal impacts from changes in RSLR.

The eight-step EO 11988–Floodplain Management evaluation process is outlined below with discussion of the Recommended Plan formulation process to demonstrate coordination and compliance with the EO.

Step 1: Determine if a proposed action is in the base floodplain (1/100 year floodplain or 1% ACE).

The Recommended Plan is within the defined base floodplain. The plan proposes to improve the level of risk reduction in the West Shore study area through a system of levees, floodwalls, and localized storm surge risk reduction measures which would reduce flood risk from tropical storm surge and address residual risk to public and life safety from tropical storm surge events.

Step 2: If the action is in the floodplain, identify and evaluate practicable alternatives to the location.

The study evaluated all practicable alternatives by following the six-step planning process and evaluating a wide range of measures and plans using available information, engineering analysis, professional judgment, and risk-informed decision-making. See Chapter 3 and Appendix F for details concerning plan formulation. Practicable alternatives considered included:



- A number of plans generally following a demarcation between wetlands and development. These were screened due to costs of pump stations and pipeline relocations or factors of completeness.
- Manchac Pass storm-surge barrier. This was screened due to surge flanking and environmental impacts.
- A storm-surge barrier at the Rigolets. This would not reduce flood risks in the study area.
- Elevate all structures within the floodplain. This was screened out due to high costs.
- Removal of existing development. This was not considered a practicable alternative.

Step 3: If the action must be in the flood plain, advise the general public in the affected area and obtain their views and comments.

The public has been advised through the integrated NEPA process and proposed outreach program. The NEPA process requires and provides for public disclosure through various means, such as scoping meetings, public notices, websites, direct mailing, and presentations to various agencies and small groups.

Throughout the study process, the team gave presentations to various agencies and various small stakeholder groups to obtain their individual views and comments. In addition, three NEPA public meetings were held in the affected area to obtain the public's view and comments. These meetings included:

- November 2, 2013 in Gonzales, LA (Ascension Parish) – Public Hearing.
- September 17, 2013 in Laplace, LA (St. John Parish) – Public Hearing.
- September 10, 2013 in Litcher, LA (St. James Parish) – Public Hearing.

Step 4: Identify beneficial and adverse impacts due to the action and any expected losses of natural and beneficial flood plain values. Where actions proposed to be located outside the base flood plain will affect the base flood plain, impacts resulting from these actions should also be identified.

Project construction would cause loss of swamp and some bottomland hardwoods but would not significantly diminish existing floodplain natural values. To compensate for these losses, the study recommends mitigation measures to offset the impacts from both the direct and indirect impacts from the levee and localized storm surge risk reduction measures. Appendix A provides more information on the mitigation plan. Additionally, the structural alignment in the Recommended Plan will have both a flood side and protected side ditch to aid in the hydraulic connectivity of the wetlands.

Beneficial impacts of the proposed Recommended Plan are listed below.

- The probability of flooding of existing infrastructure and agricultural land as a result of tropical storm surge will be reduced.
- Annualized economic losses to existing infrastructure and agricultural land will be reduced.
- Annualized flood recovery cleanup and disposal tonnage will be reduced.
- Risk to public and life safety due to flooding from tropical storm surge will be reduced.

Adverse impacts of the proposed Recommended Plan are listed here.

- Short-term and long-term direct and indirect environmental impacts will occur with the construction of the action. Wetland Value Assessment (WVA) models were run on the project levee footprint to determine the functions and values of the impacted habitats. These results are expressed in Average Annual Habitat Units. The models predict that approximately 1,189 AAHUs would be lost due to direct and indirect habitat impacts over the 50-year period of analysis. A mitigation plan to compensate for project-related direct and indirect impacts to swamp and Bottomland-Hardwood-Wet (BLH) has been developed for the project. Six mitigation plan components will provide the required compensation for habitat impacts (See Environmental Appendix, Mitigation Planning).

Step 5: If the action is likely to induce development in the base flood plain, determine if a practicable non-flood plain alternative for the development exists.

The plan cost-effectively minimizes threats to life and property and natural and beneficial floodplain values. The action is not likely to induce development in the based flood plain due to the fact that a large portion of



the base flood plain includes wetland areas. There would still be a significant economic cost to overcome for developing in these areas under both the FWOP and FWP conditions. These wetlands would be subject to existing Federal, State, and local laws and regulations regarding development of wetlands, and would limit development in these areas. This would include, but is not limited to; the Section 404 of the Clean Water, Coastal Zone Management Act, as well as local zoning ordinances. Addressing these laws and regulations would likely still be a significant economic cost to overcome for developing in these areas under both the FWOP and FWP conditions.

