DRAFT INDIVIDUAL ENVIRONMENTAL REPORT

IMPROVED PROTECTION ON THE INNER HARBOR NAVIGATION CANAL

ORLEANS AND ST. BERNARD PARISHES, LOUISIANA

IER #11 TIER 2 BORGNE

US Army Corps of Engineers®

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1.0 INTRODUCTION

The United States (U.S.) Army Corps of Engineers (USACE), Mississippi Valley Division, New Orleans District (CEMVN), has prepared this Individual Environmental Report (IER) # 11 – Tier 2 Borgne for Improved Protection on the Inner Harbor Navigation Canal (IHNC), Orleans and St. Bernard Parishes, Louisiana. This IER has been prepared as a second tier evaluation for the portion of the flood protection project that occurs near Lake Borgne and is referred to as "Tier 2 Borgne." This document provides evaluation of the potential impacts associated with the proposed construction of storm surge protection structures between the IHNC and Lake Borgne (figure 1).

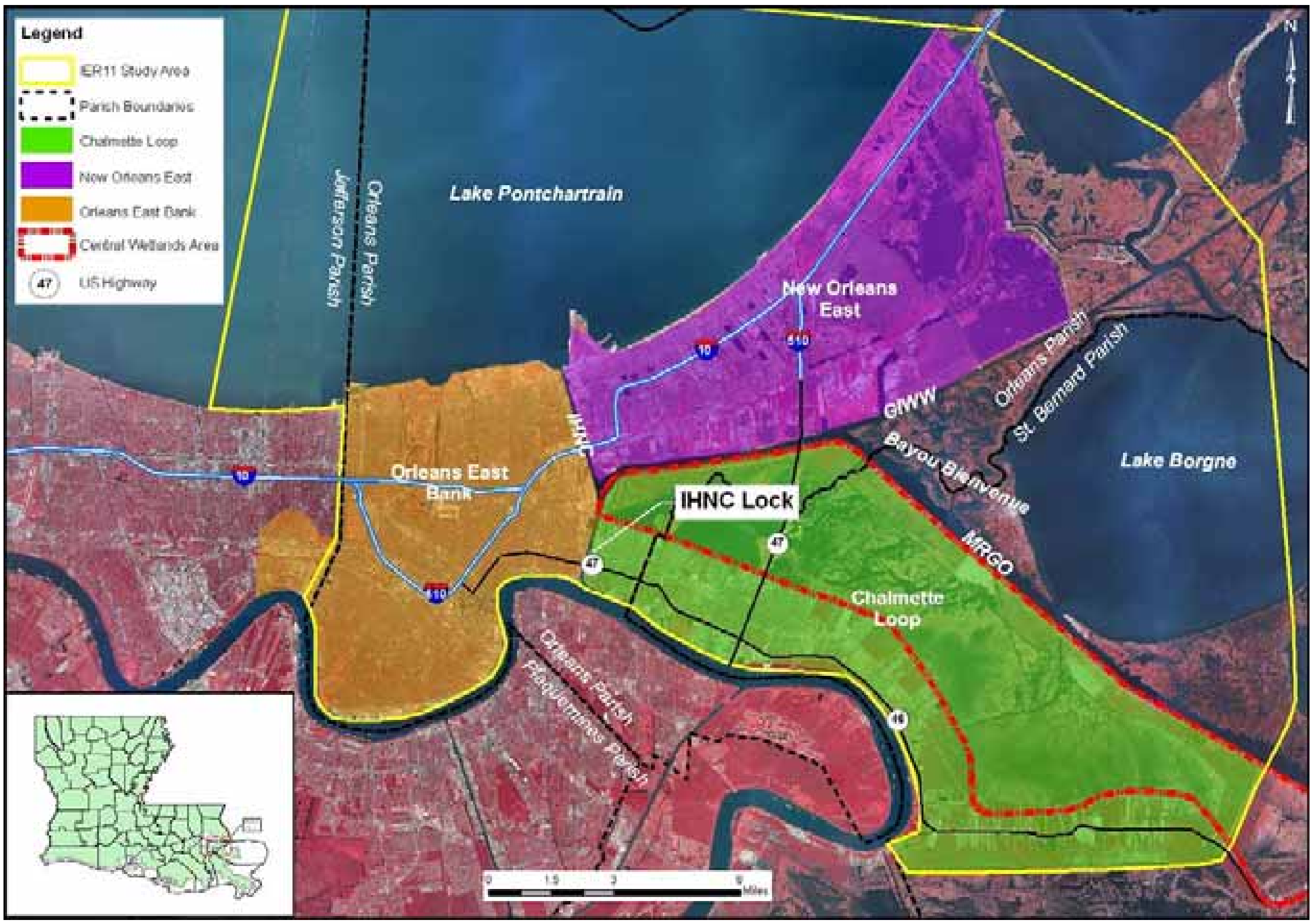

Figure 1. Tier 2 Borgne Study Area

IER # 11 - Tier 2 Borgne has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 and the Council on Environmental Quality's Regulations (40 Code of Federal Regulations [CFR] 1500-1508), as reflected in the USACE Engineering Regulation (ER) 200-2-2. The execution of an IER, in lieu of a traditional Environmental Assessment (EA) or Environmental Impact Statement (EIS), is provided for in ER 200-2-2, Paragraph 8, Environmental Quality, Procedures for Implementing the NEPA, 33 CFR 230.8, and pursuant to the Council on Environmental Quality (CEQ) NEPA Implementation Regulations (40 CFR 1506.11).

The CEMVN implemented Alternative Arrangements on 13 March 2007, under the provisions of the CEQ Regulations for Implementing the NEPA (40 CFR 1506.11). This process was implemented in order to expeditiously complete environmental analysis for any changes to the authorized system and the 100-year level of the Greater New Orleans Hurricane and Storm Damage Risk Reduction System (GNOHSDRRS), formerly known as the Hurricane Protection System (HPS), authorized and funded by Congress and the Administration. The reaches included in the proposed action are located in southeastern Louisiana and are part of the Federal effort to rebuild and complete construction of the GNOHSDRRS as a result of Hurricanes Katrina and Rita. The Alternative Arrangements can be found at www.nolaenvironmental.gov and are herein incorporated by reference.

This document, referred to as Tier 2 Borgne, is the second tier for IER # 11 "Improved Protection on the Inner Harbor Navigation Canal, Orleans and St. Bernard Parishes, Louisiana" (Tier 1) to address surges from the Gulf Intracoastal Waterway (GIWW)-Mississippi River Gulf Outlet (MRGO)-Lake Borgne complex (hereafter referred to as "Borgne complex"). Tiering is a staged approach to the NEPA described in the CEQ's Regulations for Implementing the Procedural Provisions of the NEPA (40 CFR 1500 – 1508). The Tier 1 document investigated a range of alternatives for providing the 100-year level of protection to the communities surrounding the IHNC. The alternative selected included two location ranges, "Borgne 1" and "Pontchartrain 2," within which separate storm surge protection structures could be built to address storm surges originating from the Borgne complex and Lake Pontchartrain respectively. Two Tier 2 documents are being prepared to evaluate these location ranges in more detail. This Tier 2 NEPA analysis investigates a range of alignments and design alternatives within the Borgne location range selected in the Tier 1 document. This document provides a more detailed description and analysis of footprints and alignments, construction materials and methods, and other design details than what was provided in IER # 11 Tier 1 for the Borgne location range. A second Tier 2 NEPA analysis will investigate a range of alignments and design alternatives within the Pontchartrain location range selected in the Tier 1 document.

It is the intent of the CEMVN to employ an integrated, comprehensive, and systems-based approach to hurricane and storm damage reduction in raising the entire GNOHSDRRS to the 100-year level of protection. The proposed action is intended to work in conjunction with other projects within the GNOHSDRRS to provide the 100-year level of protection, which is necessary to achieve the certification required for participation in the National Flood Insurance Program (NFIP).

This draft IER will be distributed for a 30-day public review and comment period. A public meeting specific to the proposed action will be held if requested by a stakeholder during the review period. Any comments received during the public meeting will be considered part of the official record. After the 30-day comment period, and public meeting if requested, the CEMVN District Commander will review all comments received during the review period and determine if they rise to the level of being substantive in nature. If comments are not considered to be substantive, the District Commander will make a decision on the proposed action. This decision will be documented in the form of an IER Decision Record. If a comment(s) is determined to be substantive in nature, an addendum to the IER will be prepared and published for an additional 30-day public review and comment period. After the expiration of the second public comment period, the District Commander will make a decision, documented in an IER Decision Record, on the proposed action.

1.1 PURPOSE AND NEED FOR THE PROPOSED ACTION

The term "100-year level of protection," as it is used throughout this document, refers to a level of protection which reduces the risk of hurricane surge and wave-driven flooding that the New Orleans Metropolitan area has a 1 percent chance of experiencing each year. The proposed action will satisfy the CEMVN's purpose and need to provide, in a timely manner, the 100-year level of protection from flood damage due to flooding from hurricanes and other tropical storms in the areas surrounding the IHNC. The elevations of the existing Lake Pontchartrain and Vicinity (LPV) GNOHSDRRS in the project area are below the 100-year design elevation The proposed action resulted from a defined need to reduce flood risk and storm damage to residences, businesses, and other infrastructure from hurricanes (100-year storm events), and other high water events.

The completed GNOHSDRRS would lower the risk of harm to citizens and damage to infrastructure during a storm event. The safety of people in the region is the highest priority of the CEMVN. The proposed action would serve as a piece of this overall GNOHSDRRS.

1.2 AUTHORITY FOR THE PROPOSED ACTION

The authority for the proposed action was provided as part of a number of hurricane and storm damage risk reduction projects spanning southeastern Louisiana, including the LPV Hurricane Protection Project and the West Bank and Vicinity (WBV) Hurricane Protection Project. Congress and the Administration granted a series of supplemental appropriations acts following Hurricanes Katrina and Rita to repair and upgrade the project systems damaged by the storms, which gave additional authority to the USACE to construct 100-year GNOHSDRRS projects.

The LPV project was authorized under the Flood Control Act of 1965 (Public Law [PL] 89-298, Title II, Sec. 204) which amended and authorized "project for hurricane protection on Lake Pontchartrain, Louisiana … substantially in accordance with the recommendations of the Chief of Engineers in House Document 231, Eighty-ninth Congress." The original statutory authorization for the LPV project was amended by the Water Resources Development Acts (WRDA) of 1974 (PL 93-251, Title I, Sec. 92); 1986 (PL 99-662, Title VIII, Sec. 805); 1990 (PL 101-640, Sec. 116); 1992 (PL 102-580, Sec. 102); 1996 (PL 104-303, Sec. 325); 1999 (PL 106-53, Sec. 324); and 2000 (PL 106-541, Sec. 432); Energy and Water Development Appropriations Acts of 1992 (PL 102-104, Title I, Construction, General); 1993 (PL 102-377, Title I Construction, General); and 1994 (PL 103-126, Title I Construction, General).

The Department of Defense Emergency Supplemental Appropriations to Address Hurricanes in the Gulf of Mexico and Pandemic Influenza Act of 2006 (3rd Supplemental – PL 109-148, Chapter 3, Construction, Flood Control and Coastal Emergencies) authorized accelerated completion of the project and restoration of project features to design elevations at 100 percent Federal cost. The Emergency Supplemental Appropriations Act for Defense, the Global War on Terror, and Hurricane Recovery of 2006 (4th Supplemental – PL 109-234, Title II, Chapter 3, Construction, and Flood Control and Coastal Emergencies) authorized construction of a 100-year level of protection, the replacement or reinforcement of flood walls, and the construction of levee armoring at critical locations. Additional Supplemental Appropriations include the U.S. Troop Readiness, Veterans' Care, Katrina Recovery, and Iraq Accountability Appropriations Act of 2007 (5th Supplemental – PL 110-28, Title IV, Chapter 3, Flood Control and Coastal Emergencies).

1.3 PRIOR REPORTS

Numerous studies, reports and projects have been conducted in the Tier 2 Borgne area. In addition to the studies included in IER # 11 Tier 1, which are incorporated herein by reference, the more recent studies for Tier 2 Borgne are briefly summarized below, and are incorporated herein by reference.

- On 12 June 2008, the CEMVN signed a Decision Record on IER # 15 entitled "Lake Cataouatche Levee, Jefferson Parish." The document was prepared to evaluate the potential impacts associated with raising approximately 8 miles of levees and modifying fronting protection.

- On 10 June 2008, the CEMVN signed a Decision Record on IER # 1 entitled "IER LPV, La Branche Wetlands Levee, St. Charles Parish, Louisiana." The document was prepared to evaluate the potential impacts associated with raising approximately 9 miles of earthen levees; replacing over 3,000 feet (ft) of floodwalls; rebuilding, modifying or closing five drainage structures; and modifying one railroad gate.

- On 5 June 2008, a Chief's Report on the Deep-Draft De-Authorization Study entitled "Integrated Final Report to Congress and Legislative Environmental Impact Statement for the Mississippi River-Gulf Outlet Deep-Draft De-Authorization Study" was transferred to Congress. This action deauthorized the channel and a plug will be built in near Bayou La Loutre in the near future.

- On 30 May 2008, the CEMVN signed a Decision Record on IER # 22 entitled "Government Furnished Borrow Material # 2, Jefferson and Plaquemines Parishes, Louisiana." The document was prepared to evaluate the potential impacts associated with the actions taken by the USACE while excavating borrow areas for use in construction of the GNOHSDRRS.

- On 5 May 2008, the CEMVN signed a Decision Record on IER # 23 entitled "Pre-Approved Contractor Furnished Borrow Material # 2, St. Bernard, St. Charles, Plaquemines Parishes, Louisiana, and Hancock County, Mississippi." The document was prepared to evaluate the potential impacts associated with the actions taken by commercial contractors while excavating borrow areas for use in construction of the GNOHSDRRS.

- On 14 March 2008, the CEMVN signed a Decision Record on IER # 11 (Tier 1) entitled "Improved Protection on the Inner Harbor Navigation Canal, Orleans and St. Bernard Parishes, Louisiana." The document was prepared to evaluate potential impacts associated with building navigable and structural barriers to reduce the risk of storm surge and waves from entering the IHNC from Lake Pontchartrain and/or the GIWW-MRGO-Lake Borgne complex. Two Tier 2 documents discussing alignment alternatives and designs of the navigable and structural barriers, and the impacts associated with exact footprints, are being completed (including this document, IER # 11 Tier 2 Borgne).

- On 21 February 2008, the CEMVN signed a Decision Record on IER # 18 entitled "Government Furnished Borrow Material, Jefferson, Orleans, Plaquemines, St. Charles, and St. Bernard Parishes, Louisiana." The document was prepared to evaluate the potential impacts associated with the actions taken by the USACE while excavating borrow areas for use in construction of the GNOHSDRRS.

- On 14 February 2008, the CEMVN signed a Decision Record on IER # 19 entitled "Pre-Approved Contractor Furnished Borrow Material, Jefferson, Orleans, St. Bernard, Iberville, and Plaquemines Parishes, Louisiana, and Hancock County, Mississippi." The document was prepared to evaluate the potential impacts associated with the actions taken by commercial contractors while excavating borrow areas for use in construction of the GNOHSDRRS.

- On 20 September 1985, the CEMVN signed SIR #11 entitled "Continued Maintenance Gulf Intracoastal Waterway; Petit Anse, Tigre and Carlin Bayous; and Bayou Grosse Tete, Louisiana." This report evaluated the impacts of continued removal of allowable overdepth and advanced maintenance during routine maintenance dredging and found that this action would have no additional impacts on the human environment.

- In September 1976, the Final Environmental Statement entitled "Gulf Intracoastal Waterway; Petit Anse, Tigre and Carlin Bayous; and Bayou Grosse Tete, Louisiana" was released. This document addresses the operation and maintenance of the Gulf Intracoastal Waterway and associated locks. The portion of the GIWW evaluated extends from the Sbine River to Lake Borgne in the vicinity of Rigolets Pass.

- In June 1973, the Final Environmental Statement entitled "Mississippi River -Gulf Outlet, Michoud Canal, Louisiana" was released. This document addresses the impacts of constructing a ship channel to elevation -36 ft mean low gulf (mlg) over a bottom width of 250 ft, with an 800 ft turning basin at the northern terminus, by enlarging about 1 mile of existing channel of the GIWW between the MRGO and all of the approximately 1.5 miles of the existing canal.

1.4 INTEGRATION WITH OTHER INDIVIDUAL ENVIRONMENTAL REPORTS

In addition to this IER, the CEMVN is preparing a draft Comprehensive Environmental Document (CED) that will describe the work completed and the work remaining to be constructed. The purpose of the draft CED will be to document the work completed by the CEMVN on a system-wide scale. The draft CED will describe the integration of individual IERs into a systematic planning effort. Overall cumulative impacts, a finalized mitigation plan, and future operations and maintenance requirements will also be included. Additionally, the draft CED will contain updated information for any IER that had incomplete or unavailable data at the time it was posted for public review.

The draft CED will be available for a 60-day public review period. The document will be posted on www.nolaenvironmental.gov, or can be requested by contacting the CEMVN. A notice of availability will be mailed/e-mailed to interested parties advising them of the availability of the draft CED for review. Additionally, a notice will be placed in national and local newspapers. Upon completion of the 60-day review period all comments will be compiled and appropriately addressed. Upon resolution of any comments received, a final CED will be prepared, signed by the District Commander, and made available to any stakeholders requesting a copy.

Mitigation for unavoidable impacts to the human and natural environment described in this and other IERs will be addressed in separate mitigation IERs. The CEMVN has partnered with Federal and Louisiana State resource agencies to form an interagency mitigation team that is working to assess and verify these impacts, and to look for potential mitigation sites in the appropriate hydrologic basin. This effort is occurring concurrently with the IER planning process in an effort to complete mitigation planning and construct mitigation projects expeditiously. As with the planning process of all other IERs, the public will have the opportunity to give input on the proposed work. These mitigation IERs will, as described in section 1 of this IER, be available for a 30-day public review and comment period.

1.5 PUBLIC CONCERNS

Throughout southern Louisiana, one of the greatest areas of public concern is reducing risk of hurricane, storm, and flood damage for businesses and residences, and enhancing public safety during major storm events. Hurricane Katrina forced residents from their homes, temporarily closed businesses, and, due to extensive flooding, made returning to their homes and businesses in a timely manner unsafe.

In public meetings held from March 2007 through June 2008, including 7 February 2008, 10 March 2008, 10 and 17 April 2008, and 7 and 13 May 2008, 4 June 2008, and 1, 17 and 29 July 2008, several public concerns were raised regarding improved protection on the IHNC.

Citizens in both Orleans and St. Bernard Parishes expressed concern over inadequate hurricane and storm damage risk reduction and difficulty in insuring private property during the planning and execution of the proposed project. Concerns were also expressed regarding potential human environmental impacts that could be experienced during construction, including increased noise, damage to transportation infrastructure, damage to homes and businesses from vibration during pile driving and construction vehicle movement, and disruption of historical and cultural resources. Additionally, concerns were expressed over possible land use restrictions or “takings” of private property for the sake of hurricane and storm damage risk reduction and possible impacts to the natural environment, such as wetland loss and potential impacts to threatened and endangered species. Furthermore, citizens asked CEMVN to consider any impacts the project could have on the water table, and warned that groundwater could be contaminated if pipelines carrying chemicals were damaged during construction. Comments were voiced about the possible hazards of construction in and near residential streets where children play.

Other public concerns were raised regarding the salinity of the water and the effect that this project would have on any fresh water diversion projects. Concerns regarding wetland restoration and the impacts to the environment have also been expressed. The public also expressed concerns regarding the cumulative impact of this project and the other projects within the GNOHSDRRS.

Lower Ninth Ward, New Orleans East, and St. Bernard Parish residents communicated an urgent desire to see the MRGO closed, and recommended that any hurricane and storm damage risk reduction project built to protect the IHNC should not protect Orleans Parish at the expense of other areas.

Residents have voiced the opinion that the alignment for this project should be placed as close to Lake Borgne as possible.

Public concerns also have been expressed regarding navigation. The public would like for all barges and ships to be evacuated from the protected INHC area during storm events. A primary concern expressed by local citizens, involved operation of the gates during and after construction. Because a barge gate does not open and close as quickly as a sector gate, the barge industry expressed concern for delay in shipping operations and the economic costs associated with operational delays if a barge gate was constructed instead of a sector gate.

The barge industry also requested that the Army Corps assume operational responsibility for any gates on the GIWW following construction and development of an operations/communications plan as part of this proposed action. Operations are normally the function of the State of Louisiana as the project is turned over to the state following completion of the Federal action. With respect to gate closure prior to and following a storm event, the barge industry prefers all gates to remain open until Condition Zulu is declared by the Coast Guard (12 hours prior to hurricane landfall); and likewise to be opened as soon as possible following passage of the storm as barges are frequently ready to operate soon after the passage of the storm to begin supply shipments.

With respect to design and location of the structures, the barge industry provided input to ensure that the proposed gate design would be adequate to accommodate the anticipated traffic along the GIWW. For example, the industry expressed concern regarding alternatives 1 and 2 as being potentially too close to the Paris Road bridge such that tows would need to be broken to allow for safe passage. If tows had to be broken, the industry argued that the project design would need to provide adequate mooring spaces to secure tows during reconfiguration operations.

Safety concerns regarding the width of the GIWW gate have been expressed. The Corps' Engineering Research & Development Center (ERDC) conducted an analysis which concluded that the span width of the GIWW structure would not adversely effect navigation. Secondly, the width of the GIWW gate, 150 ft, is based on the authorized dimensions of the GIWW itself. Based on CEMVN's current knowledge, a gate width of 150 ft on the GIWW is safe for navigation. However, the gate would be designed to withstand barge impact such that the hurricane and storm damage risk reduction system would not be compromised due to a collision. The CEMVN has committed to provide safe navigation through the GIWW structures during several meetings with our navigation partners and stakeholders. As such, the CEMVN and navigation industry agreed to conduct an extensive navigation simulation study, led by the ERDC, to determine the configuration of the GIWW structure and reconfirm the safety of the proposed gate dimension. The team will run various simulations, including the bypass channel, the barge swing gate, the sector gate, and running a two-way traffic scenario using both gates.

Other navigation industry concerns considered and incorporated into the project design include the need to minimize operational impacts to the industries such as during construction and tie-in to the levee system, the need to maintain an adequate turning radius into the Michoud Canal, and the need to minimize impacts to the pipeline operations.

1.6 DATA GAPS AND UNCERTAINTY

At the time of completion of this report, complete engineering designs and documentation had not been completed for all of the alternatives. This environmental impact analysis is based on preliminary designs and best professional judgment by the technical experts regarding the proposed actions and alternatives. Final engineering details of the proposed action could vary based on the final design. Estimates of materials necessary to construct the project were developed from best professional judgment and preliminary designs reports. The alternative features and associated numbers developed were used to quantify the magnitude of the proposed actions and not to prescribe detailed materials, quantities, or design specifications.

Uncertainty in the final engineering design and construction as well as slight changes to existing conditions in the future could change the impact assessments as discussed in this document. For example, access routes to the construction areas are dependent upon many variables that frequently change (weather, traffic conditions, road conditions, construction materials used, fuel prices, etc). Large quantities of construction materials would be delivered to the project area, as well as to other ongoing 100-year level of protection projects in the New Orleans Metropolitan Statistical Area (MSA). The sources for these materials and the transportation routes for delivering them have not been fully determined. Transportation of materials to construction sites could have localized short-term impacts to transportation corridors. Long-term impacts to road surfaces cannot be fully quantified at this time until the sources of all materials and transportation routes have been fully defined. All applicable new data will be reviewed as it becomes available, and CEMVN is currently completing a system-wide transportation analysis to better quantify these impacts.

Secondly, safe water elevation (SWE) studies are underway for the existing levees and floodwalls on the IHNC and GIWW between Lake Pontchartrain and the proposed action alignment. These studies are intended to determine whether any modifications or remedial actions are necessary to ensure that these levees and floodwalls meet current design criteria and future conditions with a barrier at Seabrook and within the Borgne 1 location range.

This data and any changes to the conclusions provided in this document will be evaluated and incorporated into future documents (including the draft CED). However, because of the critical nature and vital necessity for hurricane and storm damage risk reduction, and our present knowledge of impacts on society (human environment) and cultural resources caused by storms and hurricanes, construction of this GNOHSDRRS project is not being delayed pending future information.

2.0 ALTERNATIVES

2.1 ALTERNATIVES DEVELOPMENT AND PRELIMINARY SCREENING CRITERIA

NEPA requires, among other things, that while analyzing alternatives to the proposed action, a Federal agency consider an alternative of "no action." Likewise, Section 73 of the Water Resources Development Act of 1974 (PL 93-251) requires Federal agencies to give consideration to non-structural measures to reduce or prevent flood damage. As part of the Tier 1 IER # 11, the no action alternative as well the non-structural and create wetlands alternatives were evaluated and eliminated from further consideration for the Borgne complex project area because none accomplished the purpose and need of the project.

The No Action Alternative was evaluated in detail in the Tier 1 document. Because this alternative did not meet the defined purpose and need in the Tier 1 document, it was not selected for further consideration in the Tier 2 document. Likewise, although non-structural measures are widely recognized as reasonable complementary measures to other hurricane and storm damage risk reduction measures, they were eliminated from further analysis in the Tier 1 document because they do not meet the needs of the project as a stand-alone alternative for providing the 100-year level of protection. Additionally, the wetlands creation alternative was not considered an effective engineering solution in providing 100-year hurricane protection as a stand-alone alternative. However, the Tier 1 document did recognize the benefits wetlands creation can provide including flood reduction, water quality improvement and, in some instances, storm surge reduction. The analysis of these alternatives is incorporated by reference, but is not discussed further in this Tier 2 document.

A range of reasonable alternatives for this Tier 2 document was formulated through input by the CEMVN Project Delivery Team (PDT), Value Engineering Team, engineering and design consultants, as well as local government, the public, and resource agencies to achieve the purpose and need of this project. Once a full range of alternatives was established, a preliminary screening was conducted by CEMVN to identify alternatives that would proceed through further analysis. The criteria used to make this determination included engineering effectiveness, risk reduction, navigation safety, economic efficiency, and environmental and social acceptability. Those alternatives that did not adequately meet these criteria were considered infeasible and, therefore, were eliminated from further study in this IER.

2.2 DESCRIPTION OF THE ALIGNMENTS AND ALTERNATIVES

Eight potential alternatives to improve protection for the Borgne area were considered. These eight potential alternatives were carried forward after initial screening and are shown in figure 2. These alternatives, as summarized in table 1, include:

Alignment 1. Deep draft gate (350 ft by 40 ft) on the GIWW east of Paris Road Bridge and west of Michoud Slip. The gate would be built to elevation +32 ft. This would include the replacement and/or modification of approximately 39,000 linear feet (LF) of floodwalls and levees along the GIWW, Michoud Canal, and MRGO, and 22 gates[1] including the existing Bayou Bienvenue Control Structure.[2]

Alignment 2. Deep draft gate (350 ft by 40 ft) on the GIWW immediately east of Michoud Slip. The gate would be built to elevation +32 ft. This would include the replacement and/or modification of approximately 28,000 LF of floodwalls and levees along the GIWW, Michoud Canal, and the MRGO and 22 gates including the existing Bayou Bienvenue Control Structure.

Alignment 3. Shallow draft gate and bypass gate (150 ft by 16 ft each) on the GIWW approximately 500 ft east of the Michoud Canal; closure structure on the Mississippi River Gulf Outlet (MRGO) just north of the existing Bayou Bienvenue flood control gate; connected by either a floodwall (alternative 3a) or a geotextile levee (alternative 3b) across the marsh. The gates would be built to +26 ft. and the barrier would be built to +24 ft (floodwall) or +30 ft (geotextile levee). This alignment and alternatives would include the rebuilding of the existing Bayou Bienvenue flood control gate and require relocation of two pipelines. Construction of an access channel to construct the floodwall would yield approximately 900,000 cubic yards (cy) of dredge material for beneficial use.

Alignment 4. Shallow draft gate and bypass gate on the GIWW (150 ft by 16 ft each) approximately 1,150 ft east of the Michoud Canal; closure structure on the MRGO approximately 2,700 ft southeast of the existing Bayou Bienvenue flood control structure; connected by either a floodwall (alternative 4a) or a geotextile levee (alternative 4b) across the marsh, with a navigable gate at the crossing of Bayou Bienvenue (56 ft by 8 ft). The gates would be built to +26 ft and the barrier would be built to +24 ft (floodwall) or +30 ft (geotextile levee). Construction of an access channel to construct the floodwall would yield approximately 1,400,000 cy of dredge material for beneficial use.

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1 The 22 gates include 18 twenty-feet wide sliding vehicular gates along the Michoud Canal, two similar vehicular gates within the Entergy property, an additional opening within the Entergy property that has a raised ramp, but no current gate, and an existing sector gate at the Bayou Bienvenue Control Structure.

2 Flood control systems east of Michoud Canal are analyzed in IER # 7 and flood control systems east of the existing Bayou Bienvenue gate are analyzed in IER # 10.

Alignment 5. Shallow draft gate and bypass gate (150 ft by 16 ft each) on the GIWW approximately 5,100 ft east of the Michoud Canal; closure structure on MRGO approximately 7,000 ft southeast of the existing Bayou Bienvenue flood control gate; connected by either a floodwall (alternative 5a) or a geotextile levee (alternative 5b) across the marsh, with a navigable gate at the crossing of Bayou Bienvenue (56 ft by 8 ft). The gates would be built to +26 ft and the barrier would be built to +24 ft (floodwall) or +30 ft (geotextile levee). Construction of an access channel to build the floodwall would yield approximately 4,700,000 cy of dredge material for beneficial use.

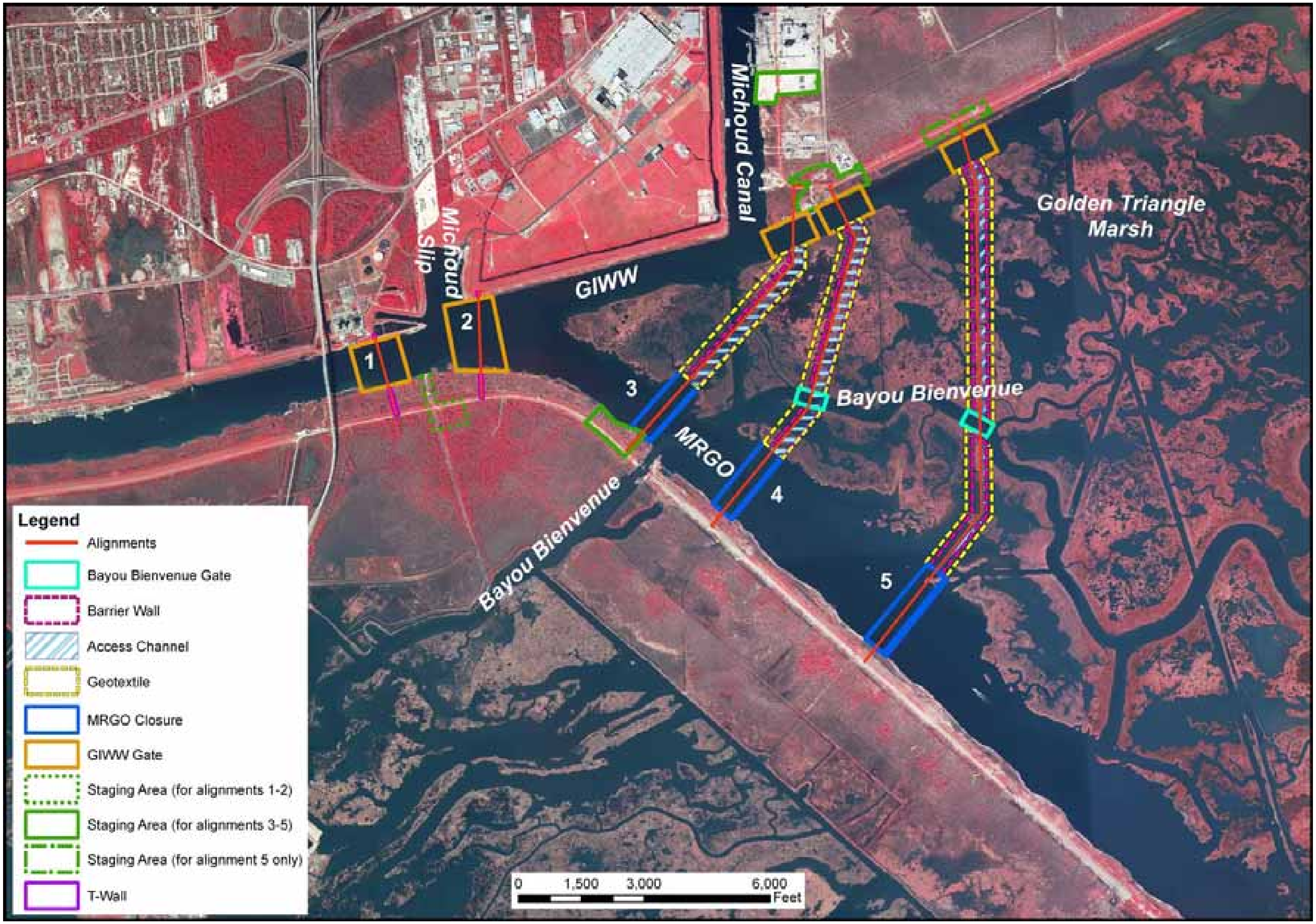

Figure 2. Potential Alignments for Improved Protection on the IHNC, Orleans and St. Bernard Parishes, Louisiana – Tier 2 Borgne

Table 1. Proposed Action and Alternatives for Tier 2 Borgne Project Area

Alignment	Alternative	Barrier		MRGO crossing	GIWW Gate		New Bayou Bienvenue Gate	Raise Existing Levees and Floodwalls	Replacement of Existing Bayou Bienvenue Gate
		Floodwall	Earthen Levee w/ Geotextile	Structural Wall or Sheet Pile Cell	Shallow Draft (Sector, Vertical Lift or Concrete Barge)	Deep Draft	Sector, Vertical Lift or Concrete Barge Gate		
1	1	n/a	n/a	n/a	n/a	✓	n/a	✓	✓
2	2	n/a	n/a	n/a	n/a	✓	n/a	✓	✓
3	3a	✓		✓	✓	n/a	n/a	n/a	✓
	3b		✓	✓	✓	n/a	n/a	n/a	✓
4	4a	✓		✓	✓	n/a	✓	n/a	n/a
	4b		✓	✓	✓	n/a	✓	n/a	n/a
5	5a	✓		✓	✓	n/a	✓	n/a	n/a
	5b		✓	✓	✓	n/a	✓	n/a	n/a

n/a = Not applicable to this alignment
✓ = Feature under this alignment

On June 5, 2008 the Assistant Secretary of the Army for Civil Works forwarded the U.S. Army Corps of Engineers Chief's Report for the Mississippi River-Gulf Outlet Deep-Draft De-authorization Study to Congress. The report recommended deauthorization and construction of a closure structure across the MRGO just south of Bayou La Loutre near Hopedale, Louisiana. Therefore, the MRGO Federal navigation channel is deauthorized and this IER # 11 -Tier 2 Borgne report assumes that a closure structure will be built at Bayou La Loutre in the near future. Based on this assumption, Alignments 3, 4, and 5 propose construction of a barrier across the MRGO rather than construction of a navigable deep draft gate.

Gate Types: Three types of gates are being considered for the GIWW and Bayou Bienvenue structures: sector gates, vertical lift gates, and concrete barge gates. The sector gate would be designed in a traditional configuration (see figure 3) similar to the existing Bayou Bienvenue sector gate; it would consist of two steel prefabricated gates which swing from abutments on both sides of the channel opening.

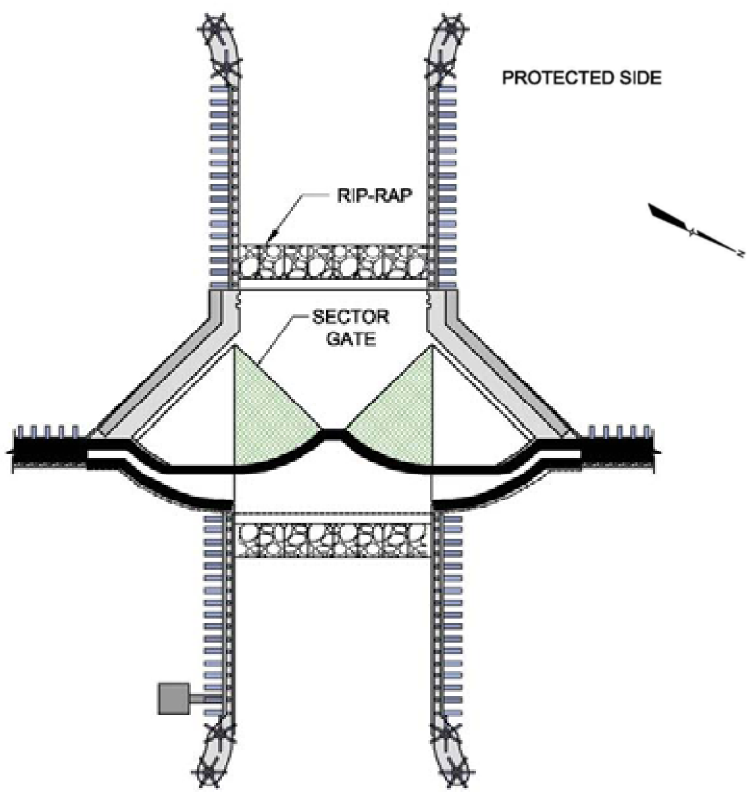

Figure 3. Example of the Sector Gate

The vertical lift gate would consist of two concrete pilasters that support a concrete or steel bridge that spans the channel and provides structural support for the vertical floodgate (figure 4). An engine would be required to move the floodgate from the open/stored position just below the bridge to the closed position at the bottom of the pilasters across the channel opening.

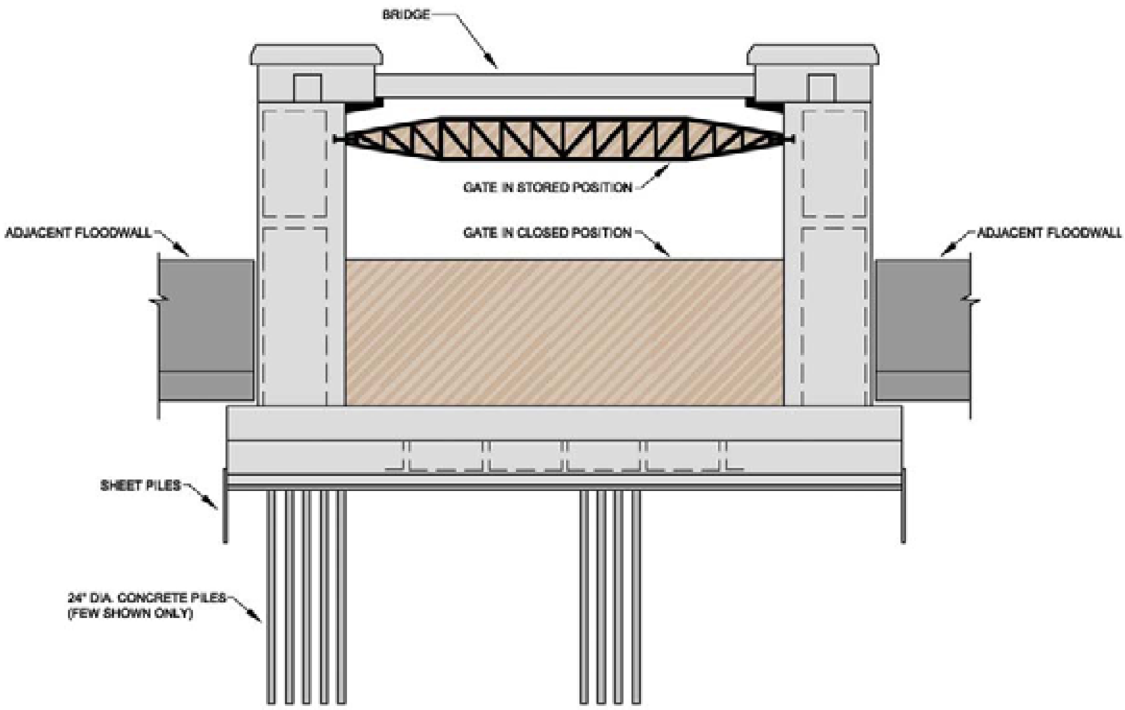

Figure 4. Example of the Vertical Lift Gate

The concrete barge gate would be a swing barge designed as an open cell caisson with the ability to be filled with water (ballasted) and float from the open to the closed position. Two abutment structures would sit spanning the channel opening and would create a seal with the swing gate in the closed position (figure 5). When in the open and closed positions, the swing barge would be sunk in place and would sit on a pile-supported landing.

Each of these gate types would have a similar footprint and would have similar environmental impacts. Therefore the gate type is not differentiated in the impacts analysis of this document. However, the type of gate has been selected for the proposed action. The selection rationale for gate type, which relies heavily on operation and maintenance considerations, is provided in section 5.

Barrier Across the Marsh: The two types of barriers across the marsh being considered are a structural wall or an earthen levee with geotextile fabric and mixed-soil cement columns. The structural wall would be plumb piles jet-grouted together to create an impervious barrier. The overall barrier footprint, including the structural wall, supporting piles, floodside access channel and protected side plunge pool would be approximately 350 ft. Pre-formed cast-in-place panels would be installed on the top of the concrete cap to complete the structural wall. Also, a concrete roadway would be built on top of the panels to provide long term maintenance access for the system.

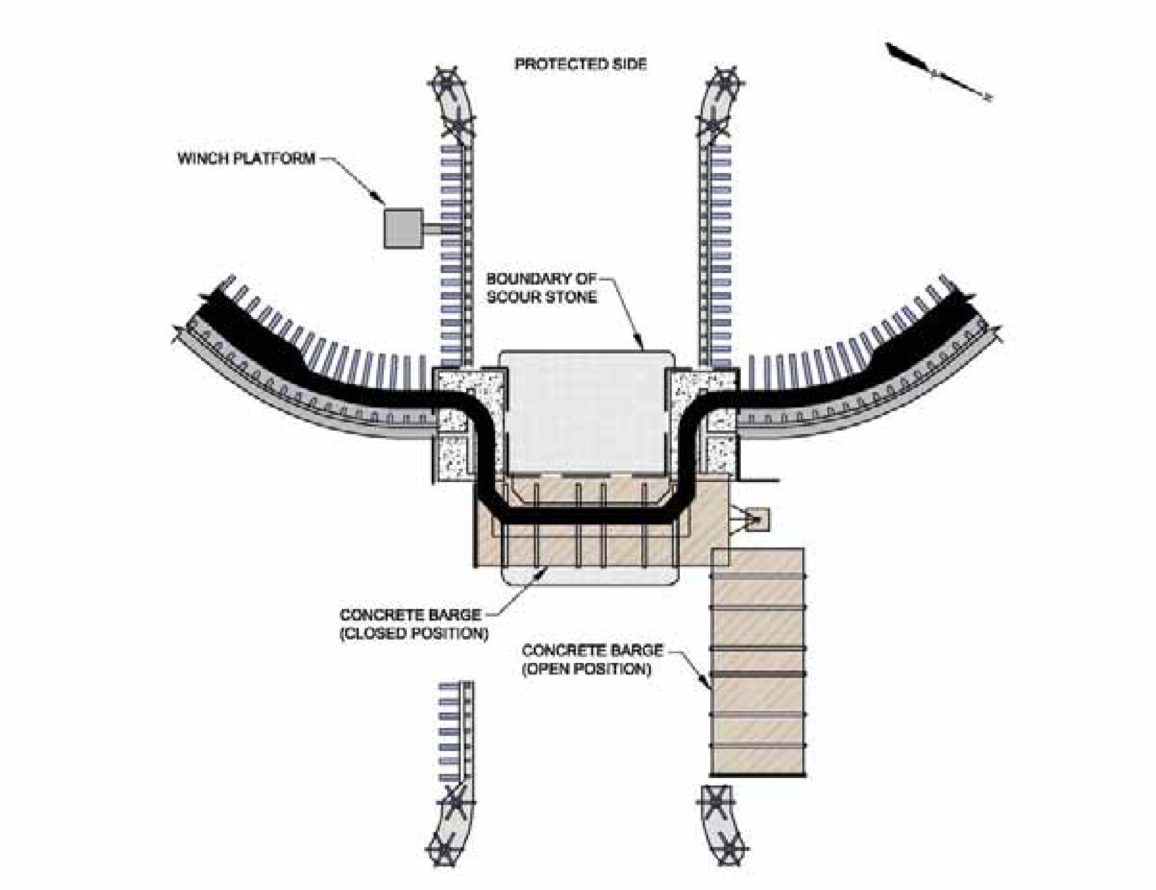

Figure 5. Example of the Concrete Barge Gate

The earthen levee with geotextile fabric and mixed soil-cement columns (figure 17) would be similar to a traditional earthen levee but would incorporate mixed soil-cement columns and geotextile fabric to increase the load bearing capacity of the underlying soils and reduce the required stability berm width, thus reducing the material requirements, project footprint and wetland impacts. The width of the berm in the earthen levee with the geotextile fabric and mixed-soil cement columns below it would be approximately 271 ft. The geotextile fabric with a sand pad would be 600 ft wide; dry-mixed soil cement columns would also be installed every 6 ft along the alignment from elevation 0.0 to -75.0 ft. In addition, a mixed-soil cement curtain would be needed to stop seepage.

The width of the earthen levee with geotextile fabric is nearly twice the width of the structural wall (600 ft and 350 ft, respectively), but one-third the size of a traditional earthen barrier; therefore, both barrier types (structural wall and levee with geotextile fabric) are carried through the environmental impact analyses for the various alternatives considered in this document.

Closure Structure at the MRGO (MRGO crossing): The two types of closure structures being considered for the MRGO crossing are a structural wall and interlocked sheet pile cells. Both alternatives would require the filling of the channel to an elevation -15 with rock/sand backfill and rip rap for support of the wall or sheet pile cells. The structural wall across MRGO would be a braced concrete wall structure which would consist of concrete plumb piles jet-grouted together to create an impervious barrier. The floodwall would also be supported by battered steel piles placed on every other 66 inch plumb pile. Additional rock/sand backfill and riprap would be placed on both the flood and protected sides for additional structural stability and to resist erosion and scour from waves and overtopping. Pre-formed cast-in-place panels would be installed on the top of the concrete cap to complete the structural wall. Also, a concrete roadway would be built on top of the panels to provide long term maintenance access for the system. The bottom width of the completed structural wall system would be approximately 380 ft at its widest point.

The sheet pile cells structure across MRGO would consist of a barrier of interlocked steel sheet piles, filled with compacted sand fill and flanked by rock and sand. The sheet piles would be configured to make a series of adjacent 50 ft diameter approximate circles, or cells. The cells would be connected by interlocked sheet pile arches on both the flood and protected side of the cells. A roadway would be constructed across the top of the sheet pile cells. The sheet pile cells would be flanked on either side by a massive sand and rock plug. The width of the completed sheet pile cell wall would be approximately 585 ft.