Step 6: As part of the planning process under the Principles and Guidelines, determine viable methods to minimize any adverse impacts of the action including any likely induced development for which there is no practicable alternative and methods to restore and preserve the natural and beneficial flood plain values. This should include reevaluation of the “no action” alternative.

Under the Principles and Guidelines, the Recommended Plan was evaluated and it was determined that the recommendation would minimize any adverse impacts by maintaining the existing hydrologic connectivity. Hydrologic connectivity would be maintained to the extent practicable through water control structures except during closure for hurricanes or tropical storms. When the system is closed, pumps would operate on average for 1.7 storms per year, which equates to a closure of structures on average 8.5 days per year. This expected rate of closure would be the same regardless of the actual rate of RSLR as closure of the system is tied to tropical storm events and the elevation trigger would be adjusted as sea level rises. 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.

The loss of natural and beneficial flood plain values would also be minimized through the existing parish floodplain management plan and zoning rules that already prevent development these areas. As stated above, the pumps would only operate on average for 1.7 storms per year. The NFS has an obligation relating to the operation of the project, specifically pump station capacities, to prevent encroachments that would impact the utility of the project when the pump station is operating. The NFS will be required to comply with flood plain management requirements and ensure that project features such as pump stations would not be impacted by developments in the areas behind the risk reduction system. The pump system is designed to match the existing gravity drainage capacity when the system is closed. The NFS would have a responsibility to ensure that this operation of the project features is maintained.

Step 7: If the final determination is made that no practicable alternative exists to locating the action in the flood plain, advise the general public in the affected area of the findings.

Alternative C was the practicable alternative for addressing flood risk in the area. The team review Alternative A as an alternative plan to C, but determined that when factoring in lessons learned from past hurricane risk reduction systems, the USACE could not select Alternative A as practicable alternative because it would be counter to these two critical risk assessment areas discussed in the IPET report (i.e., system complexity and residual risk).

A NEPA record of decision will be publically issued after approval of the Final Integrated Feasibility Report and EIS.

Step 8: Recommend the plan most responsive to the planning objectives established by the study and consistent with the requirements of the Executive Order.

Alternative C is the plan that maximizes NED benefits while being consistent with the requirements of the Executive Order. The Recommended Plan would avoid short-term and long-term adverse effects associated with the occupancy and the modification of the existing floodplain. Due to the fact that the recommendation only addresses the existing and future risk of damages from hurricane and tropical storm surge events, there would be minimum changes in the floodplain development when compared to the no action condition. Low-lying communities would still see significant residual risk from flooding associated with significant rainfall



events. In addition, as discussed in step 6, the existing floodplain would still be vulnerable to changing rates of RSLR, further limiting the development of the existing floodplain. Communities on their own, in the future, can further manage their own residual risk. Any recommendation with structures always has some level of risk of failures or overtopping. Local communities can always reduce their risk by limiting development in areas low-lying areas and in vulnerable areas of the floodplain.

6.19 Executive Order 11990, Protection of Wetlands

The EO directs Federal agencies to avoid to the extent possible, long and short term adverse impacts associated with the destruction or modification of wetlands, and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative. Mitigation planning was integrated into the study by considering, individually and collectively, each of the NEPA mitigation actions to avoid, minimize, reduce and rectify potential adverse wetland impacts to the extent practicable. Implementing the Recommended Plan requires compensatory mitigation for unavoidable impacts that will require replacing or providing substitute resources. Appendix A includes a mitigation plan. Unavoidable project-induced impacts will be mitigated in-kind, and hence, the plan complies with the EO 11990.

6.20 Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

The EO requires agencies to make achieving environmental justice (EJ) part of their missions by identifying and addressing disproportionately high and adverse human health or environmental effects of programs, policies and activities on minority and low-income populations. Potential EJ issues have been considered in planning. Additionally, homes in Convent were canvassed and given public meeting notices during a two week period from April 30 through May 10th 2013. The concept of EJ was briefly explained to the residents available, who were then asked if there were any concerns about the proposed work in the area, none were forthcoming with any specific EJ issues. Aside from the NEPA mandated meetings a specific EJ meeting was held on May 21, 2013 in Lusher, Louisiana. The meeting was centrally located and reasonably distanced (less than 10 miles) so that residents could attend if interested and because there were no large buildings available in Convent that could accommodate a large crowd. Contact information was also made available online to help assist in the identification of potential EJ issues. To date, no residents have contacted the EJ coordinator with specific EJ concerns. These public involvement efforts have provided a reasonable opportunity for residents to comment and/or attend meetings if interested per EO 12898 The USACE has concluded that implementation of Alternative C would not have a disproportionate adverse impact to minority and/or low-income residents as it would provide additional benefits to safety, life, health and properties of all residents and businesses within the study area regardless of race or income level by reducing the overall level of flood risk by the end of the period of analysis.

6.21 Executive Order 13112, Invasive Species

EO 13112 requires agencies to prevent the introduction of invasive species; provide for their control; and minimize their economic, ecological and human health impacts. The Recommended Plan is consistent with the EO to the extent practicable and permitted by law and subject to the availability of appropriations, and within Administration budgetary limits. Relevant programs and authorities to prevent invasive species introductions would be used during construction. The USACE will not authorize, fund, or carry out actions likely to cause or promote the introduction or spread of invasive species unless it has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm; and that all feasible and prudent measures to minimize risk of harm would be taken in conjunction with the actions.

6.22 Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds

EO 13186 requires agencies to take actions to further implement the Migratory Bird Treaty Act. The Recommended Plan has been evaluated for effects on migratory birds, with emphasis on species of concern. Habitats in the project area provide migratory bird shelter, nesting, feeding and roosting habitat. The Recommended Plan would potentially convert 1,112 acres of swamp habitat and 124 acres of BLH habitat to levee. The plan would enclose and potentially change hydrologic conditions of up to 8,521 acres of swamp



and BLH habitats. Implementation of the plan will require compensatory mitigation for unavoidable project-induced impacts to bird and wildlife habitat.

6.23 Land and Water Conservation Act of 1965

The Act established a fund from which Congress can make appropriations for outdoor recreation. The USACE must coordinate with the Secretary of the Interior to insure that no property acquired or developed with assistance from this Act will be converted to other purposes other than outdoor recreation uses. The USACE in coordination with CPRAB, LADWF and USFWS determined that lands acquired as part of the WSLP project would not impact property acquired or developed with assistance from the Act.



7.0 PUBLIC INVOLVEMENT (*NEPA REQUIRED)

Public involvement is an important part of planning and decision-making. Agencies, non-governmental organizations, and citizens provided valuable input for the final recommendation.

7.1 Public Meetings and Other Coordination Efforts

Public meetings in three parishes were held during the study. These meetings included:

NEPA Public Hearings

- November 2, 2013 in Gonzales, LA (Ascension Parish) – Public Hearing.
- September 17, 2013 in Laplace, LA (St. John Parish) – Public Hearing.
- September 10, 2013 in Lutcher, LA (St. James Parish) – Public Hearing.
- Approximately 700 people attended the three public hearings.
- A total of 66 attendees provided 185 individual comments.

Project Updates

- June 6, 2013 - Project update to the CPRAB, FEMA, Louisiana Department of Transportation and Development (LDOTD), Federal Highway Administration (FHWA), and other government agencies
- May 6, 2013 - Project update to CPRAB, FEMA, LDOTD, FHWA, and other agencies
- April 30, 2012 - Project update in St. John the Baptist Parish
- March 19, 2013 - Update to CPRAB, FEMA, LDOTD, FHWA, and other agencies
- February 22, 2013 - Update to CPRAB, FEMA, LDOTD, FHWA, and other agencies
- January 31, 2013 - Update to CPRAB, FEMA, LDOTD, FHWA, and other agencies
- November 15, 2012 - Project update in St. John the Baptist Parish
- February 16, 2011 - Project update to the St. John's Riverlands Civic Association

Environmental Justice Outreach

- April 30, 2013 - Door to door visits with residents in community
- May 8, 2013 - Door to door visits with residents in community
- May 10, 2013 - Door to door visits with residents in community

Environmental Justice Community Meeting

- May 21, 2013 - Environmental justice community meeting in St. James Parish

NEPA Public Scoping Meeting

- January 21, 2009 - Public scoping meeting in St. John the Baptist Parish

Meeting participants were generally most interested in potential levee alignments and impacts to their communities. Other comments focused on the construction schedule, potential impacts to wetlands, the value of hurricane evacuation routes, and funding.