Since the bottom width of the structural wall and sheet pile cells structures (380 ft and 585 ft, respectively) are similar, the footprints of these two types of barriers and the resulting environmental impacts would also be similar. Therefore the barrier type (structural wall versus sheet pile cell structures) is not differentiated in environmental impacts analyses in this document.

Although it is the CEMVN's intent to employ an integrated, comprehensive and systems based approach to hurricane and storm damage reduction in raising the GNOHSDRRS to the 100-year level of protection, each project area has its own range of alternatives. This approach allows for individual project alternative decisions to be made in a manner cognizant of unique local circumstances. At the same time, the alternatives analysis and selection remain integrated and comprehensive, considering reaches in relation to one another and other past, current, and reasonably foreseeable actions by CEMVN and other entities within the project study area. As such, the alternatives description below is organized by alignment, noting those elements that are common among all potential alignments.

2.3 PROPOSED ACTION

Alternative 4a, MRGO Structure, GIWW and Bayou Bienvenue Gates, and Wetland Structural Wall Barrier in Alignment 4

The proposed action consists of constructing approximately two miles of a new floodwall/gated system extending from the Michoud floodwall north of the GIWW to the levee on the west side of the MRGO in alignment 4 (figure 6). The height of the structure would be approximately 24 ft to 26 ft. Note: all elevations described reference the North American Vertical Datum (2004.65) (NAVD88). The floodwall/gates system would cross the GIWW, Bayou Bienvenue, the MRGO, and the Golden Triangle marsh. The system consists of a flood control sector gate

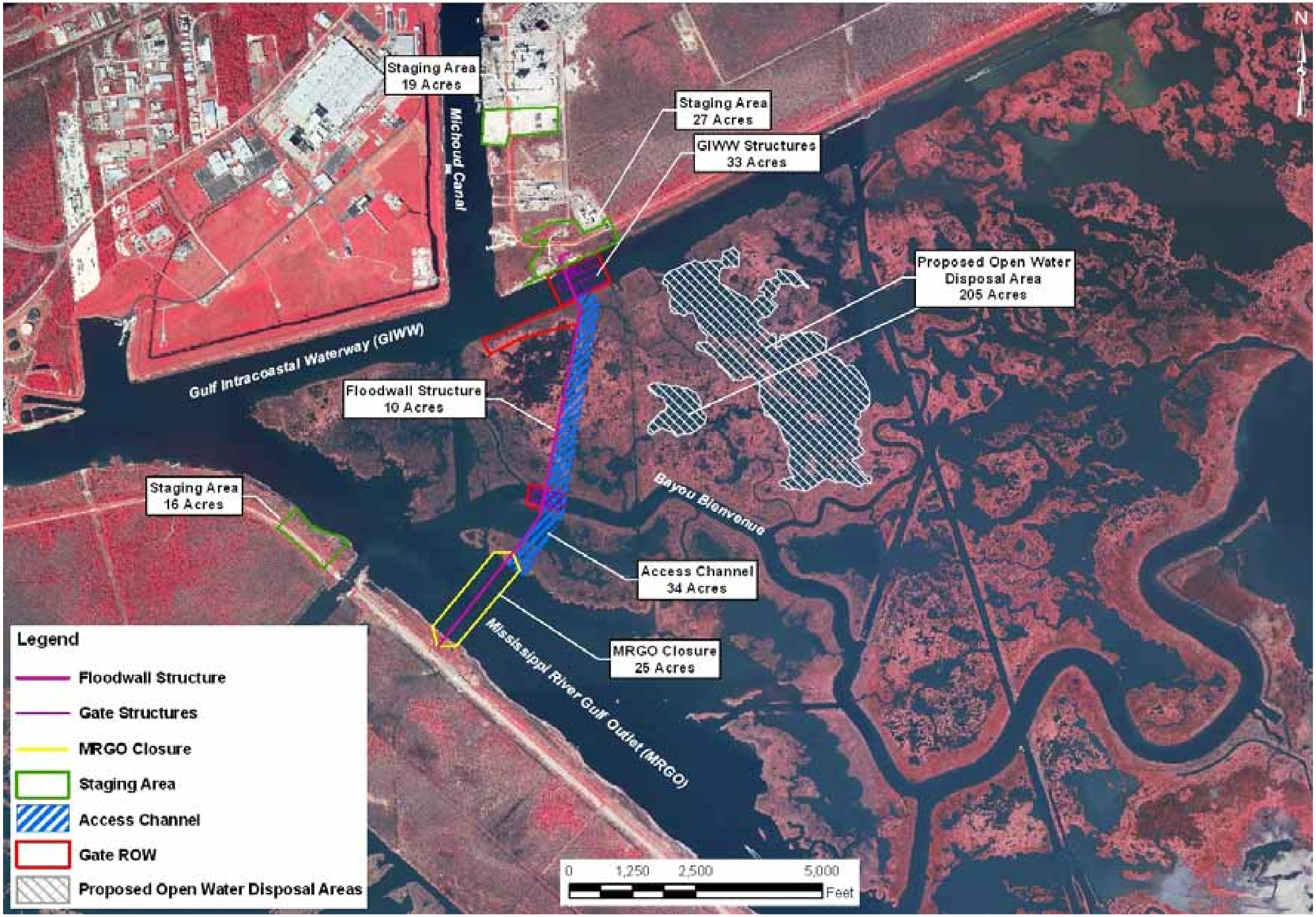

Figure 6. Proposed Action: Alternative 4a (Acreages are Approximate) and Proposed Disposal Areas for Concurrent Beneficial Use of Dredged Material

(approximately 150 ft by 16 ft) and bypass barge gate (approximately 150 ft by 16 ft) at the GIWW (approximately 1,150 ft east of the Michoud Canal), a new navigable flood control sector gate at Bayou Bienvenue (approximately 56 ft by 8 ft), a braced concrete wall across the MRGO (approximately 2,700 ft southeast of the existing Bayou Bienvenue flood control structure), and a concrete floodwall across the marsh between these waterways. The existing Bayou Bienvenue flood control structure would be maintained in its existing condition and could be used to regulate high tide events in the Central Wetlands Area (CWA).

The sector gates on the GIWW and Bayou Bienvenue would be designed in a traditional configuration similar to the existing gate at Bayou Bienvenue on the western side of the MRGO. The sector gates would consist of two steel prefabricated gates which swing from abutments on both sides of the channels. Adjacent to the GIWW sector gate, a bypass swing gate structure would be constructed to allow for continued navigation on the GIWW during construction and maintenance of the sector gate. The structural wall across the MRGO would be a braced concrete wall structure which would consist of 66 inch concrete plumb piles jet-grouted together to create an impervious barrier. The floodwall also would be supported by battered steel piles placed on every other 66 inch plumb pile. Additional erosion and scour protection would be placed on both the flood and protected sides for protection from waves and overtopping. Pre-formed cast-in-place panels would be installed on the top of the concrete cap to complete the structural wall. Also, a concrete roadway would be constructed on the top of the wall to provide long-term maintenance access for the system. The bottom width of the completed structural wall would be approximately 380 ft across the MRGO at its widest point.

The concrete structural floodwall connecting the GIWW and Bayou Bienvenue gates and the MRGO floodwall would be plumb piles jet-grouted together to create an impervious barrier. To construct the floodwall, a 350 channel would be dredged through the marsh. The floodwall would be constructed within this dredged channel, and the remaining excavated area would be developed into a 250 ft access channel on the flood side of the structural wall for use during construction and after construction for maintenance purposes and a 96 ft plunge pool on the protected side of the structural wall to absorb impact from overtopping.

The 250 ft width of the access channel is necessary due to the accelerated project schedule, which requires that multiple barges utilize the channel simultaneously for cranes driving piles, material storage and staging, and the moving of materials to various work locations. Multiple pile driving crews would be working along the face of the floodwall at all times and to ensure continuous operations, multiple supply barges may need to be towed to the working barges. This access channel must accommodate at least two possible scenarios based on the expedited schedule of this project: 1) an installation barge with nearby one-way traffic (figure 7); and 2) two-way traffic occurring on the flood side of an installation barge (figure 8). Specifically, figure 7 depicts a crane driving piles alongside a staged material barge, a second material barge brought in to replace the one currently next to the crane, and a barge with tow passing flood side of both material barges on its way to another work location. Figure 8 illustrates a scenario in which two tows pass directly behind a pile driving barge with a single material barge alongside. A minimum of six foot clearances between barges would be needed for safety reasons.

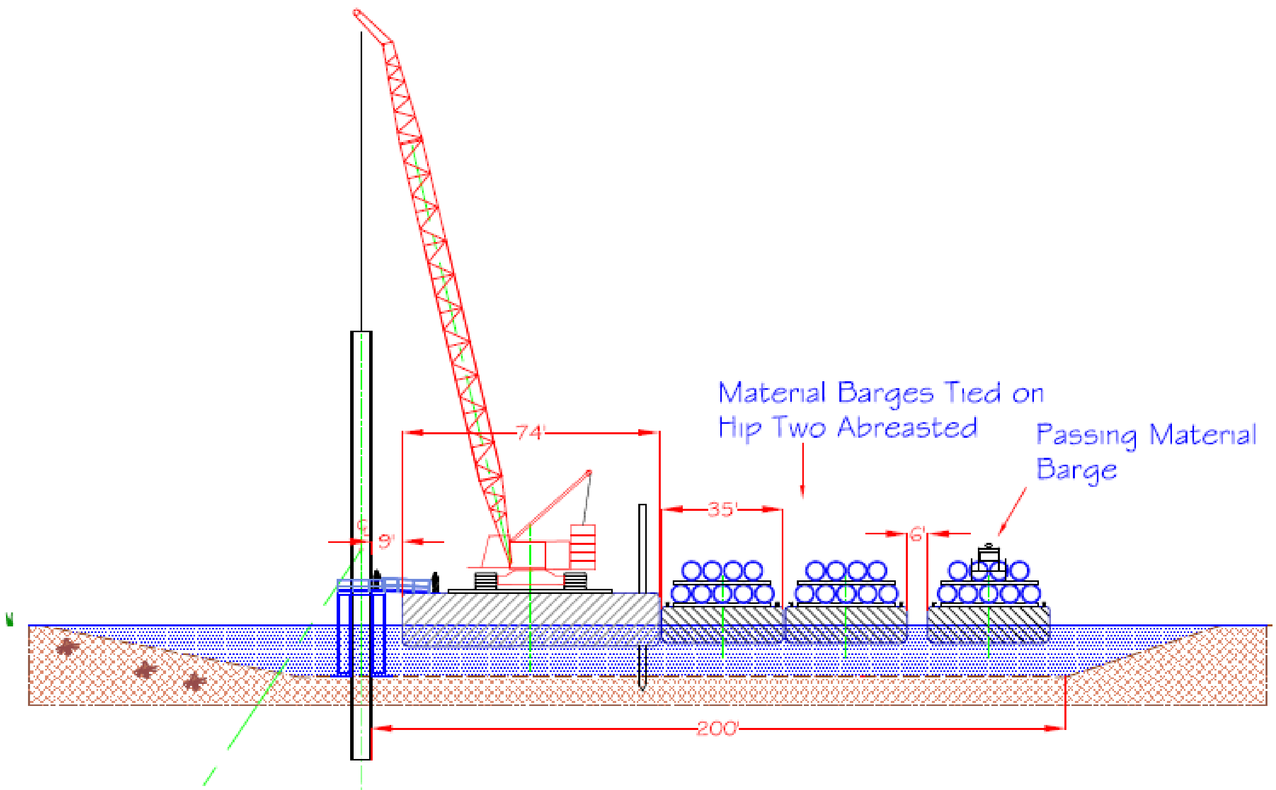

Figure 7. Possible Access Channel Traffic Scenario 1

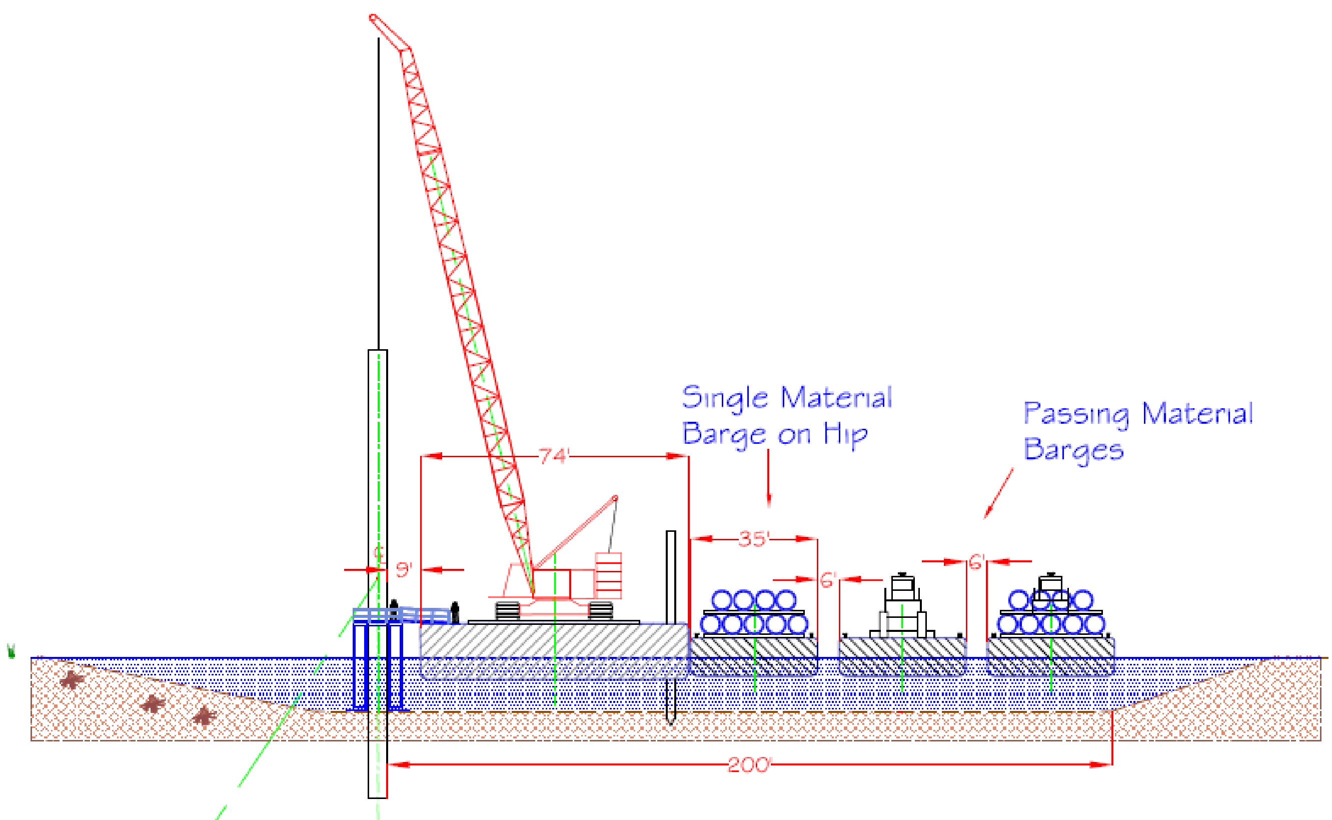

Figure 8. Possible Access Channel Traffic Scenario 2

In order to provide some level of flood protection prior to the 2009 hurricane season, this project is being proposed in two phases. The first phase, called "advanced measures," should be in place by June 2009, in preparation for the 2009 hurricane season. The second phase, called "final configuration," should be completed by 2011. The paragraphs below describe the phases of construction for each component.

Advanced Measures

As part of the advanced measures phase of the project, a bypass swing gate structure would be constructed across a portion of the GIWW to provide an approximately 150 ft wide navigation channel opening with a sill elevation of -16 ft and provide protection to an elevation of +26 ft. The gate structure would tie into the New Orleans East levee system by means of a pile-supported T-wall. To allow continued GIWW navigation during construction of the bypass gate, a 150 ft wide bypass channel would be dredged adjacent to and south of the bypass gate. This bypass channel would be used for approximately 9 months during construction of the bypass gate. Once the bypass gate is operable, the bypass gate would serve as the means of continued navigation on the GIWW during construction of an adjacent sector gate; the adjacent bypass channel would be occupied by the concrete floodwall described below. A cofferdam would be installed in the area adjacent to and north of the GIWW bypass swing gate structure to provide protection during the construction phases prior to the installation of the GIWW sector gate (figure 9). The cofferdam would provide protection to an elevation of +20.75 ft and would temporarily cut off flow in this portion of the GIWW. The cofferdam would also provide an area to build the sector gate during the second phase of construction. The width of the GIWW in this area is approximately 740 ft.

At Bayou Bienvenue, a sector gate structure would be constructed to provide a 56 ft wide permanent navigation pass with a sill elevation of -8 ft and protection to an elevation of +26 ft. During the advanced measures, a cofferdam would be installed in the area of the proposed Bayou Bienvenue sector gate structure. This temporary closure would have approximately four culverts traversing it, with each having a diameter of 4 ft. Screens with 4-5 inch mesh would be provided on the ends of these culverts to prevent substantive blockage. This cofferdam would provide protection to an elevation of +20.75 ft and the culverts would allow some flow in this portion of Bayou Bienvenue (figure 10). The width of Bayou Bienvenue in this area is approximately 400 ft.

The MRGO crossing would be a braced concrete floodwall, which would provide protection to an elevation of 20.75 ft when advanced measures are complete. The MRGO crossing area would be filled with rock/sand from the current bottom elevation of approximately -34 ft to an elevation of -15 ft prior to installation of the floodwall structure; after the concrete walls and batter pile supports are installed, additional rock/sand backfill and riprap would be placed to an elevation of +5 ft for additional structural stability and to resist scour from water overtopping the wall. The overall MRGO crossing length would be approximately 2,400 ft and the bottom width is estimated to be 380 ft at its widest point.

The advanced measures would include a concrete floodwall that would provide protection to an elevation of +20.75 ft across the wetlands area between the GIWW and MRGO. During construction, an approximately 17 ft deep by 350 ft wide channel would be dredged by a cutter-head dredge between the MRGO to the GIWW. The dredging would be necessary to remove organic sediments in the marsh area in order reach a better substrate for the floodwall construction. The excavated area would be developed into a 250 ft access channel on the flood side of the structural wall for construction access and materials delivery. On the protected side of the floodwall there would be a 96 ft channel that would act as a plunge pool to absorb impact from overtopping. The plunge pool would include scour mats; the actual depth and mat thickness will be determined by models, but the plunge pool is estimated to be approximately 17 ft deep with two ft thick scour mats. The floodwall would have a footprint width of approximately 6 ft.

The excavated area would generate approximately 1,400,000 cy of material dredged material that would be used beneficially within the 205 acre open water disposal area concurrently with the construction of the proposed action (this area will be referred to as the "Beneficial Use Area" throughout this document; shown in figures 6 and 11). Specifically, the dredged material would be directed into open water areas east of the proposed barrier structure via dredge pipe (figure 11). A limited amount of earthen and sheet pile dikes would be constructed to an elevation of +4 ft to semi-contain the dredge material within the open water ponds to prevent seepage of material into existing pipeline canals or the GIWW (figure 11). Dredge pipes would be directed into the southeastern ends of the open water areas and as the areas fill with dredged material the pipes would be backed out towards the entrance to minimize movement of the dredge pipe. A settlement analysis based on a previous study at Lake Borgne indicates the post-primary consolidation settlement height of dredge spoil will not exceed one-third of the height initially placed above the average water surface. Thus, if dredge spoil is placed to an elevation of +4 ft, it would be expected to settle to approximately +1 ft.

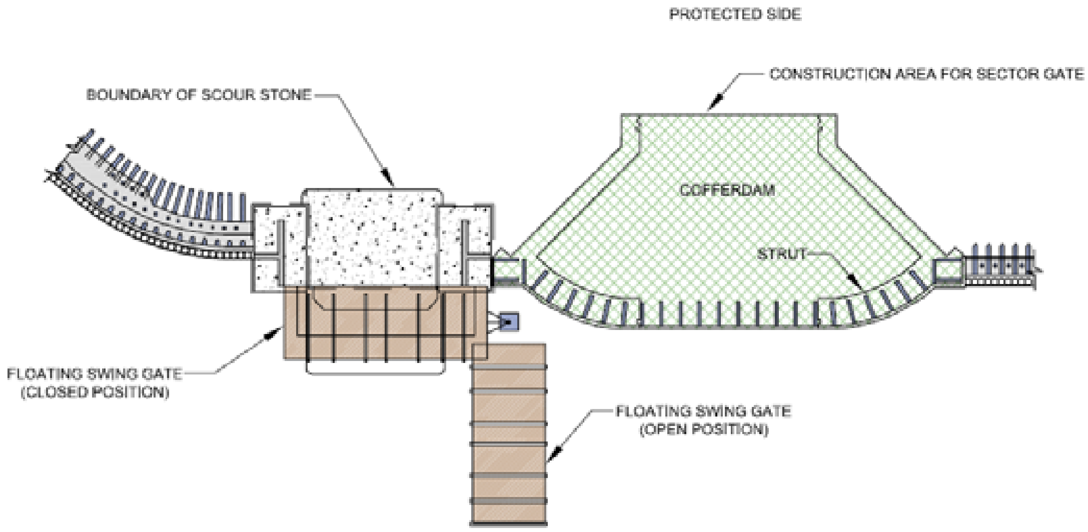

Figure 9. Example of the Advanced Measure Cofferdam & Swing Gate Design on the GIWW

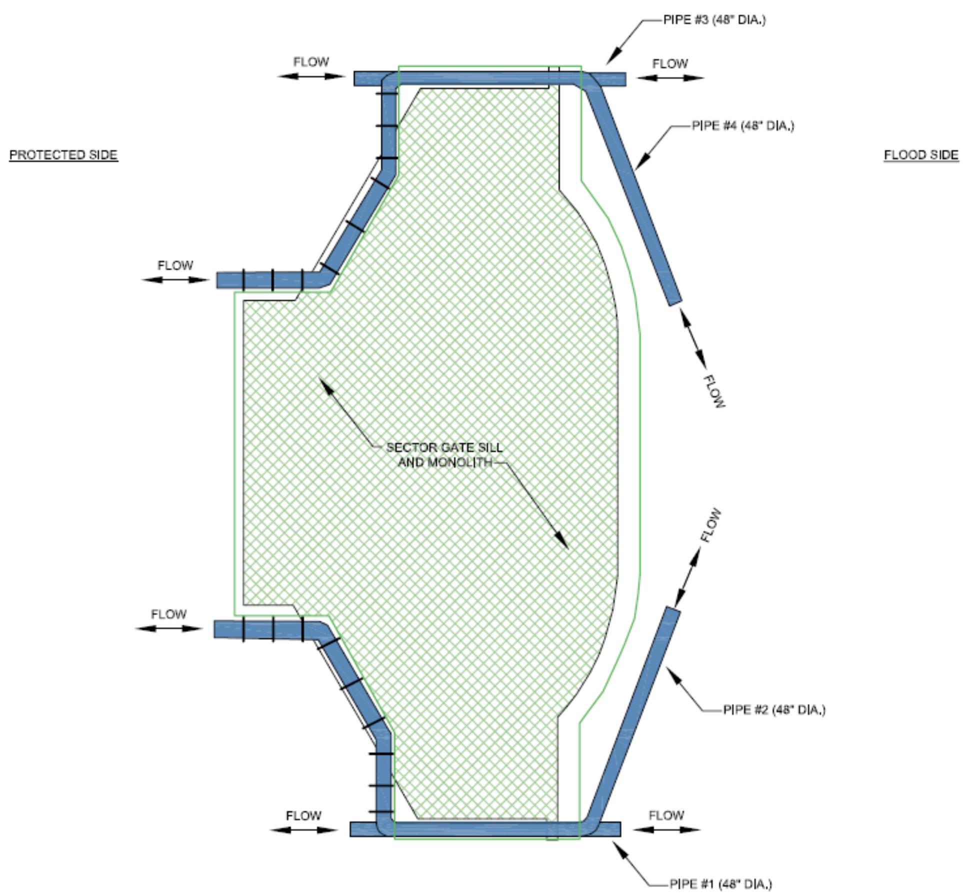

Figure 10. Bayou Bienvenue Advanced Measures Cofferdam

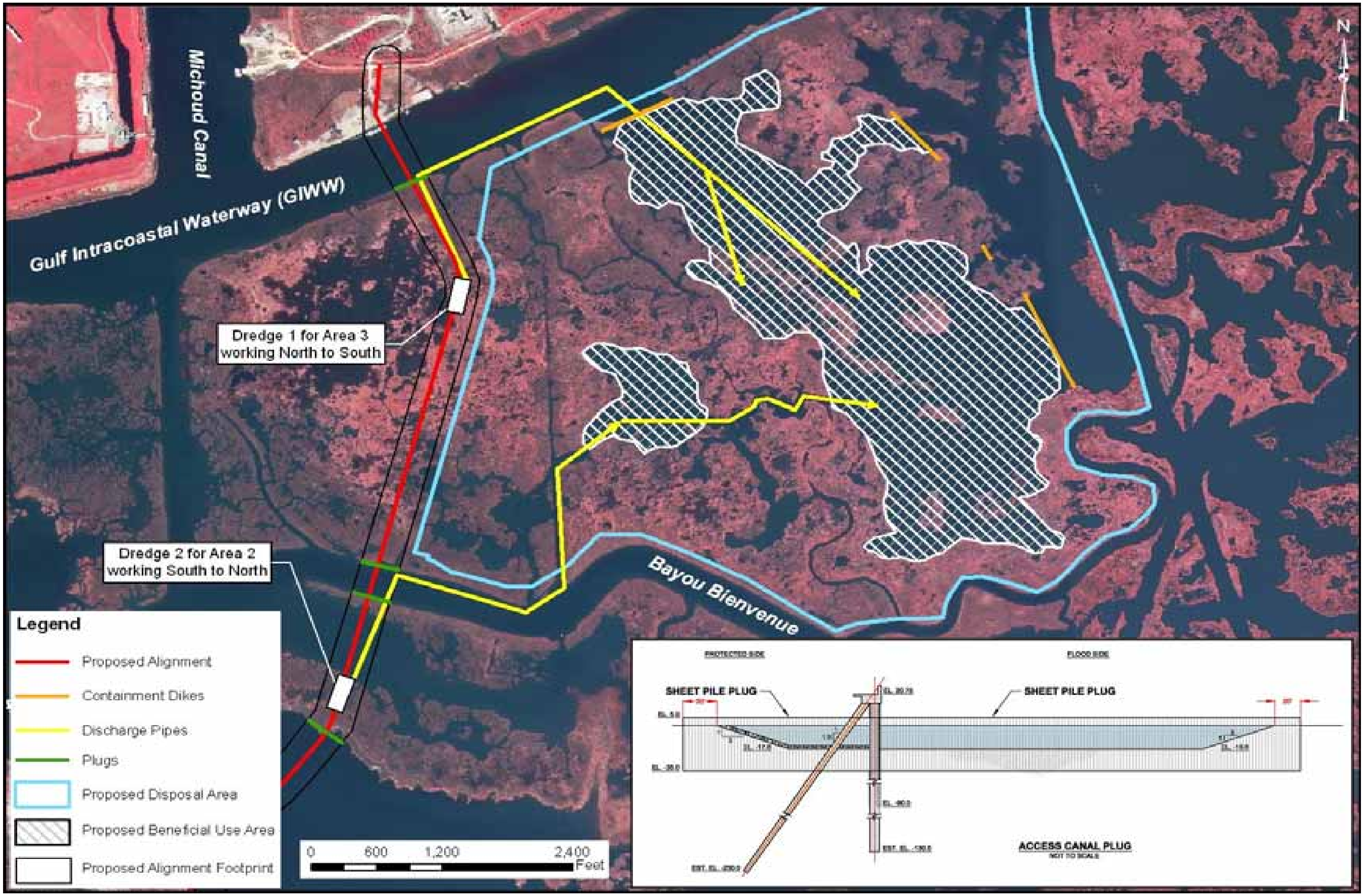

Figure 11. Proposed Beneficial Use Area, Dredge Pipes, and Access Channel Plugs

Final Configuration

The final configuration would include the construction of a sector gate across the GIWW adjacent to the bypass gate, modifications to the MRGO crossing, installation of a sector gate at Bayou Bienvenue, and other additional features to increase the protection and structural resilience of the components constructed during Advanced Measures.

The GIWW sector gate would be installed in the area of the cofferdam adjacent to the GIWW bypass swing gate to provide a 150 ft wide navigation pass with protection to an elevation of +26 ft (figure 12). The bypass gate could be operated under a number of scenarios after completion of the final configuration sector gate, which would involve varying degrees of economic and labor burden on the non-federal sponsor as part of their operation and maintenance responsibilities. The bypass gate could remain closed at all times, except during times in which the GIWW sector gate is closed for maintenance during which the bypass gate would serve as a navigational bypass channel. This would minimize the operational costs of the structure. The bypass gate could remain open all of the time to provide for maximum navigational use and water flow, except during storm events or maintenance activities. The gate could also be operated seasonally to optimize navigation and operational costs, leaving the gate open during non-hurricane season and closing it for the entire hurricane season. Under this last scenario, the bypass gate could be closed at the time the first hurricane of the season enters the Gulf. The gate would remain closed for the remainder of the season in the floating position, allowing some water flow through the system, and sunk into the sealed position when a storm is approaching. The analysis in this report of the impacts for this gate are based on the bypass gate remaining in a closed position after construction of the primary GIWW sector gate is complete. Evaluation of this scenario provides an evaluation that is most likely to have the highest level of adverse impacts.

For the final configuration of the concrete floodwall, cast-in-place concrete panels 5.25 ft tall would be placed on top of the concrete floodwall installed during Advanced Measures, bringing the protection to an elevation of +24 ft (see figure 13). A permanent access roadway for maintenance traffic would be included in the concrete cap design. The access roadway would run along the top of the floodwall.

At Bayou Bienvenue, a single sector gate would be installed in the area of the cofferdam to provide a 56 ft wide navigation pass with protection to an elevation of +26 ft. The Bayou Bienvenue sector gate would normally be maintained in the open position and only closed during tropical storm events. The existing Bayou Bienvenue flood control structure would be maintained in its existing condition and used to regulate high tide events in the CWA.

For the final configuration of the MRGO crossing, cast-in-place concrete panels 5.25 ft tall would be placed on top of the concrete floodwall installed during Advanced Measures, bringing the protection to an elevation of +24 ft (see figure 14). Also, a concrete roadway would be constructed on the protected side of the wall to provide long-term maintenance access for the system.

The gate and wall elevations of this alternative would result in controlled wave overtopping, which could result in up to 225,000,000 cubic feet of overtopping volume entering the protected side portion of the GIWW, MRGO, IHNC and Golden Triangle marsh for the design condition during a storm that produces a 1 percent exceedance surge elevation. This surge elevation has a 1 percent chance of occurring each year. To ensure that the wave overtopping volume remains within acceptable limits and the system can continue to be certified as providing the 100-year level of protection throughout its project life, the structure may require modification such as the addition of panels to the top of the floodwall in the future.

Following construction, the plunge pool and access channel would be closed to navigation and water flow by an engineered plug (see figure 11). Following construction, use of the access channel would be limited to floodwall maintenance activities, such as floodwall integrity inspection and repairs. Restricting navigation to only operation and maintenance on this channel reduces potential shoreline erosion of the eroding Golden Triangle marsh by limiting large wake-producing traffic in the channel, and limits the risk of vessel impact related damages to the floodwall. In addition, shoreline protection would be provided on both banks along the entire length of the access channel. Shoreline protection would consist of riprap, concrete slope paving, geotextiles, or other means. The protection would extend approximately 30 ft into the channel bottom and 5 feet onto the channel bank. Additionally, the scour pad on the protected side portion of this channel would provide shoreline protection as well.

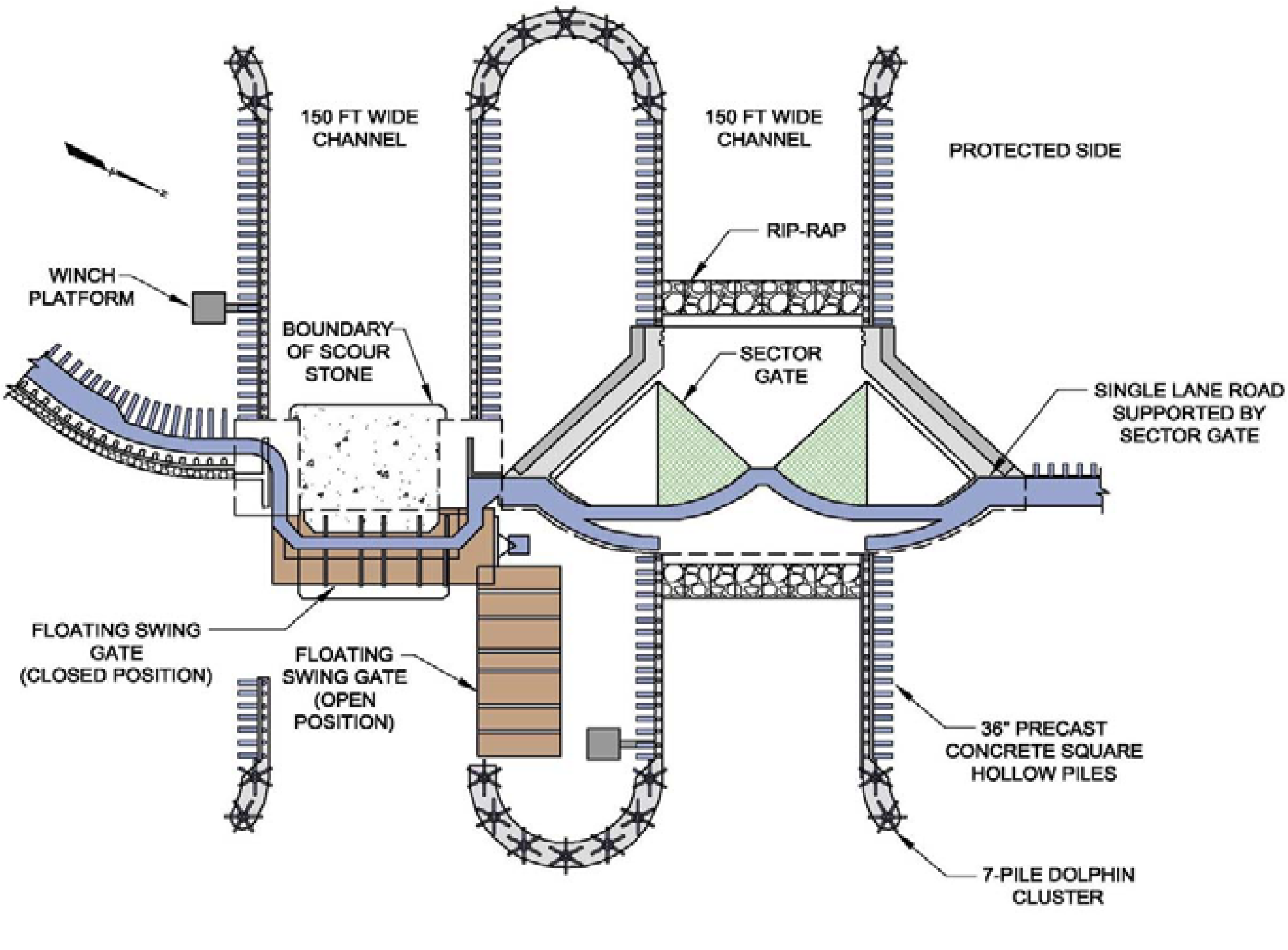

Figure 12. Final Configuration of GIWW Sector and Swing Gate

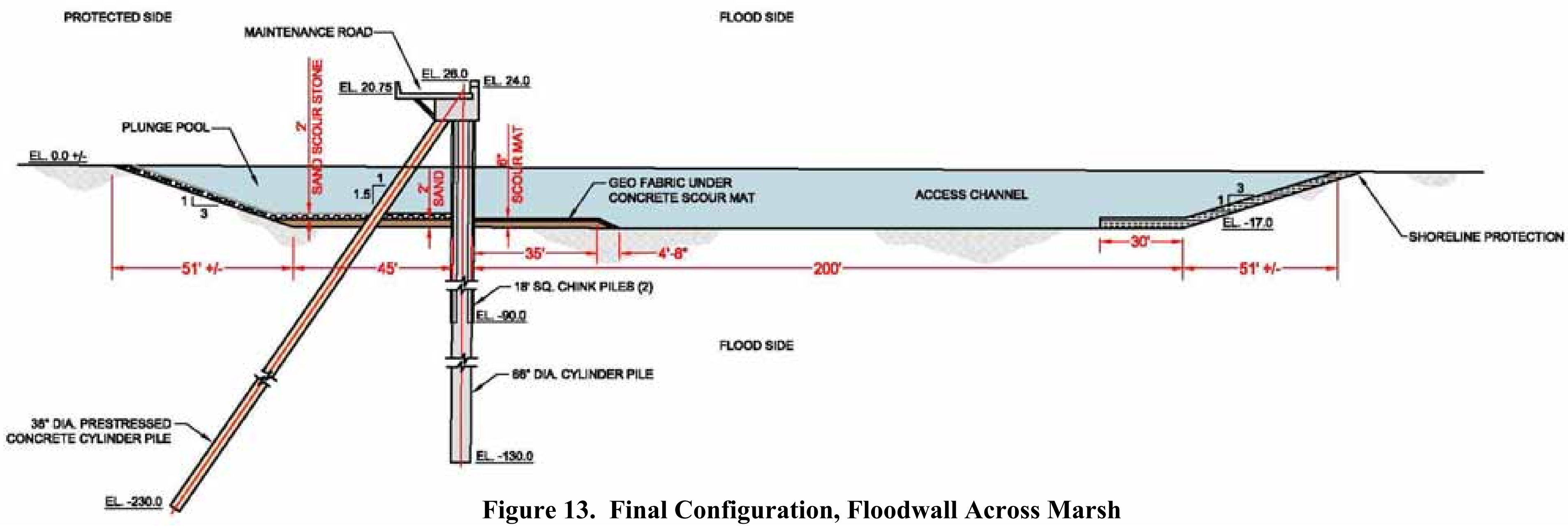

Figure 13. Final Configuration, Floodwall Across Marsh

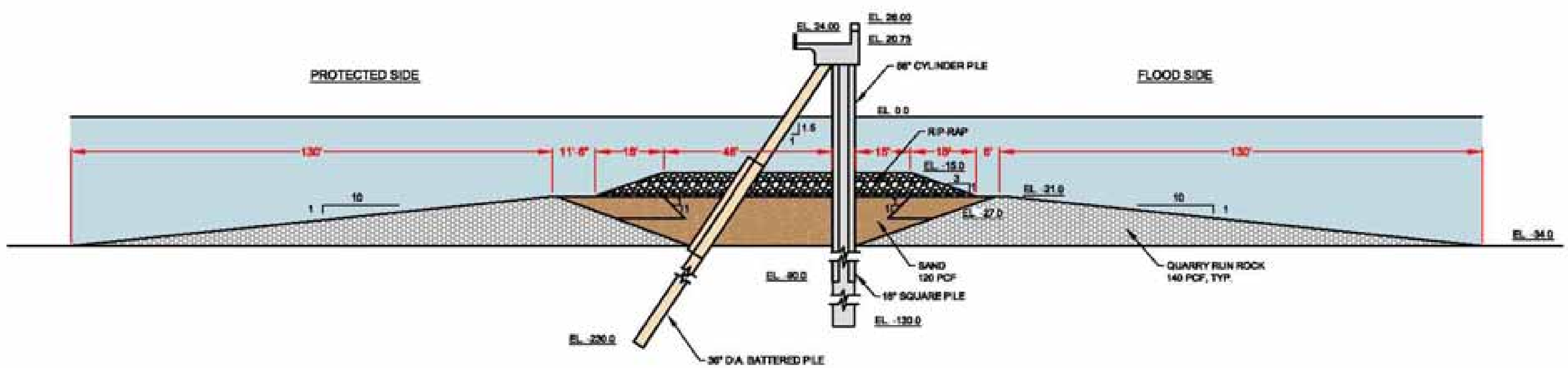

Figure 14. Final Configuration, MRGO Crossing

Armoring of Levees and Floodwalls

As an additional feature, armoring would be incorporated to protect against erosion and scour on the protected and/or flood sides of critical portions of levees and floodwalls. These critical areas include transition points (where levees and floodwalls transition into any hardened feature such as gates), that may be exposed to wave and surge overtopping during a 500-year hurricane storm event. The proposed method of armoring would be one of the following: cast-in-place reinforced concrete slabs; or concrete slope paving; articulated concrete blocks (ACB). The armoring would be incorporated into the existing levee or floodwall footprint and no additional environmental impacts would be anticipated.

Construction Related Information for Proposed Alternative

Construction of the proposed structures could begin in late-2008, and the construction activities are expected to last for approximately three years and be completed in two phases, with advanced measures in place by June 2009. The advanced measures would provide a degree of protection in preparation for the 2009 and 2010 hurricane seasons while the final features of the project are being constructed.

A significant amount of construction equipment would be required to conduct the work, including, but not limited to generators, barges, boats, cranes, trucks, bulldozers, excavators, pile hammers, graders, tractors, cement mixers, and front-end loaders. Non-forested upland areas would be used for construction staging where practicable and would be located away from heavily populated areas. Specific haul routes would be designated for construction-related traffic and would avoid residential and business areas to the maximum extent possible.

As indicated in figure 6, portions of this project require staging areas in close proximity to the project. Much of the area surrounding the project area is undeveloped with limited transportation routes available to the project sites for large equipment and large volumes of material. Proposed staging areas were selected based on the least potential for damage to the surrounding habitats. However, some impacts would be unavoidable because of the logistical requirements associated with movement of the large amount of materials required for project construction. Non-forested upland areas would be used for construction staging where practicable and would be located away from heavily populated areas. Staging areas would be used to house office trailers and for equipment and supply storage. Because the work would be largely water-based, much of the equipment and supplies would be stored at the staging areas and would be loaded onto work barges at bulkheads adjacent to the staging areas and then moved throughout the site. Temporary mooring areas consisting of clustered pile dolphins would be constructed within the channels in the immediate vicinity of the construction site to moor barges and tows. Some construction materials (e.g., concrete piles, pre-cast concrete materials, concrete mixing trucks, large stones, etc.) would be delivered to the work site on deck barges by push boats and secured along the side of the work barge. Water borne equipment such as barges, tugs, etc. will be maintained along the bulkheads adjacent to the staging areas throughout the construction phases of the project.

As indicated in figure 6, two staging areas have been proposed for the project: an area totaling approximately 46 acres north of the GIWW and east of the Michoud Canal, and a 16-acre site along the MRGO northwest of the existing Bayou Bienvenue drainage structure. The staging areas and access areas proposed adjacent to the GIWW east of the proposed GIWW gate structure include existing industrial property, the existing GIWW and Michoud Canal levee, and some secondary growth bottomland hardwood and scrub shrub edge habitat. These staging areas are proposed because of their close proximity to the construction site and for minimizing the impacts to existing businesses in the area. These staging areas were also proposed for the ease of maneuvering equipment on the site, as well as access for the convenience of transporting equipment either by barge or truck load. One of the staging areas is part of an existing concrete batch plant which would be utilized for constructing some of the concrete features of this project. Road access to the staging area along the MRGO would be via the MRGO levee to Paris Road. Any necessary restoration of this levee section, following construction activities, would be the responsibility of the construction contractors at the direction of the CEMVN.

Table 2 provides the estimated quantities of construction materials required for the completion of the proposed action.

Table 2. Estimated Construction Material Quantities Required to Complete the Proposed Action

	GIWW	**Bayou Bienvenue**	**Floodwall**	**MRGO**
Concrete (cy)	**33,900**	**9,600**	**100,900**	**23,000**
Sheet Piling square feet (sq ft)	**110,500**	**54,700**	**-**	**-**
Concrete or Steel Piles volume per linear foot (vlf)	**Steel 24" sq – 68,400** **Steel 36" sq – 33,600**	**Steel 24" sq – 26,500** **Steel 18" sq – 31,400**	**Concrete 66" - 148,200** **Steel 18" – 102,600** **Steel – 162,400**	**Concrete 66" – 56,200** **Steel 18" – 38,900** **Steel – 74,900**
Fill (cy)	**Sand – 38,000** **Gravel – 2,500**	**Sand – 17,000** **Gravel – 1,000**	**Sand – 80,800**	**Sand – 140,000**
Rock (cy)	**Riprap – 6,000**	**Riprap - 3,200**	**Riprap – 86,000** **Crushed Stone – 86,000**	**Riprap – 74,000** **Quarry Stone – 74,000**

Figure 15 illustrates the past, present, and future soil borings anticipated for the project area. Within the Golden Triangle marsh, 5-inch diameter undisturbed soil borings and cone penetrometer tests (CPTs) for the sector gate and floodwall structure of alignment 4 were drilled to depths of 150 ft to 220 ft below the existing water surface or marsh level in June and July 2008. In addition, pile load test sites would be located near the proposed alignment within the right-of-way to be acquired for this project. The footprint of each test pile would be 100 ft by

100 ft, each test would require 4 to 11 piles, and the length of the piles would range from 90 to 250 ft. Future borings would be conducted after the dredging for the floodwall across the marsh and the borings would be within the project right-of-way (ROW), no additional dredging would be required, and all piles and material would be removed or buried on site. Equipment would include a large crane (floating or land-based), a pile carrying barge, and a few smaller working boats with generators, pumps, and pile forms. Timeframes would be approximately 40 to 50 days per test, including installation/tests/removal.

One wall load test also would be conducted on the advance measures structure. The footprint of the test would be approximately 300 ft by 200 ft and would be conducted within the floodwall ROW. The test would require the construction of a braced steel sheet pile cofferdam around a section of completed wall. The length of the steel sheet pile would be approximately 200 ft. No dredging would be required and all sheet piles and material would be removed or buried on site. Equipment would include a large crane (floating or land-based), a pile carrying barge, a precast or mobile concrete mixer barge, and a few smaller working boats with generators, pumps, and pile forms. Timeframes would be approximately 60-120 days, including installation/ tests/ removal.