7.2 Draft Report Recipients

A Notice of Availability for the Integrated Draft Feasibility Report and Environmental Impact Statement was published in the Federal Register on August 23, 2013, initiating the 45 day public review period. Due to the Federal government shutdown, the comment period was extended for an additional two weeks from Tuesday, October 8, 2013 to Tuesday, October 22, 2013. This report was distributed to Federal, state, and local agencies; businesses, libraries, and universities; and others. The following stakeholders received a copy of the draft report (Table 7-1). This list has also been used for the final report submittal to the public and agencies.





Table 7-1: List of report recipients.

Louisiana Congressional	Louisiana State Senators &	Levee Districts & Floodplain
Senator Mary Landrieu	Jody Amedee, State Senator	Amite River Basin Commission
Senator David Vitter	Randal L. Gaines, State Representative	Lafourche Basin Levee District
Congressman Rodney Alexander	Gregory A. Miller, State Representative	Pontchartrain Levee District
Congressman Charles W. Boustany, Jr.	Ed Price, State Representative	
Congressman William Cassidy	Garv L. Smith, Jr., State Senator	
Congressman John Fleming	Tom Willmott, State Representative	
Congressman Cedric Richmond		
Congressman Steve Scalise		
St. Charles Parish Government	St. James Parish Government	St. John the Baptist Government
V.I. St. Pierre, Jr., Parish President	Timothy P. "Timmy" Roussel	Natalie Robottom, Parish President
Parish Council	District Conservationist	
Permit Officer	Director of Operations	
	Parish Police Jury	
Town of Gramercy Government	Town of Lusher Government	Town of Vacherie Government
Mayor	Clerk	Town Council
Aldermen	Aldermen	
Permit Official		
Federal Agencies		
Advisory Council on Historic Preservation	Department of Transportation: Division Administrator, Federal Highway Administration; Southwest Region, Federal Aviation Administration	Department of Energy: Office of Environmental Compliance
Department of Homeland Security: <i>Federal Emergency Management Agency:</i> Gary Zimmerer, Region VI	Department of Agriculture: Carl J. Breville. <i>Natural Resources Conservation Service:</i> Kevin Norton, State Conservationist; Michael Trusclair, District Conservationist	Environmental Protection Agency: Office of Federal Activities, EIS Filing Section: Region VI, Marine and Wetlands Section; Rhonda Smith, Region VI - Office of Planning and Coordination
Department of the Army: Rayford E. Wilbanks, MVD	Department of the Interior: <i>Office of Environmental Policy and Compliance. U.S. Fish and Wildlife Service:</i> Lacombe Office; Lafayette Field Office, Jeff Weller, Field Supervisor	Department of Commerce: <i>National Oceanic and Atmospheric Administration:</i> David Bernhart, Protected Species Division; Richard Hartman, Habitat Conservation Division; NEPA Coordinator, Office of Program, Planning & Integration
State of Louisiana (LA) Agencies and Offices		
Honorable Bobby Jindal	LA Department of Agriculture & Forestry: Office of Forestry; Mike Strain; Matthew Keppinger, Office of Agriculture & Environmental Science	LA Department of Public Works
Lieutenant Governor Jay Dardenne	LA Department of Environmental Quality: Environmental Planning Division ; Office of the Secretary; Scott Guilliams	LA Department of Transportation & Development
Secretary of State	LA Department of Health & Hospitals: Office of Public Health, Center for Environmental Health	LA Department of Wildlife and Fisheries: Secretary; Maurice B. Watson; Tim Morrison; Gary Lester, Natural Heritage Program



Attorney General's Office	LA Department of Natural Resources: Keith Lovell, Interagency Affairs; Charlie Mestayer, Lafayette Field Office; Division of State Lands; Office of Conservation, Surface Mining Division; Consistency Coordinator, Coastal Resources Program	Louisiana Division of Administration: State Land Office; State Planning Office
Governor's Office for Coastal Activities	Coastal Protection and Restoration Authority Board: Garret Graves	LA Office of Cultural Development: Pam Breaux, State Historic Preservation Officer; Division of Outdoor Recreation
Coastal Protection and Restoration Authority: Stephanie Zumo		LA State Board of Commerce & Industry
Native American Tribes		
Adai Caddo Indians of Louisiana	Clifton Choctaw Tribe of Louisiana	Point au Chien Tribe
Alabama Coushatta Tribe of Texas	Coushatta Tribe of Louisiana	Quapaw Tribe of Oklahoma
Biloxi Chitimacha	Four-Winds Cherokee Tribe	Seminole Tribe of Florida
Caddo Nation	Grand Caillou/Dulac Band	Seminole Nation of Oklahoma
Chitimacha Tribe of Louisiana	Isle de Jean Charles Band	Tunica-Biloxi Tribe of Louisiana
Choctaw-Apache Tribe of Ebarb	Jena Band of Choctaw Indians	United Houma Nation
Choctaw Nation of Oklahoma	Louisiana Choctaw Tribe	
Media Outlets	Businesses & Individuals	Libraries & Universities
St Charles Herald Guide	Entergy	St. John The Baptist Parish Library
L'Observateur	Wally Landry, Crucial, Inc.	St. James Parish Library
News Examiner	Donald Landry, South Louisiana Environmental Council	Louisiana State University: Craig A. Johnson, Louisiana Geographic Information Center; Charles Wilson, Office of Sea Grant Development; Dept. of Geography

7.3 Views of the Public

Comments

Verbal comments received at each of the Public Hearings were made part of the Public Hearing transcript and were included within the comment spreadsheet.

Verbal comments fell into these main points:

- Support for selecting Alignment D.
- Need to include all of the benefits associated with selecting Alignment D.
- Alignment C will push water into St. James Parish.
- Why not select D if it is only \$10 million more to construct compared to C?
- The report says most of the forested wetlands will be lost in the next 50 years due to sea level rise and saltwater intrusion - why not build D to protect the wetlands?
- Consider backwater flooding.
- Our house may be protected with a localized storm surge risk reduction plan, but our property will still flood, and we will not be able to get in and out of the area for days.

During the comment period, approximately 200 individuals provided 402 comments (via verbal at meetings, letter, email, and comment cards). A majority of the correspondence had the following themes:



- “I am requesting your assistance to promote the option Alignment D. Alignment D is the only option that will provide levee hurricane protection for St. James Parish. Alignment A and C would begin a levee in St. Charles Parish and stop short of the St. James Parish line, leaving St. James Parish unprotected and vulnerable to flooding.
- “Building a levee in St. John Parish and not protecting St. James Parish will put water/funnel water in St. James Parish”
- “We need the highways to be protected so that the emergency vehicles can get to the people who need assistance. The only way to protect our highways is Alternative “D”.

Written comments were received from a number of Congressional offices, Federal and State agencies, NGOs, towns, and citizens of affected parishes. Letters were provided from the following:

- Senator David Vitter (LA)
- Monica Salins, Executive Director of the Pontchartrain Levee Board (NFS)
- State of LA – CPRAB (NFS)
- Timothy Roussel – Parish President of St. James
- John Berthelot - State Representative of Louisiana (District 88)
- Gregory Miller – State Representative of Louisiana (District 56)
- State of LA - Department of Transportation and Development
- State of LA – State Parks
- State of LA – Department of Wildlife and Fisheries
- Town of Litcher
- Town of Gramercy
- US Fish and Wildlife Service
- National Marine Fisheries Service
- US Environmental Protection Agency
- Environmental Defense Fund
- Lake Pontchartrain Basin Foundation

Within Appendix A is the comment and response spreadsheet listing each commenter, their affiliation; comment and USACEs response; copies of the comment letter identified by a unique identifier and the public hearing transcript from each public hearing.

Independent External Peer Review

An Independent External Peer Review (IEPR) was conducted on the Draft Report during the public comment period. The IEPR comments and USACEs responses are available at the following location:

<http://www.mvn.usace.army.mil/About/Projects/WestShoreLakePontchartrain.aspx>



8.0 RECOMMENDATIONS

Information in this document was developed for feasibility analysis, with input from agencies and comments from the public, to help refine potential solutions to reduce storm surge flood damages to St. Charles, St. John the Baptist and St. James Parishes, Louisiana. These sources of information will assist the USACE Commander in making an informed decision.