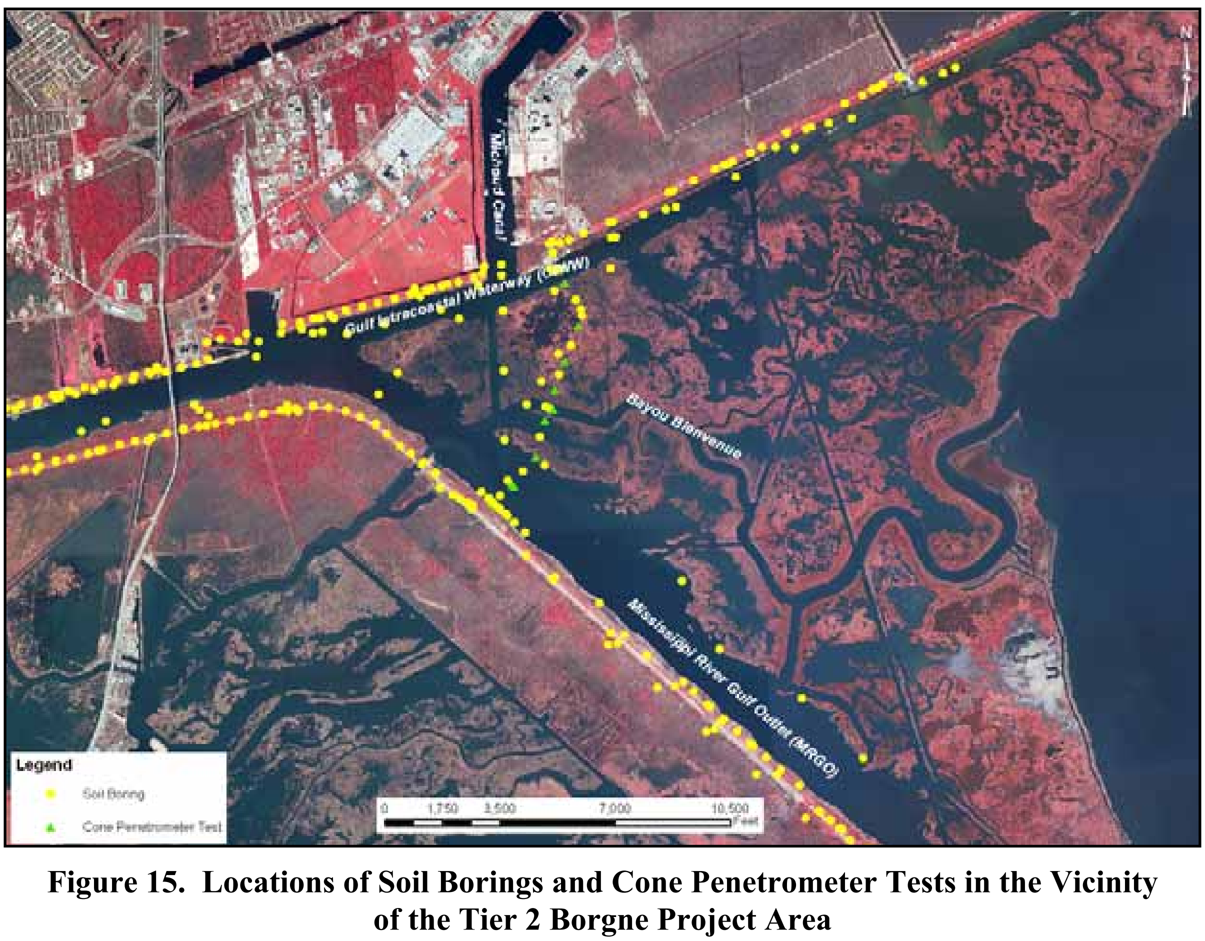

Figure 15. Locations of Soil Borings and Cone Penetrometer Tests in the Vicinity of the Tier 2 Borgne Project Area

2.4 ALTERNATIVES TO THE PROPOSED ACTION

As discussed in section 2.2, seven alternatives (see table 1) to the proposed action were considered in detail based on five possible alignments and two possible types of barriers (floodwall or geotextile levee) for the three alignments that cross existing wetlands. In addition, as indicated previously, alternatives 1, 2, 3a and 3b would also require the replacement of the existing Bayou Bienvenue gate (see figure 16).

Figure 16. Protected-Side Shift of the Existing Bayou Bienvenue Structure for Alternatives 1, 2, 3a, and 3b

Alternative 4b – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Geotextile Levee Barrier

This alternative is the same as the proposed action with the exception that this alternative would include an earthen levee with geotextile fabric across the wetlands instead of the concrete floodwall.

The footprint of the geotextile levee across the Golden Triangle would be 271 ft wide, and the footprint of the sand pad with geotextile fabric would extend past the levee footprint on either side for a total width of 600 ft (see figure 17). The entire 600 ft wide footprint would be under laid by cement columns extending to elevation -75 ft every 6 ft along the alignment. Any material dredged would be incorporated into the soil mix column or levee berms; there would be no beneficial use of the dredged material. There would be approximately 283 columns for every 6 ft of levee. For the final configuration of the levee, a second lift of earthen fill would be placed to an elevation of +30.0 ft (figure 17), which includes 6 ft of overbuild to account for the additional subsidence anticipated with an earthen system. In the design of this geotextile levee, the significant number of columns would prevent the typical settling seen with the conventional levee. Therefore, additional lifts of earthen fill, beyond the final configuration, would not be expected for the duration of the 50 year design life. Concrete slope paving would be placed along the entire levee (berm and crown of the levee) for scour protection. This levee system would require reinforced concrete T-Walls to tie in to the proposed navigable structures.

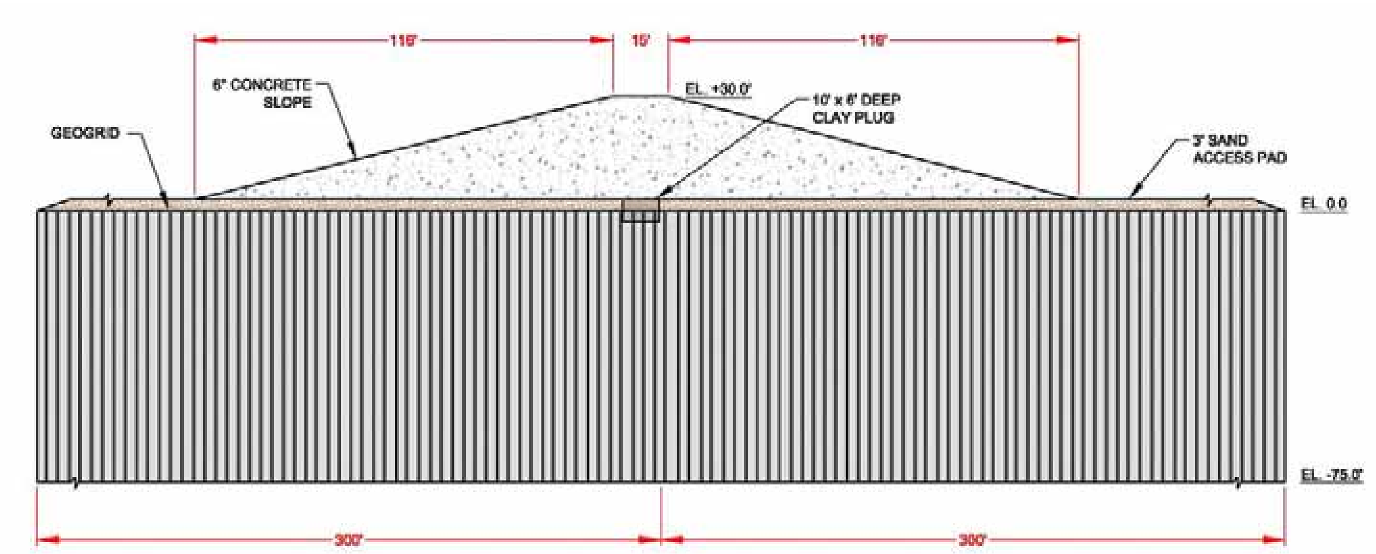

Figure 17. Example of an Earthen Levee with Soil Mixing and Geotextile

Alternative 1 – Deep Draft Gate in Alignment 1

Alternative 1 consists of a deep draft gated structure on the GIWW immediately east of Paris Road Bridge and west of Michoud Slip, modification of the existing GNOHSDRRS features, and construction of a new gate on the protected side of the existing Bayou Bienvenue control structure. This alternative would span the GIWW and tie into existing GNOHSDRRS features on either side of the GIWW, which would be raised to meet the 100-year level of protection. This alignment would include a 350 ft wide navigation pass with a draft depth elevation of -40 ft and provide protection to an elevation of +32.0 ft. The proposed gate structure would be either a vertical lift gate, or a sector gate, or a concrete barge gate. The proposed structure would be tied into the existing GNOHSDRRS with approximately 960 LF of concrete T-walls constructed to an elevation of +32 ft.

The gate and wall elevations of this alternative would result in controlled wave overtopping, which could result in overtopping volume entering the protected side portion of the GIWW, MRGO, IHNC and Golden Triangle marsh. However, the overtopping volume would be less than the proposed action due to the shorter barrier length and increased height of the structure.

This alternative would also include a new control structure at Bayou Bienvenue which would be constructed approximately 300 ft on the protected-side of the existing structure as illustrated in figure 16. The replacement structure would operate in the same manner as the existing structure, that is, when the tide rises to an elevation of +1.2 ft NAVD88, the structure would be closed, then it would be opened when the tide ebbs. The replacement structure would require construction of T-walls that tie-in to the adjacent levee reaches. After construction of the replacement structure is complete, the old structure would be de-commissioned and left in the open position, unless the local sponsor chooses to maintain the old structure as an additional line of defense.

A new feature of the control structures would be a pontoon bridge located between the old and the new structures. The bridge would allow for improved access to the levee section between the Bayou Bienvenue and Bayou Dupre control structures. A pontoon bridge would consist of fixed concrete slab approach spans leading to the main pontoon barge span, which would be flanked by steel tower anchor spans that move vertically up and down to provide access to the bridge. The barge would swing into place by means of electrical and mechanical equipment, strutted ore, cables, and anchor piers (figure 18).

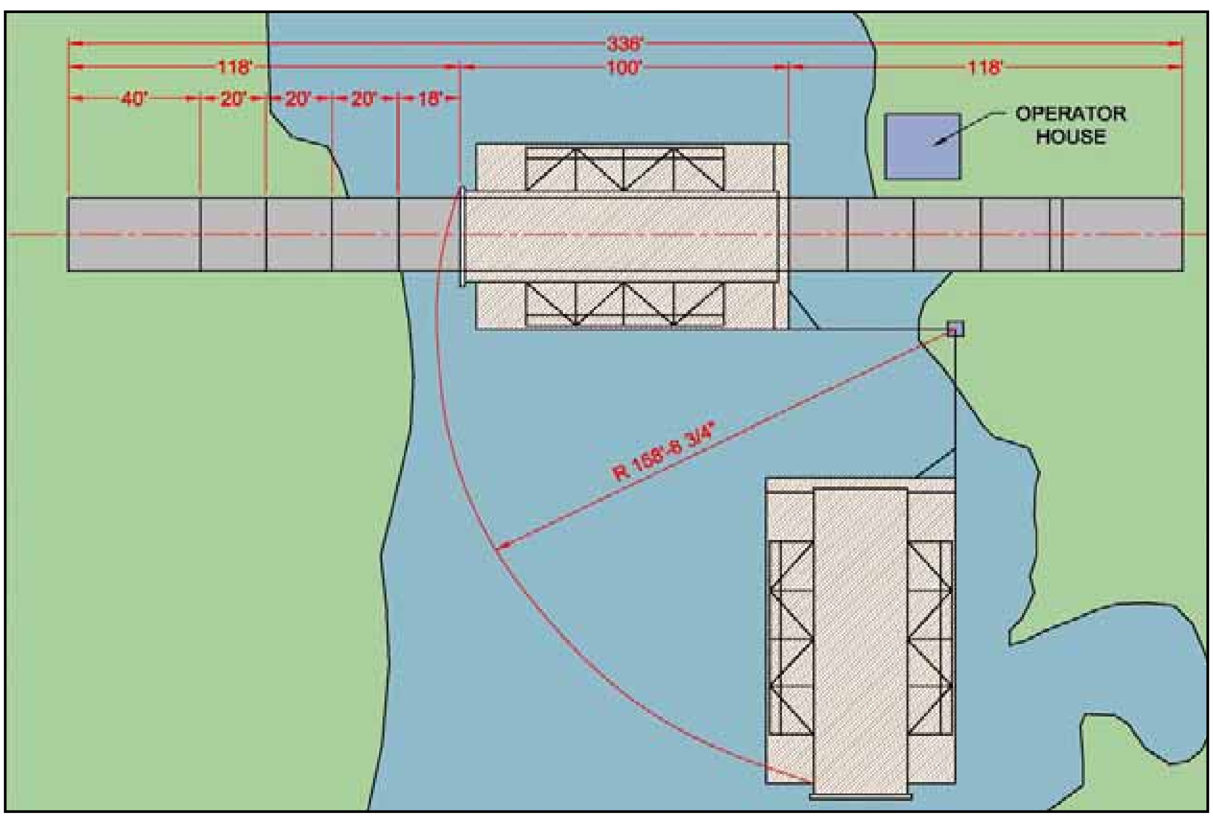

Figure 18. Example of a Pontoon Bridge in both the Open and Closed Positions

This alternative also would require raising the height of the GNOHSDRRS levees and floodwalls along the GIWW and MRGO, east of the new deep draft gate (shown in figures 19 and 20) to the 100-year level of hurricane and storm damage risk reduction using CEMVN Design Guidelines (USACE 2007a). This would include the replacement and/or modification of approximately 39,000 LF of floodwalls and levees along the GIWW, Michoud Canal, and MRGO, and 22 gates including the existing Bayou Bienvenue Control Structure (figures 19 and 20). Existing GNOHSDRRS features would be modified/replaced in kind. In some cases, it could be possible to raise a levee using a floodwall cap or replace the levee with a floodwall where space restrictions limit available right-of-way. The heights of the structures would be raised up to approximately +32 ft to tie into the deep draft gate. The heights of the structures could vary due to hydraulic conditions; however, the structures would all equally provide the 100-year level of hurricane and storm damage risk reduction. This alignment would not have an advanced measures phase because of the existing infrastructure, navigation requirements, and the size of the proposed structure.

Figure 19. Alternative 1 Deep Draft Gate and Existing GNOHSDRRS Features to Be Raised

Alternative 2 – Deep Draft Gate in Alignment 2

Alignment 2 consists of a deep draft gated structure on the GIWW immediately east of the Michoud Slip and slightly west of the confluence of the MRGO and the GIWW, modification of the existing GNOHSDRRS features, and construction of a new gate on the protected side of the existing Bayou Bienvenue control structure. This alignment would span the GIWW and tie into existing GNOHSDRRS features on either side of the GIWW. This alignment would include a 350 ft wide permanent navigation pass with a draft depth elevation of -40 ft and provide protection to an elevation of +32 ft. The proposed gate structure would be either a vertical lift gate, a sector gate, or a concrete barge gate. The proposed structure would be tied into the existing GNOHSDRRS with approximately 860 LF of concrete T-walls constructed to an elevation of +32 ft.

The gate and wall elevations of this alternative would result in controlled wave overtopping, which could result in overtopping volume entering the protected side portion of the GIWW, MRGO, IHNC and Golden Triangle marsh. However, the overtopping volume would be less than the proposed action due to the shorter barrier length and increased height of the structure.

In addition, this alternative would require the construction of a replacement control structure at Bayou Bienvenue (see figure 16) and raising the height of approximately 28,000 LF of levees along the GIWW and the MRGO east of the new deep draft gate (figures 20 and 21) to the 100-year level of hurricane and storm damage risk reduction using CEMVN Design Guidelines (USACE 2007a), as described in alternative 1 (Deep Draft Gate in Alignment 1).

Figure 20. GNOHSDRRS Structures currently in place at Michoud Canal

Figure 21. Alternative 2 Deep Draft Gate and Existing GNOHSDRRS Features to Be Raised

All existing GNOHSDRRS would be modified/replaced in kind except in those areas where an existing levee could not be expanded without impacting adjacent businesses or residences. In those cases, the levee section would either be raised using a floodwall cap or replaced by a floodwall. Although this alternative was designed to minimize impacts to adjacent properties, in some cases, even a smaller structure could impact adjacent property. The heights of the structures would be raised to approximately +32 ft to tie into the deep draft gate. The heights of the structures could vary due to hydraulic conditions; however, the structures would all equally provide the 100-year level of hurricane and storm damage risk reduction. This alignment does not have an advanced measures structure because of the existing infrastructure, navigation requirements, and the size of the proposed structure.

Alternative 3a – MRGO Structure, GIWW Gate, and Structural Wall Barrier

Alternative 3a would employ similar construction methods and materials as the proposed action, but it would be constructed in alignment 3, which consists of approximately 1.5 miles of new GNOHSDRRS extending from the Michoud floodwall east of Michoud Canal to the Chalmette Loop levee on the west side of the MRGO. The GNOHSDRRS would cross the GIWW, the Golden Triangle marsh, and the MRGO. Alternative 3a would consist of a flood control structure and bypass gate at the GIWW, a structure across the MRGO, and a concrete floodwall across the marsh between these waterways.

The gates would be built to +26 ft and the wall would be built to +24 ft. The gate and wall elevations of this alternative would result in controlled wave overtopping, which could result in overtopping volume entering the protected side portion of the GIWW, MRGO, IHNC and Golden Triangle marsh. The volume entering this storage area would be less than the volume under the proposed action but more than the volume under Alternatives 1 and 2. To ensure that the wave overtopping volume remains within acceptable limits and the system can continue to be certified as providing the 100-year level of protection throughout its project life, the structure may require modification such as the addition of panels to the top of the floodwall.

The existing Bayou Bienvenue Control Structure would also be rebuilt under this alternative on the protected side of the existing structure (see details under alternative 1 (Deep Draft Gate in Alignment 1 and figure 16)).

Construction along alignment 3 would also require relocation of two adjacent pipelines. The pipelines could be moved either to the flood side or the protected side of the new GNOHSDRRS. A flood side shift of the pipelines would consist of 6,000 linear ft of direction drilling under the MRGO, 5,000 ft of dredged channel, and another 5,000 ft of directional drilling under the GIWW, plus lay down pads and other construction disturbances. A protected side shift of the pipelines would require similar disturbance to the Golden Triangle marsh, except that the distance across the marsh would be slightly shorter. However, a protected side shift would also include another boring under the Bayou Bienvenue. The path under Bayou Bienvenue would consist of an additional 1,500 ft directional drill, additional construction disturbance, as well as an additional 2,000 ft of pipeline to make connections.

Alternative 3b – MRGO Structure, GIWW Gate, and Geotextile Levee Barrier

Alternative 3b is the same alignment as alternative 3a and consists of the same components except an earthen levee on a geotextile fabric, as described for alternative 4b, would be placed across the Golden Triangle marsh between the MRGO and GIWW structures rather than a floodwall.

Alternative 5a – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Structural Wall Barrier

Alternative 5a would employ similar construction methods and materials as the proposed action, but it would be constructed in alignment 5. Alignment 5 consists of approximately 2.6 miles of new GNOHSDRRS extending from the Michoud floodwall north of the GIWW to the levee on the west side of the MRGO. The GNOHSDRRS would cross the GIWW, the Bayou Bienvenue, the marsh, and the MRGO. Alternative 5a would consist of a flood control structure and bypass gate at the GIWW, a flood control structure across Bayou Bienvenue, a structure across the MRGO, and a concrete floodwall across the marsh between these waterways. The structural elements in this alternative would be the same as in the proposed action except for the length of the barrier required through the wetlands.

The gates would be built to +26 ft and the wall would be built to +24 ft. The gate and wall elevations of this alternative would result in controlled wave overtopping, which could result in overtopping volume entering the protected side portion of the GIWW, MRGO, IHNC and Golden Triangle marsh. The volume entering this storage area would be greater than the volume under the proposed action. To ensure that the wave overtopping volume remains within acceptable limits and the system can continue to be certified as providing the 100-year level of protection throughout its project life, the structure may require modification such as the addition of panels to the top of the floodwall.

Alternative 5b – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Geotextile Levee Barrier

Alternative 5b occurs in the same alignment as alternative 5a and consists of the same components except an earthen levee on a geotextile fabric, as described for alternative 4b, would be placed across the wetlands between the structures rather than a floodwall.

2.5 ALTERNATIVES ELIMINATED FROM FURTHER CONSIDERATION

In addition to the alternatives already eliminated from further consideration as part of the Tier 1 IER # 11 document, the following alternatives were eliminated from further consideration because they did not adequately meet the screening criteria under the Tier 2 evaluation.

Full Earthen Levee Barrier

As part of the initial evaluation of the Tier 2 Borgne, a full earthen levee across the wetlands area was eliminated from further consideration due to geotechnical instability of the marsh on which it would be built, engineering impracticality, and environmental impact. <u>MRGO segment:</u> the soils in the MRGO and adjacent marsh are very soft, primarily organic soils. With a channel elevation that varies from -40 ft to -22 ft, the +32 ft levee across the MRGO could require up to 75 ft of vertical fill in some locations to account for the depth of the channel as well as the added height to tie into the existing GNOHSDRRS. Calculations indicate that the levee with stability berms would be approximately 1800 ft wide. <u>Marsh segment:</u> with a marsh elevation of 0 ft to -5 ft and a top levee elevation of +32 ft, the levee across the marsh would be approximately 35 ft tall. It is estimated that the levee with stability berms would be approximately 900 ft wide. Approximately 4.8 million cubic yards of earthen material would be required to construct the levee. As much as 3 times this amount of material would need to be excavated due to moisture loss, compaction, settlement and consolidation. Transportation of this material would be of concern, as transportation of such a quantity of material could require approximately 720,000 truck loads or 12,000 barge loads. Because of the soil conditions, settlement would be a major concern. Preliminary calculations indicate that settlement of 15 ft to 17 ft would be expected over 50 years. Therefore an earthen levee would require multiple, frequent lifts to maintain the required levee grade. It is also expected that the placement of the levee fill would increase the turbidity of the water in the area during construction. Because of settlement, it is expected to require two to three times the normal quantity of embankment material to construct a first lift of stable levee; therefore, the cost and time to construct this alternative are not considered to be reasonable and the alternative was eliminated from further consideration.

Hollow Core Levee

The concept of the hollow concrete levee system is such that the section fills with water from the bottom as the storm surge rises. The combined weight of the concrete frame and its water filled voids inside the frame result in a gravity structure that is designed to resist hydrostatic forces and impact forces from vessel collision.

The hollow concrete levee would be comprised of trapezoidal shapes similar to that of earthen levees. The levee superstructure sections would be comprised of sloped side walls with a flat bottom slab with access to the interior via steel grating or manholes in the crest. Water inlets or ports would be incorporated into the cross section near the levee base on the flood side to allow the section to flood with water to contribute to the overall weight for stability purposes. Shear keys in the base would need to be designed to protect against sliding under design loading conditions. The substructure would consist of a concrete base slab or pad that would be supported by steel pipe piles. Excavation and granular backfill would be required to construct the pile supported concrete pad. The concrete base slab serves a two-fold purpose. It distributes loads to the pile foundations as well as serves as a "roadway" for cast-in-place construction. A typical section is shown in figure 22.

The use of a hollow core levee was eliminated from further consideration because it would not be advantageous to use in lieu of a barrier wall. The hollow core levee would require a significantly larger pile foundation resulting in a greater linear footage of piles required. In addition, the trapezoidal open chambers of the hollow core levee require an elaborate and non-reusable concrete formwork section. Conversely, the proposed action barrier has a very simple pile foundation and cap design resulting in a system that is easy to construct. In addition, because of the pile quantity and the formwork requirements for a hollow core levee, the incorporation of a hollow core levee could delay hurricane and storm damage risk reduction for the metropolitan New Orleans area by at least one hurricane season as compared to the concrete floodwall of the proposed action.

Additional Gates

The installation of additional gates to allow additional hydrologic exchange and access to transient estuarine organisms in the wetlands of the project area was considered a potential additional feature for each of the alternatives. Each gate would be 56 ft wide and the top elevation of the gate would be equal to the primary barrier structure it is tied in to. Because these gates would not need to allow for navigation, they could be sluice gates and box culverts of sufficient length to span the barrier footprint or concrete barge gate. These gates would maintain flow under normal conditions and be closed during storm events.

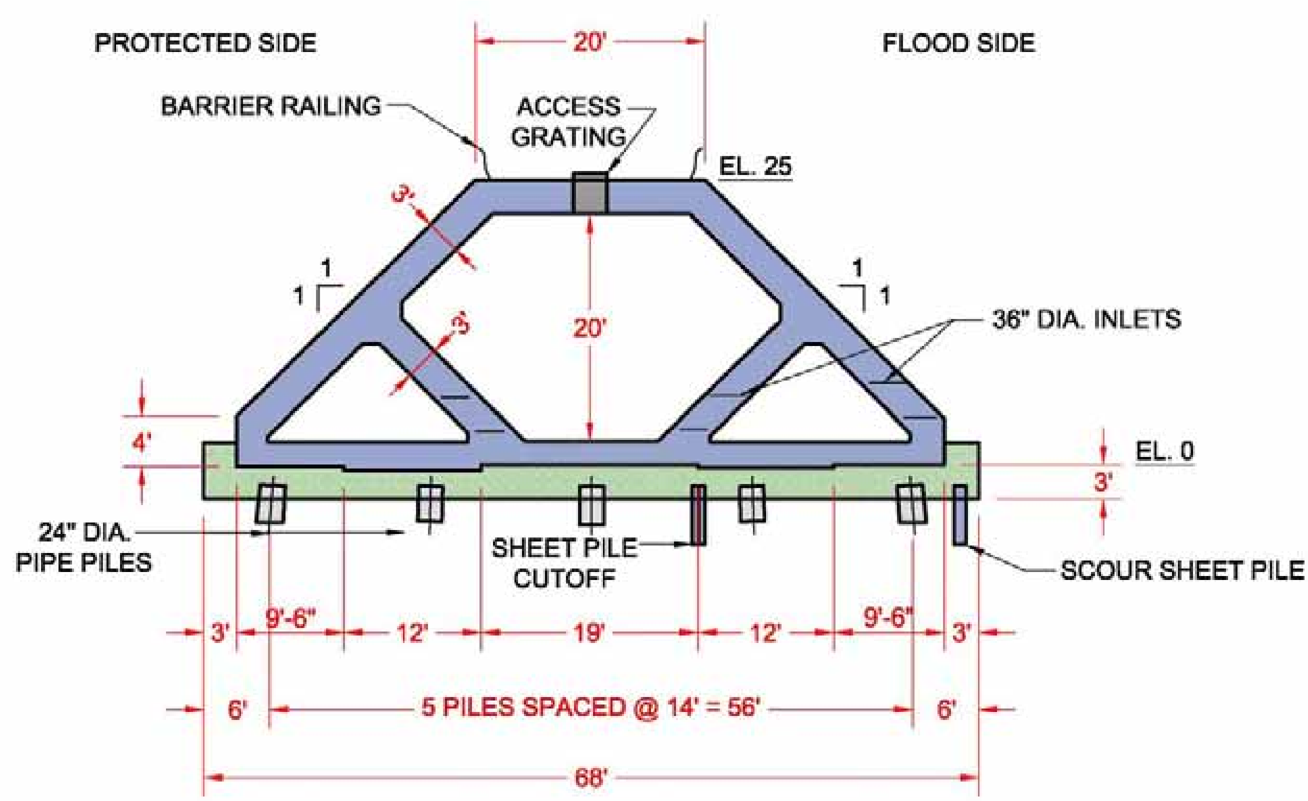

Figure 22. Hollow Core Levee – Typical Section

These gates would maintain flow under normal conditions and be closed during storm events.

These additional gates were eliminated from further consideration because benefits gained by these gates on this relatively short length of barrier did not outweigh the construction costs, Operation & Maintenance burden on the local sponsor and additional risk associated with these additional openings in the flood control barrier. Hydroperiod modeling demonstrated that such gates would not allow significant additional hydrologic exchange. The modeling results showed that the inclusion of an additional gate on both the GIWW and Bayou Bienvenue did not show a significant difference in hydrologic impacts (USACE 2008a). For example, modeling showed that either with a single gate on both the GIWW and Bayou Bienvenue or two gates each at both the GIWW and Bayou Bienvenue, maximum tidal elevations west of the barrier were generally lower by 0.10 ft or less compared to conditions with no barrier. Likewise, there was very little difference in changes to tidal prism between these two scenarios.
At a similar hurricane and storm damage risk reduction project in the region, U.S. Fish and Wildlife Service (USFWS) determined that a frequency of one passageway for fish and wildlife per 3.5 miles was adequate (USFWS 2000). Alignments 3, 4 and 5 would exceed this frequency without the inclusion of additional gates. Alignment 3 includes 1 opening in approximately 1.5 miles; Alignment 4 includes 2 openings in approximately 2 miles; Alignment 5 includes 2 openings in 2.5 miles.

2.6 SUMMARY TABLE

Table 3 provides a summary of the preliminary alternatives screening results.

Table 3. Summary of the Preliminary Alternatives Screening Results

	GIWW Gate				MRGO crossing		Bayou Bienvenue				Barrier				Existing
Alignment/ Alternative	Deep Draft	Sector	Vertical Lift	Concrete Barge	Structural Wall	Sheet Pile Cells	Sector	Vertical Lift	Concrete Barge	Replace Existing Control Structure	Flood wall	Earthen Levee w/ geotextile	Full Earthen Levee	Hollow Core Levee	Raise Existing Levees / Floodwalls
Alignment 1															
▪ Alternative 1	☑	☑	☑	☑	n/a	n/a	n/a	n/a	n/a	☑	n/a	n/a	n/a	n/a	☑
Alignment 2															
▪ Alternative 2	☑	☑	☑	☑	n/a	n/a	n/a	n/a	n/a	☑	n/a	n/a	n/a	n/a	☑
Alignment 3															
▪ Alternative 3a	n/a	■	■	■	■	■	n/a	n/a	n/a	☑	☑		X	X	☑
▪ Alternative 3b	n/a	■	■	■	■	■	n/a	n/a	n/a	☑		☑	X	X	☑
Alignment 4															
▪ Alternative 4a (Proposed Action)	n/a	☑		☑	☑		☑	n/a	☑	n/a	☑		X	X	n/a
▪ Alternative 4b	n/a	■	■	■	■	■	■	■	■	n/a		☑	X	X	n/a
Alignment 5															
▪ Alternative 5a	n/a	■	■	■	■	■	■	■	■	n/a	☑		X	X	n/a
▪ Alternative 5b	n/a	■	■	■	■	■	■	■	■	n/a		☑	X	X	n/a

■ = structure option with similar footprint as other options for this structure category
☑ = considered in detail
X = eliminated from further consideration
n/a = not applicable; this option was not formulated for this alternative

3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 ENVIRONMENTAL SETTING

General

The Tier 2 Borgne project area is located within the Lower Mississippi Delta Alluvial Plain and the East Central Louisiana Coastal watershed; specifically, between Lake Pontchartrain and Lake Borgne in the northeastern portion of the Mississippi River deltaic plain. The study area is bounded to the west by Paris Road Bridge (Highway [Hwy] 47), to the north by Old Gentilly Road, to the east by the Industrial Parkway, and to the south by the intersection of the MRGO and Lake Borgne (figure 23). The study area falls within three sub-basins of the Pontchartrain Basin: Orleans East Bank, New Orleans East and Chalmette Loop (figure 1). The Orleans East Bank Sub-basin extends westward from the IHNC to the 17th Street Canal, bordered to the north by Lake Pontchartrain and to the south by the Mississippi River. The New Orleans East Sub-basin extends eastward from the IHNC toward the Rigolets Pass, bordered on the north by Lake Pontchartrain and on the south by the GIWW. The Chalmette Loop Sub-basin extends east and south, bordered on the north by the GIWW, on the east by the MRGO, and on the south by the Mississippi River and the portion of the Chalmette Loop Levee that runs from the Mississippi River to Hwy 46 between the communities of Caernarvon and Verret (USACE 1984).

Figure 23. Regional Map of Tier 2 Borgne Project Area (2005)

Orleans and St. Bernard Parishes are located within a subtropical latitude. The climate is influenced by the many water surfaces of the nearby wetlands, rivers, lakes, streams, and the Gulf of Mexico. Throughout the year, these water bodies modify the relative humidity and temperature conditions, decreasing the range between the extremes. Summers are long and hot, with an average daily temperature of 81 degrees Fahrenheit (°F) and high average humidity. Winters are characterized by cold, dry, polar air masses moving southward from Canada, with an average daily temperature of 53°F. Average annual precipitation is approximately 61 inches with monthly averages varying from 2.8 inches in October to 6.5 inches in July (USACE 1974; National Oceanic and Atmospheric Administration [NOAA] 1987).

Precipitation in Louisiana is largely due to convectional activity in the summer and tropical storms during the winter. Due to its proximity to the Gulf of Mexico, the study area is susceptible to tropical waves, tropical depressions, tropical storms, and hurricanes. These weather events can produce significant amounts of precipitation over a very short period of time and are often accompanied by strong winds, tornadoes, and storm surge along the coastal areas. Analysis of historic data from the National Hurricane Center dataset on tropical cyclones (including tropical depressions, tropical storms, and hurricanes) of the Louisiana coast from 1900 to 1999 shows a total of 63 storms, of which 49 were Category 3 or less. Not all of these storms had direct contact with the New Orleans metro area (U.S. Geological Survey [USGS] 2002). Since 1999, a total of 10 storms, of which 7 were Category 3 or less, have impacted Louisiana (USACE 2006a)

Geology and Soils

Dominant physiographic features in the vicinity include the Gulf Intracoastal Waterway, the Mississippi River Gulf Outlet, Bayou Bienvenue, Lake Borgne, and marsh. Soil borings near the proposed alignment provided information on the nature and extent of soils and shallow sediments, along with their physical and engineering properties.

The surface and shallow subsurface is composed of 10 to 15 feet of marsh/swamp deposits. Marsh/swamp deposits are characterized by very soft to soft organic clays and peat with wood and some silt strata. These surficial deposits overly interdistributary deposits which are generally composed of very soft to medium clays and silty clays with shell fragments. Interdistributary deposits are approximately 35 feet thick. Natural levee deposits approximately 10 feet thick occur near the surface adjacent to Bayou Bienvenue. These levee deposits are composed of soft to stiff clays and silty clay deposited during flood events that occurred when this bayou was an active distributary. Interdistributary deposits overlie bay-sound and nearshore gulf deposits of soft to medium clay, silt, and sand containing shell fragments. Bay-sound and nearshore gulf deposits are approximately 5 to 10 feet thick. Pleistocene deposits are located beneath bay-sound and nearshore gulf deposits at an approximate elevation of -60 feet NAVD88. These deposits are mainly stiff to very stiff, oxidized clays, silts and sands.

The Tier 2 Borgne site contains Clovelly-Lafitte-Gentilly soils which are level, very poorly drained soils that have a moderately thick, thick, or thin mucky surface layer and clayey underlying material (US Soil Conservation Service, 1986).

Groundwater is at or near the surface.

Natural subsidence rates, including sea level rise, were mapped by CEMVN for the Louisiana Coastal Area (LCA) study. According to the LCA study, the combined sea level rise and subsidence rate for the project area is 1.8 ft per century (ft/century). Therefore, the relative sea level rise in the study area is estimated to be 1 ft over 50 years (approximately half the rate for a century, and based on the project life of 50 years). The effect of increasing sea level rise on the design still water levels and waves was investigated by the U.S. Army Engineer Research and Development Center (ERDC) (Smith and Atkinson 2007). Results indicated that the design still water levels increase more than proportional to the increase in sea level rise of 1 ft. Based on surge and wave computations, the resulting increase in design still water level was estimated at +1.5 ft, and the design wave heights increase +0.75 ft in our area of interest. The design wave periods were derived by assuming constant wave steepness. The future design heights of the GNOHSDRRS are 2 - 2.5 ft higher than the current design heights based on these numbers. The design process for this project included several mitigating factors to account for potential variation in sea level rise and/or subsidence. First, the levee/floodwall heights are designed to limit overtopping rates. Second, critical hard structures such as flood gates include an additional 2 ft due to the difficulty in modifying these structures to account for changing future conditions.

Hurricane Katrina

On 29 August 2005, Hurricane Katrina made landfall near Buras on the Louisiana Coast south of New Orleans. At landfall, Katrina was at the upper end of Category 3 intensity range with maximum sustained winds estimated at 123 miles per hour (mph). As a result of storm surge, large areas of New Orleans East and St. Bernard Parish were flooded due to the over-topping and breaching of levees and floodwalls on the INHC, the GIWW and the MRGO. While extensive wetland losses occurred south of the project area due to flooding, shearing, eroding and scouring, only relatively small wetland losses due to the Hurricanes Katrina and Rita were observed in the project area.

3.2 SIGNIFICANT RESOURCES

This section contains a list of the significant resources located in the vicinity of the proposed action, and describes in detail those resources that would be impacted, directly or indirectly, by the alternatives. Direct impacts are those that would be caused by the action taken and occur at the same time and place (40 CFR 1508.8(a)). Indirect impacts are those that would be caused by the action and would be later in time or farther removed in distance, but are still reasonably foreseeable (40 CFR 1508.8(b)). Cumulative impacts are summarized in section 4.

The resources described in this section are those recognized as significant by laws, executive orders, regulations, and other standards of national, state, or regional agencies and organizations; technical or scientific agencies, groups, or individuals; and the general public. Further detail on the significance of each of these resources can be found by contacting the CEMVN, or on www.nolaenvironmental.gov, which offers information on the ecological and human value of these resources, as well as the laws and regulations governing each resource. Search for "Significant Resources Background Material" in the website's digital library for additional information. Table 4 shows those significant resources found within the project area, and notes whether they would be impacted by any of the alternatives analyzed in this IER.

Table 4 Significant Resources in Project Study Area		
Significant Resource	**Impacted**	**Not Impacted**
Hydrology	X	
Water Quality	X	
Wetlands	X	
Fisheries	X	
Essential Fish Habitat	X	
Wildlife	X	
Threatened or Endangered Species	X	
Non-wet Uplands	X	
Cultural Resources		X
Recreational Resources	X	
Aesthetic (Visual) Resources	X	
Air Quality	X	
Noise	X	
Navigation	X	
Transportation	X	
Socioeconomic Resources Land Use, Population, Employment Environmental Justice (EJ)	X	

3.2.1 Hydrology

Existing Conditions

As described in IER 11 Tier 1 (USACE 2008b), the Pontchartrain Basin includes the estuarine areas of Lake Pontchartrain and Lake Borgne. The basin has been substantially altered by a system of waterways, levees, and hydraulic control structures which range in size from the Mississippi River to the MRGO deep-draft channel to oil well access canals.

The IHNC is hydrologically connected to the GIWW, the MRGO, Mississippi River, and Lake Pontchartrain. The IHNC is approximately 30 ft deep, with a minimum 150 ft bottom width and 300 ft top width. The GIWW west of the Michoud Canal within the project study area is authorized as 36 ft deep, 500 ft bottom width waterway. East of the Michoud Canal within the project study area, the GIWW is authorized as a 150 ft width waterway. The IHNC from the GIWW/MRGO confluence to the IHNC Lock is an authorized deep draft navigation channel, 36 ft deep and 500 ft wide. The IHNC lock is located at the southern terminus of the IHNC and allows waterborne traffic to transit to and from the Mississippi River, the GIWW and Lake

Pontchartrain. The MRGO was deauthorized as a Federal waterway on June 5, 2008, with a rock closure structure to be constructed at Bayou La Loutre.

The major influences on water levels within the basin are wind and tide with some localized effects by vessel traffic. Tidal ranges average approximately 1 ft and 2 ft at Lake Pontchartrain and Lake Borgne, respectively (Westerink et al. 2006). Average flow velocity in the IHNC is about 0.6 feet per second (ft/s); however, surface ebb and bottom velocities may exceed 2 ft/s (USACE 1997). More recent velocity modeling (USACE 2008c) has indicated that closure of the MRGO at Bayou La Loutre may decrease existing velocities in the IHNC by half however.

The basin is susceptible to flooding from hurricane storm surge. Lake Pontchartrain levels are increased by the influx of surges from Lake Borgne and the Gulf of Mexico that accompany hurricanes from the southeast, south, and southwest as well as local wind setup (USACE 1967; USACE 1995; USACE 2007b; Westerink et al. 2006).

Modeling conducted by the Interagency Performance Evaluation Task Force (IPET) indicates that the GIWW GNOHSDRRS reach has effects on storm surge due to the fact it connects Lake Borgne and Lake Pontchartrain (USACE 2007c). During storms, the surges experienced in the GIWW and the IHNC are functions of the surges generated from both Lake Borgne in the east and Lake Pontchartrain in the north. The IPET models suggest that the levees along the GIWW and the MRGO can enhance storm surge in this vicinity depending on wind speed and direction, with strong winds from the east tending to maximize the local effect (USACE 2007c).

During major storm events, storm surges can propagate north into Lake Borgne and are then redirected west into the IHNC resulting in higher surge levels and large waves. Observed peak water levels in the IHNC during Hurricane Katrina indicate a maximum water level increase of at least 6 ft between the confluence of the MRGO/GIWW and Lake Pontchartrain. Also, model analysis of conditions during that event suggests that waves up to 4 ft high occurred within the IHNC (USACE 2007c).

The historic gage record (1923-2006) at the IHNC Lock shows that the median range of low to high water levels is -0.79 to 3.71 ft National Geodetic Vertical Datum of 1929 (NGVD29). Water level reached 10.61 ft NGVD29 during Hurricane Betsy. Although there are no water level records at the IHNC Lock for Hurricane Georges, records are available for nearby locations. During Hurricane Georges, the highest recorded water level in the IHNC at the Florida Avenue Bridge was 8.35 ft NGVD (1983 ADJ.) on 27 September 1998 (USACE 1998). The highest recorded water level (high water mark) at the IHNC Lock, due to Hurricane Katrina, was recorded at 14.3 ft NAVD88 2004.65 (USACE 2007c).

Currently, the MRGO acts as a tidal conduit for the exchange of saline water from the Gulf of Mexico into the IHNC and Lake Pontchartrain. Measurements of non-storm event flows in the IHNC have demonstrated the presence of an upper layer of water flowing out from Lake Pontchartrain and a lower layer flowing toward the lake (USGS 2006). However, the construction of the MRGO closure structure at Bayou La Loutre is expected to alter this direct saline influence, decreasing the conveyance of saline water to the IHNC and Lake Pontchartrain.

In addition to flows and water levels, sediment transport is another aspect of hydrology. The conveyance of sediment in the water column can significantly affect aquatic habitat, including benthic fauna and emergent wetland plants. Suspended sediment is important to the biological structure and function of a water body or wetland, and the amount and composition of suspended sediments is affected by both natural and human factors.

Before major flood control projects were constructed on the Mississippi River, the major source of sediment was the Mississippi River. The sediment load into the Golden Triangle marsh of the study area was probably higher than it is today, allowing the wetlands to trap sediment to maintain their elevation. The much reduced current sediment transport into the wetlands is one factor contributing to the net losses presently occurring.

Suspended sediment can also be attributed to erosion. Bank erosion and channel deposition have been observed along the IHNC, the GIWW, and the MRGO. The bank erosion is partly due to wave action, tidal movement, vessel traffic, and the effect of storm surges Erosion rates within the MRGO are approximately 35 ft/yr along the north bank and 15 ft/yr along the south bank. (USACE 2004b) Erosion losses on some portions of the south shore of Lake Borgne amount to 15 ft/yr. Substantial resuspension and redistribution of sediments during storm events have also been documented (USACE 2007b). Dredging can be required to remove deposited sediment after severe storms in addition to normal annual maintenance dredging activities (USACE 2007d). However, no dredging has been undertaken at any location in the MRGO/GIWW since Hurricane Katrina in 2005.

To counter the current sediment deficit and erosion problems, shoreline stabilization and marsh creation projects are proposed within the study area. For example, the Lake Borgne Shoreline Protection Project (PO-30) has been developed to curtail the erosion experienced by the "land bridge" between the MRGO and Lake Borgne in order to keep the connection between Lake Borgne and the MRGO from widening and to maintain the historic physical separation of these water bodies (USEPA 2005). Furthermore, the deauthorization of the MRGO could decrease shoreline erosion in the study area by restricting channel use by deep draft vessels.

Discussion of Impacts

The alternatives' impacts to hydrology were assessed based on the potential for changes in velocity, influence on the CWA which is the wetlands enclosed by the Chalmette Loop Levee system as depicted on figure 1), tidal prism, hydroperiod and interaction of the GNOHSDRRS system during storm events. Modeling scenarios to analyze impacts of gates and the barrier were developed and reviewed by ERDC, MVN and an interagency team made up of USFWS, National Marine Fisheries Service (NMFS), EPA, and LDNR, as well as experts from the University of New Orleans, Texas A&M, University of Florida, and Notre Dame, and international private industry firms including Royal Haskoning and Arcadis/Bioengineering. The key hydrodynamic models which were applied during this study were ADCIRC and RMA/TABS. These models are unique and have their own assumptions in terms of geometry schematization and model resolution. The modeling scenarios were very computationally and labor intensive, and required the use of extensive Department of Defense supercomputer resources. For the following analysis the modeling scenarios developed by the experts above addressed a range of scenarios to analyze the impacts for the structures and barriers within the study area. The results of these modeling scenarios are summarized in the following sections. Details on the results can be found in appendix B.

Proposed Action: Alternative 4a - MRGO Structure, GIWW and Bayou Bienvenue Gates, and Structural Wall Barrier in Alignment 4

Direct Impacts to Hydrology

As discussed in section 2, the proposed action includes advanced hurricane storm damage risk reduction measures and final measures with gate structures along the GIWW and Bayou Bienvenue. Modeling has shown that the proposed structures could result in localized velocity changes within the navigable waterways of the project area. Modeling results for an opening of 56 ft width on Bayou Bienvenue predict flows greater than 2.4 ft/s through Bayou Bienvenue 50 percent of the time during the wet period (March) in an area approximately twice the distance from the gate. A maximum velocity of 8 ft/s was noted in Bayou Bienvenue; however, upon further analysis this spike was attributed to a frontal passage in March of 2006. Expected velocities from this model within the GIWW would be approximately 0.6 ft/s. For all locations, modeling scenarios indicated that changes in velocities and water levels diminished on both sides of the structures at distances from the structure on the order of twice the width of the structure (USACE 2008c).

Hydrology modeling examined fifty-two locations on the flood side (east) and protected side (west) of the proposed alignment (figure 24). The gate width dimension of the GIWW and Bayou Bienvenue structures were approximated in the model simulations. However, the bottom elevations were approximated as the channel bottom elevations as opposed to the sill elevation. When the sill is included the impacts of the proposed action on the tidal range behind the barrier are expected to increase by 3 inches. The simulated water level time series for the base case, including the MRGO closure at Bayou La Loutre, were compared to the proposed alignment water levels. Tidal phase, tidal amplitude, and duration of inundation were analyzed at all 52 locations.

Of the 25 points analyzed on the flood side of the barrier, 14 points show no change in duration of wetting/drying; the tidal phase was unchanged. Some of these 14 points showed as much as +/- 2.4 inches change in the amount of water on the marsh (i.e. sometimes up to 2.4 inches more, sometimes up to 2.4 inches less). Of the remaining 11 points, 2 points showed the marsh being wet for 1-2 hours longer per day and 3 points showed the marsh being wet for 1-2 hours less per day. The amount of additional water on the marsh for all of these locations is small (approx 2.4 inches or less). The worst case scenario for the flood side shows a single location with continuous flooding; i.e. no wetting/drying cycle. For this worst case, the marsh is flooded 15 hours more each day. The amount of additional water on the marsh for this location is small (approx 3 inches or less).