8.1 Recommended Plan

The Recommended Plan is Alternative C, which is the plan that maximizes NED benefits while protecting the nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements. Alternative C begins at the west guide levee of the Bonnet Carré Spillway and extends to Hope Canal. The recommended plan also includes a localized storm surge risk reduction system in the communities of Gramercy, Lucher and Grand Point, which are located outside of the proposed levee system (Figure 5-2). The purpose of this localized storm surge risk reduction system is to maximize the net benefits in the entire study area and to adequately address the limited potential for induced damages, as described in Chapter 3.9.4. The levee system is based on a 1% probability storm level of risk reduction and a 2020 intermediate RSLR condition. Future levee lifts will be maintained in order to maintain the 1% probability storm level of risk reduction levee system so long as the project remains authorized. The localized storm surge risk reduction system focused on providing risk reduction above the 1% AEP storm stages in 2020.

8.1.1 Levee System

As described in Chapter 5.1, the levee system is approximately 18.27 miles long and includes 4 pump stations and 2 drainage structures along the alignment. All borrow material would come from the canals and ditches associated with the levee features and the Bonnet Carré Spillway. The pump stations would only operate during hurricane and tropical storm surge events and the drainage structures would be open outside of these events. Rainfall and high tides would still cause significant flooding of the swamps within the levee-enclosed area. As stated above the system would only prevent flooding of these areas under storm events.

8.1.2 Localized Storm Surge Risk Reduction System

As described in Chapter 5.1, the main localized storm surge risk reduction measures include berms and flap gates on existing drainage features and roadways. Additional flood proofing measures such as the raising of residential structures, non-residential structure flood proofing, and small individual berms around non-residential structures, are limited to a few structures located outside of the two major berms in Gramercy/Lucher and Grand Point in St. James Parish. Property owner participation in the additional flood proofing measures will be voluntary. A flood proofing agreement will be executed between the property owner and the NFS for the elevation of residential structures. A flood proofing agreement will also be executed between the property owner and the NFS for the non-residential structures. It is expected that occupants will need to temporarily relocate from the individual residences that are being elevated as a part of the localized storm surge risk reduction component. No relocation is necessary for flood proofing individual non-residential structures. Because participation in the elevation of dwellings is voluntary, owner-occupants are not eligible for relocation assistance as indicated in 49 CFR Part 24.

8.1.3 Mitigation requirements

Mitigation for fish and wildlife habitat impacts is included as a project feature.

8.2 Plan Implementation

The following sections describe the NFS financing and the division of plan responsibilities.

8.2.1 Federal and Non-Federal Cost-Sharing

The State of Louisiana acting through the CPRAB will be the NFS for design, construction, operation, maintenance, repair, rehabilitation and replacement. The cost share for the design and construction of the project will be 65 percent Federal and 35 percent non-Federal. Among other responsibilities, the CPRAB





must provide all project LERRDs required for the project and submit any work-in-kind (WIK) request for approval by the Federal government for the pre-construction engineering, and design (PED) of the project. WIK associated with the construction for both the structural and localized storm surge risk reduction system components of the project will be negotiated with the NFS, contingent upon approval at the Assistant Secretary of the Army for Civil Works (ASACW) (or appropriate designee) in accordance with applicable guidance and regulations. The OMRR&R cost of the project is estimated to cost on an average annual basis \$5,070,000 and is a 100 percent NFS responsibility. The estimated total project cost for the recommended plan is \$718,091,000 at a FY 2015 price level.

8.2.2 Federal Responsibilities

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

8.2.3 Non-Federal Responsibilities

Federal implementation of the project would be subject to the NFS agreeing in a binding written agreement to comply with applicable Federal laws and policies, and to perform the following non-Federal obligations, including, but not limited, to the following:

- a) Provide 35 percent of total project costs as further specified below:
 1. Provide the required non-Federal share of design costs in accordance with the terms of a design agreement entered into prior to commencement of design work for the project;
 2. Provide, during the first year of construction, any additional funds necessary to pay the full non-Federal share of design costs;
 3. Provide all lands, easements, and rights-of-way, including those required for relocations, the borrowing of material, and the disposal of dredged or excavated material; perform or ensure the performance of all relocations; and construct all improvements required on lands, easements, and rights-of-way to enable the disposal of dredged or excavated material, all as determined by the Government to be required or to be necessary for the construction, operation, maintenance, repair, rehabilitation and replacement of the project;
 4. Provide, during construction, any additional funds necessary to make its total contribution equal to 35 percent of total project costs;
- b) Shall not use funds from other Federal programs, including any non-Federal contribution required as a matching share therefore, to meet any of the non-Federal obligations for the project unless the Federal agency providing the funds verifies in writing that such funds are authorized to be used to carry out the project;
- c) Not less than once each year, inform affected interests of the extent of protection afforded by the project;
- d) Agree to participate in and comply with applicable Federal floodplain management and flood insurance programs;
- e) Comply with Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), which requires a non-Federal interest to prepare a floodplain management plan within one



year after the date of signing a project partnership agreement, and to implement such plan not later than one year after completion of construction of the project;