Of the 27 points analyzed on the protected side of the barrier, 11 points show no change in duration of wetting/drying; the tidal phase was unchanged. Some of these 11 points showed as much as +/- 2.4 inches change in the amount of water on the marsh (i.e. sometimes up to 2.4

inches more, sometimes up to 2.4 inches less). Of the remaining 16 points, 1 point showed the marsh being wet for 1-2 hours longer per day and 7 points showed the marsh being wet for 1-2 hours less per day. According to the model results, the amount of additional water on the marsh for all of these locations is small (approx 2.4 inches or less). The worst case scenario for the protected side shows 2 locations with continuous flooding; i.e. no wetting/drying cycle. For this worst case, the marsh is flooded up to 10 hours more each day. The amount of additional water on the marsh for these locations is small (approx 3 inches or less).

Modeling of the hydroperiod was also conducted to determine the range of impacts exhibited by varying gate widths and conditions during construction of both the advanced measures and the final configuration. When the widths of gate structures proposed on Bayou Bienvenue and the GIWW are doubled, results show very little difference. This indicates that maintaining the bypass gate on the GIWW in the open position would result in little benefit to hydrology and may not warrant the additional operations and maintenance costs.

During construction, when the cofferdam across Bayou Bienvenue as described under advanced measures in section 2.3 is in place, the model predicts that the proposed action generally results in an increase in maximum tidal depth of about 3.6 inches on the flood (east) side of the proposed barrier and maximum water levels are lowered by 1.8 inches or less on the protected side (west) of the barrier. This equates to interior marsh areas being wetted by more than 2 hours less than baseline conditions. Although culverts through the cofferdam will allow some flow to pass through the temporary closure structure, the proposed culverts will not completely offset the impacts because the estimated maximum discharge through the culverts would be approximately 10% of the original maximum discharge through Bayou Bienvenue.

Upon completion of the final configuration, when compared to the baseline condition, the model predicts that the proposed action could generally result in lower maximum tidal elevations in the protected side of the marsh. Surface elevations are expected to be lower by generally 2.4 inches or less. The maximum water surface elevation is raised by 2.4 inches or less in the flood side of the marsh and in the MRGO (figure 25) (USACE 2008a).

Based on the modeling results, the proposed action is expected to have a limited effect on the flow and stages in the CWA. While tidal amplitude changes are not anticipated in the vicinity (flood side) of the Bayou Dupre gate, the tidal range may be reduced by approximately 33% (4 inches) in the vicinity (flood side) of the Bayou Bienvenue gate due to the proposed action (USACE 2008a). As a consequence, the flow influx through Bayou Bienvenue is expected to decrease. The tidal fluctuations inside the CWA are also expected to be reduced by less than 4 inches because there is less influx through Bayou Bienvenue as a result of the proposed action.

Three locations in the Bayou Bienvenue channel were also analyzed on the flood side of the proposed alignment between Lake Borgne and the proposed alignment. During advanced measures, no tidal phase difference was noted by the model. For the final configuration, no differences were noted for the tidal phase, tidal amplitude, and duration of inundation for any of these three locations when comparing the base case to the proposed alignment. In other words, the proposed alignment, once construction is complete, is predicted to have no impact on the simulated water levels at these locations in Bayou Bienvenue.

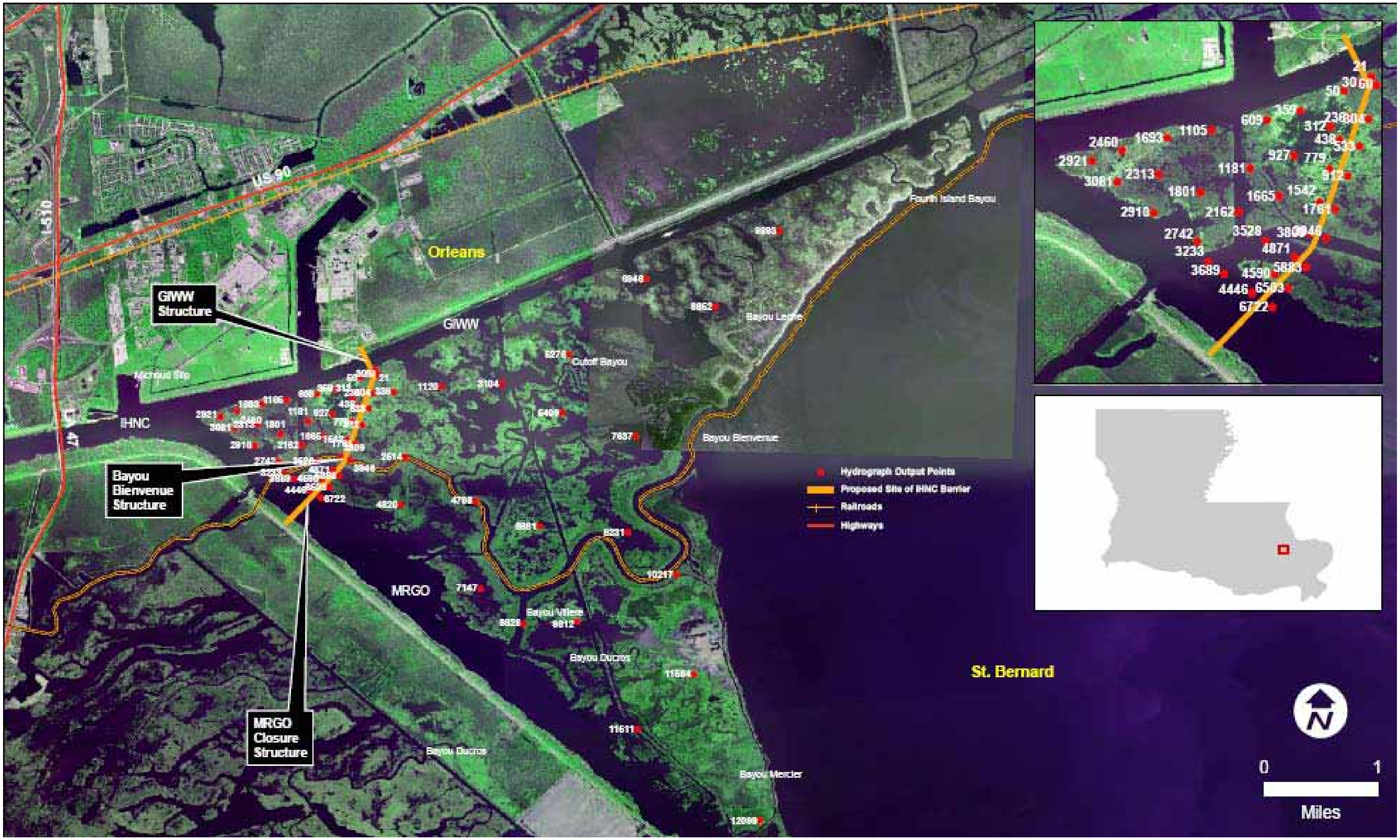

Figure 24. Fifty-two Output Points Investigated in Hydroperiod Modeling (USACE 2008a).

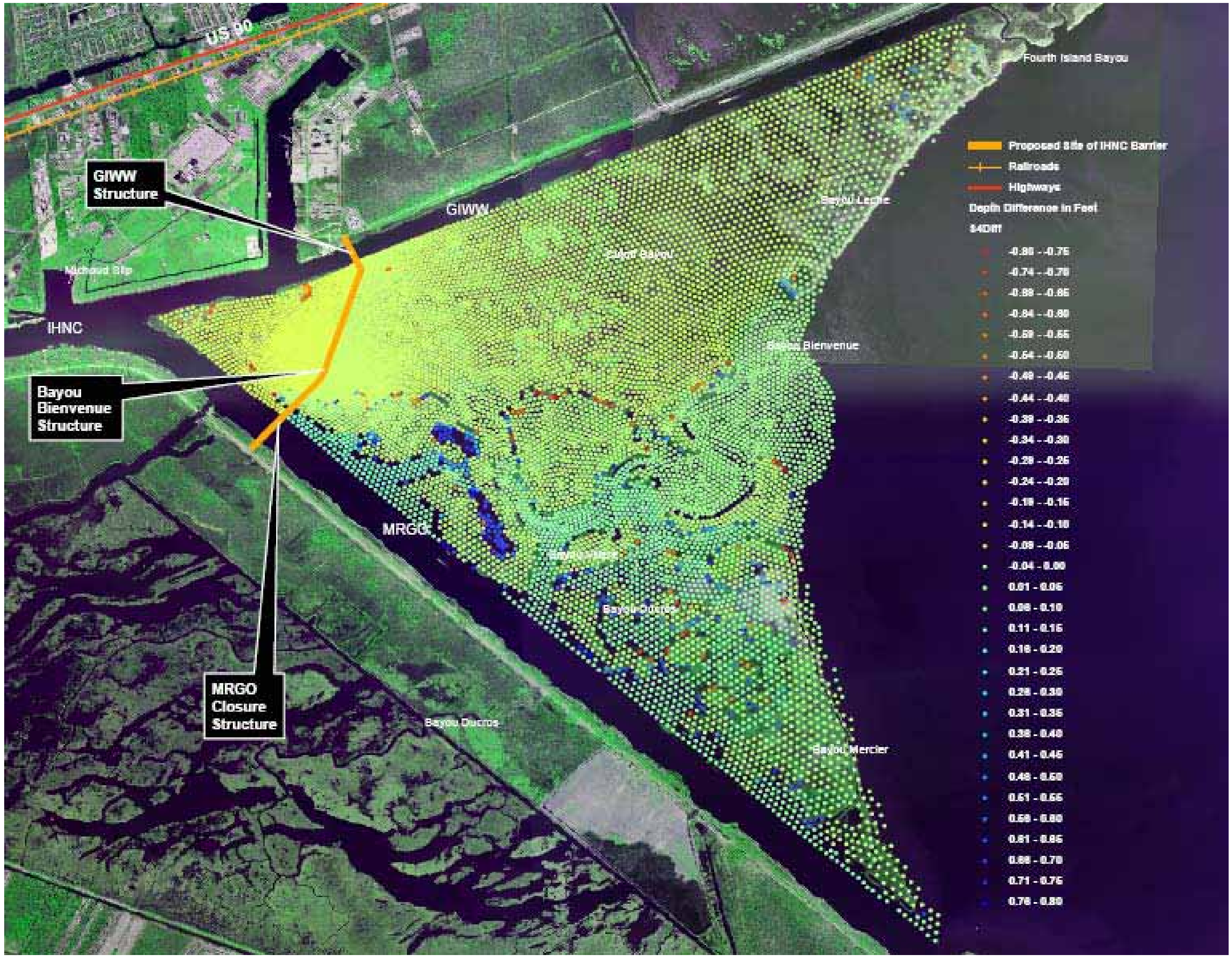

Figure 25. Tidal Inundation Depth Difference between Proposed Action Final Configuration and Base Conditions Including the MRGO Deauthorization Closure at Bayou La Loutre (USACE 2008a)

Inundation areas were calculated for depths greater than 0.25 ft, 0.5 ft, 0.75 ft, and 1.0 ft NAVD88 2004.65. The modeled results for both the protected side and flood side as compared to the existing (MRGO open) and base (MRGO closed at Bayou La Loutre) conditions are presented in table 5.

Table 5. Maximum and Minimum Inundated Areas

Protected Side (x 1000 acres)						
Depth (ft)	Existing Case		Base Case		Proposed Action	
	Min	Max	Min	Max	Min	Max
0.25	0.3	0.7	0.3	0.7	0.4	0.6
0.5	0.3	0.7	0.3	0.7	0.4	0.6
0.75	0.2	0.6	0.2	0.6	0.3	0.5
1	0.2	0.5	0.2	0.5	0.2	0.4
Flood Side (x 1000 acres)						
Depth (ft)	Existing Case		Base Case		Proposed Action	
	Min	Max	Min	Max	Min	Max
0.25	5.7	9.3	5.8	9.2	5.9	9.4
0.5	5.6	9.2	5.7	9.1	5.8	9.2
0.75	5.0	8.7	5.1	8.5	5.2	8.5
1	4.4	8.0	4.5	7.8	4.7	7.8

The difference between the maximum water volume and the minimum water volume defines the tidal prism. Percentages were computed to show how this volume of water is influenced by the barrier configuration of the proposed action. The model predicts that a nearly 30 percent decrease in tidal prism can be expected within the Golden Triangle marsh on the protected side of the proposed barrier and a 3.5 percent decrease can be expected on the flood side of the barrier (USACE 2008a). These results demonstrate that placement of the structures restrict tidal exchange within the protected side and to a lesser extent, flood side of the marsh.

Surge modeling and flood risk assessment of the project area (USACE 2007e) demonstrates that surge height increases as it moves from east to west in the Borgne complex, due to the narrowing of the corridor between the GIWW and the MRGO as it approaches the IHNC (USACE 2008d). Subsequent overtopping analysis (overtopping due to wave action during a 100 year event) has shown that greater volumes are expected the further east the alignment (due to longer barrier lengths required for more eastern alignments). Although water level rise due to overtopping behind the barrier is higher for the alignments that are located more eastward (Alignments 3, 4 and 5), the more westerly alignments (Alignments 1 and 2) result in a greater water level rises due to rainfall in relation with the available storage volume.

Indirect Impacts to Hydrology

Hydrologic changes as discussed above may indirectly correlate to impacts to water quality and wetlands which can result in loss of habitat. This loss of habitat has the potential to impact both aquatic and terrestrial species. These impacts are discussed in further detail within other significant resource sections of the document.

Cumulative Impacts to Hydrology

By providing a storm surge barrier across the Golden Triangle marsh, the incremental effect of the proposed action, in combination with other projects in the vicinity (discussed in section 4.0), would significantly reduce the effect of surges from extreme events up to the 100-year storm level and beyond. This would result in further enhancement of the entire proposed 100-year hurricane and storm damage risk reduction system throughout the area (USACE 2008b).

As shown in figure 26, when 2007-without-Borgne-barrier statistics are plotted along with 2010-with-Borgne-barrier statistics for a point #140 located near Seabrook/Lake Pontchartrain, resulting curves of still water elevation are nearly identical. However, the structure at Seabrook in addition to the proposed action could increase local friction in IHNC channel, which could result in decreases in the maximum surface velocity by ~0.05 ft/sec (Martin et al. 2008).

The proposed action will have additive impacts to identified future projects such as a proposed gate structure at the Lake Pontchartrain/IHNC interface, closure of the MRGO at Bayou La Loutre and the possible freshwater diversion at Violet, all resulting in altered hydrologic flows within the study area. For example, the proposed action, in conjunction with a gate structure at the Lake Pontchartrain/IHNC interface, could result in an increase in water levels within the GIWW/IHNC up to 1.5 ft due to overtopping with both gates closed during a storm that produces a 1 percent exceedance surge elevation. This surge elevation has a 1 percent chance of occurring each year. Furthermore, the project area is no longer freely connected with the sediment source of the Mississippi River due to numerous past flood control projects in the area.

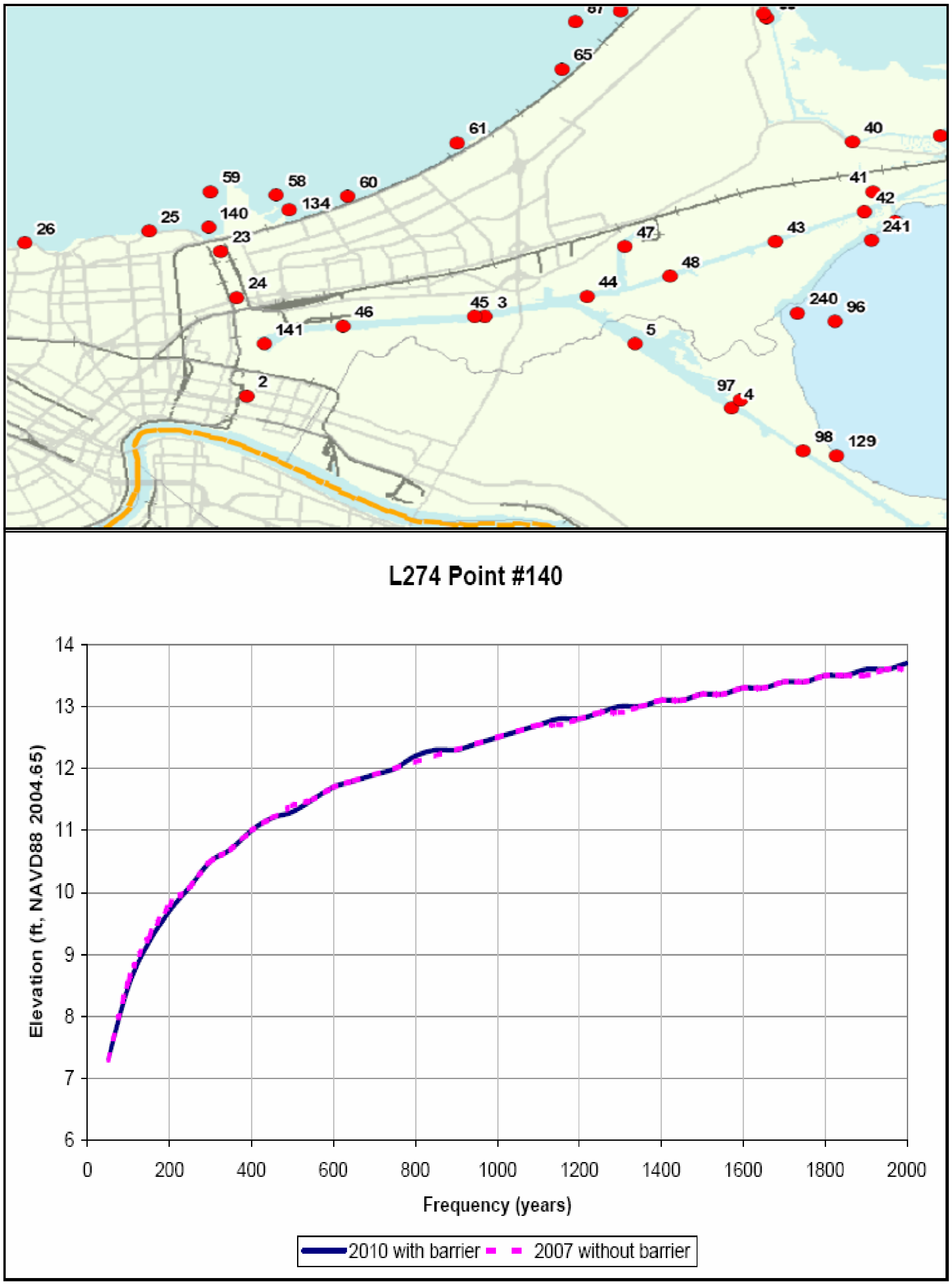

Figure 26. Comparison of Still Water Elevations using 2007-without-barrier statistics and 2010-with-barrier statistics

Alternative 4b – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Geotextile Levee Barrier in Alignment 4

Direct Impacts to Hydrology

Alternative 4b follows the same alignment as the proposed action, but includes a geotextile levee instead of a floodwall. The alignment and gate structures would be the same as the proposed action resulting in impacts to hydrology similar to those described under the proposed action.

Indirect Impacts to Hydrology

Indirect impacts under this alternative would be the same as those discussed under the proposed action.

Cumulative Impacts to Hydrology

Alternative 4b follows the same alignment as the proposed action only with a different barrier technology. Alternative 4b cumulative impacts to hydrology would be the same as described under the proposed action.

Alternative 1 – Deep Draft Gate in Alignment 1

Direct Impacts to Hydrology

This alternative would result in minor velocity increases of approximately 0.3 ft/s within the immediate vicinity of the gate structure. Alternative 1 has little potential for impacting the tidal flow within the CWA since the structure is north of the system's control structures. No impacts to hydrology are anticipated from replacement of the existing Bayou Bienvenue Control Structure, as the opening of the new control structure would be the same width as the current structure; therefore flow through the structure would not be expected to change and it would be operated in the same manner as the existing Bayou Bienvenue gate.

During storm events, the alternative would experience potential for lesser overtopping volumes than the proposed action due to the shorter barrier length. However, this alignment allows for a smaller storage volume to account for rainfall and storm influence on the protected side of the structure from Lake Pontchartrain, and may result in higher storm surge than the proposed action (storm surge increases the further west the alignment is placed due to the channelization of the storm surge through the marsh and into the IHNC (USACE 2008d)).

Indirect Impacts to Hydrology

Alternative 1 does not cross the Golden Triangle marsh and would not require a second gate structure across Bayou Bienvenue as does the proposed action; therefore, indirect impacts to resources such as wetlands and fisheries are expected to be less than the proposed action.

Cumulative Impacts to Hydrology

The incremental effect of this alternative, in combination with other projects in the vicinity (discussed in section 4.0), would significantly reduce the effect of surges from extreme events up to the 100-year storm level. This would result in further enhancement of the entire proposed 100-year hurricane and storm damage risk reduction system throughout the area (USACE 2008b).

Future projects such as a proposed gate structure at the Lake Pontchartrain/IHNC interface and the MRGO closure at Bayou La Loutre will result in altered hydrologic flows within the study area. The structure at Seabrook in addition to the proposed action could increase local friction in IHNC channel, which could result in decreases in the maximum surface velocity by ~0.5 ft/sec (Martin et al. 2008). The cumulative impact of any altered flow through the gate structure is minor when considered with past and present activities because the hydrology has already been altered by the maintained navigable waterways (GIWW, IHNC, MRGO) and the existing GNOHSDRRS.

Alternative 2 – Deep Draft Gate in Alignment 2

Direct Impacts to Hydrology

Alternative 2 is similar to alternative 1, but follows an alignment slightly to the east of alternative 1. Direct impacts to hydrology would be similar to those described in alternative 1, including minor increases in velocity. However, this alternative would experience larger overtopping volumes and provide slightly larger storage area during storm events than alternative 1. No impacts to hydrology are anticipated from replacement of the existing Bayou Bienvenue Control Structure. The opening of the new control structure would be the same width as the current structure; therefore flow through the structure would not be expected to change.

Indirect Impacts to Hydrology

Indirect impacts under this alternative would be the same as those discussed under alternative 1.

Cumulative Impacts to Hydrology

Cumulative impacts to hydrology would be similar to those described in alternative 1.

Alternative 3a – MRGO Structure, GIWW Gate, and Structural Wall Barrier in Alignment 3

Direct Impacts to Hydrology

Changes in velocity around the gate structure on the GIWW are expected to be similar to those described under the proposed action. No impacts to hydrology are anticipated from the new replacement Bayou Bienvenue Control Structure. The opening of the new control structure would be the same width as the current structure; therefore flow through the structure would not change.

Based on hydroperiod modeling, a typical response under alternative 3a would be an increase in maximum tidal depth of about 0.3 ft on the flood (east) side of the proposed barrier and maximum water levels are lowered by 0.15 ft or less on the protected side (west) of the barrier. This equates to interior marsh areas being wetted by more than 2 hours less than baseline conditions.

This alternative requires a shorter barrier length across the marsh than the proposed action, resulting in a decreased loss of hydrologic connection. This shorter barrier length also translates to a lesser potential for overtopping volumes (overtopping volumes have been directly correlated to barrier length (USACE 2008d)), but potentially higher storm surge during a storm event than the proposed action. This alignment also has a slightly smaller storage volume in the IHNC to handle overtopping volumes as compared to the proposed action.

Indirect Impacts to Hydrology

Indirect impacts under alternative 3a would be the same as those discussed under the proposed action

Cumulative Impacts to Hydrology

Cumulative impacts under alternative 3a would be similar to those described under the proposed action.

Alternative 3b – MRGO Structure, GIWW Gate, and Geotextile Levee Barrier in Alignment 3

Direct Impacts to Hydrology

Alternative 3b follows the same alignment as alternative 3a only with a different barrier technology. Alternative 3b impacts to hydrology would be the same as described under alternative 3a.

Indirect Impacts to Hydrology

Indirect impacts under this alternative would be similar to those discussed under alternative 3a.

Cumulative Impacts to Hydrology

Alternative 3b follows the same alignment as alternative 3a only with a different barrier technology. Alternative 3b cumulative impacts to hydrology would be similar to those described under alternative 3a.

Alternative 5a – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Structural Wall Barrier in Alignment 5

Direct Impacts to Hydrology

Alternative 5a follows an alignment to the east of the proposed action; however, the same project components are included. Changes in velocity around the gate structures and the potential for change in the tidal prism are expected to be similar to those of the proposed action.

This alternative requires the longest barrier length across the marsh, resulting in a greater loss of hydrologic connection than the proposed action. This increased barrier length also translates to the greatest potential for overtopping volumes to be experienced during a storm event based on the correlation between barrier length and overtopping volumes (USACE 2008d). However, this alternative would provide greater storage area during storm events than the proposed action.

Indirect Impacts to Hydrology

Indirect impacts under this alternative would be the same as those discussed under the proposed action.

Cumulative Impacts to Hydrology

Due to the alignment of alternative 5a and component make-up, cumulative impacts under alternative 5a would be similar to those described under the proposed action.

Alternative 5b – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Geotextile Levee Barrier in Alignment 5

Direct Impacts to Hydrology

Alternative 5b follows the same alignment as alternative 5a, but includes a different barrier technology. Alternative 5b impacts to hydrology would be the same as described under the alternative 5a.

Indirect Impacts to Hydrology

Indirect impacts under this alternative would be the same as those discussed under alternative 5a.

Cumulative Impacts to Hydrology

Alternative 5b follows the same alignment as alternative 5a only with a different barrier technology. Alternative 5b cumulative impacts to hydrology would be similar to those described under alternative 5a.

3.2.2 Water Quality

Existing Conditions

U.S. Environmental Protection Agency (EPA) Surf Your Watershed data places the project area within the Eastern Louisiana Coastal Watershed, U.S. Geological Survey (USGS) Cataloging Unit 08090203 (USEPA 2008).

Water quality within the watershed is evaluated throughout several riverine, estuarine, and wetlands/freshwater systems and is reported by the State of Louisiana for inclusion in the EPA's National Assessment Database. State water quality assessments are typically based on five types of monitoring data: biological integrity, chemical, physical, habitat, and toxicity. The State's program consists of a fixed station long-term network, intensive surveys, special studies, and wastewater discharge compliance sampling (Louisiana Department of Environmental Quality [LDEQ] 2006).

For the State's 2006 Water Quality Integrated Report, the LDEQ used EPA's Consolidated Assessment and Listing Methodology to designate water quality within the major water systems of the State. Water quality within the Borgne 1 alternative area was determined to be impaired and given a rating of Integrated Report Category (IRC) 4c, Water body Impairment Combination (WIC) exists but a pollutant (anthropogenic source) does not cause the specific WIC cited, or IRC 5, WIC exists for one or more uses, and a total maximum daily load (TMDL) is required for the specific WIC cited.

The major systems within the area include listings as non-supporting designated use for oyster production and fish and wildlife propagation. Specific impairments along the GIWW, Bayou Bienvenue, and the MRGO include high fecal coliform results and low dissolved oxygen levels (LDEQ 2006).

A TMDL is developed for those impairments that are preventing a waterbody from achieving its designated use. TMDLs are prepared by the EPA with input and review by the State. TMDLs to address fecal coliform levels for assessment unit ids LA041601_00 (Intracoastal Waterway-Inner Harbor Navigation Canal to Chef Menteur Pass) and LA041901_00 (Mississippi River Gulf Outlet-Intracoastal Waterway to Breton Sound) are expected to be finalized by 2011. No schedule has been developed to address dissolved oxygen levels within LA041901_00 or fecal coliform levels within LA042004_00 (Bayou Bienvenue-Mississippi River Gulf Outlet to Bayou Villere).

Discussion of Impacts

Points for assessment of the alternatives are potential for scour, turbidity/suspended sediment impacts, changes in regional salinity values and dissolved oxygen.

Proposed Action: Alternative 4a - MRGO Structure, GIWW and Bayou Bienvenue Gates, and Structural Wall Barrier in Alignment 4

Direct Impacts to Water Quality

While the potential for scour around the proposed GIWW bypass swing gate, the adjacent GIWW sector gate, and the Bayou Bienvenue gate exists, proper scour protection is included as part of the design criteria of the structures to prevent this from having a significant impact on water quality. No lasting impacts to water quality as a result of scour are expected.

Both fill and excavation activities as described in the proposed action would be required to prepare the site for construction of the proposed gate structures and barriers. The construction and fill activities would result in localized, temporary turbidity impacts. During construction, these suspended sediments would be released into the surrounding waters and wetlands. Most of the earth moving activities (dredging and backfilling) will take place in the first 6 months of construction and will be minimal after that point. Water quality will be managed utilizing best management practices (BMPs) to the maximum extent practicable.

Additionally, dredged sediment will be disposed of in the designated disposal area as shown on figure 6 as part of beneficial use efforts discussed in section 2.3. This will increase the potential for suspended sediments to be released into the water column.

Release of sediment into the water column as part of these activities could temporarily decrease oxygen levels in the waters immediately surrounding the construction site by inhibiting photosynthesis or promoting solar heating. Also, some particles could contain chemically reduced substances (e.g., sulfides), which have a high chemical oxygen demand (COD), while other particles may have microorganisms attached, which could decompose organic matter and create a biological oxygen demand (BOD). Thus, a localized and temporary reduction in dissolved oxygen could occur in the immediate area of discharge. Oxygen levels are expected to return to normal soon after construction.

Long-term impacts on dissolved oxygen (DO) after construction is complete were assessed using analytical modeling of DO with an ambient DO of 5.42 milligram per liter (mg/L) for the various cross sections throughout the project area (Dortch and Martin 2008; for details on modeling results, see appendix B). Results show that the mean bottom DO may decrease by 0.11 mg/L (from 3.69 ± 1.09 mg/L to 3.58 ± 1.29 mg/L) (mean ± 1 standard deviation) when comparing the base condition of a closure of the MRGO at Bayou La Loutre with a scenario similar to the proposed action. Although this value is below the standard for estuarine systems (4.0 mg/L), DO concentrations in the project area are already depressed and periodically fall below 4.0 mg/L (Dortch and Martin 2008).

Excessive turbidity can also lead to water body temperature increases. Increased suspended solids produced during construction could absorb incident solar radiation and slightly increase the temperatures of water bodies, especially near the surface. However, these effects would be temporary and would occur only during construction.

Although this alternative includes a MRGO crossing near Bayou Bienvenue, the proposed action is not expected to have a significant change in existing salinity regimes within the project area. Modeling results have shown a slight (± 0.1 part per thousand [ppt]) change in salinity inside the CWA during the wet season, and a ±1.0 ppt change adjacent to the MRGO crossing during the dry season under the proposed action (for details on modeling results, see appendix B). During wet conditions (March), salinity is expected to decrease by 0.15 ppt in the MRGO near Bayou Bienvenue and increase by 0.3 ppt in the IHNC near Seabrook (Martin et al. 2008). Maximum changes to salinity in the project area would be 1.0 ppt or less with the proposed action. The proposed gate structures at Bayou Bienvenue and the GIWW are designed to allow for continued tidal exchange except in times of impending storm threat or during maintenance periods when the gates would be closed. It is anticipated that the most significant changes in salinity would be as a result of construction of a de-authorization structure on the MRGO further to the south at Bayou La Loutre as discussed in Cumulative Impacts below and not as a result of the proposed action.

Changes in hydrology, as discussed in section 3.2.1, may impact water quality within the project area. Periods of longer inundation may contribute to the erosive forces acting on the wetland habitats within the project area which may lead to increased levels of suspended sediment within the water column. Increased suspended sediment may decrease oxygen levels by inhibiting photosynthesis or promoting solar heating, which can lead to high COD or create a BOD.

Indirect Impacts to Water Quality

Indirect impacts to water quality could occur as a result of boats having to navigate through the proposed gate structures. With the gate structures present and a more constricted navigational opening there is a slight risk for damage to occur to vessels that pass through the gates, which could result in releases of fuels and oils into the water column. The potential for these impacts to occur are minimized, however, through design parameters that require structures to allow for “safe” passage velocities, and navigational aids such as guidewalls, fendering, dolphins, and Coast Guard signage.

Cumulative Impacts to Water Quality

The incremental effects of the proposed action are not expected to have a significant long-term effect on the large-scale water quality conditions in the study area since the water quality will continue to be influenced by industrial and commercial uses. Concurrent construction of other 100-year GNOHSDRRS projects could cause short-term impacts to water quality that could exceed LDEQ’s water quality standards. The cumulative construction impacts of the proposed action would be additive to similar impacts caused by other GNOHSDRRS projects planned. This could lead to increased turbidity and possible reductions in dissolved oxygen levels in the vicinity and downstream of construction activities. These impacts would generally be localized to areas where construction would occur and are anticipated to be temporary. The implementation of BMPs and Stormwater Pollution Prevention Plans (SWPPPs) would minimize cumulative impacts from construction.

Continued industrial activities, urban wastewater discharges, and construction activities contribute to a continued decline in water quality within the study area. However, state and Federal programs are in place to regulate and improve water quality, so the net cumulative impact over time could be the improvement of water quality for the study area. The temporary impacts associated with this alternative would not be expected to detract from these projects and programs.

The MRGO closure at Bayou La Loutre could produce environmental benefits through partial restoration of estuarine salinity gradients. Modeling conducted by ERDC illustrated that the closure of the MRGO at Bayou La Loutre had a significant effect on monthly average bottom salinity values not only in MRGO/GIWW/IHNC, but also in the Lake Borgne area. Most areas are expected to show decreases of 3-4 ppt, with the MRGO channel showing the highest decrease in the region just north of the La Loutre closure at approximately 10 ppt (Martin et al. 2008). Salinity stratification is expected to be reduced north of the total closure structure which is anticipated to reduce salinity stratification in Lake Pontchartrain. The salinity changes described for the proposed action would be minimal compared to the shift that would occur due to the MRGO closure at Bayou La Loutre.

Salinity modeling showed that the addition of a gate structure at Seabrook could produce small increases in salinity on the order of approximately 0.15 ppt during the wet period. The dry period showed a no changes to salinity with the addition of the Seabrook gate structure.

The addition of a gate structure at Seabrook could have a lowering affect on DO. This might be attributed to the gate partially blocking flow interaction within the IHNC & Lake Pontchartrain. When all of the DO levels in the project area are averaged under the proposed action, the addition of the Seabrook gate structure decreases the DO from 3.58 to 3.51.

Upon completion of construction, localized water quality enhancements would be expected within the wetlands created and enhanced by this project and the projects planned and under investigation by CEMVN and Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) due to pollutant trapping and processing. Due to the size of wetlands affected relative to the water quality issues, it is not expected that these benefits would result in observable large-scale cumulative improvements in water quality.

Alternative 4b – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Geotextile Levee Barrier in Alignment 4

Direct Impacts to Water Quality

Alternative 4b follows the same alignment as the proposed action; however, a geotextile levee barrier across the marsh replaces the concrete floodwall discussed in the proposed action. Potential for impacts to water quality as a result of scour, salinity changes, and long term DO would be the same as those of the proposed action.

In contrast, a higher potential for impacts associated with turbidity exists under alternative 4b than the proposed action. The geotextile levee barrier would have a wider cross section and footprint width than the proposed action. Due to constructability constraints, it is anticipated that construction would take significantly longer for the geotextile levee barrier than for the floodwall discussed in the proposed action. There would be an increase in the time that ground disturbing activities and potential impacts from turbidity would occur. Therefore impacts to water clarity, salinity, and DO as described under the proposed action may continue for a longer period of time when compared to the proposed action.

Indirect Impacts

Indirect impacts under this alternative would be the same as those discussed under the proposed action.

Cumulative Impacts to Water Quality

The cumulative effects of this alternative to water quality would be similar to those described in the proposed action, with the exception that it would take significantly longer to construct the geotextile levee and a greater area of disturbance would be necessary due to the wider cross section. Therefore, under alternative 4b there is a potential for a greater degree of water quality impact than under the proposed action. These temporary impacts would be minimized through the use of BMPs and SWPPPs. As discussed under the proposed action, it is anticipated there could still be a net gain in water quality due to regulatory programs in place to improve water quality.

Alternative 1 – Deep Draft Gate in Alignment 1

Direct Impacts to Water Quality

Alternative 1 is a shorter waterbody crossing than the proposed action and does not cross the marsh area. However, construction-related impacts to water clarity, salinity and DO as described under the proposed action would still exist. Alternative 1 could have an increased potential for stormwater runoff to contribute to turbidity impacts when compared to the proposed action due to the extended footprint encompassed by the additional levee and floodwall work east of Alignment 1. However, these impacts can be minimized through proper use of BMPs and a properly executed SWPP.

The potential for scour around the deep draft gate structure exists as is expected around gate structures within all of the alternatives. However, this would be minimized through incorporation of proper scour protection included as part of the design criteria of the structure.

A comparison of the base condition including the MRGO closure at Bayou La Loutre and a modeling scenario similar to alternative 1 shows an increase of 0.3 mg/L in the mean bottom DO values after construction is complete (increasing from approximately 3.69 mg/L to 3.99 mg/L) (Dortch and Martin 2008).

Modeling results have shown a ± 0.25 part per thousand (ppt) change in salinity inside the CWA and MRGO, and as much as +1.5ppt in the IHNC during the wet season (March) under

Alternative 1. During dry conditions (September), salinity is expected to change by ±0.5 ppt in the MRGO and GIWW and ±1.0 ppt in the IHNC (Martin et al. 2008).

Indirect Impacts to Water Quality

Similar to the proposed action, indirect impacts to water quality could occur as a result of boats having to navigate through the proposed gate structure. With the gate structure present and a more constricted navigational opening, there is a slight risk for damage to occur to vessels that pass through the gates which could result in releases of fuels and oils into the water column.

Alignment 1 is located far enough east of the Paris Road Bridge that there are no bridge approach problems anticipated for deep draft vessels. However, the proximity of the gate on Alignment 1 to the bridge could cause a bottleneck in traffic as barge traffic exits the gate and stops prior to passing the bridge. This required time would be increased while cofferdams are in place during construction of the gate structure. This bottleneck could make the structure more susceptible to vessel impact and increase the potential for indirect water quality impacts from fuel and oil releases. However, the potential for these impacts to occur are minimized through design parameters that require structures to allow for "safe" passage velocities and navigational aids such as guidewalls, fendering, dolphins, and Coast Guard signage.

Cumulative Impacts to Water Quality

Salinity modeling showed that the addition of a gate structure at Seabrook to Alternative 1 could produce small decreases in salinity on the order of approximately 0.25 -1.0 ppt during the wet period. The dry period showed a larger decrease of approximately 0.5-1.0 ppt. The differences with the addition of the Seabrook gate during both periods may be attributable to tidal phasing effects created by the addition of the Seabrook structure.

Salinity fluctuations caused by this alternative and the Seabrook gate structure, coupled with the 3-4 ppt changes with the MRGO closure at Bayou La Loutre, may impact the health and growth of individuals. The types of impacts would be similar to those described above in the proposed action.

The addition of a gate structure at Seabrook could have an additive effect on DO. When all of the DO levels in the project area are averaged under the Alternative 1, the addition of the Seabrook structure increases the DO from 3.69 to 4.03 mg/L.

When construction of this alternative is considered cumulatively with the required modifications to the existing system surrounding the GIWW, Michoud Slip, Michoud Canal and the MRGO, this alternative would result in an overall greater temporary impact to water quality due to turbidity than the proposed action. These impacts would be minimized through the use of BMPs and SWPPPs. Therefore these temporary and minimized impacts are not likely to detract from any benefits gained from existing water quality regulatory programs.

Alternative 2 – Deep Draft Gate in Alignment 2

Direct Impacts to Water Quality

Similar to alternative 1, alternative 2 is a shorter waterbody alignment than the proposed action and does not cross the marsh area. This alternative is along an alignment across the GIWW and MRGO confluence, and is 580 ft longer than alternative 1 and would result in slightly greater turbidity impacts than alternative 1.

The potential for scour around the deep draft gate structure exists, as is expected; however, this would be minimized through incorporation of proper scour protection included as part of the design criteria of the structure. No impacts to salinity regimes are expected with this alternative.

Indirect Impacts to Water Quality

The location of this alignment could make the approach into the Michoud Slip more difficult due to a tight turning radius. This could increase the possibility of indirect impacts to water quality due to damaged vessel leakage. However, the potential for these impacts to occur are minimized through design parameters that require structures to allow for “safe” passage velocities, and navigational aids such as guidewalls, dolphins, and Coast Guard signage.

Cumulative Impacts to Water Quality

The cumulative effects of this alternative to water quality would be nearly identical to those described in alternative 1, with the exception that a slightly greater area of disturbance would be necessary for construction of the gate structure and a lesser area of existing levee and floodwall would need to be modified. When construction of this alternative is considered cumulatively with the required modifications to the existing levees and floodwalls, this alternative would result in an overall greater temporary impact to water quality due to turbidity than the proposed action. These impacts would be minimized through the use of BMPs and SWPPPs. Therefore these temporary and minimized impacts are not likely to detract from any benefits gained from existing water quality regulatory programs.

Alternative 3a – MRGO Structure, GIWW Gate, and Structural Wall Barrier in Alignment 3

Direct Impacts to Water Quality

Alternative 3a follows alignment 3 and has impacts, such as those brought on by changes in hydrology, similar to those discussed in the proposed action except that it does not create a new crossing of Bayou Bienvenue. However, this alignment will require the construction of a replacement gate on the protected side of the existing Bayou Bienvenue control structure. There remains potential for scour around the proposed GIWW shallow draft gate and the existing Bayou Bienvenue gate, however, as with all alternatives, proper scour protection is included as part of the design criteria of the structure to reduce such impacts.

The length of the barrier associated with alternative 3a is less than that of the proposed action; therefore there should be less water quality impacts from construction under alternative 3a. However, alignment 3 would necessitate relocation of an existing pipeline that would result in additional temporary impacts to water quality. These impacts would be minimized through use of BMPs and SWPPPs during excavation and construction. Alternative 3a is not expected to have a significant change in existing salinity regimes within the project area. Operation of proposed gate structures would allow for continued tidal exchange except in times of impending storm threat when the gates would be closed.

Indirect Impacts to Water Quality

Indirect impacts to water quality would be similar to those of the proposed action.

Cumulative Impacts to Water Quality

When the necessary pipeline relocation is considered along with construction of this alternative, cumulative impacts for this alternative would be similar to those of the proposed action.

Alternative 3b – MRGO Structure, GIWW Gate, and Geotextile Levee Barrier in Alignment 3

Direct Impacts to Water Quality

Alternative 3b would have the same direct impacts to water quality as alternative 3a except that the potential for impacts resulting from turbidity would be increased due to an increased cross-sectional width of the geotextile levee (600 ft) as compared to the structural wall (350 ft). The geotextile levee also has a longer construction schedule than the structural wall due to the amount of material that must be placed. The water quality implications of the geotextile levee are similar to those discussed under alternative 4b.

Indirect Impacts to Water Quality

Indirect impacts to water quality would be similar to those of the alternative 4b.

Cumulative Impacts to Water Quality

Alternative 3b would have the same cumulative impacts to water quality as alternative 3a except that the potential for impacts resulting from turbidity would be increased due to the increased footprint and construction schedule associated with the geotextile levee. The water quality implications of the geotextile levee are similar to these discussed under alternative 4b.

Alternative 5a – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Structural Wall Barrier in Alignment 5

Direct Impacts to Water Quality

Alternative 5a has a similar configuration to that of the proposed action. However, alignment 5 is further east and has a barrier crossing the wetlands approximately 5,200 ft longer than that of the proposed action. This extended length would nearly double the construction time and increase the area of ground disturbing activities translating into a higher potential for impacts to water quality resulting from turbidity.

As discussed under the proposed action, this alternative includes gates at GIWW and Bayou Bienvenue to allow for tidal exchange. While there is a potential for scour around these gates, appropriate scour protection would be incorporated into the final design of any structure that is constructed.

This alternative also includes a closure of the MRGO channel approximately 10,500 ft south of the existing Bayou Bienvenue flood control gate. This structure is not expected to have a significant change in existing salinity regimes within the project area. Modeling results have shown a slight (± 0.1 ppt) change in salinity inside the CWA during the wet season and adjacent to the MRGO crossing during the dry season. Locations of proposed gate structures along the GIWW and Bayou Bienvenue are designed to allow for continued tidal exchange (except in times of impending storm threat when the gates would be closed).

Indirect Impacts to Water Quality

Indirect impacts to water quality would be similar to those of the proposed action.

Cumulative Impacts to Water Quality

Alternative 5a would have similar cumulative impacts to water quality as the proposed action. The potential for impacts resulting from turbidity would be increased for alternative 5a due to the longer barrier length. These water quality implications are expected to be temporary and would not result in changes to the long term health of the ecosystem.

Alternative 5b – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Structural Wall Barrier in Alignment 5

Direct Impacts to Water Quality

Alternative 5b would have the same direct impacts to water quality as alternative 5a; however, the potential for impacts resulting from turbidity would be increased due to the increased cross-sectional width of the geotextile levee (600 ft) as compared to the structural wall (350 ft).The water quality implications of the geotextile levee are similar to those discussed under alternative 4b. This alternative would have the longest overall construction schedule within the water because it has the longest crossing of the Golden Triangle marsh and consists of a geotextile levee. Therefore, this alternative would have the greatest potential of all the alternatives for impacts resulting from construction-related turbidity to occur.

Indirect Impacts to Water Quality

Similar to alternative 5a, indirect impacts to water quality could occur as a result of boats having to navigate through the gate on the GIWW and at Bayou Bienvenue. The potential for these impacts to occur are minimized however through design parameters that require structures to allow for “safe” passage velocities.

Cumulative Impacts to Water Quality

Alternative 5b would have the same cumulative impacts to water quality as alternative 5a except that the potential for impacts resulting from turbidity would be increased due to the increased footprint and construction schedule associated with the geotextile levee as compared to the structural wall. The water quality implications of the geotextile levee are similar to those discussed under alternative 4b.

3.2.3 Wetlands

Existing Conditions

The coastal vegetation resources in the Borgne 1 area formerly consisted of bottomland forest and freshwater/intermediate, brackish, and saline marshes. Historically, the influx of high volumes of freshwater from the Mississippi River system maintained marshes in the study area as predominantly freshwater/intermediate or brackish. Changes in the extent of habitat types in the study area are a result of both biotic (living) and abiotic (non-living) forces. These forces, many related to the geophysical processes of deltas, are consistent across Louisiana’s deltaic marshes. Natural subsidence and the development of human infrastructure are the main causes of a general decline of marsh and other wetland habitats (USACE 2007b).