- f) Publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in adopting regulations, or taking other actions, to prevent unwise future development and to ensure compatibility with protection levels provided by the project;
- g) Prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) such as any new developments on project lands, easements, and rights-of-way or the addition of facilities which might reduce the level of protection the project affords, hinder operation and maintenance of the project, or interfere with the project's proper function;
- h) Comply with all applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended (42 U.S.C. 4601- 4655), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way required for construction, operation, and maintenance of the project, including those necessary for relocations, the borrowing of materials, or the disposal of dredged or excavated material; and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act;
- i) For so long as the project remains authorized, OMRR&R the project or functional portions of the project, including any mitigation features, at no cost to the Federal government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal government; provided, however, that the NFS shall have no obligation to address loss of risk reduction due to relative sea level rise through the repair, rehabilitation or replacement of localized storm surge risk reduction components associated with the construction of large ring berms around groups of residential structures, nor shall the NFS be obligated to OMRR&R those flood proofing measures that constitute elevation of individual residential structures or construction of small ring berms around individual non-residential or light industry/warehouse structures.
- j) Give the Federal government a right to enter, at reasonable times and in a reasonable manner, upon property that the NFS owns or controls for access to the project for the purpose of completing, inspecting, operating, maintaining, repairing, rehabilitating, or replacing the project;
- k) Hold and save the United States free from all damages arising from the construction, operation, maintenance, repair, rehabilitation, and replacement of the project and any betterments, except for damages due to the fault or negligence of the United States or its contractors;



- l) Keep and maintain books, records, documents, or other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of 3 years after completion of the accounting for which such books, records, documents, or other evidence are required, to the extent and in such detail as will properly reflect total project costs, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 CFR Section 33.20;
- m) Comply with all applicable Federal and State laws and regulations, including, but not limited to: Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d) and Department of Defense Directive 5500.11 issued pursuant thereto; Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army"; and all applicable Federal labor standards requirements including, but not limited to, 40 U.S.C. 3141-3148 and 40 U.S.C. 3701 – 3708 (revising, codifying and enacting without substantial change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a et seq.), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 et seq.), and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c et seq.);
- n) Perform, or ensure performance of, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the CERCLA, Public Law 96-510, as amended (42 U.S.C. 9601-9675), that may exist in, on, or under lands, easements, or rights-of-way that the Federal government determines to be required for construction, operation, and maintenance of the project, including those lands, structures and interests necessary for the implementation of all of the localized storm surge risk reduction components of the Project as described in this Report. However, for lands that the Federal government determines to be subject to the navigation servitude, only the Federal government shall perform such investigations unless the Federal government provides the NFS with prior specific written direction, in which case the NFS shall perform such investigations in accordance with such written direction;
- o) Assume, as between the Federal government and the NFS, complete financial responsibility for all necessary cleanup and response costs of any hazardous substances regulated under CERCLA that are located in, on, or under lands, easements, or rights-of-way that the Federal government determines to be required for construction, operation, and maintenance of the project, including those lands, structures and interests necessary for the implementation of all of the localized storm surge risk reduction components of the Project as described in this Report;
- p) Agree, as between the Federal government and the NFS, that the NFS shall be considered the operator of the project for the purpose of CERCLA liability, and to the maximum extent practicable, operate, maintain, repair, rehabilitate, and replace the project in a manner that will not cause liability to arise under CERCLA; and
- q) Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended (42 U.S.C. 1962d-5b), and Section 103(j) of the Water Resources Development Act of 1986, Public Law 99-662, as amended (33 U.S.C. 2213(j)), which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until each non-Federal interest has entered into a written agreement to furnish its required cooperation for the project or separable element.
- r) Shall not use any project features or lands, easements, and rights-of-way required for such features as a wetlands bank or mitigation credit for any other project;
- s) Pay all costs due to any project betterments or any additional work requested by the sponsor, subject to the sponsor's identification and request that the Government accomplish such betterments or



additional work, and acknowledgement that if the Government in its sole discretion elects to accomplish the requested betterments or additional work, or any portion thereof, the Government shall so notify the NFS in writing that sets forth any applicable terms and conditions.