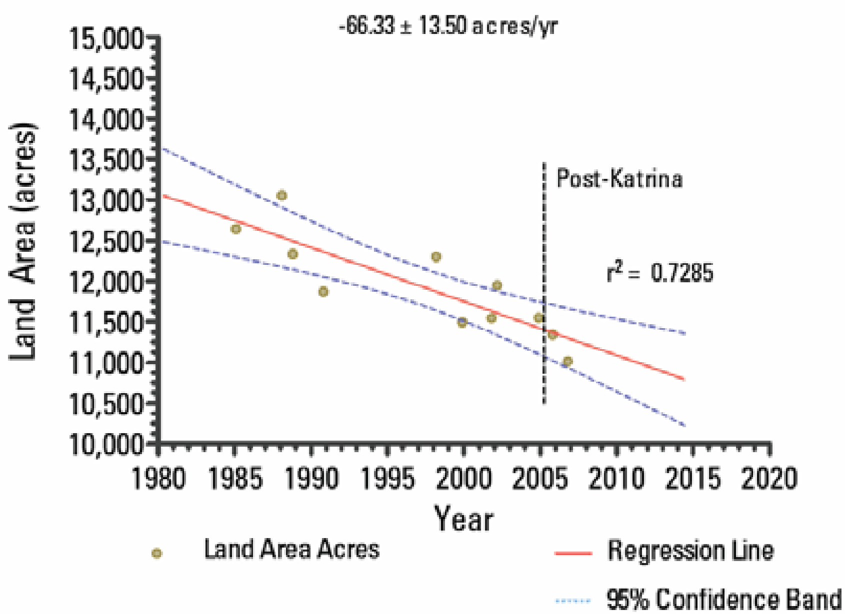

Figure 27. Golden Triangle Land Area Trends: 1985 to 2006

Specifically, there is a continuing progression toward open water that is partially driven by continual subsidence of marsh. Land loss trends are represented in figure 27 (Barras 2006). Sediments associated with normal freshwater flow are blocked from entering the coastal marshes due to human alteration of the landscape for flood protection and navigation. Consequently, wetlands are not being replenished through the natural deltaic process (USACE 2004a). Over time, saltwater intrusion as a result of multiple factors including subsidence and manmade navigation channels has raised salinity levels, causing a conversion of freshwater/intermediate marsh to saline marsh. Today, brackish and saline marshes in the study area wetlands are dominated by a few plants tolerant of the increased salinity levels such as smooth cordgrass (*Spartina alterniflora*), glasswort (*Salicornia virginica*), and salt grass (*Distichlis spicata*) (Site investigation field trip, April 14, 2008).

The storm surge associated with Hurricane Katrina may have further contributed to temporary increases in salinity within many previously freshwater/intermediate and brackish marshes within the study area. The storm surge destroyed a portion of the levee structure located between CWA and the MRGO and led to the replacement of relatively freshwater/brackish water with more saline water. Comparison of 2005 and 2006 aerial photography, along with site verification, showed tree loss within the study area, primarily in bottomland forest and cypress-tupelo swamps.

According to information provided in the IPET report, there is no indication flooding and subsequent floodwater pumping from Greater New Orleans contributed to loss in the delta, wetland, and Gulf of Mexico areas outside the city (USACE 2007g). A much greater impact to regional habitat and biological resources is the physical damage or alteration of habitats (USACE 2007g). These impacts include the loss of bottomland hardwoods and cypress-tupelo swamps to wind and storm surge damage and the intrusion of saltwater into previously freshwater/intermediate or brackish marshes initiated through breaches or overtopping of the levees (USACE 2007g).

Figure 28 illustrates the habitat types that currently exist within the study area. The study area consists primarily of three wetland marsh types: freshwater marsh, brackish-intermediate marsh, and salt marsh. Marshland type and distribution was determined for this study using Louisiana Department of Wildlife and Fisheries (LDWF) data (LDWF 2001). This data is part of the Louisiana GIS Digital Map, May 2007 Compilation DVD.

Freshwater/intermediate marshes were once prevalent in the study area. Predominant vegetative species within these marshes include Jamaica sawgrass (*Cladium jamaicense*), bull tongue arrowhead (*Sagittaria lancifolia*), maiden cane (*Panicum hemitomon*), slough sedge (*Carex obnupta)*, cattails (*Typha latifolia*), and rushes (*Juncus phaeocephalus*). Aquatically adapted wildflowers such as yellow pond-lily (*Nuphar polysephalum)*, water buttercup (*Ranunculus orthorhynchus)*, and succulent water parsley (*Oenanthe sarmentosa)* are also typical freshwater/intermediate marsh inhabitants. Freshwater/intermediate marshes support the greatest array of wildlife species of the three marsh types found within the study area, especially wintering waterfowl.

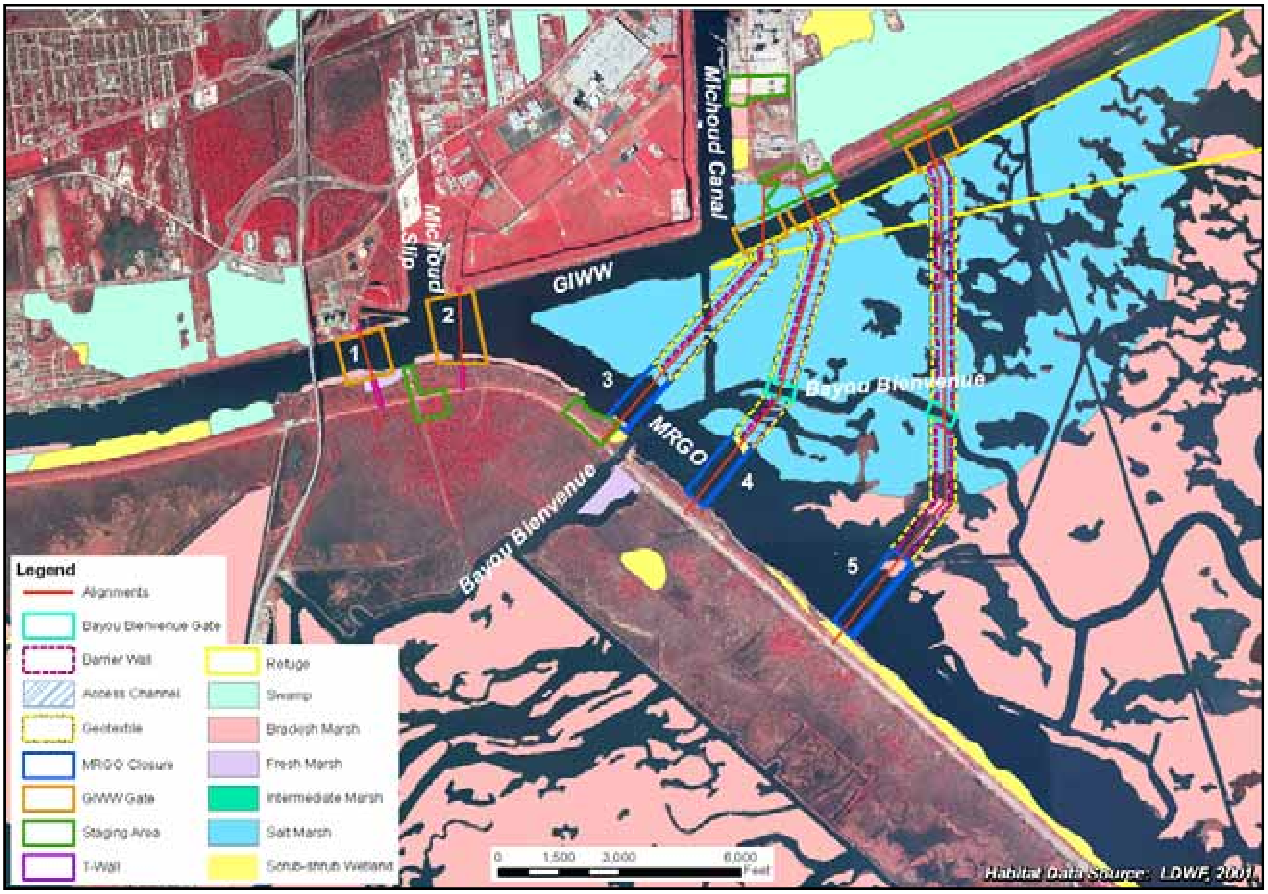

Figure 28: Tier 2 Borgne Area Showing the Proposed Action, Alternative Alignments, Wetlands, Habitat Types, and the NWR

Brackish marshes are found in areas where enough freshwater can enter the system to maintain low salinity levels. Brackish marsh types are dominated by salt meadow cordgrass (*Spartina patens*), cowpea (*Vigna luteola*), and salt marsh bulrush (*Schoenoplectus maritimus*). Wiregrass gentian (*Gentiana pannelliana*), black needle rush (*Juncus roemerianus*), saltwort (*Batis maritima*), sturdy bulrush (*Schoenoplectus robustus*), coast cockspur grass (*Echinochloa walteri*), Jamaica sawgrass (*Cladium jamaicense*), arrowhead (*Sagittaria* sp.), and common reed (*Phragmites australis*) are also present (Visser et al. 1998). Brackish marshes act as important nursery and feeding areas for many species of amphibians, reptiles, birds, and mammals.

Salt marshes support very little plant species diversity and are heavily dominated by rooted smooth cordgrass, glasswort, and salt grass (LDWF 1997). Other plants such as rushes (*Juncus* spp.), saltwort, and black mangrove (*Avicennia germinans*) inhabit the saline marshes in low densities (Visser et al. 1998). This habitat is located mainly in the vicinity of the confluence of the MRGO and the GIWW. Saline marshes provide valuable nursery and developmental habitats for aquatic organisms. Several species of reptiles inhabit the marsh. Numerous birds use the saline marshes as feeding habitat.

In addition, pockets of scrub-shrub wetland and swamp can be found within the project area. The primary difference between scrub-shrub wetlands (<6 m) and swamps (>6 m) is plant height

(Cowardin et al. 1979). These wetlands are characterized by substrate that is flat and can vary from mud to sand, though highly organic, with muddy soils being the most common. These wetlands are among some of the most sensitive habitats because of their high biological use and value, difficulty of cleanup, and potential for long-term impacts to many organisms (NOAA 1997).

Changes in the existing wetland community are expected as a result of the closure of the MRGO at Bayou La Loutre. As described in sections 3.2.1 and 3.2.2, this closure could produce environmental benefits through partial restoration of estuarine salinity gradients and tidal conditions. It also could prevent the loss of a significant percentage of marsh expected to be lost in the future without the closure (USACE, 2008e).

Discussion of Impacts

Proposed Action: Alternative 4a - MRGO Structure, GIWW and Bayou Bienvenue Gates, and Structural Wall Barrier in Alignment 4

Direct Impacts to Wetlands

Direct impacts of the proposed action include gate tie-ins along the GIWW and Bayou Bienvenue, construction of the structural barrier and associated access channels across the marsh and tie-in of the MRGO crossing to the existing GNOHSDRRS. Temporary impacts would also be associated with areas designated as construction staging or laydown areas. Table 6 categorizes the direct wetland impacts associated with the proposed action and the other evaluated alternatives. For the proposed action, areas of temporary impacts associated with known construction right-of-way needs were included.

The proposed action includes construction of a structural wall, in lieu of a geotextile levee, across the marsh in an attempt to minimize the footprint of the impact on the marsh. The concrete barrier with a flood side maintenance access channel and a protected side plunge pool would be approximately 350 ft wide as compared to the larger footprint of other barrier technologies (e.g., geotextile levee is approximately 600 ft. wide). In order to minimize the potential for erosion, shoreline protection would be added along the length of the access channel and scour mats would line the protected side plunge pool.

While some impacts are unavoidable due to the alignment, the proposed action seeks to minimize permanent impacts on the wetland communities. For example, the project intends to allow for dredged material to be used beneficially, rather than disposing of it in an upland disposal site.

Table 6. Wetland Impacts for the Proposed Action and Alternatives (acres)								
	Swamp	**Brackish Marsh**	**Fresh Marsh**	**Salt Marsh**	**Scrub/shrub Wetland**	***Total Wetland****	**Open Water**	**Upland***
Proposed Action	0.3	3	0	74	3	*80.3*	45	45
Alternative 4b	0.3	3	0	102	3	*108.3*	47	45
Alternative 1	4	7	4	21	18	*54*	25	346
Alternative 2	4	9	0.8	21	18	*52.8*	40	272
Alternative 3a*	0.3	3	1.3	53	0.2	*57.8*	32	45
Alternative 3b*	0.3	3	1.3	72	0.2	*76.8*	33	45
Alternative 5a	0.3	13	0	77	0	*90.3*	58	59
Alternative 5b	0.3	14	0	109	0	*123.3*	79	59

**Does not include additional acreages for pipeline relocation. Impacts are estimated to be 11.5 – 24.3 acres but could be up to 57 acres based on construction techniques.*

Figure 6 identifies the proposed open water disposal area for the beneficial use of dredged material. The boundaries include the proposed alignment for the project to the west, the south bank of the GIWW to the north, an unnamed pipeline canal to the east, and Bayou Bienvenue north bank and Cutoff Bayou north bank to the south.

Discharge pipelines would be floated in over open water rather than through existing marsh to aid in placement of material while minimizing construction related impacts to the marsh. The dredge pipes would be directed into the open water ponds, and as they fill with dredged material, the pipes will be backed out towards the entrance to minimize movement of the pipes. The initial fill elevation is + 4 ft, and settlement is estimated to be to approximately +1. Earthen and sheet pile dikes would be constructed to +4 ft to semi-contain the dredged material within the open water ponds and prevent spillage into the GIWW. Elevation of fill on existing marsh surrounding the open water ponds would not exceed 6 inches, with some limited areas not exceeding 12 inches; at this elevation the dredge pipe would be moved to decrease impacts to existing marsh. Another measure to prevent existing marsh from having more than the 6 inches elevation of dredged material stacking on it would be that the earthen dikes within the project area may be breached to allow dredged material to settle into adjacent open water ponds west of the unnamed pipeline canal. If necessary, the dikes would be breached following construction to allow reestablishment of the hydrologic regime.

Indirect Impacts to Wetlands

As discussed in the IER # 11 Tier 1 document, any barrier constructed through the marsh could cause indirect impacts to marsh habitats through alteration of water circulation and sediment processes (USACE 2008b). The proposed action would partially enclose approximately 403 acres of brackish and saline marsh, leaving approximately 6,915 acres on the floodside of the floodwall and gates within the Golden Triangle marsh. Modeling of the hydroperiod both on the protected side of the barrier and the flood side was conducted to quantify the potential for change in wetland inundation. This modeling has indicated that the proposed action impacts inundation intervals of the marsh areas for both the advanced and final measures.

While the hydrologic connection is maintained through the gates at GIWW and Bayou Bienvenue these openings do not replicate existing conditions. The modeling results indicate that the proposed action could result in altered hydrology and inundation levels which may indirectly contribute to the continued trend of marsh loss. Kuhn et al. (1999) found that small changes in tidal amplitude decreased sedimentation created conditions conducive for subsidence. Additionally, Kuhn et al. (1999), found that small decreases (0.16 to .33 ft) in tidal amplitude resulted in greater occurrence of *Spartina patens*, a high marsh species relative to *S. alterniflora* an emergent species. Managed marshes with less sedimentation and lower tidal amplitude also had statistically significantly less primary production. A more detailed discussion of the changes in hydrology can be found in section 3.2.1.

Cumulative Impacts to Wetlands

The proposed action would result in the unavoidable direct loss of marsh as indicated in table 6, and indirect loss caused by changes to hydrology and inundation levels. These impacts would be mitigated. When considered cumulatively with other marsh creation projects, the impacts of this project could be partially offset (USACE 2008b).

Alternative 4b – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Geotextile Levee Barrier in Alignment 4

Direct Impacts to Wetlands

Alternative 4b would follow the same alignment as the proposed action and therefore would have similar direct impacts to wetlands. However, the geotextile levee barrier would have an increased footprint compared to the proposed action. The geotextile levee would include a sand pad with geotextile fabric that extends the levee footprint on either side for a total of 600 ft (as compared to the 350 ft width of the proposed action). Table 6 above categorizes the direct wetland impacts associated with the construction of the alternative and required laydown areas.

Indirect Impacts to Wetlands

Indirect impacts would be similar to those described under the proposed action.

Cumulative Impacts to Wetlands

Cumulative impacts would be similar to those described under the proposed action; however, Alternative 4b would result in greater unavoidable direct loss of marsh as indicated in table 6. These impacts would be mitigated, and additional positive benefits could occur from beneficial use of the dredged material.

Alternative 1 – Deep Draft Gate in Alignment 1

Direct Impacts to Wetlands

Table 6 above categorizes the direct wetland impacts associated with the construction of the alternative, including raising levees and floodwalls and required staging areas. Direct impacts to wetlands under this alternative include deep draft gate tie-ins along the GIWW. Temporary impacts would also be associated with areas designated as construction staging areas. In addition, construction of a replacement for the existing control structure at Bayou Bienvenue could impact wetland habitat during the construction period. Construction of the structure and levee tie-ins would occur primarily on existing upland spoil and levee.

Indirect Impacts to Wetlands

Indirect impacts would be associated with construction of the gate structure on the GIWW along with the additional impacts associated with the replacement of the existing control structure at Bayou Bienvenue. Construction in the bayou channel could cause the indirect impacts of increased turbidity and sedimentation within the nearby wetlands. However, these impacts on wetlands and aquatic habitat would be short-term.

Cumulative Impacts to Wetlands

Any direct impacts to wetlands would be mitigated; therefore the cumulative impact of this project in combination with other projects (discussed in section 4.0) is not anticipated to be significant.

Alternative 2 – Deep Draft Gate in Alignment 2

Direct Impacts to Wetlands

Alternative 2 follows an alignment slightly to the east of alternative 1 but would have similar direct impacts. Table 6 categorizes the direct wetland impacts associated with the construction of this alternative, including raising levees and floodwalls and construction of a replacement structure for the existing control structure at Bayou Bienvenue to provide 100-year level of protection and required laydown areas.

Indirect Impacts to Wetlands

Indirect impacts would be similar to those described under alternative 1

Cumulative Impacts to Wetlands

Cumulative impacts would be similar to those discussed under alternative 1.

Alternative 3a – MRGO Structure, GIWW Gate, and Structural Wall Barrier in Alignment 3

Direct Impacts to Wetlands

Alternative 3a would follow an alignment east of the Michoud Canal and would include structures similar to the proposed action along the GIWW and the MRGO. However, this alignment would require the construction of a replacement for the existing control structure at Bayou Bienvenue. Construction of the Bayou Bienvenue replacement structure and levee tie-ins would occur primarily on existing upland spoil and levee.

Table 6 categorizes the direct wetland impacts associated with this alternative and the required staging areas. This alternative also crosses an existing pipeline that would require relocation, potentially resulting in an additional temporary disturbance of approximately 11.5 - 24.3 acres of marsh habitat. The amount of impacted habitat could increase to 57 acres on the protected side of the structure depending on the construction techniques used.

As discussed under the proposed action, this alternative would include beneficial use of dredged material (from the access channel). Also, in order to minimize the potential for erosion, shoreline protection would be added along the length of the barrier as described for the proposed action in section 2.3.

Indirect Impacts to Wetlands

Indirect impacts would be similar to those described under the proposed action along with the additional impacts associated with the construction of a new control structure at Bayou Bienvenue. Construction in the bayou channel could cause the indirect impacts of increased turbidity and sedimentation within the nearby wetlands. However, these impacts on wetlands and aquatic habitat would be short-term.

Although the indirect impacts due to changes in hydrology would be similar to the proposed action, less wetlands would be partially enclosed by the floodwall than would be under the proposed action. This alignment would partially enclose approximately 165 acres of brackish and saline marsh, leaving approximately 7,153 acres on the floodside of the floodwall and gates.

Cumulative Impacts to Wetlands

Cumulative impacts would be similar to those described under the proposed action; however, Alternative 3a would result in the unavoidable direct loss of marsh as indicated in table 6.

Alternative 3b – MRGO Structure, GIWW Gate, and Geotextile Levee Barrier in Alignment 3

Direct Impacts to Wetlands

Alternative 3b would have direct impacts to wetlands similar in nature to those of alternative 3a, including relocation of the pipeline, construction of a replacement for the existing control structure at Bayou Bienvenue, with the added impact of a wider footprint (due to the width required for a geotextile levee). Impacts associated with a geotextile levee would be similar to those discussed under alternative 4b. Table 6 categorizes the direct wetland impacts associated with the construction of the alternative and required laydown areas.

Indirect Impacts to Wetlands

Indirect impacts would be similar to those described under alternative 3a. This alternative would have a greater turbidity impact to the surrounding area due to the increase in earthmoving activities associated with a levee.

Cumulative Impacts to Wetlands

Cumulative impacts would be similar to those described under 3a with the additional direct loss of marsh due to the increased footprint of a levee.

Alternative 5a – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Structural Wall Barrier in Alignment 5

Direct Impacts to Wetlands

Alternative 5a would include direct impacts similar to those of the proposed action, but would have the greatest direct impact to the marsh area of all the alignments due to the length of the barrier required. Table 6 categorizes the direct wetland impacts associated with this alternative and the required laydown areas.

As discussed under the proposed action, this alternative would include beneficial use of dredged material. Also, in order to minimize the potential for erosion, shoreline protection would be added along the length of the barrier.

Indirect Impacts to Wetlands

Indirect impacts would be similar to those described under the proposed action; however, a greater amount of wetlands would be partially enclosed by this alternative. This alignment would partially enclose approximately 1,058 acres of brackish and saline marsh, leaving approximately 6,260 acres on the floodside of the floodwall and gates.

Cumulative Impacts to Wetlands

Cumulative impacts would be similar to those described under the proposed action; however, Alternative 5a would result in the unavoidable direct loss of marsh as seen in table 6. These impacts would be mitigated, and additional positive benefits could occur from beneficial use of the dredged material.

Alternative 5b – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Geotextile Levee Barrier in Alignment 5

Direct Impacts to Wetlands

Alternative 5b would have direct impacts to wetlands similar to those of alternative 5a, with the added impact of a wider footprint (due to the width required for a geotextile levee). Impacts associated with a geotextile levee would be similar to those discussed under alternative 4b. Table 6 categorizes the direct wetland impacts associated with the construction of the alternative and required laydown areas.

Indirect Impacts to Wetlands

Indirect impacts would be similar to those described under the alternative 4b.

Cumulative Impacts to Wetlands

Cumulative impacts would be similar to those described under alternative 4b; however, alternative 5b would result in the unavoidable direct loss of marsh as indicated in table 6. Impacts would be mitigated.

3.2.4 Aquatic Resources

<u>Existing Conditions</u>

The extent and type of the aquatic resources within the study area is dependent on seasonal changes in environment (water quality, hydrology, and weather), and seasonal and daily variations in the water level (tides and freshwater inflow). Aquatic habitats that occur within the project area are wetlands (fresh/intermediate, brackish, and salt marsh), open water, estuarine bottom (under open water), and submerged aquatic vegetation (SAV). The open water habitat includes tidally influenced brackish water in the GIWW, the MRGO, Michoud Canal, Michoud Slip, Bayou Bienvenue, and tidal streams through out the marsh between the MRGO and the GIWW. Estuarine bottom habitat in the project area includes marsh deposits, which are substrates consisting of a mixture of very soft to soft organic clays and peat with some silt. An SAV bed is known to occur at the southeast corner of Michoud Slip, off the GIWW east of the MRGO confluence. Water quality of the open water resources has been discussed in detail in section 3.2.2 and wetlands have been discussed in section 3.2.3.

All of the aquatic communities in the project area play an important role in the cycling of nutrients and food energy through coastal ecosystems. These communities produce detritus that is transferred as food energy for higher trophic levels via zooplankton, bivalves, crustaceans, and small fishes. Some organisms that serve as intermediate stages of the foodweb utilize open water, benthic, epibenthic and nearshore habitats that occur within the project area.

Balance of the populations of zooplankton and phytoplankton is important for a healthy ecosystem or estuary. The dominant groups of phytoplankton are diatoms and dinoflagellates. These species, along with green and blue-green algae, are responsible for large blooms in the study area waters, particularly in the summer when high temperatures and low turbidity stimulate their proliferation. Large phytoplankton blooms are also linked to nutrient-rich runoff from the developed and agricultural portions of the contributing watershed.

The zooplankton present in the study area includes a variety of forms. Certain species resemble plankton in the adult stage of their life cycle (e.g., jellyfish); others only resemble plankton in earlier life stages and become benthic or free-swimming as adults (e.g., oysters). Zooplankton abundance varies with salinity, and seasonal patterns of abundance have also been observed.

Dominant motile benthic species likely to occur in the shallow fringes of these communities include serpulid worms (polychaetes), gastropods, such as the oyster drill (*Thais haemostoma*) and moon snail (*Polinices lewisii*), and crustaceans, such as the hermit crab (*Clibanarius vittatus*) and mud crabs (*Rhithropanopeus harrisii*, *Neopanope texana*, and *Panopeus herbstii*). Economically important crustacean species that occur throughout the project area include blue crabs (*Callinectes sapidus,)* brown shrimp (*Litopenaeus setiferus)* and white shrimp (*Farfantepenaeus duorarum)*. Other common invertebrates that may occur within the project area are bivalves, such as the common rangia (*Rangia cuneata*) and American oyster (*Crassostrea virginica*). Sessile macroepifauna, such as the sea pansy (*Renilla mulleri*) and acorn barnacles (*Balanus* sp.), are found throughout the project area and occur within on hard surfaces, such as pilings, rock jetties, and other structures (Hoese and Moore 1998). Many of these species are dominant food items in the diet of fish species, including sciaenids and flounder, as well as large marine fishes such as grouper and snapper.

Historically, SAV was a significant component of aquatic habitat located within the study area however; there is only one small remaining SAV bed in the project area. SAV communities have declined as water quality conditions have declined. Much of the remaining SAV may have been impacted as a result of Hurricane Katrina (USGS 2005).

SAV communities in the Lake Borgne and Lake Pontchartrain Basins are comprised primarily of widgeon grass (*Ruppia maritima*), hydrilla (*Hydrilla verticillata*), grassleaf mudplantain (*Heteranthera dubia*), Eurasian watermilfoil (*Myriophyllum spicatum*), wild celery (*Vallisneria americana*), and sago pondweed (*Potamogeton pectinatus*). The one small SAV bed in the project area near Michoud Slip is not expected to be impacted by any of the proposed alternatives.

Discussion of Impacts

Aquatic resources rely on a combination of characteristics necessary for survival, growth, reproduction and to maintain the synergy of the ecosystem. Changes to tides, hydrology, water characteristics and available habitat and prey species are some of the factors that may be altered by the proposed project. Additionally, impacts to aquatic resources would occur by changing estuarine substrate, estuarine open water and estuarine wetlands within the footprint of the barrier and gate (table 5). The below sections describe in detail how the various alternatives may cause relative change in the project area. For the purposes of this analysis, existing conditions include the closure of the MRGO at Bayou La Loutre. Impacts will be discussed in relation to the various alternatives and other projects in the area. This assessment of potential impacts to aquatic resources is based on scientific literature and modeling of water quality (salinity), hydrology/hydroperiod (velocity and tidal prism) and fish passage in the project area. Temporary and permanent impacts to aquatic resources that will be discussed in the sections below include:

- Effect on migratory movements;
- Impacts on active and passive transport of eggs and larvae;
- Impact to water characteristics (temperature, salinity, turbidity, DO);
- Access of organisms to quality abiotic (temperature, salinity, turbidity and DO) and biotic (predator-prey interactions and marsh edge) habitat;
- Incidental mortality of some fish and prey species specifically during the construction activities; and
- Alterations to hydrology, tidal prism, and velocity.

Proposed Action – Alternative 4a, MRGO Structure, GIWW and Bayou Bienvenue Gates, and Structural Wall Barrier in Alignment 4

Direct Impacts to Aquatic Resources

Direct impacts to aquatic resources would occur due to changes in estuarine substrate, estuarine open water and wetlands within the footprint of the floodwall and other structures. Direct impacts to aquatic resource habitats within the footprint of the proposed action are shown in table 6 in section 3.2.3. Direct impacts to aquatic resources outside of the footprint are discussed in the below paragraphs.

Mortality of some aquatic resources including sessile benthic organisms may occur during construction activities from increased turbidity or burial during dredging activities. Most motile organisms are expected to relocate until construction activities are complete; however sessile organisms in the construction area could be buried. Dredged material would be used to create a Beneficial Use Area within the project area. Although sessile organisms could be buried, dredged material placed in open water ponds could have positive benefits for aquatic resources such as creation of conditions conducive for future establishment of marsh habitat.

As discussed in section 2.3, an access channel would be dredged for construction of the barrier; however, both ends of the channel would be closed with an engineered plug. CEMVN would design additional water flow ability during the final design to prevent stagnation of the access channels if deemed necessary after consultation with the resource agencies. The portion of this channel not occupied by the barrier after construction would create more open water habitat; however this habitat is already abundant in the project area. The channel would not create high quality habitat for aquatic resources or significantly facilitate active and passive transport of organisms because the channels would be plugged at each end as well as at Bayou Bienvenue.

During the advanced measures, a 150-ft wide barge gate would be constructed on the GIWW to allow for unimpeded navigation and to maintain flow. Bayou Bienvenue would have four 48 inch culverts that would replace the existing 400 foot navigable channel to allow water exchange and very limited movement of aquatic resources while the cofferdam is in place during construction of the permanent gate. While the culverts and cofferdam is in place, a limited number of organisms will be able to move between the flood and protected side of the barrier through Bayou Bienvenue and surrounding tidal streams.

The culverts in place on Bayou Bienvenue during construction would reduce the flow to approximately 10% of the existing discharge with an estimated velocity of 3.2 ft/sec. Organisms that rely on passive transport and migrate up and down the water column during the course of the day may be prohibited from being transported through the culverts depending on their location in the water column in relation to the depth of the culvert. Additionally, the movement of larger fishes would be impeded through the culverts. The full impacts of the culverts to motile organisms is unknown because the modeling tools utilized for this large scale effort cannot appropriately address small scale features such as 48 inch culverts. However, it is expected that while the culverts may allow for some water exchange, closing of Bayou Bienvenue could significantly alter active/passive movement and access to quality habitat for many aquatic resources in the Bayou Bienvenue area. Blocking access to quality habitat or preventing movement of organisms could cause an increase in predation of some species and change available prey items in a localized area, thereby decreasing the health and growth rates of some individual aquatic organisms. Localized alterations in community structure could also occur.

Under current conditions, mobile aquatic resources can move to adjacent marsh to avoid high flows. After the proposed action is in place, aquatic resources will be unable to freely utilize adjacent marsh and will have to traverse the gates to access the alternate side of the barrier. Movement of organisms will be constricted to the gate openings, blocking movement through the existing tidal streams.

Modeling has shown localized velocity increases in the immediate vicinity of the proposed gates after construction (USACE 2008a, appendix B). These velocities, as described in section 3.2.1, could at times exceed the average swimming speed of smaller fishes and macroinvertebrates (Smith 2008). Given these results, the proposed project would be manageable for larger fishes (> 300mm) but it would be difficult for smaller fishes (< 100 mm) and macroinvertebrates to traverse the gate at Bayou Bienvenue (Smith 2008).

Fish movement through the various gates would fluctuate with tides and weather events. During some weather or tide events conditions may occur that hinder fish and macroinvertebrates movement; however, movement would not be inhibited during all conditions. Additionally, the project area is already altered and fish and invertebrates are most likely exposed to unfavorable conditions for passage under current conditions (prior to MRGO closure at Bayou La Loutre).

The proposed action could directly impact aquatic resources on the flood and protected side of the barrier. Possible impacts could be: impeding active and passive transport of eggs and larvae across the barrier, blocking access to habitat, and blocking access to prey items. These impacts could result in alterations in behavior, decreases in growth, and localized changes to the community structure.

Indirect Impacts to Aquatic Resources

Both temporary and permanent indirect impacts to aquatic resources would occur from reduced passive and active transport of zooplankton and phytoplankton in localized areas. Temporary reductions in water quality and permanent changes in circulation patterns may also negatively impact transport of plankton. Passive and active transport of organisms may also be temporarily interrupted during construction of the gates on the GIWW when the gates need to be closed. Changes in water quality may cause a disconnect between optimal abiotic and biotic conditions, resulting in changes in the distribution of motile aquatic resources in localized areas.

Indirect impacts on aquatic resources may occur during construction due to changes in water characteristics. Impacts on aquatic resources most likely would be temporary; indirect impacts would be caused by the displacement of organisms from localized areas due to elevated turbidity levels, decreased DO, and increased BOD associated with construction dredging activities. Analytical modeling results show that the mean bottom DO may decrease by 0.11 mg/L (from 3.69 ± 1.09 mg/L to 3.58 ± 1.29 mg/L) (mean ±1standard deviation) when comparing the base conditions including a closure of the MRGO at Bayou La Loutre with a scenario similar to Alignment 4 (Dortch and Martin 2008). Most organisms are expected to relocate from areas with unfavorable conditions until construction activities are complete; however, depressed DO levels in the project area may lead to behavioral changes, decreased growth rates, and decreased survivability in some aquatic resources. Although the values mentioned above are below the standard for estuarine systems (4.0 mg/L), DO concentrations in the project area are already depressed and periodically fall below 4.0 mg/L (Dortch and Martin 2008).

As described in section 3.2.2., both during and after construction, a localized alteration in the salinity of open-water habitats may occur because freshwater influx and tides would be restricted in the marsh between the GIWW and the MRGO on both sides of the barrier. This impact would occur because the barrier could alter the volume and timing of saltwater from Lake Borgne, the MRGO and GIWW to the protected side of the barrier. Maximum changes to salinity in the project area would be 1.0 ppt or less with the proposed action. This change in salinity would not impact most aquatic resources under typical conditions. Some conditions in which organisms may be impacted by 1.0 ppt change in salinity are; (1) the organism is already sick, (2) the organism is sessile such as oysters, rangia or barnacles and is located in an area with existing conditions near its optimal or lethal threshold already, or (3) salinity causes changes in types or quantity of prey available. Impacts would not occur to populations of organisms but individual aquatic organisms may be impacted under the conditions described above. Salinity fluctuations of 1.0 ppt are considered normal and occur under natural conditions throughout tidal cycles and seasons. Individual aquatic organisms impacted by 1.0 ppt salinity changes that occur because of the proposed action would probably be impacted under natural conditions as well. Impacts could range from changes in behavior to slower growth rates to death.

As discussed in section 3.2.1 changes in hydrology under the proposed action include changes in tidal depth and tidal prism. During construction and after construction is a complete a localized alteration in the hydrology of open-water habitats may occur because freshwater influx and tides would be restricted in the marsh between the GIWW and the MRGO.

Modeling has also indicated that the proposed action impacts inundation intervals of the marsh areas. As described in section 3.2.3, Kuhn et al. (1999), found that small decreases (0.16 to 0.33 ft) in tidal amplitude resulted in greater occurrence of *Spartina patens*, a high marsh species relative to *S. alterniflora* an emergent species. If similar changes in marsh species composition occur in the proposed project area less emergent marsh would be available for aquatic resources. Additionally Kuhn et al. (1999) found that small changes in tidal amplitude decreased sedimentation and created conditions conducive for subsidence. Managed marshes with less sedimentation and lower tidal amplitude also had statistically significantly less primary production.

Based on these results, it is likely that the proposed action could impact aquatic habitats and aquatic resources even though the project area is already highly altered and estuarine species are accustomed to wide fluctuations in their environment (Dunson and Travis 1994). These impacts may occur as less marsh edge habitat would be available and less sedimentation creating more open water habitat could occur, causing a possible reduction in primary productivity.

During construction activities such as pile driving, behavioral changes and sub-lethal impairments to the hearing of some fishes may occur (Hastings and Popper 2005). Hearing impairments have been shown to reduce some fish species' ability to locate prey, increase risk of predation and possibly reduce reproductive success (Hastings and Popper 2005). The occurrence of fish mortality from construction noise is not well understood; however; some literature has documented fish mortality after pile driving activities at various distances (Caltrans 2001; Caltrans 2004). Although individual aquatic organisms may be taken during construction activities for the proposed alignment, the number of organisms affected is not expected to impact populations of fishes because most species are expected to move away from the area. Smaller fish may be impacted more than larger fish because it takes smaller organisms more energy to travel the same distance as a larger fish.

Cumulative Impacts to Aquatic Resources

Potential cumulative impacts to aquatic resources could occur from construction-related activities (e.g., turbidity from dredging, noise) and from the proposed structures (e.g., changes in salinity, velocity, and circulation/flow). Although the project area has already been altered by the maintained navigable waterways (GIWW, IHNC, MRGO) and the existing GNOHSDRRS, the proposed action would contribute to changes (both beneficial and negative) to aquatic resources.

Construction-related activities would result in negative impacts to aquatic resources, but these impacts would be temporary (during construction) and localized (to the construction area and to individual organisms). Cumulative impacts to aquatic resources within the entire project area or to communities/populations of organisms are not anticipated to be significant.

Operation/implementation of the components proposed in this project, in combination with other projects (as discussed in section 4.0), would have both positive and negative cumulative impacts to aquatic resources. Changes in salinity would occur from the closure of the MRGO at Bayou La Loutre, with minor contributions in salinity change from the proposed action. Modeling conducted by ERDC illustrated that the closure of the MRGO at Bayou La Loutre has a significant effect on monthly average bottom salinity values not only in MRGO/GIWW/IHNC, but also in the Lake Borgne area. Most areas showed decreases of 3-4 ppt, with the MRGO channel showing the highest decrease in the region at a point just north of the La Loutre closure at approximately 10 ppt (Martin et al. 2008).

The overall change to salinity would be both positive and negative to aquatic resources. Conditions would be restored somewhat to historical conditions (e.g., pre-MRGO) including a more freshwater/brackish system. These conditions would be more conducive for production of oysters and other aquatic resources, but could impact the existing aquatic resources by replacing brackish emergent marsh with less saline open water habitats. Changes in salinity with the proposed action in addition to the changes expected with the MRGO closure at Bayou La Loutre could cause community shifts in localized areas such as adjacent to the closure of the MRGO near Bayou Bienvenue and Bayou La Loutre. Salinity fluctuations of 1.0 ppt due to the proposed action, coupled with the 3-4 ppt changes due to the MRGO closure at Bayou La Loutre, may impact a greater number of individual aquatic organisms than described for the proposed action and may impact healthy as well as sick individual aquatic organisms. The types of impacts would be similar to those described above. Reductions in salinity (primarily from closure of MRGO at Bayou La Loutre, with minor changes from the proposed action) would impact the existing system in the short-term, but would restore the area to more historic conditions in the long-term.

As discussed under cumulative impacts to hydrology (section 3.2.1), the proposed action, when considered with future projects such as a proposed gate structure at the Lake Pontchartrain/IHNC interface and the closure of the MRGO at Bayou La Loutre, would result in altered hydrology and water characteristics within the study area. Changes in hydrology and water characteristics that would directly and indirectly impact aquatic resources as described above in the direct and indirect impacts sections. The addition of changes in hydrology and water characteristics from other projects to the proposed action would result in cumulative impacts to aquatic resources. The bulleted list below itemizes the known additive impacts from other projects in the area along with the proposed action:

- The gate structure at Seabrook in addition to the proposed action could increase local friction in IHNC channel which could result in decreases in the maximum surface velocity by ~0.05 ft/sec (Martin et al. 2008). Aquatic resources could benefit from the decrease in surface velocity;
- Salinity fluctuations of 1.0 ppt, coupled with the 3-4 ppt changes with the MRGO closure at Bayou La Loutre, may impact the a greater number of individual aquatic organisms than described above and may impact healthy as well as sick individual aquatic organisms. The types of impacts would be similar to those described above;
- Salinity modeling showed that the addition of a gate structure at Seabrook could produce small increases in salinity on the order of approximately 0.15 ppt during the wet period. The dry period showed a no changes to salinity with the additional of the Seabrook structure. This decrease in addition to the 1.0 – 4.0 ppt decrease with the MRGO closure at Bayou La Loutre in the vicinity of the IHNC could cause additive impacts to aquatic

resources. These additive impacts could range from changes in behavior to slower growth rates to decreases in survival of some species. Depending on the salinity gradient some fishes may not be able to osmoregulate and the change in salinity may become a barrier to fish passage.

- The proposed action in conjunction with the closure of MRGO at bayou La Loutre, results in lower maximum tidal elevations west of the barrier and in the interior portions of the marsh. As discussed in the direct and indirect impacts section above small changes in elevations have been shown to cause shifts in marsh community structure which could create less marsh edge habitat available for aquatic resources and thereby impact the health and growth of individual aquatic organisms.
- The addition of a gate structure at Seabrook could have a lowering affect on DO as described in section 3.2.2. Most organisms are expected to relocate from areas with unfavorable conditions; however, depressed DO levels in the project area may lead to behavioral changes, decreased growth rates, and decreased survivability in some aquatic resources.

The proposed action includes beneficial use of dredged material. This beneficial use, in conjunction with future projects of shoreline protection, marsh enhancement, and freshwater diversion (as discussed in section 4.0), would assist in improving habitat for aquatic resources.

Alternative 4b – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Geotextile Levee Barrier in Alignment 4

Direct Impacts to Aquatic Resources

Direct impacts to aquatic resources under alternative 4b would be similar to the proposed action (alternative 4a); however, the construction of the geotextile levee would increase the footprint of the flood barrier to 600 ft (versus 350 ft for the floodwall). The construction time to build the geotextile levee would result in disturbance to water clarity, salinity, and DO for a longer period of time compared to the braced concrete wall with the proposed action. The expanded footprint would also result in a larger area of habitat disturbance than the proposed action (see table 6).

Indirect Impacts to Aquatic Resources

Indirect impacts to aquatic resources would be similar to the proposed action; however, the construction of the geotextile levee would increase the footprint of the barrier causing a slight increase to water disturbances during construction. Increases in disturbance would result from the longer construction time to build the geotextile levee and temporary disturbances to the water column, including water clarity, salinity, and DO.

Cumulative Impacts to Aquatic Resources

Cumulative impacts to aquatic resources for alternative 4b would be similar to those under the proposed action.

Alternative 1 – Deep Draft Gate in Alignment 1

Direct Impacts to Aquatic Resources

Permanent direct impacts to aquatic resources would occur due to changes in fringe marsh, estuarine substrate (over open water) and open water within the footprint of the deep draft gate and from raising existing levees (table 6). However, these impacts would be less than those under Alignments 3-5 with respect to aquatic resources because of the larger footprint across the marshes between the GIWW and the MRGO in alternatives 3-5.

Temporary direct impacts to aquatic resources may occur during construction. Mortality of some organisms may occur during construction activities from burial; most are expected to relocate until construction activities are complete. Organisms are expected to move from unfavorable conditions surrounding the construction area; this change is not expected to affect the overall aquatic habitat in the project area or populations of aquatic resources. Negative impacts resulting from these activities would be minimized to the maximum extent possible by installing a cofferdam around construction activities and using other BMPs.

In addition to raising the levees, construction and replacement of the existing control structure at Bayou Bienvenue could disrupt aquatic habitat, fisheries habitat and EFH in the bayou during construction and a much smaller portion (approximately 0.5 acre) of the channel would be permanently occupied by the control structures (table 6).

Alternative 1 could directly impact aquatic resources on both sides of the gate. Possible impacts could be: impeding active and passive transport of eggs and larvae through the gate, and impeding migration of larger organisms. These impacts could occur because the gate would decrease the existing 570-foot-wide by approximately 40-foot-deep channel to a 350-foot-wide by 40-foot-deep channel.

Indirect Impacts to Aquatic Resources

Indirect impacts on aquatic resources may occur during construction due to changes in water characteristics. Impacts would most likely be temporary indirect impacts caused by the displacement of organisms from localized areas due to elevated turbidity levels, decreased DO, and increased BOD associated with construction and dredging activities.

Construction of a replacement for the existing control structure in the Bayou Bienvenue channel and adjacent wetlands could cause downstream increases in turbidity and sedimentation that could impact fish survival and growth. However, those impacts would be short-term, with effects ceasing shortly after completion.

A comparison of the base condition including the MRGO closure at Bayou La Loutre and a modeling scenario similar to alternative 1 shows an increase of 0.3 mg/L in the mean bottom DO values after construction is complete (increasing from approximately 3.69 mg/L to 3.99 mg/L) (Dortch and Martin 2008). Although this value is below the standard for estuarine systems (4.0 mg/L), DO concentrations in the project area are already depressed and periodically fall below

4.0 mg/L. Additionally, most organisms have the ability to move from unfavorable conditions. These impacts due to changes in abiotic characteristics would be less with alternative 1 than in alternatives 3-5.

Indirect impacts from construction noise are expected to be similar to the proposed action. Although individual aquatic organisms may be taken during construction activities for this alternative the number of organisms affected is not expected to impact populations of aquatic resources. Similarly to the proposed action, alternative 1 would have a potential for turbidity impacts from the footprint encompassed and additional impacts by the additional levee work. These impacts are not expected to be more than the proposed action because SWPPPs will be used to control land based turbidity.

The reconnaissance study of fish passages in the project area used published average and burst swimming speeds of three species (red drum, spotted sea trout and brown shrimp) and modeled maximum velocities at various locations to determine if fish and invertebrate passage would be affected by the alternative 1. The model predicts velocities will remain less than 0.5 ft/s (Smith 2008). Mean swimming speed for larger fish are well above 0.3 ft/s; however smaller fish may have some difficulty traversing large areas with this velocity (mean swimming speed is approximately 0.1 ft/s). Impacts to fish passage due to velocities with this alternative are limited because the project area is already altered with numerous gates and channels. Velocities greater than the average swimming speed of some life stages of some species most likely already occur under current conditions (prior to closure of the MRGO at Bayou La Loutre). Under current conditions, aquatic resources can move to adjacent fringe marsh to avoid high flows. With Alternative 1, aquatic resources will be able to utilize adjacent fringe marsh but will have to traverse the gate to access Lake Pontchartrain or the Golden Triangle marsh.

Small localized alterations in the hydrology and salinity of open-water habitats may occur because freshwater influx and tides would be restricted from the existing 570 ft wide by approximately 40 ft deep channel to a 350 ft wide and 40 ft deep channel. This would result in velocity increases to approximately 0.5 ft/s within the immediate vicinity of the gate structure and no expected change in the tidal prism (Martin et al. 2008). Based on salinity modeling results, Alignment 1 would have no impact on aquatic resources because of slight changes to salinity (± 0.1 ppt) (Martin et al. 2008).

Cumulative Impacts to Aquatic Resources

Cumulative impacts of alternative 1, in conjunction with other projects in the vicinity (discussed in section 4.0), would include temporary, construction-related impacts, and permanent impacts to velocity.

Salinity modeling showed that the addition of a gate structure at Seabrook to Alternative 1 could produce small decreases in salinity on the order of approximately 0.25 -1.0 ppt during the wet period. The dry period showed a larger decrease of approximately 0.5-1.0 ppt. The differences with the addition of Seabrook during both periods may be attributable to tidal phasing effects created by the addition of the Seabrook structure. Impacts to aquatic resources from this additive effect could range from changes in behavior to slower growth rates to decreases in survival of some species. Depending on the salinity gradient some fishes may not be able to osmoregulate and the change in salinity may become a barrier to fish passage.

Salinity fluctuations caused by this alternative and the Seabrook structure, coupled with the 3-4 ppt changes with the MRGO closure at Bayou La Loutre, may impact the health and growth of individual aquatic organisms. The types of impacts would be similar to those described above in the proposed action.

The structure at Seabrook in addition to the proposed action could increase local friction in the IHNC channel which could result in decreases in the maximum surface velocity by ~0.5 ft/sec (Martin et al. 2008). Aquatic resources could benefit from the decrease in surface velocity.

The addition of a gate structure at Seabrook could have an additive effect on DO. When all of the DO levels in the project area are averaged under the Alternative 1, the addition of the Seabrook structure increases the DO from 3.69 to 4.03 mg/L. Because the addition of the Seabrook structure to Alternative 1 would marginally improve the DO levels in the vicinity of the IHNC, there would be no additive impacts to aquatic resources.

Alternative 2 – Deep Draft Gate in Alignment 2

Direct Impacts to Aquatic Resources

Direct impacts to aquatic resources would be similar to alternative 1 (see table 6). The slight increase in impacts due to a larger gate could be balanced with the reduction in the amount of existing levees and floodwalls that would be raised. These impacts would be less than with Alignments 3-5 because of the floodwall crossing the Golden Triangle marsh in Alignments 3-5.

Indirect Impacts to Aquatic Resources

Indirect impacts to aquatic resources would be similar to alternative 1.

Cumulative Impacts to Aquatic Resources

Cumulative impacts from alternative 2 would be similar to those discussed under alternative 1.

Alternative 3a – MRGO Structure, GIWW Gate, and Structural Wall Barrier in Alignment 3

Direct Impacts to Aquatic Resources

Direct impacts to aquatic resources would occur due to changes in fresh/intermediate and salt marsh, estuarine substrate (over open water habitat) and open water within the footprint of the floodwall and other structures (table 6), and are similar in nature to those described under the proposed action. In addition to impacts from the construction of the barrier, there would be additional temporary impacts from relocation of the pipeline associated with this alignment potentially resulting in an additional temporary disturbance of marsh habitat. These additional impacts would include further fragmenting marsh and creating more open water habitat. Impacts associated with the pipeline relocation would be temporary, and would be mitigated. Fragmenting marsh and creating more open water could decrease access to emergent marsh, resulting in increases in predation for juvenile fishes and macroinvertebrates and possible decreases in growth rates.

Direct impacts to aquatic resources may occur during dredging and disposal of material due to burial by sediment or slurry. Mortality of some individual organisms including sessile benthic species may occur; however motile organisms are expected to relocate until construction activities are complete.

A 350 ft wide by 17 ft deep access channel would be dredged for construction of the barrier. This channel would create additional open water habitat; however, both ends of the channels would be closed with an engineered plug. The channels would not create high quality habitat for aquatic resources species or significantly facilitate active and passive transport of organisms parallel to the floodwall.

In addition to raising the levees, construction and replacement of the existing control structure at Bayou Bienvenue could disrupt aquatic habitat, fisheries habitat and essential fish habitat in the bayou during construction and a much smaller portion (approximately 0.5 acre) of the channel would be permanently occupied by the control structures (table 6).

Alternative 3a could directly impact aquatic resources on the flood and protected side of the barrier. Possible impacts could be: impeding active and passive transport of eggs and larvae across the barrier, blocking access to habitat, and blocking access to prey items as described for the proposed action. These impacts could result in alterations in behavior, decreases in growth, and localized changes to the community structure.

Indirect Impacts to Aquatic Resources

Indirect impacts to aquatic resources would be similar in nature and area of impact to the proposed action.

In addition to impacts from the construction of alternative 3a, a pipeline would need to be relocated. Additional disturbance to turbidity, salinity, and DO would occur during the relocation of the pipeline. Changes in water quality may cause a disconnect between abiotic and biotic conditions, resulting in changes in the distribution of non-sessile aquatic resources in localized areas; however, this is not expected to impact populations of organisms.

Construction of a replacement for the existing control structure in the Bayou Bienvenue channel and adjacent wetlands could cause downstream increases in turbidity and sedimentation that could impact fish survival and growth. However, those impacts would be short-term, with effects ceasing shortly after completion.

During construction and after construction is complete, localized alterations in the velocity, hydrology and salinity of open-water habitats may occur because freshwater influx and tides would be restricted in the marsh between the GIWW and the MRGO. Although Alignment 3a has a shorter distance of floodwall, the distance between conduits of tidal exchange is longer than the proposed action. This may impact aquatic resources by causing organisms to travel longer distances to relocate between the flood and protected sides of the barrier while seeking food, protection from predators, and quality habitat.

Cumulative Impacts to Aquatic Resources

Cumulative impacts under alternative 3a would be similar to those described under the proposed action.

Alternative 3b – MRGO Structure, GIWW Gate, and Geotextile Levee Barrier in Alignment 3

Direct Impacts to Aquatic Resources

Direct impacts to aquatic resources would be similar to alternative 3a with a larger footprint needed to construct the geotextile levee (table 6). As discussed in alternative 3a, additional impacts from relocation of a pipeline and the construction of a replacement for the existing control structure at Bayou Bienvenue would occur.

Indirect Impacts to Aquatic Resources

Indirect impacts to aquatic resources would be similar to alternative 3a, with a larger footprint needed to construct the geotextile levee (table 6). As discussed in alternative 3a, additional impacts from relocation of a pipeline and the construction of a replacement for the existing control structure at Bayou Bienvenue would occur.

Cumulative Impacts to Aquatic Resources

Cumulative impacts to aquatic resources for alternative 3b would be similar to those discussed under alternative 3a and the proposed action.

Alternative 5a – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Structural Wall Barrier in Alignment 5

Direct Impacts to Aquatic Resources

Direct impacts to aquatic resources would be similar in nature to, but greater than, the proposed action and would occur due to changes in estuarine substrate (under open water habitat), estuarine open water, and wetlands within the footprint of the floodwall and other structures (table 6).

As with the proposed action, direct impacts to aquatic resources on the flood and protected side of the barrier could occur. Possible impacts could be: impeding active and passive transport of eggs and larvae across the barrier, blocking access to habitat, and blocking access to prey items. These impacts could result in alterations in behavior, decreases in growth, and localized changes to the community structure.

Temporary direct impacts to aquatic resources that may occur during construction would be similar to the proposed action with a larger area of disturbance (table 6).

Indirect Impacts to Aquatic Resources

During and following construction, indirect impacts to aquatic resources may occur from localized reduction in available habitat and access to quality habitat. These impacts are expected to be similar to the proposed action with the exception of the larger footprint resulting in a larger area of disturbance. Additionally, passive and active transport of aquatic resources may be interrupted during construction in small localized areas due to reduced water quality and small changes in circulation patterns.

During construction, small localized alterations in the velocity, hydrology and salinity of open-water habitats may occur because freshwater influx and tides would be restricted in the marsh between the GIWW and the MRGO. Delay in tidal pulse, changes to salinity, DO, water surface elevation and velocity would be similar to the proposed action; therefore, impacts to aquatic resources would be similar also.

Cumulative Impacts to Aquatic Resources

Due to the similarity in alignment of alternative 5a and component make-up to the proposed action, cumulative impacts under alternative 5a would be similar to, but greater than, those described under the proposed action.

Alternative 5b – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Geotextile Levee Barrier in Alignment 5

Direct Impacts to Aquatic Resources

Direct impacts to aquatic resources would be similar to alternative 5a with a 54-acre increase in the footprint needed to construct the geotextile levee (table 6). Additionally, a much longer construction time would be required for alternative 5b as compared to alternative 5a and the proposed action.

Indirect Impacts to Aquatic Resources

Indirect impacts to aquatic resources would be similar to alternative 5a with an increase in the footprint needed to construct the geotextile levee (table 6). Additionally, a much longer construction time would be required for alternative 5b as compared to alternative 5a and the proposed action.

Cumulative Impacts to Aquatic Resources

Cumulative impacts to aquatic resources would be similar to alternative 5a with an increase in the footprint and timeframe needed to construct the geotextile levee.

3.2.5 Fisheries

Recreational and commercial fisheries are considered a vital part of Louisiana's economy. According to a national survey by the USFWS, Louisiana's recreational fishing industry was worth $605 million dollars in 1993 (Weber et al. 1995). In 2006, two of the United States' top commercial fishing ports were in Louisiana (NOAA 2006), and over 33 percent of commercial fish harvested in the lower 48 states came from the Louisiana coastal zone (CRCL 2000).

The landings of all the fisheries species combined in the State of Louisiana in 2005 and 2006 are shown in table 7. These include finfish, shrimp, crabs, and benthic fauna.

Table 7
Annual Landing Statistics for all Fisheries Species Combined for the State of Louisiana in 2005 and 2006

Year	Metric Tons	Pounds	Value ($)
2005	385,231	849,280,372	251,677,999
2006	414,711	914,270,916	270,727,835
Grand Totals	799,942	1,763,551,288	522,405,834

Source: NOAA Fisheries 2007.

Waters of the study area provide habitat for a number of finfish species. These species fill a variety of ecological niches and support commercial and recreational harvests either directly (in the form of takes) or by providing prey for harvested species. Movement between fresher and more saline waters is essential to the life history of many of these species. Some marine species have increased in abundance following the hurricanes, perhaps due to a decrease in fishing effort. For example, the fall 2005 trawl surveys found no indication of reductions in offshore fish or shrimp populations or saltwater fish kills. In fact, trawl catches of certain species averaged 30 percent greater than average pre-Katrina catches (USACE 2006).

The five most encountered fish species during recreational fishing in Louisiana are red drum (*Sciaenops ocellatus*), black drum (*Pogonias cromis*), speckled trout (*Cynoscion nebulosus*), Atlantic croaker (*Micropogonias undulatus*), and sand seatrout (*Cynoscion arenarius*) (Patillo et al. 1997). Other important sport fish species of fresh to slightly brackish waters include black crappie (*Pomoxis nigromaculatus*), white crappie (*Pomoxis annularis*), bluegill (*Lepomis macrochirus*), redear sunfish (*Lepomis microlophus*), largemouth bass (*Micropterus salmoides*), spotted sunfish (*Lepomis punctatus*), yellow bass (*Morone mississippiensis*), catfish (*Ictalurus punctatus*), and menhaden (*Brevoortia patronus*) (USACE 1984). The waters of Lake Borgne and other brackish portions of the study area support commercial and recreational fisheries of southern flounder (*Paralichthys lethostigma*), sheepshead (*Archosargus probatocephalus*), sea catfish (*Arius felis*), sand seatrout, speckled seatrout, Atlantic croaker, red drum, and black drum. Economically important commercial fisheries also occur for brown shrimp (*Farfantepenaeus aztecus)*, white shrimp (*Litopenaeus setiferus*), blue crab *(Callinectes sapidus)*, and oysters (*Crassostrea virginica*) in Lake Borgne and Lake Pontchartrain Basins. Private oyster leases occur in the western and southwestern portions of Lake Borgne. Commercial catches of catfish, drum, buffalo (*Ictiobus* spp.), and alligator gar (*Atractosteus spatula*) are confined to fresher waters (USACE 1984). Below commercially and recreationally important fishes are grouped by fishery classification (table 8). A description of the contribution of major commercial and recreational fisheries is discussed in the following paragraphs.

Table 8
Representative Game and Commercial Fisheries Species Known to Occur in the Project Area

Common Name	Scientific Name	2006 Value (dollars)*
Saltwater Species		
Brown shrimp	*Farfantepenaeus aztecus*	$37,781,737
Tarpon	*Megalops atlanticus*	--
White shrimp	*Litopenaeus setiferus*	$106,499,545
Pink shrimp	*Farfantepenaeus duorarum*	$18,015
Red drum	*Sciaenops ocellatus*	--
Atlantic croaker	*Micropogonias undulatus*	$30,770
Black drum	*Pogonias cromis*	$1,365,989
Gafftopsail catfish	*Barge marinus*	--
Seatrout	*Cynoscion* sp.	$16,022
Sheepshead	*Archosargus probatocephalus*	$194,652
Southern flounder	*Paralichthys lethostigma*	$112,258
Striped mullet	*Mugil cephalus*	$4,287
Gulf menhaden	*Brevoortia patronus*	$33,547,127
Sea catfish	*Arius felis*	--
American oyster	*Crassostrea virginica*	$35,851,947
Atlantic rangia	*Rangia cuneata*	--
Blue crab	*Callinectes sapidus*	$32,677,480

Freshwater Species		
Alligator gar	*Atractosteus spatula*	$418,752
Catfish	*Ictalurus* spp.	$1,548,917
Flathead catfish	*Pylodictis olivaris*	$160,014
Gizzard shad	*Dorosoma cepedianum*	$641,674
Threadfin shad	*Dorosoma petenense*	--
Buffalo	*Ictiobus* sp.	$784,369
Bass	*Micropterus* spp. and *Morone* spp	--
Crappie	*Pomoxis* spp.	--
Freshwater drum	*Aplodinotus grunniens*	--
Sunfishes	*Lepomis* spp.	--

Source: Gulf States Marine Fisheries Commission (GSMFC) 2008
* No data were located on species with "--" noted in the 2006 economic value column.

Brown shrimp (Farfantepenaeus aztecus) and white shrimp (Litopenaeus setiferus)

NMFS annual shrimp landing data from 1988-2000 documents that brown shrimp landings continually exceed those of white shrimp in the combined areas of Lake Pontchartrain and Lake Borgne. With the exception of 1985, which showed exceptionally high landings of brown shrimp, peak landings of brown shrimp and white shrimp were similar to those observed in the 1970s. Life history characteristics and habitat preferences of brown and white shrimp are described in section 3.2.6 (Essential Fish Habitat - EFH).

Blue crab *(Callinectes sapidus)*

The Gulf of Mexico is responsible for a considerable percentage of the nation's blue crab landings. In the 1990's, the Gulf of Mexico produced 29 percent of the commercial and recreational harvest of blue crabs in the United States. However, Louisiana blue crab landings were consistently higher than any other Gulf state. Louisiana blue crab landings in the 1990's represented 72.2 percent of the total Gulf production, in which the annual average was 44.2 million pounds, and was valued at $22.4 million. The state also led the nation in 1987, 1988, 1991, and 2002 (Guillory and Perret 1998). More recently, Louisiana produced a total of 38.1 million pounds of blue crab in 2005, valued at $27.4 million (USACE 2006b).

In general, there has been a decline in blue crab abundance. The decline in legal-sized crabs (50 centimeters [cm]) has been linked to excessive fishing pressure on larger individuals or "gross over fishing" (Hammerschmidt et al. 1998), while the decline of early life stage crabs and juveniles is associated with high predation rates in the northern Gulf estuaries and more importantly the loss of valuable nursery habitat as Louisiana continues to experience accelerated rates of coastal land loss (Perry et al. 1998; Rabalais et al.1995;Guillory 1997; Duffy 1989; Boesch et al. 1994).

A decline in blue crab landings in Lake Pontchartrain in the 1970s resulted in a mean annual catch of 1.4 million pounds, or only about 9 percent of the total state landings, compared to 2.6 million pounds (27 percent) in 1959-64 (Thompson and Stone 1980). By 1978-81, the mean annual catch had increased to 2.1 million pounds or about 12 percent of the total state catch, which represented a break in the steady decline noted in the preceding years (Thompson and Stone 1980).

The blue crab is an important commercial species for Lake Pontchartrain and Lake Borgne and spends a majority of its life in those bodies of water; however, blue crabs must migrate throughout the entire estuary (estuarine-dependent) to complete their life cycle. They will inhabit a salinity range from 0 to nearly 35 ppt. Temperature is another important factor throughout the life of a blue crab, because growth of the species is regulated by water temperature. Growth, through molting of the exoskeleton (outer shell), occurs when water temperatures are greater than 59°F (15 degrees Celsius [°C]). Water temperature above 91°F (33°C) is lethal (USACE 2004a). When air temperatures drop below 50°F, males and immature females will bury themselves and remain in a state of torpor throughout the winter, while mature female crabs will leave the shallow, inshore waters and seek higher saline, warmer waters. This migration of mature female crabs, in which they migrate considerable distances over just a few days to reach the higher salinity, is also a migration towards the spawning areas. The females will use tidal transport to migrate down the estuary towards the Gulf of Mexico during fall months to spawn (Perry et al. 1998).

The female crabs will release the larvae in the higher saline waters to be transported out over the continental shelf to undergo various stages of development. Early life stage crabs then use tidal transport to migrate from offshore to upper estuarine, lower saline, protective benthic habitat such as internal marsh areas, the marsh edge within Lake Borgne, and the marsh edge and SAV in Lake Pontchartrain (Perry et al. 1998). The early life stage blue crabs are transported into the estuary two times throughout the year (early summer and fall) to settle at suitable, protective habitat near the migration corridors and inlets into the estuarine system (Etherington and Eggleston 2000). Later juveniles and adult crabs move out of dense vegetation and farther into the upper estuary, lower saline areas, and into open water, unstructured habitat (Pile et al. 1996). In the Gulf of Mexico, blue crabs reach sexual maturity at 10-12 months (Guillory 1997).

American Oysters (*Crassostrea virginica*)

Production of oysters in Louisiana has been relatively stable for the last 50 years, with harvest from public beds replacing the decreasing harvest from private leases. However, the Louisiana oyster industry has been experiencing many stressors over the past several decades that threaten the long-term sustainability of both the industry and the resource. Increasing coastal land loss is reducing the amount of marsh that provides shelter to reefs, and saltwater intrusion is exacerbating disease and predation. In addition, the industry is faced with changing environmental conditions, fluctuating market demands, public perception issues, and increased competition.

Oysters spawn from March through November in the northern Gulf of Mexico (Bulter 1954) and the peak of spawning season in Louisiana is between May and early June (Stanley and Sellers 1986). Spawning is triggered mostly by temperatures above 20^{o}C for normal spawn and above 25^{o}C for mass spawning (Pattillo et al. 1997). Salinity can influence spawning by causing a delay if salinity is too high; if salinity remains high this can cause an increased occurrence of disease and a decrease in survivability of spat oysters (Stanley and Sellers 1986).

Upon setting or attachment, the sessile juveniles are referred to as spat. Spat-fall on the Gulf coast typically occurs from March to mid-November (Gunter 1955). Typical spat-fall for Lake Borgne and Lake Pontchartrain occurs from mid-May to mid-September depending on water conditions. Juveniles begin to develop once larvae attach. In the Gulf, sexual maturity of oysters may occur as soon as four weeks after attachment, but generally maturation occurs at 18 to 24 months of age (Quast et al. 1988).

Growth rates of adult oysters can vary greatly depending on conditions. Some adult oysters have been documented to grow at a rate of 50 mm/year (Bulter 1954). Gunter (1951) provides growth rates of 60 mm in the first year, 90 mm in the second year, and 115 mm in the third year. Based on these growth rates, it is possible for an oyster to reach harvestable size 76.2 mm (3 inches) within two years.

It is unclear if significant oyster resources are in the footprint of the project area; however oyster leases occur near the south shore of Lake Borgne east of the proposed action. There is a moderate probability of oysters occurring in the open water areas with firm substrate or other hard surfaces.

Atlantic croaker (*Micropogonias undulatus*)

Atlantic croaker are estuarine-dependent, in which they migrate throughout the entire estuary during various stages of their life cycle. This species inhabits deep coastal habitats near passes and channels as adults and emergent marsh habitats as juveniles (Lassuy 1983). Spawning typically takes place from October through February with a peak in December. Croakers typically spend their first two years in the estuary before migrating to deep water. Atlantic croaker grow at faster rates in mesohaline (5 – 18 ppt) habitats and are found at higher densities in marsh edge habitats (Weber 2004).

According to Pattillo et al. (1997), this species is abundant in Lake Borgne and Lake Pontchartrain for all life history stages. There is a high probability of the Atlantic croaker occurring in the open water habitat type commonly found within the study area during all life history stages, which offers the soft-bottomed substrates it prefers (Lassuy 1983). Juvenile Atlantic croaker are also associated with emergent marsh habitats over silt/mud or oyster shell substrate, and there is a high probability of occurrence in tidally-flooded marshes (Weber 2004).

Black drum (*Pogonias cromis*)

Black drum are an estuarine-dependent species and spawn in nearshore habitats in passes from November through May. Juveniles prefer non-vegetated habitats with muddy substrate, and adults occur over non-vegetated sand, mud habitats, and over oyster reefs. The open water habitats that occur within the project area have characteristics similar to those preferred by juvenile black drum (i.e., non-vegetated, muddy bottoms of open water), and they are considered common as juveniles in the project area. Adult black drum may also occur in non-vegetated habitat all year round in the project area (Pattillo et al. 1997).

Sand seatrout (*Cynoscion arenarius*)

Sand seatrout is an estuarine resident species that occurs throughout the Gulf in nearshore habitats (Pattillo et al. 1997). It spawns primarily in shallow, higher salinity habitats (Sutter and McIlwain 1987) from February though October (Ditty et al. 1988). Typical habitats preferred by juvenile sand seatrout are flooded marshes and seagrass meadows with soft organic substrates (Benson 1982). Adults are found in open water over most substrate types (Pattillo et al. 1997).

Juveniles typically inhabit flooded estuarine marshes of the project area between June and September (Patillo et al. 1997). Pattillo et al. (1997) consider juvenile sand seatrout to be abundant in Lake Borgne and Lake Pontchartrain. Adults are common from May through September.

Spotted seatrout (*Cynoscion nebulosus*)

Spotted seatrout are estuarine residents, spending their entire life cycle in estuarine waters. Spawning typically occurs from March to October, with a peak between April and August (Ditty et al. 1988). Spawning takes place in passes as well as in shallow, grassy habitats in bays with moderate salinities. Adults and juveniles prefer seagrass meadows and sandy to muddy substrates. Spotted seatrout feed on zooplankton as larvae, larger invertebrates and small fish as juveniles, and primarily fish as adults (Pattillo et al. 1997). Juvenile and adult spotted seatrout are common through out the study area with adults being more abundant during spring and early summer and abundance peeking during late summer and early fall for juveniles (Patillo et al. 1997).

Tarpon (*Megalops atlanticus*)

Historically, tarpon were abundant throughout Gulf of Mexico coastal waters. Recent declines in the tarpon population are due to increased fishing pressure, pesticides, fragmentation of habitat, and development (Boschung and Mayden 2004). The tarpon is considered an inshore game fish and is highly angled due to its fighting ability. The season for tarpon is from March through June. Adult tarpon live in Gulf open waters, but young tarpon may be found in brackish water around marsh channels. Adults sometimes may also move up larger rivers that empty into the Gulf (TPWD 2007). Adult and juvenile tarpon are common in Lake Borgne and Lake Pontchartrain (Patillo et al. 1997). Several fishing tournaments are organized where tarpon is one of the angled species. In Louisiana at least two large fishing tournaments, Grand Isle Tarpon Rodeo and South Pass Tarpon Rodeo, have a category for tarpon over 4.5 ft total length.

Discussion of Impacts

Fisheries rely on a combination of favorable abiotic (salinity, temperature, turbidity, DO) and biotic (protection from predators, food availability) characteristics that are necessary for high fishery production (Peterson 2003). Impacts will be discussed in relation to the various alternatives and other authorized projects in the project area. The assessment of potential impacts to fishery resources are based on scientific literature and modeling of water quality (salinity), hydrology, hydroperiod (velocity and tidal prism), and fish passage in the project area. Impacts to fishery resources that will be discussed in the sections below include:

- Effect on migratory movements;
- Impacts on active and passive transport of eggs and larvae;
- Recruitment of larvae and juveniles into nursery habitat;
- Impacts due to changes in water characteristics (temperature, salinity, turbidity, DO);
- Access of organisms to quality abiotic (temperature, salinity, turbidity and DO) and biotic (predator-prey interactions and marsh edge) habitat;
- Incidental mortality of some fish and prey species; and
- Alterations to hydrology and velocity.

Proposed Action: Alternative 4a - MRGO Structure, GIWW and Bayou Bienvenue Gates, and Structural Wall Barrier in Alignment 4

Direct Impacts to Fisheries

Direct impacts to fishery resources could occur by removing estuarine substrate (under open water), estuarine open water and marsh (fresh/intermediate and salt marsh) within the footprint of the floodwall and other structures (see table 6 in section 3.2.3). Placement of the floodwall could cause a localized reduction in and access to marsh edge and inner habitat because conduits between the protected and flood side of the barrier would occur only on Bayou Bienvenue and the GIWW. A reduction in access to these habitats has direct and indirect consequences: direct impacts include less quality habitat available for organisms. Specifically, marsh edge habitat is a critical link in the recruitment of fishery species (Peterson and Turner 1994; Minello et al. 1994).

During construction activities, incidental mortality of some individual organisms may occur from burial during dredging and placement of disposal material. Most fishes are expected to relocate until construction activities are complete. Material would be dredged using a cutterhead dredge to remove and then pump the slurry mixture via pipeline to a designated disposal area. While individual organisms are expected to move from unfavorable conditions, this change is not expected to affect populations of commercial or recreationally important species. If oysters occur in the footprint of the project area, they could have a greater chance of being impacted by construction activities due to their sessile nature. Dredged material placed in open water ponds could have positive benefits, such as enhancing the existing habitat and creating conditions conducive to future establishment of marsh habitat.

During the advanced measures, a 150 ft wide barge gate would be constructed on the GIWW to allow flow. The proposed cofferdam on Bayou Bienvenue would have four 48 inch culverts that would replace the existing 400 foot navigable channel. The expected duration that Bayou Bienvenue would be in this condition is approximately two years which would reduce the flow to approximately 10% of the existing discharge. Although the culverts would allow water exchange during construction of the permanent gate, organisms that rely on passive transport and migrate up and down the water column during the course of the day may be prohibited from being transported through the culverts depending on their location in the water column in relation to the depth of the culvert. Additionally, the movement of larger fisheries species would be impeded through the culverts.

These conditions could cause changes in the behavior, increase predation and decrease growth rates of fisheries species. This could be caused by requiring species to travel longer distances (expend more energy) to access quality habitat, search for prey and hide from predators. These conditions could also have indirect impacts by changing the distribution of prey items in the vicinity.

The full impacts of the culverts to motile organisms is unknown because the modeling tools utilized for this large scale effort cannot appropriately address small scale features such as culverts. However, it is expected that while the culverts may allow for some water exchange, closing off Bayou Bienvenue could significantly alter active/passive movement and access to quality habitat for many aquatic resources in the Bayou Bienvenue. Blocking access to quality habitat or preventing movement of organisms could cause an increase in predation of some species and change available prey items in a localized area, thereby decreasing growth rates of some individual aquatic organisms. Localized alterations in community structure could also occur.

Under current conditions, fish can move to adjacent marsh to avoid high flows. After the proposed action is in place, aquatic resources will be unable to freely utilize adjacent marsh and will have to traverse the gates to access the alternate side of the barrier. Movement of organisms will be constricted to the gate openings, blocking movement through the existing tidal streams.

Modeling has shown localized velocity increases in the immediate vicinity of the proposed gates (USACE 2008a). These velocities, as described in section 3.2.1, could at times exceed the average swimming speed of smaller fishes and macroinvertebrates (Smith 2008). Given these results, the proposed project would be manageable for larger fishes (> 300mm) but it would be difficult for smaller fishes (< 100 mm) and macroinvertebrates to traverse the gate at Bayou Bienvenue (Smith 2008). Fish movement through the various gates would fluctuate with tides and weather events. During some weather or tide events conditions may occur that hinder fish and macroinvertebrate movement; however, movement would not be inhibited during all conditions. Additionally, the project area is already altered and fish and invertebrates are most likely exposed to unfavorable conditions for passage under current conditions (prior to MRGO closure at Bayou La Loutre).

Indirect Impacts to Fisheries

Placement of the floodwall could cause both temporary and permanent impacts as a localized reduction in and access to marsh edge and inner marsh habitat because conduits between the protected and flood side of the barrier would occur only on Bayou Bienvenue and the GIWW. A reduction in access to these habitats has direct and indirect consequences: indirect impacts may include slower growth rates because organisms use more energy to hide from predators or search for prey items, an increase risk of predation, and a decrease in prey items that occur in these habitats.

Indirect impacts on fisheries may occur during construction due to changes in water characteristics. Impacts on fisheries most likely would be temporary; indirect impacts would be caused by the displacement of organisms from localized areas due to elevated turbidity levels, decreased DO, and increased BOD associated with construction dredging activities. Analytical modeling results show that the mean bottom DO may decrease by 0.11 mg/L (from 3.69 ± 1.09 mg/L to 3.58 ± 1.29 mg/L) (mean ±1standard deviation) when comparing base conditions including a closure of the MRGO at Bayou La Loutre with a scenario similar to Alignment 4 (Dortch and Martin 2008). Most organisms are expected to relocate from areas with unfavorable conditions until construction activities are complete; however, depressed DO levels in the project area may lead to behavioral changes, decreased growth rates, and decreased survivability in some fisheries species. Although this value is below the standard for estuarine systems (4.0 mg/L), DOs in the project area are already depressed and periodically fall below 4.0 mg/L (Dortch and Martin 2008).

Temporary and permanent impacts could occur as localized alterations in the salinity of open-water habitats because freshwater influx and tides would be restricted in the Golden Triangle marsh between the GIWW and the MRGO. This impact would occur because the barrier could alter the volume and timing of saltwater from Lake Borgne, the MRGO and GIWW to the protected side of the barrier. Maximum changes to salinity in the project area would be 1.0 ppt or less with the proposed action. This change in salinity would not impact fisheries resources under typical conditions. Some conditions in which organisms may be impacted by a 1.0 ppt change in salinity are: (1) the organism is already sick; (2) the organism is sessile, such as oysters, rangia, or barnacles, and is located in an area with existing conditions near its optimal or lethal threshold already; or (3) salinity causes changes in types or quantity of prey available. Impacts would not occur to populations of organisms but individual aquatic organisms may be impacted under the conditions described above. Salinity fluctuations of 1.0 ppt are considered normal and occur under natural conditions throughout tidal cycles and seasons. Individual aquatic organisms impacted by 1.0 ppt salinity changes that occur because of the proposed action would probably be impacted under natural conditions as well. Impacts could range from changes in behavior to slower growth rates to death.

As discussed in section 3.2.1, changes in hydrology under the proposed action include changes in tidal depth and tidal prism. Both during and after construction is complete, a localized alteration in the hydrology of open-water habitats may occur because freshwater influx and tides would be restricted in the marsh between the GIWW and the MRGO. Modeling has also indicated that the proposed action impacts inundation intervals of the marsh areas. Kuhn et al. (1999) found that small decreases (0.16 to .33 ft) in tidal amplitude resulted in greater occurrence of *Spartina patens*, a high marsh species, relative to *S. alterniflora*, an emergent species. If similar changes in marsh species composition occur in the proposed project area, less emergent marsh would be available for fisheries resources. Additionally Kuhn et al. (1999) found that small changes in tidal amplitude decreased sedimentation and created conditions conducive for subsidence. Managed marshes with less sedimentation and lower tidal amplitude also had statistically significantly less primary production.

Based on these results, it is likely that the proposed action would impact fisheries resources including habitats even though the project area is already highly altered and estuarine species are accustomed to wide fluctuations in their environment (Dunson and Travis 1994). These impacts may occur as less marsh edge habitat would be available, less sedimentation creating more open water habitat could occur, causing a possible reduction in primary productivity.

Construction activities such as pile driving may cause behavioral changes and sub-lethal impairments to the hearing of some fishes (Hastings and Popper 2005). Hearing impairments have been shown to reduce some fish species' ability to locate prey, increase risk of predation and possibly reduce reproductive success (Hastings and Popper 2005). The occurrence of fish mortality from construction noise is not well understood; however; some literature has documented fish mortality after pile driving activities at various distances (Caltrans 2001; Caltrans 2004). Although individual aquatic organisms may be taken during construction activities for the proposed alignment, the number of organisms affected is not expected to impact populations of fishes because most species are expected to move away from the area. Smaller fish may be impacted more than larger fish because it takes smaller organisms more energy to travel the same distance as a larger fish.

Cumulative Impacts to Fisheries

Potential cumulative impacts to fisheries could occur from construction-related activities (e.g., turbidity from dredging, noise) and from the proposed structures (e.g., changes in salinity, velocity, and circulation/flow). Although the project area has already been altered by the maintained navigable waterways (GIWW, IHNC, MRGO) and the existing GNOHSDRRS, the proposed action would contribute to changes (both beneficial and negative) to fisheries.

Operation/implementation of the components proposed in this project, in combination with other projects (as discussed in section 4.0), would have both positive and negative cumulative impacts to fisheries. Changes in salinity would occur from closure of the MRGO at Bayou La Loutre, with minor contributions in salinity change from the proposed action. Modeling conducted by ERDC illustrated that the closure of the MRGO at Bayou La Loutre had a significant effect on monthly average bottom salinity values not only in MRGO/GIWW/IHNC, but also in the Lake Borgne area. Most areas showed decreases of 3-4 ppt, with MRGO showing the highest decrease in the region just north of the La Loutre closure at approximately 10 ppt (Martin et al. 2008). Salinity fluctuations of 1.0 ppt, coupled with the 3-4 ppt changes with the MRGO closure at Bayou La Loutre, may impact a greater number of individual aquatic organisms than described above and may impact healthy as well as sick individual aquatic organisms. The types of impacts would be similar to those described above in Indirect Impacts.

As discussed under cumulative impacts to hydrology (section 3.2.1), the proposed action, when considered with future projects such as a proposed gate structure at the Lake Pontchartrain/IHNC interface and the closure of the MRGO at Bayou La Loutre, would result in altered hydrology and water characteristics within the study area. Changes in hydrology and water characteristics would directly and indirectly impact fisheries as described above in the direct and indirect impacts sections. The addition of changes in hydrology and water characteristics from other projects to the proposed action would result in cumulative impacts to fisheries. The bulleted list below itemizes the known additive impacts from other projects in the area along with the proposed action:

- The gate structure at Seabrook in addition to the proposed action could increase local friction in IHNC channel which could result in decreases in the maximum surface velocity by ~0.05 ft/sec (Martin et al. 2008). Fisheries could benefit from the decrease in surface velocity by improving fish passage conditions;
- Salinity fluctuations of 1.0 ppt, coupled with the 3-4 ppt changes with the MRGO closure at Bayou La Loutre, may impact a greater number of individual aquatic organisms than described above and may impact healthy as well as sick individual aquatic organisms. The types of impacts would be similar to those described above;
- Salinity modeling showed that the addition of a gate structure at Seabrook could produce small increases in salinity on the order of approximately 0.15 ppt during the wet period. The dry period showed a no changes to salinity with the addition of the Seabrook gate structure. This decrease in addition to the 1.0 – 4.0 ppt decrease with the MRGO closure at Bayou La Loutre in the vicinity of the IHNC could cause additive impacts to aquatic resources. These additive impacts could range from changes in behavior to slower growth rates to decreases in survival of some species. Depending on the salinity gradient some fishes may not be able to osmoregulate and the change in salinity may become a barrier to fish passage.
- The proposed action in conjunction with the closure of MRGO at Bayou La Loutre, results in lower maximum tidal elevations west of the barrier and in the interior portions of the marsh. As discussed in the direct and indirect impacts section above small changes in elevations have been shown to cause shifts in marsh community structure which could create less marsh edge habitat available for aquatic resources and thereby impact the health and growth of individual aquatic organisms.
- The addition of a gate structure at Seabrook could have a lowering affect on DO as described in section 3.2.2. Most organisms are expected to relocate from areas with unfavorable conditions; however, depressed DO levels in the project area may lead to behavioral changes, decreased growth rates, and decreased survivability in some fisheries.

The proposed action includes beneficial use of dredged material. This beneficial use, in conjunction with future projects of shoreline protection, marsh enhancement, and freshwater diversion (as discussed in section 4.0), would assist in improving habitat for fisheries.

Alternative 4b – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Geotextile Levee Barrier in Alignment 4

Direct Impacts to Fisheries

Direct impacts to fishery resources would be similar to the proposed action; however the construction of the geotextile levee would increase the footprint of the flood barrier to 600 ft (versus 350 ft for the floodwall). The construction time to build the geotextile levee would result in disturbance to water clarity, salinity, and DO for a longer period of time compared to the braced concrete wall of the proposed action. The expanded footprint would also result in a larger area of habitat disturbance than the proposed action (see table 6).

Indirect Impacts to Fisheries

Indirect impacts to fishery resources would be similar to the proposed action; however, the construction of the geotextile levee would increase the footprint of the barrier causing an increase to water disturbances during construction. Increases in disturbance would result from the longer construction time to build the geotextile levee and temporary disturbances to the water column, including water clarity, salinity, and DO.

Cumulative Impacts to Fisheries

Cumulative impacts to fishery resources for alternative 4b would be similar to the proposed action. Alternative 4b follows the same alignment as the proposed action, with the only difference being the technology of the structure and a larger footprint.

Alternative 1 – Deep Draft Gate in Alignment 1

Direct Impacts to Fisheries

Permanent direct impacts to fishery resources would occur due to changes in fringe wetlands, estuarine substrate (under open water habitat) and open water within the footprint of the deep draft gate and tie-ins (table 6 in section 3.2.3). Impacts from raising the existing levees would result in approximately 20 acres of impacts to wetlands (swamp, fresh marsh, and salt marsh).

In addition to raising the levees, construction and replacement of the existing control structure at Bayou Bienvenue could disrupt fisheries habitat in the bayou during construction and a much smaller portion (approximately 0.5 acre) of the channel would be permanently occupied by the control structures (table 6).

Placement of dredged material during construction may cause mortality of some individual aquatic organisms due to burial. Most fishes are expected to relocate until construction activities are complete. This change is not expected to affect populations of fishery species. Negative impacts resulting from these activities would be minimized to the maximum extent possible by using BMPs.

Alternative 1 could directly impact fisheries on both sides of the gate. Possible impacts could be: impeding active and passive transport of eggs and larvae through the gate, and impeding migration of larger organisms. These impacts could occur because the gate would decrease the existing 570-foot-wide by approximately 40-foot-deep channel to a 350-foot-wide by 40-foot-deep channel.

Indirect Impacts to Fisheries

Indirect impacts on fishery resources may occur during construction due to changes in water characteristics. Impacts on fishery species would most likely be temporary; indirect impacts include the displacement of organisms from localized areas due to elevated turbidity levels, decreased DO, and increased BOD associated with construction and dredging activities.

Construction of a replacement for the existing control structure in Bayou Bienvenue and adjacent wetlands could cause downstream increases in turbidity and sedimentation that could impact fish survival and growth. However, those impacts would be short-term, with effects ceasing shortly after completion.

Analytical modeling of a comparison of the base conditions including the MRGO closure at Bayou La Loutre and a modeling scenario similar to Alignments 1 and 2 shows no change in the mean bottom DO values (3.69 mg/L) (Dortch and Martin 2008). Although this value is below the standard for estuarine systems (4.0 mg/L), DO concentrations in the project area are already depressed and periodically fall below 4.0 mg/L. Additionally, most fisheries species have the ability to move from unfavorable conditions.

Indirect impacts from construction noise are expected to be similar to the proposed action. Although individual aquatic organisms may be taken during construction activities for the proposed action the number of organisms affected is not expected to impact populations of fishes. Alternative 1 would have a potential for turbidity impacts from the footprint encompassed and impacts by the additional levee work. These impacts are not expected to be more than the proposed action because SWPPPs will be used to control land based turbidity.

The reconnaissance study of fish passages in the project area used published average and burst swimming speeds of three species (red drum, spotted sea trout and brown shrimp) and modeled maximum velocities at various locations to determine if fish and invertebrate passage would be affected by alternative 1. The model predicts velocities will remain less the 0.5 ft/s (Smith 2008). Mean swimming speed for larger fish are well above 0.3 ft/s; however smaller fish (mostly larvae and juvenile life history stages) may have some difficulty traversing large areas with this velocity (mean swimming speed of juvenile red drum, seatrout, and shrimp is approximately 0.1 ft/s). Adverse impacts to fish passage due to high velocities with the proposed project are additive to the already altered conditions in the project area. However, certain fish and invertebrates species and life stages are exposed to unfavorable conditions for passage under current conditions (prior to the closure of the MRGO at Bayou La Loutre), whereas other species and life stages use such higher flow velocities to aid in distribution if survival is possible given those conditions or other stressors they may be subjected to those that happen to coincide with such events. Based on these predictions, an overall reduction in cross sectional area associated with this gate likely would reduce the amount and potential type of fisheries organisms passing through the gate and accessing habitat on the protected side. Under current conditions, aquatic resources can move to adjacent fringe marsh to avoid high flows. With Alternative 1, aquatic resources will be able to utilize adjacent fringe marsh but will have to traverse the gates to access Lake Pontchartrain or the Golden Triangle marsh.

Small localized alterations in the hydrology and salinity of open-water habitats may occur because freshwater influx and tides would be restricted from the existing 570 ft wide by approximately 40 ft deep channel to a 350 ft wide and 40 ft deep channel. This would result in no expected change in the tidal prism (Martin et al. 2008). Based on salinity modeling results, Alignment 1 would have no impact on fisheries resources because of slight changes to salinity (± 0.1 ppt) (Martin et al. 2008). Salinity fluctuations caused by this alternative, coupled with the 3-4 ppt changes with the MRGO closure at Bayou La Loutre, may impact the health and growth of individual aquatic organisms. The types of impacts would be similar to those described above in the proposed action.

Cumulative Impacts to Fisheries

Cumulative impacts of alternative 1, in conjunction with other projects in the vicinity (discussed in section 4.0), would include temporary, construction-related impacts, and permanent impacts to velocity. The incremental addition of impacts to fisheries from alternative 1 would not be significant. The structure at Seabrook in addition to the proposed action could increase local friction in IHNC channel which could result in decreases in the maximum surface velocity by ~0.5 ft/sec (Martin et al. 2008). Fisheries resources could benefit from the decrease in surface velocity.

Salinity modeling showed that the addition of a gate structure at Seabrook to Alternative 1 could produce small decreases in salinity on the order of approximately 0.25 -1.0 ppt during the wet period. The dry period showed a larger decrease of approximately 0.5-1.0 ppt. The differences with the addition of Seabrook during both periods may be attributable to tidal phasing effects created by the addition of the Seabrook structure. Impacts to fisheries from this additive effect could range from changes in behavior to slower growth rates to decreases in survival of some species. Depending on the salinity gradient some fishes may not be able to osmoregulate and the change in salinity may become a barrier to fish passage.

Salinity fluctuations caused by this alternative and the Seabrook closure structure, coupled with the 3-4 ppt changes with the MRGO closure at Bayou La Loutre, may impact the health and growth of individual aquatic organisms. The types of impacts would be similar to those described above in the proposed action.

The addition of a closure structure at Seabrook could have an additive effect on DO. When all of the DO levels in the project area are averaged under the Alternative 1, the addition of the Seabrook structure increases the DO from 3.69 to 4.03 mg/L. Because the addition of the Seabrook structure to Alternative 1 would marginally improve the DO levels in the vicinity of the IHNC, there would be no additive impacts to fisheries.

Alternative 2 – Deep Draft Gate in Alignment 2

Direct Impacts to Fisheries

Direct impacts to fishery resources would be similar to those discussed in alternative 1 (see table 6). The increase in impacts due to the larger gate could be balanced with the reduction in the amount of existing levees and floodwalls that would be raised. These impacts would be less than with alternatives 3-5 because these alignments would not cross the marshes and aquatic habitat between the GIWW and the MRGO.

Indirect Impacts to Fisheries

Indirect impacts to fishery resources would be similar to alternative 1.

Cumulative Impacts

Cumulative impacts to fisheries resources for alternative 2 would be similar to alternative 1.

Alternative 3a – MRGO Structure, GIWW Gate, and Structural Wall Barrier in Alignment 3

Direct Impacts to Fisheries

Direct impacts to fisheries resources would occur due to changes in fresh/intermediate and salt marsh, estuarine substrate (over open water habitat) and open water within the footprint of the floodwall and other structures (table 6), and are similar in nature to those described under the proposed action. In addition to impacts from the construction of the barrier, there would be additional temporary impacts from relocation of the pipeline associated with this alignment potentially resulting in additional temporary disturbance of marsh habitat. These additional impacts would include further fragmenting marsh and creating more open water habitat. Impacts associated with the pipeline relocation would be temporary, and would be mitigated. Fragmenting marsh and creating more open water could decrease access to emergent marsh, resulting in increases in predation for juvenile fishes and macroinvertebrates and possible decreases in growth rates.

A 350 ft wide by 17 ft deep access channel would be dredged for construction of the barrier. This channel would create additional open water habitat; however, both ends of the channels would be closed with an engineered barrier or plug. The channels would not create high quality habitat for fisheries resources species or significantly facilitate active and passive transport of organisms parallel to the floodwall.

In addition to raising the levees, construction and replacement of the existing control structure at Bayou Bienvenue could disrupt aquatic habitat, fisheries habitat and EFH in the bayou during construction and a much smaller portion (approximately 0.5 acre) of the channel would be permanently occupied by the control structures (table 6).

Alternative 3 could directly impact fisheries resources on the flood and protected side of the barrier. Possible impacts could be: impeding active and passive transport of eggs and larvae across the barrier, blocking access to habitat, and blocking access to prey items. These impacts could result in alterations in behavior, decreases in growth, and localized changes to the community structure.

Indirect Impacts to Fisheries

Indirect impacts to fishery resources would be similar to the proposed action; however the smaller footprint of the flood barrier would result in a smaller area disturbed during construction. Similar to direct impacts for this alternative; additional indirect impacts would occur from relocation of a pipeline. These impacts are expected to be similar in nature to other construction activities. Indirect disturbances are expected to be temporary and are not expected to impact populations of fish.

Construction of a replacement for the existing control structure in Bayou Bienvenue and adjacent wetlands could cause downstream increases in turbidity and sedimentation that could impact fish survival and growth. However, those impacts would be short-term, with effects ceasing shortly after completion.

Impacts to velocity, hydrology, and salinity are assumed to be similar to the proposed action.

During construction and after construction is complete, localized alterations in the velocity, hydrology, and salinity of open-water habitats may occur because freshwater influx and tides would be restricted in the Golden Triangle marsh between the GIWW and the MRGO. Although Alignment 3a has a shorter distance of floodwall, the distance between conduits of tidal exchange is longer than Alignment 4 (the proposed action). This may impact fisheries species by causing organisms to travel longer distances to relocate between the flood and protected sides of the barrier while seeking food, protection from predators and quality habitat.

Cumulative Impacts to Fisheries

Cumulative impacts under alternative 3a would be similar to those described under the proposed action.

Alternative 3b – MRGO Structure, GIWW Gate, and Geotextile Levee Barrier in Alignment

Direct Impacts to Fisheries

Direct impacts to fishery resources would be similar to alternative 3a with a larger footprint and additional construction duration needed to construct the geotextile levee (table 6 in section 3.2.3). Similarly to alternative 3a, relocation of the pipeline would result in an additional temporary disturbance of marsh habitat.

Indirect Impacts to Fisheries

Indirect impacts to fishery resources would be similar to alternative 3a with a larger footprint needed to construct the geotextile levee (table 6 in section 3.3.2). Similarly to alternative 3a, additional impacts from the construction of a pipeline and the construction of a replacement for the existing control structure at Bayou Bienvenue would occur.

Cumulative Impacts to Fisheries

Cumulative impacts to fishery resources for alternative 3b are similar to alternative 3a and the proposed action.