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

A handwritten signature in dark ink, reading "Richard L. Hansen". The signature is written in a cursive style and is positioned above a horizontal line.

Richard L. Hansen
Colonel, U.S. Army
District Engineer



9.0 LIST OF PREPARERS (*NEPA Required)

Name	Office	Discipline/Role
Tim Axtman	RPEDS Plan Formulation Branch	Senior Plan Formulator
Christopher Brown	RPEDS Environmental Compliance Branch	HTRW
Michael Brown	RPEDS Environmental Compliance Branch	404(b)(1) Evaluation
Troy Constance	Chief, RPEDS	District Quality Control
Travis Creel	RPEDS, Plan Formulation Branch	Lead Plan Formulator
Rob Dauenhauer	Engineering Division, Structures Branch	Structures Design
Nathan Dayan	RPEDS Environmental Planning Branch	Environmental Manager, Fisheries Resources, Essential Fish Habitat
Pamela Deloach	Engineering Division, Engineering Control Branch	District Quality Control
Joan Exnicios	Chief, RPEDS Environmental Planning Branch	District Quality Control
Douglas Ferrell	Engineering Division, Design Services Branch	Relocations
Tammy Gilmore	RPEDS Environmental Planning Branch	Wildlife Resources, Endangered Species
Eric Glisch	Engineering Division, Hydraulics and Hydrologic Branch	Water Quality; 404(b)(1)
Richel Green	Engineering Division, Design Services Branch	Relocations
Judith Gutierrez	Real Estate Division	District Quality Control
Rebecca Hill	RPEDS Environmental Planning Branch	Tribal Liaison Coordination
Paul Hughbanks	RPEDS Environmental Planning Branch	Archaeology
William P. Klein Jr.	RPEDS Environmental Planning Branch	Environmental Manager, Planning, Habitat Impacts
Fay Lachney	RPEDS Plan Formulation Branch	Senior Plan Formulator
Mark Lahare	RPEDS Environmental Compliance Branch	Wetlands, Cumulative Impact Analysis
Patricia Leroux	RPEDS Environmental Planning Branch	Appendices, Vegetation Resources
J. Ben Logan	RPEDS Economics Branch	Socioeconomic Resources





Name	Office	Discipline/Role
Keven Lovetro	RPEDS Economics Branch	Socioeconomic Resources
Brian Maestri	RPEDS Economics Branch	Socioeconomic Resources
Greg Miller	Chief, RPEDS Plan Formulation Branch	Mitigation Plan; District Quality Control
Kelly McCaffrey	RPEDS Environmental Planning Branch	Aesthetic Resources
Joe Musso	RPEDS Environmental Compliance Branch	Air Quality; HTRW
An Nguyen	Engineering Division, Civil Branch	Levee Design
Darrell Normand	Engineering Division, Design Services Branch	Cost Engineering
Paul Oakland	Engineering Division, Design Services Branch	Relocations
Hasan Pourtaheri	Engineering Division, Hydraulics and Hydrologic Branch	ADCIRC & Surge Modeling
Miguel Ramos	Engineering Division, Design Services Branch	Cost Engineering
Courtney Reed	RPEDS Economics Branch	Socioeconomic Resources
Jerica Richardson	RPEDS, Plan Formulation Branch	Plan Formulator, Environmental Justice
Sandra Stiles	RPEDS Environmental Planning Branch	District Quality Control
Daniel Sumerall	RPEDS Environmental Planning Branch	Coastal Zone Consistency
Christopher Talbert	Engineering Division, Design Services Branch	Relocations
Danielle Tommaso	RPEDS, Plan Formulation Branch	Plan Formulator
Ron Taylor	Engineering Division, Hydraulics and Hydrologic Branch	Interior Drainage
Walter Teckemeyer	Engineering Division, Engineering Control Branch	Project Engineer
Jeff Varisco	Programs & Project Management Division	Project Manager
Jennifer Wedge	Engineering Division, Structures Branch	Structures Design
Laura Lee Wilkinson	RPEDS Environmental Planning Branch	Noise
Debra Wright	RPEDS Environmental Planning Branch	Recreational Resources