Alternative 5a – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Structural Wall Barrier in Alignment 5

Direct Impacts to Fisheries

Direct impacts to fishery resources would be similar to the proposed action and would occur due to changes in estuarine substrate, estuarine open water, and wetlands within the footprint of the floodwall and other structures (table 6). Alignment 5 has the longest barrier length (2.6 miles) across the marsh; therefore the impacts would be greater with regard to fisheries resources than those from Alignments 1-4. The differences in impacts are a result of the larger footprint associated with this alignment and the floodwall crossing the marshes between the GIWW and the MRGO.

As with the proposed action, a 150-ft wide barge gate would be constructed on the GIWW to allow for unimpeded navigation and to maintain flow. The proposed cofferdam on Bayou Bienvenue would have four 48 inch culverts to allow water exchange and movement of organisms while the cofferdam is in place during construction of the permanent gate. Similar to the proposed action, the impacts of the culverts to fisheries resources is unknown because the modeling tools utilized for this large scale effort cannot appropriately address small scale features such as culverts.

As with the proposed action, direct impacts to fisheries resources on the flood and protected side of the barrier could occur. Possible impacts could be: impeding active and passive transport of eggs and larvae across the barrier, blocking access to habitat, and blocking access to prey items. These impacts could result in alterations in behavior, decreases in growth, and localized changes to the community structure.

Temporary direct impacts to fisheries resources that may occur during construction would be similar to the proposed action with a larger area of disturbance (table 6) and length of time to construct.

Indirect Impacts to Fisheries

Indirect impacts would be similar to the proposed action with an increase in the footprint. This increase in footprint may cause slightly larger area which indirect impacts occur compared to alternatives 1 through 4. During and following construction, indirect impacts to fisheries resources may occur from localized reduction in available habitat and access to quality habitat. Additionally, passive and active transport of organisms may be interrupted during construction in small localized areas due to reduced water quality and small changes in circulation patterns.

Impacts to velocity, hydrology, and salinity are assumed to be similar to the proposed action.

During construction, small localized alterations in the velocity, hydrology and salinity of open-water habitats may occur because freshwater influx and tides would be restricted in the marsh between the GIWW and the MRGO. After construction is complete, a 150-ft gate on the GIWW and 56-ft wide gate on Bayou Bienvenue would be open except during storm events. Delay in tidal pulse, changes to salinity, DO, water surface elevation and velocity would be similar to the proposed action.

Cumulative Impacts to Fisheries

Cumulative impacts to fishery resources for alternative 5a would be similar to the proposed action.

Alternative 5b – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Geotextile Levee Barrier in Alignment 5

Direct Impacts to Fisheries

Direct impacts to aquatic resources would be similar to alternative 5a with an increase in the footprint needed to construct the geotextile levee (table 6). Additionally, a much longer construction time would be required for alternative 5b as compared to alternative 5a and the proposed action.

Indirect Impacts to Fisheries

Indirect impacts to fishery resources would similar to alternative 5a with an increase in the footprint needed to construct the geotextile levee (table 6). Additionally, a much longer construction time would be required for alternative 5b as compared to alternative 5a and the proposed action.

Cumulative Impacts to Fisheries

Cumulative impacts to fishery resources for Alignment 5b would be similar to Alignment 5a with an increase in the footprint and timeframe needed to construct the geotextile levee.

3.2.6 Essential Fish Habitat

<u>Existing Conditions</u>

Project vicinity wetlands, shell and mud substrate, and water bottoms have been identified as essential fish habitat (EFH) for various life stages of red drum, brown shrimp, white shrimp, pink shrimp, Spanish mackerel, and gulf stone crab (table 9). Detailed information on federally managed EFH and EFH species and their EFH is provided in the 2005 generic amendment of the Fishery Management Plans for the Gulf of Mexico prepared by the Gulf of Mexico Fishery Management Council (GMFMC). The generic amendment was prepared as required by the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act; PL 104-297).

The open waters, bottom substrates, and intertidal marshes of Lake Pontchartrain and Lake Borgne are considered EFH under the estuarine component. The primary categories of EFH occurring in the project vicinity include mud bottoms and emergent marsh (both marsh edge, and inner marsh). A single SAV bed occurs in the project area on the north shore of the GIWW near the Michoud Slip. A more detailed description of wetlands and aquatic habitats in the project area is provided in sections 3.2.3 and 3.2.4.

The following discussion describes the preferred habitat of species with EFH in the vicinity of the proposed project area.

Table 9. Life-Stages of Federally Managed Species that Commonly Occur within the Project Area and the Associated Types of Designated EFH

Species	Life Stage	System *	EFH
Brown Shrimp	Eggs	M	sand/ shell/ soft bottom
	Larvae	M	planktonic, sand/ shell/ soft bottom, SAV, emergent marsh, oyster reef
	Juvenile	E	SAV, sand/ shell/ soft bottom, emergent marsh, oyster reef
	Adult	M	SAV, sand/ shell/ soft bottom, emergent marsh, oyster reef
White Shrimp	Eggs	M	Sand/ shell/ soft bottom
	Larvae	M	planktonic
	Juvenile	E	SAV, soft bottom, emergent marsh
Pink Shrimp	Eggs	M	sand/ shell bottom
	Larvae	M	planktonic, sand/ shell bottom, SAV
	Juvenile	E	sand/shell substrate
Gulf stone crab	Eggs	E/M	sand/shell/soft bottom
	Larvae/ postlarvae	E/M	planktonic/ oyster reefs, soft bottom
	Juvenile	E	sand/shell/soft bottom, oyster reef
Red drum	Larvae/ postlarvae	E	all estuaries planktonic, SAV, sand/ shell/ soft bottom, emergent marsh
	Juvenile	E/M	SAV, sand/shell/soft/hard bottom, emergent marsh
	Adult	M/E	SAV, pelagic, sand/shell/soft/hard bottom, emergent marsh
Spanish mackerel	Juvenile	M/E	Pelagic
	Adult	E/M	Pelagic

Source: NMFS 2006a
* E = estuarine, M = marine

<u>Brown Shrimp (*Farfantepenaeus aztecus*)</u>

According to Patillo et al. (1997) adult, juvenile, and larval brown shrimp are expected to occur in the project area (Patillo et al. 1997); however GMFMC (1998) records show that only juvenile life stages occur in the project area. Juvenile brown shrimp are considered highly abundant to abundant within the project area from April to October. Juveniles occur at higher abundances in high temperatures, low DO, moderately turbid, and mesohaline (5 – 16 ppt) water (Jones et al.

2002; Baltz and Jones 2003). The density of post-larvae and juveniles is highest in emergent marsh edge habitat and SAV with soft substrates, and decreasing densities occur in intertidal creeks, inner marsh, shallow open water, and oyster reefs (Clark et al. 2004; Rakocinski et al. 1992; Baltz et al. 1993; Peterson and Turner 1994; GMFMC 1998). There is a high probability that juvenile brown shrimp could occur within the brackish emergent wetlands and tidal stream habitats located in the Golden Triangle within the project area.

Adult brown shrimp typically inhabit offshore waters (Patillo et al. 1997). Although individual adults may occur within the project area in open water habitat with turbid waters and soft sediments (Patillo et al. 1997; Lassuy 1983), adult brown shrimp are considered rare throughout the year in the project area (GMFMC 1998). Brown shrimp postlarvae feed on phytoplankton, zooplankton, epiphytes, and detritus. Juveniles and adults prey primarily on amphipods, polychaetes, and chironomid larvae and would also feed on algae and detritus (Patillo et al. 1997).

White Shrimp (*Litopenaeus setiferus*)

Adult white shrimp are expected to occur in the project area (Patillo et al. 1997) on a seasonal basis (GMFMC 1998). Adult white shrimp tolerate temperatures between 7 and 38ºC, and survival is high between 2 and 35 ppt. Spawning adults prefer salinity above 27 ppt. Spawning generally occurs offshore from spring to late fall (spawning peaks in the summer between June and July) (Turner and Brody 1983) outside the project area. Post-larval white shrimp become benthic upon reaching estuarine nursery areas, where they seek shallow water with muddy sand bottoms high in organic detritus. Post-larval and juvenile white shrimp are typically associated with estuarine mud habitats or peat bottoms with large quantities of decaying organic matter or vegetative cover. Juvenile white shrimp inhabit turbid estuaries and marsh edges (Patillo et al. 1997) and are likely to inhabit areas of open water and/or emergent marsh habitats in the GIWW, the MRGO, and Golden Triangle all year round. Adult white shrimp may prefer higher salinity open water habitats.

Juvenile white shrimp are common to abundant within the project area from July though October (GMFMC 1998). Juvenile white shrimp are most abundant between 15 and 33ºC, and prefer <10 ppt (Muncy 1984).

Like brown shrimp, post-larval white shrimp feed on phytoplankton, zooplankton, epiphytes, and detritus. Juveniles and adults prey on amphipods, polychaetes, and chironomid larvae and also consume algae and detritus (Patillo et al. 1997).

Pink Shrimp (*Farfantepenaeus duorarum*)

According to GMFMC (1998), adult and juvenile pink shrimp are expected to occur in the project area; however, Patillo et al. (1997) indicates juveniles rarely occur in the project area. Juveniles may prefer SAV meadows where they burrow into the substrate. Postlarvae, juveniles, and adults may prefer a mixture of course sand/shell/mud with immature stages found on substrates with vegetative detritus. Densities of pink shrimp are lowest in marshes, low in mangroves, and greatest near or in SAV (Patillo et al. 1997). Since SAV is limited to one small bed on the northeast shore of the GIWW near Michoud Slip, juvenile pink shrimp are not expected to occur in large numbers in the project area. However GMFMC (1998) records juvenile pink shrimp are common throughout the year in the project area while adults are rare.

Postlarvae feed on phytoplankton, zooplankton, epiphytes, and detritus. Juveniles and adults prey on amphipods, polychaetes, and chironomid larvae and consume algae and detritus (Patillo et al. 1997).

Red Drum (*Sciaenops ocellatus*)

Adult and juvenile red drum occur in a variety of habitats in the project area. Adults are common April through October (GMFMC 1998). Spawning occurs outside the project area in deeper water near the mouths of bays and inlets (Pearson 1929). Planktonic larvae are carried by currents into bays and estuaries (Peters and McMichael 1987), where they settle into the tidally-influenced emergent wetlands (Stunz et al. 2002a) such as those found in the Golden Triangle. Juvenile red drum prefer specific habitat types, occurring at higher densities in seagrass meadows (Stunz et al. 2002a) and growing faster there and in brackish emergent marsh (Stunz et al. 2002b). Additionally, juvenile red drum prefer a mesohaline (5 – 16 ppt) to euryhaline salinity regime (16-36 ppt) and growth rates are highest between 18.3 and 31.0ºC (GMFMC 1998).

Juvenile red drum are common to abundant within the project area's shallow open water and brackish emergent marsh habitats year-round (GMFMC 1998). There is a moderate probability of adult red drum occurring in the project area because they spend more time offshore as they age (GMFMC 1998). However, spawning adult red drum could occur in the open water and emergent marsh areas of the project area and in open waters and emergent marsh within and adjacent to the GIWW, the MRGO, and in the Golden Triangle marsh.

Various Prey Species

In addition to the species discussed above, coastal wetlands within the study area provides nursery and foraging habitat for other economically important marine species like blue crab, gulf menhaden, striped mullet, spotted seatrout, sand seatrout, black drum, and southern flounder. Some of these species serve as prey for other fish species managed under the Magnuson-Stevens Act by the GMFMC (e.g. mackerels, snappers, groupers) and highly migratory managed by NMFS (e.g. billfishes and sharks). Fishes that serve as prey for these species were discussed in more detail in the Fishery Resources section (3.2.5).

Discussion of Impacts

Proposed Action: Alternative 4a - MRGO Structure, GIWW and Bayou Bienvenue Gates, and Structural Wall Barrier in Alignment 4

Direct Impacts to EFH

Direct impacts to EFH would occur due to changes in estuarine substrate including sand/shell and mud bottom and open water within the footprints of the floodwall and other structures. Impacts to aquatic resource habitats from the proposed action are shown in table 6 in section

3.2.3. In table 6, EFH acreages for water column and sand/shell/mud substrate are the same acres as open water and emergent marsh habitat is addressed as brackish and salt marsh. Direct impacts to aquatic resources outside of the footprint are discussed in the below paragraphs.

During construction and operation of the proposed project, direct impacts to EFH and EFH species may occur from a localized reduction in available nursery habitat for juveniles and access to marsh edge habitat on both sides of the barrier. Access to marsh edge habitat is a critical link in the recruitment of EFH species (Peterson and Turner 1994; Minello et al. 1994). This habitat provides protection from predators and abundant food sources. Marsh edge habitat has been linked to higher densities of organisms, higher growth rates, and greater numbers regarding survival to the adult life stage (Peterson et al. 2000; Weber 2003).

Mortality of some individual organisms designated as EFH species may occur during construction activities due to burial during dredging and disposal. Most organisms are expected to relocate until construction activities are complete. While individual organisms are expected to move from unfavorable conditions, this change is not expected to affect populations of managed species for which EFH has been designated. Dredged material will be used to create a Beneficial Use Area within the project area. Open water ponds will be enhanced in this area to create conditions conducive for additional marsh habitat to establish in the future. Temporary and potentially permanent construction impacts to EFH may occur associated with the Beneficial Use Area due to turbidity, conversion of water bottom and column. The Beneficial Use Area would have a positive impact to some species by creating more edge habitat (vegetated or unvegetated) but could have a negative impact on bottom-dwelling species that prefer the existing conditions to edge habitat. The negative impact could displace organisms to other areas.

As discussed in section 2.3, an access channel would be dredged for construction of the barrier. The portion of this channel not occupied by the barrier after construction would create additional open water habitat; however, both ends of the channel would be closed with an engineered plug. CEMVN would design additional water flow ability during the final design to prevent stagnation of the access channels if deemed necessary after consultation with the resource agencies. The channel would create more open water habitat; however this habitat is already abundant in the project area. The channel would not create high quality habitat for aquatic resources or significantly facilitate active and passive transport of organisms because the channels would be plugged at each end as well as at Bayou Bienvenue.

During the advanced measures, a 150-ft wide barge gate would be constructed on the GIWW to allow for unimpeded navigation and to maintain flow. The proposed cofferdam on Bayou Bienvenue would have four 48 inch culverts to allow water exchange and very limited movement of some life history stages of some species while the cofferdam is in place during construction of the permanent gate. While the culverts and cofferdam is in place, a limited number of organisms will be able to move between the flood and protected side of the barrier through Bayou Bienvenue and surrounding tidal streams.

The culverts in place on Bayou Bienvenue during construction would reduce the flow to approximately 10% of the existing discharge with an estimated velocity of 3.2 ft/sec Organisms that rely on passive transport and migrate up and down the water column during the course of the day may be prohibited from being transported through the culverts depending on their location in the water column in relation to the depth of the culvert. Additionally, the movement of larger fishes would be impeded through the culverts. It is expected that while the culverts may allow for some water exchange, closing of Bayou Bienvenue could significantly alter active/passive movement and access to quality habitat for many aquatic resources in the Bayou Bienvenue. Blocking access to quality habitat or preventing movement of organisms could cause an increase in predation of some species and change available prey items in a localized area, thereby decreasing the health and growth rates of some individual aquatic organisms. Localized alterations in community structure could also occur.

Under current conditions, EFH species can move to adjacent marsh to avoid high flows. After the proposed action is in place, EFH species will be unable to freely utilize adjacent marsh and will have to traverse the gates to access the alternate side of the barrier. Movement of organisms will be constricted to the gate openings, blocking movement through the existing tidal streams.

Modeling has shown localized velocity increases in the immediate vicinity of the proposed gates (USACE 2008a). These velocities, as described in section 3.2.1, could at times exceed the average swimming speed of smaller fishes and macroinvertebrates (Smith 2008). Given these results, the proposed project would be manageable for larger fishes (> 300mm) but it would be difficult for smaller fishes (< 100 mm) and macroinvertebrates to traverse the gate at Bayou Bienvenue (Smith 2008). Fish movement through the various gates would fluctuate with tides and weather events. During some weather or tide events conditions may occur that hinder fish and macroinvertebrates movement; however, movement would not be inhibited during all conditions. Additionally, the project area is already altered and fish and invertebrates are most likely exposed to unfavorable conditions for passage under current conditions (prior to MRGO closure at Bayou La Loutre).

The proposed action could directly impact EFH on the flood and protected side of the barrier. Possible impacts could be: impeding active and passive transport of eggs and larvae across the barrier, blocking access to habitat, and blocking access to prey items. These impacts could result in alterations in behavior, decreases in growth, and localized changes to the community structure.

Indirect Impacts to EFH

Placement of the floodwall could cause both temporary and permanent impacts as a localized reduction in and access to marsh edge and inner marsh habitat because conduits between the protected and flood side of the barrier would occur only on Bayou Bienvenue and the GIWW. A reduction in access to these habitats has direct and indirect consequences: indirect impacts may include slower growth rates because organisms use more energy to hide from predators or search for prey items, an increase risk of predation, and a decrease in prey items that occur in these habitats. Additionally, changes to the tidal prism and hydrology could cause habitat shifts toward open water reducing the amount of marsh edge habitat available for EFH species.

Indirect impacts on EFH and EFH species may occur during construction due to changes in water characteristics. Impacts on EFH and EFH species most likely would be temporary; indirect impacts would be caused by the displacement of organisms from localized areas due to elevated turbidity levels, decreased DO, and increased BOD associated with construction dredging activities. Analytical modeling of DO used an ambient DO of 5.42 mg/L for the various (n= 11) cross sections throughout the project area (Dortch and Martin 2008). Results show that the mean bottom DO may decrease by 0.11 mg/L (from 3.69 ± 1.09 mg/L to 3.58 ± 1.29 mg/L) (mean ±1standard deviation) when comparing the base conditions including the closure of the MRGO at Bayou La Loutre with a scenario similar to Alignment 4. Most organisms are expected to relocate from areas with unfavorable conditions until construction activities are complete; however, depressed DO levels in the project area may lead to behavioral changes, decreased growth rates, and decreased survivability in some EFH and EFH species. Although all the values mentioned above are below the standard for estuarine systems (4.0 mg/L), DO concentrations in the project area are already depressed and periodically fall below 4.0 mg/L (Dortch and Martin 2008). Additionally, most fishes are expected to relocate from areas with unfavorable water characteristics until construction activities are complete.

Temporary and permanent impacts could occur as localized alterations in the salinity of open-water habitats because freshwater influx and tides would be restricted in the Golden Triangle marsh between the GIWW and the MRGO on both sides of the barrier. This impact would occur because the barrier could alter the volume and timing of saltwater from Lake Borgne, the MRGO and GIWW to the protected side of the barrier. Maximum changes to salinity in the project area would be 1.0 ppt or less with the proposed action. This change in salinity would not impact EFH or EFH species under typical conditions. Some conditions in which organisms may be impacted by 1.0 ppt change in salinity are; (1) the organism is already sick, (2) the organism is sessile such as oysters, rangia or barnacles and is located in an area with existing conditions near its optimal or lethal threshold already, or (3) salinity causes changes in types or quantity of prey available. Impacts would not occur to populations of organisms but individual aquatic organisms may be impacted under the conditions described above. Additionally, 1.0 ppt changes in salinity are considered normal and occur under natural conditions throughout tidal cycles and seasons. Individual aquatic organisms impacted by 1.0 ppt salinity changes that occur because of the proposed action would probably be impacted under natural conditions as well. Impacts could range from changes in behavior to slower growth rates to death.

As discussed in section 3.2.1, changes in hydrology under the proposed action include changes in tidal depth and tidal prism. Both during and after construction is a complete a localized alteration in the hydrology of open-water habitats may occur because freshwater influx and tides would be restricted in the marsh between the GIWW and the MRGO.

Modeling has also indicated that the proposed action impacts inundation intervals of the marsh areas. Kuhn et al. (1999) found that small decreases (0.16 to .33 ft) in tidal amplitude resulted in greater occurrence of *Spartina patens*, a high marsh species relative to *S. alterniflora* an emergent species. If similar changes in marsh species composition occur in the proposed project area less emergent marsh would be available for EFH and EFH species. Additionally Kuhn et al. (1999) found that small changes in tidal amplitude decreased sedimentation created conditions conducive for subsidence. Managed marshes with less sedimentation, lower tidal amplitude also had statistically significantly less primary production.

Based on these results, it is likely that the proposed action would impact EFH and species with designated EFH even though the project area is already highly altered and estuarine species are accustomed to wide fluctuations in their environment (Dunson and Travis 1994). These impacts may occur as less marsh edge habitat would be available, less sedimentation creating more open water habitat could occur, causing a possible reduction in primary productivity. Conversely, the beneficial use of dredged material under the proposed action could support the conversion of open water habitat into marsh habitat in the future within the 205 acre Beneficial Use Area, possibly creating EFH habitat in the future.

Impacts to EFH as a result of these changes could be decrease in growth rates, and health of some individual aquatic organisms. Additionally if some species are unable to overcome velocities they may not have access to quality habitat or prey further reducing growth rates and overall health of some individual aquatic organisms.

Construction activities such as pile driving may cause behavioral changes and sub-lethal impairments to the hearing of some fishes (Hastings and Popper 2005). Hearing impairments have been shown to reduce some fish species' ability to locate prey, increase risk of predation and possibly reduce reproductive success (Hastings and Popper 2005). The occurrence of fish mortality from construction noise is not well understood; however; some literature has documented fish mortality after pile driving activities at various distances (Caltrans 2001; Caltrans 2004). Although individual aquatic organisms may be taken during construction activities for the proposed alignment, the number of organisms affected is not expected to impact populations of fishes because most species are expected to move away from the area. Smaller fish may be impacted more than larger fish because it takes smaller organisms more energy to travel the same distance as a larger fish.

Cumulative Impacts to EFH

Potential cumulative impacts to EFH and species with designated EFH could occur from construction-related activities (e.g., turbidity from dredging, noise) and from the proposed structures (e.g., changes in salinity, velocity, and circulation/flow). Although the project area has already been altered by the maintained navigable waterways (GIWW, IHNC, MRGO) and the existing GNOHSDRRS, the proposed action would contribute to changes (both beneficial and negative) to EFH and EFH species.

Operation/implementation of the components proposed in this project, in combination with other projects (as discussed in section 4.0), would have both positive and negative cumulative impacts to EFH and EFH species. Changes in salinity would occur from closure of the MRGO at Bayou La Loutre, with minor contributions in salinity change from the proposed action. Modeling conducted by ERDC illustrated that the closure of the MRGO at Bayou La Loutre had a significant effect on monthly average bottom salinity values not only in MRGO/GIWW/IHNC, but also in the Lake Borgne area. Most areas showed decreases of 3-4 ppt, with MRGO showing the highest decrease in the region just north of the La Loutre closure at approximately 10 ppt (Martin et al. 2008). The overall change to salinity would be both positive and negative to EFH and EFH species as described above in the direct and indirect impacts sections. Conditions would be restored somewhat to historical conditions (e.g., pre-MRGO) including a more freshwater/brackish system. These conditions would impact the existing habitats and resources. Salinity fluctuations of 1.0 ppt, coupled with the 3-4 ppt changes with the MRGO closure at

Bayou La Loutre, may impact a greater number of individual aquatic organisms than described above and may impact healthy as well as sick individual aquatic organisms. The types of impacts would be similar to those described above. For the past five decades (since construction of MRGO), the system has had an influx of saltwater and has adapted to higher salinity levels. Reductions in salinity (primarily from closure of MRGO at Bayou La Loutre, with minor changes from the proposed action) would impact the existing system in the short-term (localized community and habitat shifts), but would restore the area to more historic conditions in the long-term.

As discussed under cumulative impacts to hydrology (section 3.2.1), the proposed action, when considered with future projects such as a proposed gate structure at the Lake Pontchartrain/IHNC interface, closure of the MRGO at Bayou La Loutre, and Violet Diversion would result in altered hydrology and water characteristics within the study area. Changes in hydrology and water characteristics would directly and indirectly impact EFH and EFH species as described above in the direct and indirect impacts sections. The addition of changes in hydrology and water characteristics from other projects to the proposed action would result in cumulative impacts to EFH. The bulleted list below itemizes the known additive impacts from other projects in the area along with the proposed action:

- The structure at Seabrook in addition to the proposed action could increase local friction in IHNC channel which could result in decreases in the maximum surface velocity by ~0.05 ft/sec (Martin et al. 2008). EFH species could benefit from the decrease in surface velocity by improving fish passage conditions;
- Salinity fluctuations of 1.0 ppt, coupled with the 3-4 ppt changes with the MRGO closure at Bayou La Loutre, may impact a greater number of individual aquatic organisms than described above and may impact healthy as well as sick individual aquatic organisms. The types of impacts would be similar to those described above;
- Salinity modeling showed that the addition of a gate structure at Seabrook could produce small increases in salinity on the order of approximately 0.15 ppt during the wet period. The dry period showed no changes to salinity with the additional of the Seabrook gate structure. This decrease in addition to the 1.0 – 4.0 ppt decrease with the MRGO closure at Bayou La Loutre in the vicinity of the IHNC could cause additive impacts to aquatic resources. These additive impacts could range from changes in behavior to slower growth rates to decreases in survival of some species. Depending on the salinity gradient some fishes may not be able to osmoregulate and the change in salinity may become a barrier to fish passage.
- The proposed action in conjunction with the closure of MRGO at Bayou La Loutre, results in lower maximum tidal elevations west of the barrier and in the interior portions of the marsh. Surface elevations are expected to be lower by generally 0.20 ft or less. The maximum water surface elevation is raised by 0.20 ft or less in the exposed, exterior portions of the marsh and in the MRGO (USACE 2008a). As discuss in the direct and indirect impacts section above small changes in elevations have been shown to cause shifts in marsh community structure which could create less marsh edge habitat available for EFH species and thereby impact the health and growth of individual aquatic organisms.

- The addition of a gate structure at Seabrook could have a lowering affect on DO as discussed in section 3.2.2. Most organisms are expected to relocate from areas with unfavorable conditions; however, depressed DO levels in the project area may lead to behavioral changes, decreased growth rates, and decreased survivability in some EFH species.

The proposed action includes beneficial use of dredged material for marsh enhancement. This marsh enhancement, in conjunction with future projects of shoreline protection, and freshwater diversion (as discussed in section 4.0), would assist in improving habitat for EFH in the project area.

The addition of changes in hydrology and water characteristics from other projects to the proposed action would result in cumulative impacts to EFH and EFH species.

The proposed action includes beneficial use of dredged material. This beneficial use, in conjunction with future projects of shoreline protection, marsh enhancement, and freshwater diversion (as discussed in section 4.0), would assist in improving habitat for EFH species.

Alternative 4b – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Geotextile Levee Barrier in Alignment 4

Direct Impacts to EFH

Direct impacts to EFH would be similar to those discussed under the proposed action; however the construction of the geotextile levee would increase the footprint of the flood barrier to 600 ft (verses 350 ft for the floodwall). The construction time to build the geotextile levee would result in disturbance to water clarity, salinity, and DO for a longer period of time compared to the braced concrete wall than with the proposed action. The expanded footprint would also result in a larger area of habitat disturbance than the proposed action (see table 6).

Indirect Impacts to EFH

Indirect impacts to EFH and species with designated EFH would be the same as described under the proposed action. Increases in disturbance would result from the longer construction time to build the geotextile levee and would result in temporary disturbances to the water column Therefore longer disturbance to water clarity, salinity, and DO may occur for the geotextile levee in alternative 4b as compared to the braced concrete wall in alternative 4a.

Cumulative Impacts to EFH

Cumulative impacts to EFH under alternative 4b would be similar to those described under the proposed action. Alternative 4b follows the same as alignment as alternative 4a, with the only difference being the technology of the structure.

Alternative 1 – Deep Draft Gate in Alignment 1

Direct Impacts to EFH

Permanent direct impacts to EFH would occur due to changes in fringe wetlands, estuarine substrate and open water within the footprint of the deep draft gate (table 6 in section 3.2.3).

As with the proposed action, temporary direct impacts, such as mortality of some EFH species, may occur during construction activities due to burial during excavating and placement of disposal material. Most fishes are expected to relocate until construction activities are complete. Individual organisms are expected to move from unfavorable conditions surrounding the construction area. Negative impacts resulting from these activities would be minimized to the maximum extent possible by using BMPs.

In addition to raising the levees, construction and replacement of the existing control structure at Bayou Bienvenue could disrupt EFH in the bayou during construction and a much smaller portion (approximately 0.5 acre) of the channel would be permanently occupied by the control structures (table 6).

Alternative 1 could directly impact aquatic resources on both sides of the gate. Possible impacts could be: impeding active and passive transport of eggs and larvae through the gate, and impeding migration of larger organisms. These impacts could occur because the gate would decrease the existing 570-foot-wide by approximately 40-foot-deep channel to a 350-foot-wide by 40-foot-deep channel.

Indirect Impacts to EFH

Indirect impacts on EFH may occur during construction due to changes in water characteristics. Impacts on EFH species would most likely be temporary, indirect impacts caused by the displacement of organisms from localized areas due to elevated turbidity levels, decreased DO, and increased BOD associated with construction excavation/dredging activities. Analytical modeling of DO used an ambient DO of 5.42 mg/L for the various (n= 11) cross sections throughout the project area (Dortch and Martin 2008). A comparison of the base condition including the MRGO closure at Bayou La Loutre and a modeling scenario similar to alternative 1 shows an increase of 0.3 mg/L in the mean bottom DO values after construction is complete (increasing from approximately 3.69 mg/L to 3.99 mg/L) (Dortch and Martin 2008). Although this value is below the standard for estuarine systems (4.0 mg/L), DO concentrations in the project area are already depressed and periodically fall below 4.0 mg/L.

Construction of a replacement for the existing control structure in Bayou Bienvenue and adjacent wetlands could cause downstream increases in turbidity and sedimentation that could impact survival and growth of EFH species. However, those impacts would be short-term, with effects ceasing shortly after completion.

Indirect impacts from construction noise are expected to be similar to the proposed action. Although individual aquatic organisms may be taken during construction activities for the proposed action the number of organisms affected is not expected to impact populations of fishes. Alternative 1 would also have a potential for turbidity impacts from the footprint encompassed and additional impacts by the additional levee work. These impacts are not expected to be more than the proposed action because SWPPPs will be used to control land based turbidity.

The reconnaissance study of fish passages in the project area used published average and burst swimming speeds of three species (red drum, spotted sea trout and brown shrimp) and modeled maximum velocities at various locations to determine if fish and invertebrate passage would be affected by alternative 1. The model predicts velocities will remain less the 0.5 ft/s (Smith 2008). Mean swimming speed for larger fish are well above 0.3 ft/s; however smaller fish (mostly larvae and juvenile life history stages) may have some difficulty traversing large areas with this velocity (mean swimming speed of juvenile red drum, seatrout and shrimp is approximately 0.1 ft/s). Adverse impacts to fish passage due to high velocities with this alternative are additive to the already altered conditions in the project area. Under current conditions, EFH species can move to adjacent fringe marsh to avoid high flows. With Alternative 1, EFH species will be able to utilize adjacent fringe marsh but will have to traverse the gates to access Lake Pontchartrain or the Golden Triangle marsh.

Some fish and invertebrates species and life stages are exposed to unfavorable conditions for passage under current conditions (prior to closure of the MRGO at Bayou La Loutre), whereas other species and life stages use such higher flow velocities to aid in distribution if survival is possible given those conditions or other stressors they may be subjected to that happen to coincide with such events. Based on these predictions, an overall reduction in cross sectional area associated with this gate likely would reduce the amount and potential type of organisms passing through the gate and accessing habitat on the protected side.

The preliminary salinity model runs a scenario similar to Alignments 1 and 2 with the closure of the MRGO south of Bayou La Loutre. Based on salinity modeling results, Alignment 1 would have no impact on EFH or EFH species because salinity would change by ± 0.1 ppt in the area near the Bayou Bienvenue control structure during dry season conditions (Martin et al. 2008). EFH (marsh) would also not be affected by changes to salinity. *Spartina alterniflora*, the dominant marsh edge vegetation species, proliferates in brackish and saline waters (Stutzenbaker 1999).

Small localized alterations in the hydrology and salinity of open-water habitats may occur because freshwater influx and tides would be restricted from the existing 570 ft wide by approximately 40 ft deep channel to a 350 ft wide and 40 ft deep channel. Based on modeling results, Alignment 1 would have some impact on EFH or EFH species because of changes to hydrology, salinity, and velocity even though the existing project area has already been highly altered (see base conditions for phase I modeling; Martin et al. 2008) and these organisms are accustomed to highly variable environment (Dunson and Travis 1994).

Cumulative Impacts to EFH

Under alternative 1, in addition to the construction and operation of a deep draft navigation gate across the GIWW, existing levees and floodwalls in the Borgne 1 area would be raised to 100-year level of the GNOHSDRRS. These actions would contribute to cumulatively substantial alterations. However, compensatory mitigation would be provided to offset the project induced portion of these impacts (discussed in section 4.0). The incremental addition of impacts to EFH from Alternative 1 would be less than Alternatives 3-5. The structure at Seabrook in addition to the proposed action could increase local friction in IHNC channel which could result in decreases in the maximum surface velocity by ~0.5 ft/sec (Martin et al. 2008). EFH species could benefit from the decrease in surface velocity.

Salinity modeling showed that the addition of a gate structure at Seabrook to Alternative 1 could produce small decreases in salinity on the order of approximately 0.25 -1.0 ppt during the wet period. The dry period showed a larger decrease of approximately 0.5-1.0 ppt. The differences with the addition of Seabrook during both periods may be attributable to tidal phasing effects created by the addition of the Seabrook structure. Impacts to EFH species from this additive effect could range from changes in behavior to slower growth rates to decreases in survival of some species. Depending on the salinity gradient some fishes may not be able to osmoregulate and the change in salinity may become a barrier to fish passage.

Salinity fluctuations caused by this alternative and the Seabrook closure structure, coupled with the 3-4 ppt changes with the MRGO closure at Bayou La Loutre, may impact the health and growth of individual aquatic organisms. The types of impacts would be similar to those described above in the proposed action.

The addition of a gate structure at Seabrook could have an additive effect on DO. When all of the DO levels in the project area are averaged under the Alternative 1, the addition of the Seabrook structure increases the DO from 3.69 to 4.03 mg/L. Because the addition of the Seabrook structure to Alternative 1 would marginally improve the DO levels in the vicinity of the IHNC, there would be no additive impacts to EFH species.

Alternative 2 – Deep Draft Gate in Alignment 2

Direct Impacts to EFH

Permanent direct impacts to EFH would be similar to those discussed under alternative 1 (see table 6). The increase in impacts due to the larger gate would be balanced with the reduction in the amount of existing levees and floodwalls that would be raised. These impacts would be less than with alternatives 3a, 3b, 4a, 4b, 5a and 5b because these alignments would not cross the marshes and aquatic habitat between the GIWW and the MRGO.

Indirect Impacts to EFH

Indirect impacts to EFH would be similar to those discussed in alternative 1.

Cumulative Impacts to EFH

Cumulative impacts to EFH would be similar to those discussed in alternative 1.

Alternative 3a – MRGO Structure, GIWW Gate, and Structural Wall Barrier in Alignment 3

Direct Impacts to EFH

Direct impacts to EFH and EFH species would occur due to changes in fresh/intermediate and salt marsh, estuarine substrate (over open water habitat) and open water within the footprint of the floodwall and other structures (table 6), and are similar in nature to those described under the proposed action. In addition to impacts from the construction of the barrier, there would be additional temporary impacts to marsh from relocation of the pipeline. These additional impacts would include further fragmenting marsh, creating more open water habitat and disturbing substrate under open water. Impacts associated with the pipeline relocation would be temporary, and would be mitigated. Fragmenting marsh and creating more open water could decrease access to emergent marsh, resulting in increases in predation for juvenile fishes and macroinvertebrates and possible decreases in growth rates.

In addition to raising the levees, construction and replacement of the existing control structure at Bayou Bienvenue could disrupt aquatic habitat, fisheries habitat and EFH in the bayou during construction and a much smaller portion (approximately 0.5 acre) of the channel would be permanently occupied by the control structures (table 6).

Alternative 3 could directly impact aquatic resources on the flood and protected side of the barrier. Possible impacts could be: impeding active and passive transport of eggs and larvae across the barrier, blocking access to habitat, and blocking access to prey items. These impacts could result in alterations in behavior, decreases in growth, and localized changes to the community structure.

Indirect Impacts to EFH

Indirect impacts would be similar in nature to the proposed action; however the smaller footprint of the flood barrier would result in a smaller area disturbed during construction. Similar to direct impacts for this alternative; additional indirect impacts would occur from relocation of a pipeline. These impacts are expected to be similar in nature to other construction activities. Indirect disturbances are expected to be temporary and are not expected to impact populations of EFH species.

Construction of a replacement for the existing control structure in Bayou Bienvenue and adjacent wetlands could cause downstream increases in turbidity and sedimentation that could impact the survival and growth of EFH species. However, those impacts would be short-term, with effects ceasing shortly after completion.

Impacts to velocity, hydrology, and salinity are assumed to be similar to the proposed actions.

During and after construction, localized alterations in the velocity, hydrology, and salinity of open-water habitats may occur because freshwater influx and tides would be restricted in the Golden Triangle marsh between the GIWW and the MRGO

Cumulative Impacts to EFH

Cumulative impacts would be similar to those described under the proposed action.

Alternative 3b – MRGO Structure, GIWW Gate, and Wetland Levee Barrier in Alignment

Direct Impacts to EFH

Direct impacts to EFH and EFH species would be similar to Alignment 3a with a larger footprint needed to construct the geotextile levee (table 6 in section 3.2.3). Similarly to Alignment 3a, relocation of the pipeline would result in additional temporary impacts to marsh habitat.

Indirect Impacts to EFH

Indirect impacts to EFH and EFH species would be similar to Alignment 3a with a larger footprint needed to construct the geotextile levee (table 6 in section 3.3.2). Similarly to Alignment 3a, additional impacts from the construction of a pipeline and the construction of a replacement for the existing control structure at Bayou Bienvenue would occur.

Cumulative Impacts to EFH

Cumulative impacts would be similar to those described under alternative 3a.

Alternative 5a – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Structural Wall Barrier in Alignment 5

Direct Impacts to EFH

Direct impacts to EFH and EFH species would be similar to the proposed action and would occur due to changes in estuarine substrate, estuarine open water, and wetlands within the footprint of the floodwall and other structures (table 6). Alignment 5 has the longest barrier length (2.6 miles) across the marsh; therefore the impacts would be greater with regard to EFH and EFH species than those from Alignments 1-4. The differences in impacts are a result of the larger footprint associated with this alignment and the floodwall crossing the marshes between the GIWW and the MRGO and additional time to construct.

As with the proposed action, during the advanced measures, a 150-ft wide barge gate would be constructed on the GIWW to allow for unimpeded navigation and to maintain flow. The proposed cofferdam on Bayou Bienvenue would have four 48” culverts to allow water exchange and movement of organisms while the cofferdam is in place during construction of the permanent gate. The culverts in place on Bayou Bienvenue during construction would reduce flow to approximately 10% with an estimated velocity of 3.2 ft/sec.

As with the proposed action, direct impacts to EFH species could occur. Possible impacts could be: impeding active and passive transport of eggs and larvae across the barrier, blocking access to habitat, and blocking access to prey items. These impacts could result in alterations in behavior, decreases in growth, and localized changes to the community structure.

Temporary direct impacts to EFH and EFH species that may occur during construction would be similar to the proposed action with a larger area of disturbance (table 6).

Indirect Impacts to EFH

Indirect impacts would be similar to the proposed action with an increase in the footprint. During and following construction, indirect impacts to EFH species may occur from localized reduction in available habitat and access to quality habitat. Additionally, passive and active transport of organisms may be interrupted during construction in localized areas due to reduced water quality and small changes in circulation patterns. This increase in footprint may cause a larger area in which indirect impacts occur.

Impacts to velocity, hydrology and salinity are assumed to be similar to the proposed actions.

During construction, small localized alterations in the velocity, hydrology, and salinity of open-water habitats may occur because freshwater influx and tides would be restricted in the marsh between the GIWW and the MRGO. After construction is complete, a 150-ft gate on the GIWW and 56-ft wide gate on Bayou Bienvenue would be open except during storm events. Delay in tidal pulse, changes to salinity, DO, water surface elevation, and velocity would be similar to the proposed action; therefore, impacts to aquatic resources would also be similar.

Cumulative Impacts to EFH

Cumulative impacts to EFH and EFH species would be similar to those described under the proposed action.

Alternative 5b – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Geotextile Levee Barrier in Alignment 5

Direct Impacts to EFH

Direct impacts to EFH would be similar to those described under the proposed action; however the construction of the geotextile levee would increase the acreages of marsh impacted (table 6) and a longer time to construct.

Indirect Impacts to EFH

Indirect impacts would be similar to those described under alternative 5a and the proposed action.

Cumulative Impacts to EFH

Cumulative impacts would be similar to those described under alternative 5a and the proposed action.

3.2.7 Wildlife

Existing Conditions

The diversity and abundance of wildlife inhabiting the project area are dependent on the quality and extent of suitable habitats available. The wildlife habitats in the areas potentially affected by the proposed IER #11 Tier 2 Borgne project include tidal marsh, open waters (man-made waterways as well as bayous and openings in the marsh), forested wetlands (swamp), scrub-shrub communities, and open grass areas maintained along levees and floodwalls. The wetland habitats (marsh and swamp) and open water habitats were described in previous sections. The terrestrial wildlife habitats potentially affected are located along the northern shorelines of the GIWW and the southwestern shore of the MRGO near the existing levees and floodwalls that line these waterways.

Terrestrial wildlife habitat in the project area along the GIWW and MRGO consists principally of swamp (bottomland hardwood and scrub-shrub) as well as upland scrub-shrub and herbaceous communities on higher ground created by dredge spoils deposited during construction of the waterways and fill deposited during construction of the levees and floodwalls. These habitats occur in areas east of the Michoud Canal along the north shore of the GIWW, east of the Paris Road bridge along the south shore of the GIWW, and along the west shore of the MRGO north of Bayou Bienvenue. The vegetation communities in the areas along levees and floodwalls consist mainly of planted grasses with herbs and scattered shrubs and small trees. The grass habitats along the levees and floodwalls are subject to periodic mowing and provide limited cover or other habitat components supportive of wildlife. Thus, habitats for terrestrial wildlife are present within the project area predominantly in swamp and scrub-shrub communities on the protected-side of the levees and, in some places, between the levees and the waterways. The majority of the project area is covered predominantly by brackish and saline marsh and open water, which provides habitat for aquatic and semi-aquatic wildlife, especially wading birds, waterbirds, and waterfowl.

Wildlife that typically inhabit terrestrial or brackish aquatic habitats such as those in the project area include a diverse assemblage of amphibians, reptiles, birds, and mammals. Species from each of these classes that may occur in the habitats of the project area can be identified based on the geographical ranges and habitat preferences of each species. An amphibian that may occur in these habitats is the Gulf Coast toad (*Bufo valliceps*). Reptiles that may utilize habitats such as those of the project area include the American alligator (*Alligator mississippiensis*), Mississippi diamondback terrapin (*Malaclemys terrapin pileata*), common snapping turtle (*Chelydra* *serpentina*), green anole (*Anolis carolinensis*), Gulf salt marsh snake (*Nerodia clarkii clarkii*), marsh brown snake (*Storeria dekayi limnetes*), and rough green snake (*Opheodrys aestivus*) (Conant and Collins 1998; Felley 1992; Wigley and Lancia 1998). Sea turtles, which could occur in the open water habitats of the project area, are protected species that are discussed in section 3.2.8.

Mammals that may occur in the habitats of the project area include the nutria (*Myocastor coypus*), muskrat (*Ondatra zibethicus*), swamp rabbit (*Sylvilagus aquaticus*), marsh rice rat (*Oryzomys palustris*), cotton mouse (*Peromyscus gossypinus*), golden mouse (*Ochrotomys nuttalli*), least shrew (*Cryptotis parva*), raccoon (*Procyon lotor*), and white-tailed deer (*Odocoileus virginianus*) (Whitaker 1998; Wigley and Lancia 1998). Marine mammals that may occur in the waterways and open waters of the marsh in the project area include the bottlenose dolphin (*Tursiops truncatus*), which is the only cetacean likely to occur in the inshore bay and estuarine habitats of the project area (NOAA 2008), and the West Indian manatee (*Trichechus manatus*) (Abadie et al. 2000), which is endangered and discussed in section 3.2.8.

Birds that may utilize the habitats of the project area include both nonmigratory residents of the region and migratory species that are present only part of the year. Nonmigratory species that may use these habitats include the anhinga (*Anhinga anhinga*), great blue heron (*Ardea herodias*), great egret (*Ardea alba*), tricolored heron (*Egretta tricolor*), snowy egret (*Egretta thula*), black-crowned night heron (*Nycticorax nycticorax*), green heron (*Butorides virescens*), white ibis (*Eudocimus albus*), barred owl (*Strix varia*), bald eagle (*Haliaeetus leucocephalus*), downy woodpecker (*Picoides pubescens*), common crow (*Corvus brachyrhynchos*), red-winged blackbird (*Agelaius phoeniceus*), and northern cardinal (*Cardinalis cardinalis*). Migrant birds that may occur in the area only during the spring/summer breeding season include the acadian flycatcher (*Empidonax virescens*) and barn swallow (*Hirundo rustica*). Migrant birds that may occur in the area only during winter include the gray catbird (*Dumetella carolinensis*), rusty blackbird (*Euphagus carolinus*), swamp sparrow (*Melospiza georgiana*), song sparrow (*Melospiza melodia*), mallard (*Anas platyrhynchos*), blue-winged teal (*Anas discors*), and diving ducks that winter in the open waters of the marsh, such as the lesser scaup (*Aythya affinis*), greater scaup (*Aythya marila*), canvasback (*Aythya valisineria*), and redhead (*Aythya americana*) (Dunn and Alderfer 2006; Wigley and Lancia 1998).

Although the bald eagle was recently delisted as a federally threatened species (August 2007), it continues to be protected under the Bald and Golden Eagle Protection Act, as well as the Migratory Bird Treaty Act. Habitats suitable for use by the bald eagle are present in St. Bernard and Orleans Parishes, and occurrences of the bald eagle have been recorded in both parishes. However, habitats in the immediate IER #11 Tier 2 Borgne project area do not have characteristics that would be particularly attractive to bald eagles for nesting, such as large bald cypress or other tall trees. Consequently, the bald eagle would not be expected to nest or regularly forage in the project area.

Discussion of Impacts

Proposed Action: Alternative 4a - MRGO Structure, GIWW and Bayou Bienvenue Gates, and Structural Wall Barrier in Alignment 4

Direct Impacts to Wildlife

Under the proposed action, construction of the new structures along Alignment 4a would not result in the loss of high quality habitat for terrestrial wildlife because the footprint of the new gate structure on the bank of the GIWW and of the closure structure on the bank of the MRGO would remain within areas along the floodwall/levee that are covered mainly by grass and are periodically mowed. Although there could be effects on terrestrial birds, mammals, reptiles, and amphibians from construction and clearing, the project footprint in these areas would affect marginal, mainly grassy habitat that has become established on the spoil areas along the waterways and does not provide important habitat for wildlife. However, in conjunction with the construction of the Alignment 4a structures, there also would be a requirement for the clearing of scrub-shrub in a staging area of 16 acres located on the west bank of the MRGO.

The relatively small areas of terrestrial habitat potentially affected by the project are adjacent to large areas of similar habitat. The presence of construction-related activity, machinery, and noise would be expected to cause most wildlife, terrestrial and aquatic, to avoid the construction area and adjacent habitats during the construction period. The greatest potential for effects on wildlife associated with the proposed action would occur during construction, which is anticipated to last approximately 3 years.

Prior to the clearing of the forested portion of the staging area, it would be surveyed for the occurrence of nesting colonies of wading birds, such as herons, egrets, and ibises, or water birds, such as the anhinga (*Anhinga anhinga*) and double-crested cormorant (*Phalacrocorax auritus*). In order to minimize the potential for clearing of this area to disturb colonial-nesting birds if they are in the area, procedures recommended by the USFWS would be followed. Accordingly, the project area would be inspected prior to construction by the USFWS or other qualified personnel for the presence of colonies during the nesting season (typically February through September in this region, depending on the species). Construction-related activities that would occur within 1,000 ft of a colony would be restricted to the non-nesting period. The 1,000-ft buffer would be maintained during the nesting season (USFWS 2007a). Although bald eagles may nest in mature trees near marshes and open water habitat, eagle nests have not been recorded in the project area and the USFWS has determined that the proposed action would not be likely to adversely affect the bald eagle (USFWS 2007a).

Aquatic wildlife using marsh and open-water habitats in the project area are mobile and could move to similar habitats in the area at the start of construction activities. Underwater noise from pile driving can be harmful to marine animals in many ways, producing effects that range from avoidance and other behavioral changes to injury and death. Pile-driving activities in the GIWW and MRGO, which are open waters where wildlife could be exposed to the highest sound impulses, would have the greatest potential to cause adverse effects on individual aquatic organisms present in the vicinity. Pile driving activities in the marsh, including open water ponds within the marsh, would be less likely to adversely affect wildlife due to the sound attenuation provided by the marsh.

The proposed action alignment would continue to allow the movement of marine wildlife (e.g., dolphins and manatees) between the eastern and western sides of the structures through the open gates. The gate structures on the GIWW and Bayou Bienvenue would provide two large openings through which wildlife could pass within the 2-mile long alignment. This is a frequency of one passageway for wildlife per mile. At a similar hurricane and storm damage risk reduction project in the region, USFWS determined that a frequency of one passageway for fish and wildlife per 3.5 miles was adequate (USFWS 2000). Accordingly, the proposed gate structures for Alignment 4 are expected to provide adequate passageways for wildlife to cross the barrier.

Dolphins and birds could be affected if changes in hydrology and water quality affect their prey (e.g., fish, shrimp, and mollusks). However, these changes and associated effects on prey are predicted to be minimal based on the results of hydrological modeling, as previously discussed in sections on Aquatic Resources (section 3.2.4), Fishery Resources (section 3.2.5), and EFH (section 3.2.6). The proposed action would result in some restrictions on migratory movements of prey organisms and their ability to access tidal creeks and marsh as a result of the floodwall barrier. However, the mobility of birds, dolphins, and other marine wildlife likely would allow them to adapt to any resulting changes in the locations of prey concentrations in the project vicinity. The infrequent operation of the gates on the GIWW and Bayou Bienvenue would be relatively slow and would pose little to no potential to adversely impact wildlife.

The proposed action alignment would cross brackish and saline marsh habitat that is within the perimeter of the Bayou Sauvage National Wildlife Refuge (NWR), as shown in figure 28. Approximately 19 acres of marsh within the refuge would be lost due to the segment of the floodwall, access channel and GIWW gate structure that would cross the refuge. The construction of the proposed action in this narrow corner of the refuge would not substantially adversely impact wildlife within the refuge, as discussed above. The beneficial use that would be provided by the dredged sediments from this project would benefit the eroding and subsiding marsh within the refuge east of Alignment 4a.

Indirect Impacts to Wildlife

Potential indirect impacts on wildlife from the proposed action mainly would involve the displacement of wildlife populations from the area within the project footprint. Movement of the limited numbers of wildlife that currently inhabit this area into surrounding, unimpacted habitats would not be expected to result in exceedances of the carrying capacity of the extensive, adjacent, similar habitats.

Cumulative Impacts to Wildlife

Potential cumulative impacts on wildlife from the proposed action mainly would involve the combined effects on wildlife from habitat loss and displacement of wildlife populations from the multiple LPV projects in the New Orleans area. The habitats that would be affected in the vicinity of the Golden Triangle marsh are not high-quality or unique habitats but are similar to extensive areas of marsh and spoils in the New Orleans region. The potentially impacted habitat areas are very small in the context of similar habitats in the region. Movement of the limited numbers of wildlife that currently inhabit these areas into surrounding, unimpacted habitats would not be expected to result in exceedances of the carrying capacity of the extensive, adjacent habitats. In addition, wildlife habitat impacts from this and other LPV flood control projects would be mitigated through wetland creation and enhancement activities designed to minimize cumulative habitat losses in the project area and the region. As a result, the proposed action would contribute negligibly to the minimal cumulative impacts on wildlife occurring in the region.

Alternative 4b – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Geotextile Levee Barrier in Alignment 4

Direct, Indirect, and Cumulative Impacts to Wildlife

The principal difference between the proposed action and alternative 4b is that the alternative barrier would be a geotextile levee, which would have a greater width and larger footprint than the floodwall used in the proposed action. As a result, the existing open water and marsh within the larger footprint of the levee would be filled, resulting in less habitat (table 6) for aquatic wildlife than under the proposed action. The larger area of saline marsh and open water habitat that would be lost under this alternative would result in corresponding increases in direct impacts on wildlife resources. Thus, direct impacts on wildlife under alternative 4b would be very similar to the minimal impacts from the proposed action.

Indirect Impacts to Wildlife

The increased area of marsh and open water habitat that would be filled under this alternative would be larger than for the proposed action and would result in corresponding increases in indirect impacts on wildlife resources. Thus, indirect impacts on wildlife under this alternative would be essentially the same as the indirect impacts from the proposed action.

Cumulative Impacts to Wildlife

The increased area of saline marsh and open water habitat that would be filled under this alternative would be larger than for the proposed action and would result in corresponding increases in cumulative impacts on wildlife resources. Thus, cumulative impacts on wildlife under this alternative would be essentially the same as the cumulative impacts from the proposed action.

Alternative 1 – Deep Draft Gate in Alignment 1

Direct Impacts to Wildlife

The construction of the deep-draft gate and floodwalls within the GIWW at Alignment 1 would not result in the loss of quality habitat for wildlife. The footprint of the new gate structure and the floodwalls between the gate and the north and south shorelines of the GIWW would be within the man-made navigation channel. The gate would remain open except during infrequent storm events and maintenance activities and would continue to allow the movement of marine mammals (dolphins and manatees) between the eastern and western sides of the structure. Dolphins and birds could be affected if changes in hydrology and water quality affect their prey (e.g., fish, shrimp, and mollusks). However, these changes and associated effects on prey are predicted to be minimal based on the results of hydrological modeling, as previously discussed in the Aquatic Resources, Fishery Resources, and EFH sections. The mobility of birds, dolphins, and other marine wildlife likely would allow them to adapt to any resulting changes in the locations of prey concentrations in the project vicinity. The closure of the gate on the GIWW would be infrequent and relatively slow and would have a negligible potential to directly impact wildlife.

Terrestrial wildlife habitat that could be affected at Alignment 1 occurs in two areas: a 2-acre floodwall corridor extending approximately 700 ft from the south shore of the GIWW to the Chalmette Loop levee, and a 13-acre staging area about 700 ft east of the floodwall. The habitat in both areas is predominantly scrub-shrub wetland but includes smaller areas of scrub-shrub on spoils near the levee. The staging area encompasses the grassed levee and a cleared area between the GIWW and the levee and extending south, so the acreage of impacted scrub-shrub habitat would be approximately half the acreage of the staging area, or approximately 7 acres. Thus, a total of approximately 9 acres of scrub-shrub habitat could be lost due to clearing for this alignment. As discussed for the proposed action, prior to the clearing of the two forested areas, they would be surveyed for the occurrence of nesting colonies of wading birds. The project area would be inspected prior to construction by the USFWS or other qualified personnel for the presence of colonies during the nesting season (typically February through September in this region, depending on the species). Construction-related activities that would occur within 1,000 ft of a colony would be restricted to the non-nesting period. The 1,000-ft buffer would be maintained during the nesting season (USFWS 2007a).

The relatively small areas of terrestrial habitat potentially affected by the project are adjacent to large areas of similar habitat to the east, west, and south. The presence of construction-related activity, machinery, and noise would be expected to cause most wildlife to avoid the construction area and adjacent habitats during the construction period. The greatest potential for effects on wildlife associated with alternative 1 would occur during construction, which is anticipated to last approximately 3 years. The impacted forest eventually could be restored in the staging area after construction is completed, and wildlife may return to this area after it is re-vegetated.

Aquatic wildlife using marsh and open-water habitats in the project area are mobile and could move to similar habitats in the area at the start of construction activities. Underwater noise from pile driving can be harmful to marine animals in many ways, producing effects that range from avoidance and other behavioral changes to injury and death. Pile-driving activities in the GIWW, which is open water where wildlife could be exposed to the highest sound impulses, would have the greatest potential to cause adverse effects on individual animals present in the vicinity.

Also in conjunction with alternative 1, a replacement control structure would be built on the Bayou Bienvenue channel 300 ft to the protected-side of the existing structure. This project would not result in the loss of quality wildlife habitat because the footprint of the new structure on each bank of the bayou would remain within spoil areas that are covered mainly by grass and are periodically mowed. The proposed pontoon bridge structure associated with the control structure would replace a very small area of shoreline habitat that currently is covered by rock. The operation of the bridge would be relatively slow, noisy, and infrequent and therefore would have little or no adverse impacts on wildlife. The greatest potential for effects on wildlife from this project would occur during the construction period. The presence of construction-related activity, machinery, and noise would be expected to cause most wildlife to avoid the construction area as well as nearby habitats during the construction period. The project footprint would affect a very small area of marginal, mainly grassy habitat that has become established on the spoils area along the bayou adjacent to the armored shoreline near the current structure. In addition, the small area potentially affected by the project is adjacent to a large area of similar habitat to the northwest and southeast. Wildlife currently using the habitat in the project corridor, including birds, mammals, reptiles, and amphibians, could move to adjacent habitats at the start of construction, and some may return to the vicinity of the new structure after the area is re-vegetated with turf grasses following construction. Thus, the proposed action is unlikely to have a substantial, adverse, direct impact on wildlife.

Indirect Impacts to Wildlife

Potential indirect impacts on wildlife from alternative 1 would primarily involve the displacement of wildlife populations from the area within the project footprint. Movement of the limited numbers of wildlife that currently inhabit this area into surrounding, unimpacted habitats would not be expected to result in exceedances of the carrying capacity of the extensive, adjacent, similar habitats.

Cumulative Impacts to Wildlife

Potential cumulative impacts on wildlife from alternative 1 would mainly involve the combined effects on wildlife from habitat loss and displacement of wildlife populations from the multiple LPV flood control projects in the New Orleans area. The habitats that would be affected are not high-quality or unique habitats, but are similar to extensive areas of water bottoms and scrub-shrub in the New Orleans region. Many of the effects on wildlife from these projects would be short term, occurring mainly during the construction period. The potentially impacted habitat areas are very small in the context of similar habitats in the region. If the area impacted by the construction of the proposed project were added to the areas of similar habitats potentially impacted by other LPV projects, the loss of this type of wildlife habitat would be minimal relative to the available habitat remaining. Movement of the limited numbers of wildlife that currently inhabit the affected project areas into surrounding, unimpacted habitats would not be expected to result in exceedances of the carrying capacity of the extensive, adjacent habitats. In addition, wildlife habitat impacts from this and other LPV flood control projects would be mitigated through wetland creation and enhancement activities designed to minimize cumulative habitat losses in the project area and the region. As a result, alternative 1 would contribute negligibly to the minimal cumulative impacts on wildlife occurring in the region.

Alternative 2 – Deep Draft Gate in Alignment 2

Direct Impacts to Wildlife

The structures to be constructed for alternative 2 would be essentially the same as for Alternative 1. However, they would be located approximately 2,100 ft east on the GIWW and, as a result, shorter segments of the existing levees and floodwalls of the GNOHSDRRS would need to be raised to the 100-year level of protection for this alignment versus alternative 1. Similar to alternative 1, a replacement control structure would be built on Bayou Bienvenue 300 ft to the protected-side of the existing structure. Thus, direct impacts on wildlife under this alternative would be essentially the same as or slightly less than the minimal impacts from alternative 1.

Indirect Impacts to Wildlife

Indirect impacts to wildlife from this alternative would be essentially the same as for alternative 1.

Cumulative Impacts to Wildlife

Cumulative impacts to wildlife from this alternative would be essentially the same as for alternative 1.

Alternative 3a – MRGO Structure, GIWW Gate, and Structural Wall Barrier in Alignment 3

Direct Impacts to Wildlife

The principal differences between the proposed action and alternative 3a are the shorter length of the floodwall barrier across the marsh at alternative 3a, the lack of a gate structure in the marsh because this alignment does not cross Bayou Bienvenue, and the need to construct in conjunction with this alternative a new control structure on the Bayou Bienvenue channel 300 ft to the protected-side of the existing structure. In addition, this alignment would intersect an existing pipeline. The pipeline would need to be relocated, potentially resulting in an additional temporary disturbance of approximately 11.5 - 24.3 acres of marsh habitat. The amount of impacted habitat could increase to 57 acres depending on the construction techniques used. Under alternative 3a, the floodwall would be west of the proposed action alignment, resulting in a shorter barrier and a smaller footprint. The decreased footprint would reduce by approximately 35.5 acres the area of saline (brackish and salt) marsh and open water habitat that would be permanently lost compared to the proposed action (table 6). This decrease in impacted habitat area would result in a corresponding decrease in direct impacts on wildlife resources relative to the proposed action. As discussed for alternative 1, the construction of the new control structure on Bayou Bienvenue where it crosses the Chalmette Loop levee would have negligible impacts on wildlife.

Modeling results indicate that a delay in tidal pulse, an increase in water surface elevation, and small changes in salinity could occur in the protected-side marsh under some conditions. Such changes may affect individual organisms but are not expected to substantially affect aquatic habitats or food web dynamics. It is unlikely that this alternative would affect prey availability and impact wildlife that feed on the aquatic food web in the Golden Triangle marsh. Thus, direct impacts on wildlife under this alternative would be slightly smaller than, but very similar to the impacts from the proposed action.

Indirect Impacts to Wildlife

Indirect impacts to wildlife from this alternative would be very similar to those described for the proposed action.

Cumulative Impacts to Wildlife

Cumulative impacts to wildlife from this alternative would be very similar to those described for the proposed action.

Alternative 3b – MRGO Structure, GIWW Gate, and Geotextile Levee Barrier in Alignment 3

Direct Impacts to Wildlife

The principal difference between alternative 3a and alternative 3b is the different type of barrier across the marsh. Under alternative 3b, the barrier would be an earthen levee with geotextile and soil mixing, which would have a larger footprint than the floodwall used in alternative 3a. Under alternative 3b, the levee would be west of the proposed action alignment, resulting in a shorter barrier but a footprint only slightly smaller than the proposed action (15.5 acres; table 6) due to the greater width of the levee versus the floodwall. Thus, the extent of saline marsh and open water habitat that would be lost under this alternative would be almost equal to those lost under the proposed action. The direct impacts on wildlife under this alternative would be very similar to the minimal impacts from the proposed action and alternative 3a.

Indirect Impacts to Wildlife

Indirect impacts to wildlife under this alternative would be very similar to the impacts from the proposed action and alternative 3a.

Cumulative Impacts to Wildlife

Cumulative impacts to wildlife associated with this alternative would be very similar to the minimal impacts from the proposed action and alternative 3a.

Alternative 5a – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Structural Wall Barrier in Alignment 5

Direct Impacts to Wildlife

The principal difference between the proposed action and alternative 5a is the greater length of the floodwall barrier across the marsh at alignment 5. Under alternative 5a, the floodwall would be east of the proposed action alignment, resulting in a longer barrier and a larger footprint. The increased footprint area includes an additional 14-acre staging area along the existing floodwall on the GIWW where the new alignment would tie in, an area of negligible value to wildlife. Therefore, the wildlife habitat lost under this alternative would be approximately 19 acres greater than under the proposed action. This increased area of 19 acres of saline marsh and open water habitat is relatively small and would result in correspondingly small increases in direct, indirect, and cumulative impacts on wildlife resources. Thus, impacts on wildlife under this alternative would be slightly larger but very similar to the minimal impacts from the proposed action.

Indirect Impacts to Wildlife

Indirect impacts on wildlife under this alternative would be slightly larger but very similar to the minimal impacts from the proposed action.

Cumulative Impacts to Wildlife

Cumulative impacts to wildlife associated with this alternative would be slightly larger but very similar to the minimal impacts from the proposed action.

Alternative 5b – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Geotextile Levee Barrier in Alignment 5

Direct Impacts to Wildlife

The principal differences between the proposed action and alternative 5b are the different types of barriers across the marsh and the greater length of the barrier at alignment 5. Under alternative 5b, the barrier would be an earthen levee with geotextile and soil mixing, which would have a larger footprint than the floodwall used in alternative 5a and the proposed action. Under alternative 5b, the levee would have a larger footprint than the alternative 5a floodwall and an increased footprint area. The increased area (54 acres; table 6) of saline and brackish marsh and open water habitat that could be lost under this alternative would result in corresponding increases in direct, indirect, and cumulative impacts on wildlife resources. Thus, impacts on wildlife under this alternative would be larger than but similar to the impacts from alternative 5a and the proposed action.

Indirect Impacts to Wildlife

Indirect impacts to wildlife under this alternative would be very similar to the minimal impacts from the proposed action and alternative 5a.

Cumulative Impacts to Wildlife

Cumulative impacts to wildlife associated with this alternative would be very similar to the minimal impacts from the proposed action and alternative 5a.

3.2.8 Threatened or Endangered Species

Existing Conditions

In accordance with the provisions of the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 USC 1531 et seq.), the CEMVN requested information on protected, proposed, and candidate species and critical habitat that may occur in the vicinity of IER # 11 and the proposed Tier 2 Borgne project from the USFWS office in Lafayette, Louisiana. In response and in accordance with the provisions of the ESA and the Migratory Bird Treaty Act of 1918 (40 Stat. 755, as amended; 16 USC 703 et seq.), USFWS responded in a letter 6 December 2007 (USFWS 2007a). USFWS determined that, of the federally listed species that occur in the region and for which USFWS has responsibility, most were unlikely to be adversely affected by the proposed project. USFWS identified only one species that potentially could be impacted by the IER #11 project: the endangered West Indian manatee (*Trichechus manatus*) (USFWS 2007a). In addition, four federally listed species that are the responsibility of NMFS have a potential to occur in the project area: the threatened Gulf sturgeon (*Acipenser oxyrinchus desotoi*), the endangered Kemp's ridley sea turtle (*Lepidochelys kempii*), the threatened loggerhead sea turtle (*Caretta caretta*), and the threatened green sea turtle (*Chelonia mydas*). CEMVN requested concurrence from the National Marine Fisheries Service (NMFS) with its determination that the project is not likely to adversely affect listed sea turtle species, Gulf sturgeon, or designated Gulf sturgeon critical habitat. NMFS provided its concurrence in a letter dated 12 August 2008 (NMFS 2008a). These species are discussed below.

West Indian Manatee

The West Indian manatee is Federally and state-listed as endangered and also is protected under the Marine Mammal Protection Act of 1972, under which it is considered depleted (USFWS 2001). It occurs in both freshwater and saltwater habitats within tropical and subtropical regions and includes two subspecies, the Florida manatee (*T. manatus latirostris*) and the Antillean manatee (*T. manatus manatus*). The primary human-related threats to the manatee include watercraft-related strikes (impacts and/or propeller strikes), crushing and/or entrapment in water control structures (flood gates, navigation locks), and entanglement in fishing gear (discarded fishing line, crab traps) (USFWS 2007b).

The Florida manatee can occur throughout the coastal regions of the southeastern U. S. and may disperse greater distances during warmer months; it has been sighted as far north as Massachusetts and as far west as Texas. However, the manatee is a subtropical species with little tolerance for cold, and it returns to and remains in the vicinity of warm-water sites in peninsular Florida during the winter (USFWS 2007b; USFWS 2007c). Thus, the manatee is not a year-round resident in Louisiana, but it may migrate there during warmer months. Manatees prefer access to natural springs or man-made warm water and waters with dense beds of submerged aquatic or floating vegetation. Manatees prefer to forage in shallow grass beds that are adjacent to deeper channels. They seek out quiet areas in canals, creeks, lagoons, or rivers, using deeper channels as migratory routes (USFWS 1999).

There have been 110 reported sightings of manatees in Louisiana since 1975 (LDWF 2005). Sightings in Louisiana have been uncommon and sporadic, and have included occurrences in

Lake Pontchartrain and in the vicinity of the MRGO and Bayous Bienvenue and Dupre (Abadie et al. 2000). Although manatees can occur in the Golden Triangle, preferred food sources (submerged or floating aquatic vegetation) are not abundant in the project area. Given the extensive areas of relatively undisturbed wetlands in the region and the frequent passage of boats and large vessels through the GIWW and MRGO, it is unlikely that manatees would utilize as habitat or frequently occur in the project area.

Gulf Sturgeon

The Gulf sturgeon is federally listed as threatened throughout its range and is state-listed as threatened in Louisiana. It supported an important commercial fishing industry during the late 19th and early 20th centuries. A minor commercial fishery was reported to exist for Gulf sturgeon in Lake Pontchartrain and its tributaries during the late 1960s (USFWS and NOAA 2003). Throughout most of the 20th century, Gulf sturgeon suffered population declines due to over fishing, habitat loss, water quality deterioration, and barriers to historic migration routes and spawning areas (dams). In 1991, the Gulf sturgeon was listed as a threatened species under the Endangered Species Act (16 United States Code [U.S.C.] 1531 et seq). The present range of the species extends from Lake Pontchartrain and the Pearl River system in Louisiana and Mississippi east to the Suwannee River in Florida (USFWS and NOAA 2003).

The Gulf sturgeon is an anadromous fish that migrates from saltwater into large coastal rivers to spawn and spend the warm months. Subadults and adults typically spend the three to four coolest months in estuaries or Gulf of Mexico waters before migrating into rivers as temperatures increase (USFWS and GSMFC 1995). This migration typically occurs from mid-March through June (Rogillio et al. 2007). Most adults spend eight to nine months each year in rivers before returning to the estuary or the Gulf of Mexico by mid-November to early December. Thus, the Gulf sturgeon spends the majority of its life in freshwater (USFWS and GSMFC 1995), yet subadult and adult Gulf sturgeon do not feed significantly in freshwater; instead, they rely almost entirely on the estuarine and marine areas for feeding. Young-of-the-year and juveniles feed mostly in the riverine environment (USFWS and NOAA 2003).

Critical habitat identifies specific areas that are essential to the conservation of a listed species. Various activities in or adjacent to each of the critical habitat units may affect certain physical and biological features necessary to the preservation of the species and, therefore, may require special management considerations or protection. Fourteen geographic areas (units) among the Gulf of Mexico rivers and tributaries have been designated as critical habitat for this species. Offshore critical habitat for the Gulf sturgeon extends from Lake Borgne and the Rigolets along the Gulf Coast to the Suwannee Sound, Florida. Of the 14 units designated by USFWS and the NMFS among Gulf of Mexico rivers and tributaries, Units 1 to 7 are river systems and Units 8 to 14 are estuarine and marine systems (USFWS and NOAA 2003). The project area is adjacent to portions of Unit 8, which encompasses Lake Pontchartrain east of the Lake Pontchartrain Causeway, all of Little Lake, the Rigolets, Lake Catherine, Lake Borgne, and the Mississippi Sound. Critical habitat follows the shorelines of each water body. Estuaries and bays located adjacent to riverine units were designated as critical habitat to protect unobstructed passages for sturgeon between feeding and spawning areas (USACE 2006c). Sturgeon migrations to rivers that enter Lake Pontchartrain follow routes through Lake Borgne and the Rigolets. Studies conducted by the LDWF have shown the presence of Gulf sturgeon in Lake Pontchartrain, the Rigolets, and Lake Borgne during the winter and during periods of migration to and from marine environments. Thus, critical habitat was designated for the Gulf sturgeon in each of these areas (USACE 2006c).

In Lake Borgne from the 1950s through the 1980s, many Gulf sturgeon were reported as taken incidentally in shrimp trawls between August and October. At least 22 additional records of Gulf sturgeon in Lake Borgne exist. These occurrences were located around the perimeter of the lake, including Bayou Bienvenue and the Violet Canal, which connects to Bayou Dupre. USFWS/NMFS have included all of Lake Borgne as critical habitat (USFWS and NOAA 2003). The only recent sighting of Gulf sturgeon within the MRGO occurred during a sonic tracking study completed by the Corps Engineer Research and Development Center (ERDC) January 19, 2005. ERDC tracked a Gulf sturgeon moving from within the MRGO above Bayou La Loutre toward the marshes adjacent to the MRGO. Gulf sturgeon have also been collected in Breton Sound and from bayous connected to the MRGO. This suggests that, due to the proximity of the MRGO to the Breton Islands, sturgeon may use this channel as a passageway from Lake Borgne to the islands (USACE 2006c). However, the MRGO has not been designated as critical habitat (USFWS and NOAA 2003).

The IER # 11 Tier 2 Borgne project area is adjacent to designated critical habitat for the Gulf sturgeon in Lake Borgne. Gulf sturgeon may pass through the GIWW, the MRGO, and Bayou Bienvenue and may forage in the Golden Triangle marshes principally during the three to four coolest, winter months and periods of migration to and from Lake Borgne and the Mississippi Sound. Gulf sturgeon would not be expected to occur in the project areas during the eight to nine warmer months of the year. Gulf sturgeon would not be expected to utilize the open water areas of the project area as a significant habitat component because the soils in the project area do not have characteristics consistent with the substrate types that Gulf sturgeon prefer to forage over. As a result, their presence in these areas would be transitory and incidental.

Kemp's Ridley, Loggerhead, and Green Sea Turtles

Sea turtles are air-breathing reptiles with large flippers and streamlined bodies. They inhabit tropical and subtropical marine and estuarine waters around the world. Of the seven species in the world, six occur in waters of the U.S., and all are listed as threatened or endangered. The three species identified by NMFS as potentially occurring in the vicinity of the project area are similar in appearance, though they differ in maximum size and coloration. The Kemp's ridley is the smallest sea turtle; adults average about 100 pounds with a carapace length of 24 to 28 inches and a shell color that varies from gray in young individuals to olive green in adults. The loggerhead is the next largest of these three species; adults average about 250 pounds with a carapace length of 36 inches and a reddish brown shell color. The green is the largest of the three; adults average 300 to 350 pounds with a length of more than 3 ft and brown coloration (its name comes from its greenish colored fat). The Kemp's ridley has a carnivorous diet that consists mainly of crabs and may also include fish, jellyfish, and mollusks. The loggerhead has an omnivorous diet that includes fish, jellyfish, mollusks, crustaceans, and aquatic plants. The green has a herbivorous diet of aquatic plants, mainly seagrasses and algae, which is unique among sea turtles. All three species are known to forage as juveniles and adults in nearshore waters, including estuaries, in Louisiana and may be more likely to occur there in months when the waters are warmer. The Kemp's ridley and loggerhead turtles are likely to find suitable foraging habitat for invertebrates and fish in the open waters of the Golden Triangle. The green turtle is less likely to occur there due to the scarcity of the seagrasses on which they feed. All three species nest on sandy beaches, which are not present in the project area, and the Kemp's ridley does not nest in Louisiana. The life stages that may occur in the Golden Triangle area are likely to be older juveniles to adults (NMFS 2008b).

Discussion of Impacts

Proposed Action: Alternative 4a - MRGO Structure, GIWW and Bayou Bienvenue Gates, and Structural Wall Barrier in Alignment 4

Direct Impacts to Threatened or Endangered Species

As discussed previously, the manatee was the only Federally listed endangered or threatened species identified by USFWS as having a potential to be impacted by the IER #11 project. In addition, there is the possibility that four species under NMFS jurisdiction, the Gulf sturgeon and Kemp's ridley, loggerhead, and green sea turtles, also could occur in or migrate through the area. Construction of the proposed action would result in the loss of a limited area of aquatic habitat potentially used by these five species. The aquatic footprint of the entire alignment, including the gates on the GIWW and Bayou Bienvenue, the MRGO crossing, and the floodwall with access channel would cover an area of approximately 125.3 acres of marsh and open water bottoms (table 6). Approximately 45 acres of this area are open water, the habitat type that mainly would be used by the manatee, sturgeon, and sea turtles. Additionally, approximately 205 acres of open water habitat will be lost through the placement of dredged material in the Beneficial Use Area.

The greatest potential for direct effects on these listed species from the proposed action would occur during the construction period (estimated to be approximately 3 years). The presence of construction-related activity, machinery, and noise likely would cause the manatee, sturgeon, and sea turtles to avoid the project area during construction. Underwater noise from pile driving can be harmful in many ways to marine mammals, turtles, and fish. Pile-driving activities in the GIWW and MRGO, which are open waters where these species may be exposed to the highest sound impulses, would have the greatest potential to cause adverse effects on individual aquatic organisms present in the vicinity. Pile driving activities in the marsh, including open water ponds within the marsh, would be unlikely to adversely affect these species beyond the immediate construction zone due to the sound attenuation provided by the marsh. The manatee and Gulf sturgeon have the potential to occur in the area during only part of the year, and such occurrences, particularly for the manatee, are expected to be infrequent. Sea turtle occurrences in the area also appear to be infrequent and are less predictable but least likely during the colder months. All of these species are highly mobile and could move away from the sound. Therefore, the likelihood that they would be present when pile driving is occurring and would remain close enough to the sound source to be injured appears to be very small.

In order to minimize the potential for construction activities under the proposed action to cause impacts to the manatee, standard manatee protection measures would be followed. These procedures have been recommended by USFWS (USFWS 2007a) and adopted by USACE (2005) for use in situations where in-water construction activities potentially could occur where manatees may be present. These procedures include the following:

> All contract personnel associated with the project would be informed of the potential for manatees to be present and of the need to avoid collisions with manatees, which are protected under the Endangered Species Act and the Marine Mammal Protection Act of 1972. All construction personnel would be responsible for observing water-related activities for the presence of manatees. Temporary signs would be posted before and during all construction activities to remind personnel to be alert for the possible presence of manatees during active construction operations and within vessel movement zones in the work area; at least one sign would be placed where it would be visible to the vessel operator. Siltation barriers would be made of material in which manatees could not become entangled and would be properly secured and monitored if used. If a manatee were to be sighted within 100 yards of the active work zone, special operating conditions would be implemented, including: no operation of moving equipment within 50 ft of a manatee; all vessels would operate at no wake/idle speeds within 100 yards of the work area; and siltation barriers, if used, would be re-secured and monitored. Activities would not resume until the manatee has left the 100-yard buffer zone around the work area on its own accord. Then, special operating conditions would no longer be necessary, and careful observation would resume. Any sighting of a manatee would be immediately reported to the USFWS Lafayette, Louisiana field office and the Natural Heritage Program of the LDWF.

In order to minimize the potential for construction activities under the proposed action to cause impacts to sea turtles, construction conditions recommended by NMFS in their August 12, 2008 letter (NMFS 2008a) would be followed. These conditions include the following:

> All personnel associated with the project would be instructed of the potential presence of sea turtles and the need to avoid collisions with sea turtles. All construction personnel would be responsible for observing water-related activities for the presence of these species. All construction personnel would be advised that there are civil and criminal penalties for harming, harassing, or killing sea turtles, which are protected under the Endangered Species Act of 1973. Siltation barriers would be made of materials in which sea turtles cannot become entangled, be properly secured, and be regularly monitored to avoid protected species entrapment. All vessels associated with the construction project would operate at “no wake/idle” speeds at all times while in the construction area and while in water depths where the draft of the vessel provides less than a 4-foot clearance from the bottom. All vessels would preferentially follow deep-water routes (e.g. marked channels) whenever possible. If a sea turtle is seen within 100 yards of the active daily construction/dredging operation or vessel movement, all appropriate precautions would be implemented to ensure its protection. These precautions would include the cessation of operation of any moving equipment closer than 50 feet from a sea turtle. Operation of any mechanical construction equipment would cease immediately if a sea turtle is seen within

a 50-foot radius of the equipment. Activities would not resume until the turtle has departed the project area of its own volition. Any collision with and/or injury to a sea turtle would be reported immediately to the NMFS' Protected Resources Division (727-824-5312) and the local authorized sea turtle stranding/rescue organization (NMFS 2006b).

Following construction, the manatee, Gulf sturgeon, and sea turtles would be able to swim through the GIWW and Bayou Bienvenue gates with little hindrance when the gates are open, which they would be most of the time. Particularly for the manatee, however, these gates could pose a limited risk of injury during the long-term period of operation. Entrapment in water-control structures and navigational locks is the second largest human-related cause of manatee deaths (USFWS 2001). The two gates would be closed only infrequently as needed to prevent flooding associated with major storms and for maintenance. The low likelihood of a manatee being present in the project area because it does not provide suitable/preferred manatee habitat, combined with the low likelihood of a gate being closed when a manatee is present, would minimize the potential for a manatee to be trapped or injured by the operation of a gate. In addition, the relatively slow movement of the gates would likely give a manatee time to move out of the gate opening. The faster-swimming sturgeon and sea turtles would be unlikely to be at risk from injury due to the closing of the gates.

Collisions with boats and barges are a primary human-related threat to manatees and sea turtles and pose a risk to these species in the GIWW, Bayou Bienvenue, and other waterways of the Golden Triangle under existing conditions. Under the proposed action, the presence of gates on the GIWW and Bayou Bienvenue would constrict the channels through which both vessels and wildlife pass, increasing the potential for injuries to manatees and sea turtles should they swim through a gate at the same time a vessel is passing through. Given the relative rarity of manatees and sea turtles in the project area, the likelihood of this occurrence is expected to be very low. In addition, the slow speeds of vessels required as they pass through the gates would increase the response time available to these animals to avoid a collision and, if an impact occurs, the degree of injury generally will be lower if the boat or barge is operating at slower speeds (USFWS 2007b). Thus, the potential short-term or long-term direct effects on the manatee and sea turtles resulting from the proposed action at Alignment 4 would be unlikely to adversely affect these species.

Although the faster-swimming Gulf sturgeon and sea turtles could avoid construction-related activity and the closing of the gates on the GIWW and Bayou Bienvenue, these species could be affected if changes in hydrology and water quality affect salinity or their food sources. The proposed action could result in some restrictions on migratory movements of Gulf sturgeon through Bayou Bienvenue when flow is restricted to four culverts during the construction period. However, alternative migration routes would be available using the GIWW, IHNC, or Chef Menteur Pass. The proposed action also could result in some restrictions on the movements of prey organisms and their ability to access tidal creeks and marsh as a result of the floodwall barrier.

Although construction of the proposed action may impact Gulf sturgeon prey species in the area, Gulf sturgeon are not expected to frequent the upper reaches of the MRGO and prefer to forage over sandy substrates in waters greater than 2 ft deep. Substrates characteristic of the tidal bays and creeks would largely consist of clays and mud. In addition, if Gulf sturgeon were to enter Bayou Bienvenue, it would most likely be from Lake Borgne where they are commonly found, not the MRGO. As such, although access to the tidal creeks and bays behind the proposed structure would be removed by the construction of the proposed alternative and impacts Gulf sturgeon prey species in these areas may occur, impacts to Gulf sturgeon as a species would not be expected.

In summary, there is the possibility that five Federally-listed species (the manatee, Gulf sturgeon, and Kemp's ridley, loggerhead, and green sea turtles) could occur in the project area. The manatee could transit the area sporadically during the summer, the Gulf sturgeon may be in the area during several months mainly in winter, and sea turtles may enter the area occasionally, mainly during warmer months. The potential for individuals of any of these species to be impacted by the proposed action appears to be minimal. Procedures for preventing disturbance to these species would be employed during construction, further minimizing the potential for individuals to be affected by the proposed action. Therefore, these endangered and threatened species would be unlikely to be adversely affected by direct impacts from the proposed action.

Indirect Impacts to Threatened or Endangered Species

Indirect impacts on endangered or threatened species are effects that could occur later in time than direct impacts but still are reasonably certain to occur (NMFS 2006c). Given that future operation of the new structures at Alignment 4 would be the same as described above for initial operation of the structures, indirect impacts on endangered or threatened species from the proposed action would be essentially the same as direct impacts. Thus, indirect impacts would be unlikely to adversely affect manatees, Gulf sturgeon, or sea turtles.

Cumulative Impacts to Threatened or Endangered Species

Cumulative impacts to endangered and threatened species from the proposed action could occur mainly as a result of the combined effects of this project and the other LPV projects in the New Orleans area on habitat available to the manatee and Gulf sturgeon. Consultation and coordination with USFWS (manatee) and NMFS (Gulf sturgeon and sea turtles) have been performed or are ongoing for the other IER projects from Lake Pontchartrain to the area of Lake Borgne, the Chalmette Loop, and the MRGO. Construction of a MRGO closure structure at Bayou La Loutre will block passage for Gulf sturgeon, manatees, and sea turtles up and down the MRGO in that area. However, there are numerous other alternate routes, such as Bayou La Loutre, the Back Levee Canal, Lena Lagoon, Lake Athanasio, and Alabama Bayou, that would continue to allow passage through the marshes and northern portion of the MRGO. Consequently, there would be no substantial cumulative impacts on these species from closure of the MRGO at the Bayou La Loutre ridge in conjunction with its closure at Alignment 4.

Proposed dredging of access channels to the Lake Pontchartrain lakefront north of the IER #11 project area for the purpose of constructing flood control projects in that area could impact relatively small areas that may currently be used for foraging within designated critical habitat for the Gulf sturgeon in the lake. The habitats that would be affected in the IER #11 project area are not unique or critical habitats for the sturgeon, or for the other listed species. The potentially impacted habitat areas within Alignment 4 are very small in the context of similar habitats in the region used by these species and would not contribute substantially to impacts to these species in conjunction with other projects. None of these areas provide quality foraging habitat for the herbivorous manatee and green sea turtle, and these wide-ranging species would not be expected to depend on the affected areas for food or shelter. If the areas impacted by the construction of the proposed project were added to the areas of similar habitats potentially impacted by other LPV projects, the loss of this habitat type would be negligible in comparison to the available habitat remaining for these species. Thus, cumulative impacts from the proposed action would be unlikely to adversely affect the manatee, Gulf sturgeon, or Kemp's ridley, loggerhead, or green sea turtles.

Alternative 4b – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Geotextile Levee Barrier in Alignment 4

Direct Impacts to Threatened or Endangered Species

The principal difference between the proposed action and alternative 4b is that the alternative barrier would be a geotextile levee, which would have a greater width and larger footprint than the floodwall used in the proposed action. Thus, impacts on these species from this alternative could be greater than the impacts from the proposed action but would be unlikely to adversely affect these species.

Indirect Impacts to Threatened or Endangered Species

The increased area of saline marsh and open water habitat that would be filled under this alternative would be larger than for the proposed action and could result in corresponding increases in indirect impacts on threatened or endangered species. However, given the limited potential for occurrences of these species in the project area and the small magnitude of predicted changes in hydrology, indirect impacts on manatees, Gulf sturgeon, or sea turtles are expected to be insignificant and would be unlikely to adversely affect these species.

Cumulative Impacts to Threatened or Endangered Species

The area of saline marsh and open water habitat that would be filled under this alternative would be larger than for the proposed action and would result in corresponding increases in project contributions to cumulative impacts on threatened or endangered species. Given the limited area of available habitat in alternative 4b's project area for these threatened or endangered species in the project area, cumulative impacts on manatees, Gulf sturgeon, or sea turtles associated with this alternative would be incremental, similar to the cumulative impacts described for the proposed action, and unlikely to adversely affect these species.

Alternative 1 – Deep Draft Gate in Alignment 1

Direct Impacts to Threatened or Endangered Species

The construction of the deep-draft gate and floodwalls within the GIWW at Alignment 1 would result in a negligible loss of habitat for the manatee, Gulf sturgeon, and sea turtles. The footprint of the new gate structure and the floodwalls between the gate and the north and south shorelines of the GIWW would be within the man-made navigation channel, resulting in the filling of approximately 25 acres of open water bottoms. This area within the channel would provide minimal foraging habitat for the Gulf sturgeon, Kemp's ridley sea turtle, and loggerhead sea turtle and essentially none for the herbivorous manatee and green sea turtle. During the construction period, the employment of procedures protective of the manatee, sturgeon, and sea turtles, as described under the proposed action, would minimize the potential for impacts. Underwater noise from pile driving can be harmful in many ways to marine mammals, sea turtles, and fish. Pile-driving activities in the GIWW, which is open water where manatees, sea turtles, and Gulf sturgeon could be exposed to the highest sound impulses, would have the greatest potential to cause adverse effects on individuals present in the vicinity. The manatee and Gulf sturgeon have the potential to occur in the area during only part of the year, and such occurrences, particularly for the manatee, are expected to be infrequent. All five species are highly mobile and could move away from the sound. Therefore, the likelihood that they would be present when pile driving is occurring and would remain close enough to the sound source to be injured appears to be very small.

During the operational period of the project, the gate would remain open except during infrequent storm events and would continue to allow the movement of manatees, sturgeon, and sea turtles between the eastern and western sides of the structure. Sturgeon and sea turtles could be affected if changes in hydrology and water quality affect their prey (invertebrates). However, these changes and associated effects on salinity or prey organisms are predicted to be minimal based on the results of hydrological modeling, as was discussed in the Aquatic Resources (section 3.2.4), Fishery Resources (section 3.2.5), and EFH (section 3.2.6) sections and the expected infrequent use of these gates.

The operation of the gate on the GIWW would be infrequent and its movement would be relatively slow, so it would pose little to no risk of injury to these species. Entrapment in water-control structures and navigational locks is the second largest human-related cause of manatee deaths (USFWS 2001). However, the flood gate would be closed infrequently as needed to prevent flooding associated with major storms and for maintenance. The low likelihood of a manatee being present in the project area combined with the low likelihood of the flood gate being closed when a manatee is present and the relatively slow movement of the structure would minimize the potential for a manatee to be trapped or injured. Faster-swimming Gulf sturgeon and sea turtles would be very unlikely to be affected. When the gate is open, which it would be most of the time, manatees, Gulf sturgeon, and sea turtles would be able to swim through the structure in the bayou channel without hindrance. Thus, the potential short-term or long-term direct effects on the manatee, Gulf sturgeon, or Kemp's ridley, loggerhead, or green sea turtles resulting from alternative 1 would be unlikely to adversely affect these threatened or endangered species.

Collisions with boats and barges are a primary human-related threat to manatees and sea turtles and pose a risk to these species in the GIWW, Bayou Bienvenue, and other waterways of the Golden Triangle under existing conditions. Under the proposed action, the presence of gates on the GIWW and Bayou Bienvenue would constrict the channels through which both vessels and wildlife pass, increasing the potential for injuries to manatees and sea turtles should they swim through a gate at the same time a vessel is passing through. Given the relative rarity of manatees and sea turtles in the project area, the likelihood of this occurrence is expected to be very low. In addition, the slow speeds of vessels required as they pass through the gates would increase the response time available to these animals to avoid a collision and, if an impact occurs, the degree of injury generally will be lower if the boat or barge is operating at slower speeds (USFWS 2007c).

The construction in association with alternative 1 of a new control structure on Bayou Bienvenue, 300 ft to the protected-side of the existing structure where the channel crosses the Chalmette Loop levee under alternative 1, would not result in the loss of habitat for endangered or threatened species. The greatest potential for direct effects on endangered and threatened species would occur during the construction period. The presence of construction-related activity, machinery, and noise potentially could cause these species to avoid the project area during construction. Procedures for protection of the manatee, sturgeon, and sea turtles during construction would be followed at this location. After the completion of construction and during the subsequent long-term period of operation, the flood gate would be the main component of this structure with a potential to affect these five listed species. The flood gate would be closed infrequently as needed to prevent high tides as well as flooding associated with major storms. The pontoon bridge would also be operated infrequently, to allow maintenance vehicles to cross the bayou. Such operation may have the potential to entrap or injure a manatee. The potential for injury to individuals of these species from operation of this gate would be similar to that described for the gate on the GIWW.

Thus, the potential short-term or long-term direct effects on the manatee, Gulf sturgeon, and Kemp's ridley, loggerhead, and green sea turtles resulting from the proposed action at Alignment 1 would be essentially the same as described for the proposed action and would be unlikely to adversely affect these species.

Indirect Impacts to Threatened or Endangered Species

Given the limited potential for occurrences of these species in the project area and the small magnitude of predicted changes in hydrology associated with alternative 1, indirect impacts on manatees, Gulf sturgeon, or sea turtles are expected to be insignificant and would be unlikely to adversely affect these species.

Cumulative Impacts to Threatened or Endangered Species

Given the limited area of available habitat for manatees, Gulf sturgeon, or sea turtles that have the potential to occur in Alignment 1's project area, cumulative impacts on these species associated with this alternative would be incremental, similar to the cumulative impacts described for the proposed action, and unlikely to adversely affect these species.

Alternative 2 – Deep Draft Gate in Alignment 2

Direct Impacts to Threatened or Endangered Species

The structures to be constructed at Alignment 2 would be essentially the same as for Alignment 1, but they would be located approximately 2,100 ft east on the GIWW and would result in the filling of about 40 acres of water bottoms in the waterway, 15 acres more than alternative 1. This area within the channel would provide minimal foraging habitat for these five species. Similar to alternative 1, a new control structure would be built on Bayou Bienvenue 300 ft to the protected-side of the existing structure. Direct impacts from this alternative on the five listed species would be essentially the same as the minimal impacts from alignment 1. Thus, alignment 2 would not adversely affect the manatee, Gulf sturgeon, or Kemp's ridley, loggerhead, or green sea turtles.

Indirect Impacts to Threatened or Endangered Species

Indirect impacts on manatees, Gulf sturgeon, or sea turtles from alternative 2 are expected to be essentially the same as those described for alternative 1, and they would not adversely affect these species.

Cumulative Impacts to Threatened or Endangered Species

Cumulative impacts on manatees, Gulf sturgeon, or sea turtles from alternative 2 are expected to be essentially the same as those described for alternative 1, and they would not adversely affect these species.

Alternative 3a – MRGO Structure, GIWW Gate, and Structural Wall Barrier in Alignment 3

Direct Impacts to Threatened or Endangered Species

The principal differences between the proposed action and alternative 3a are the shorter length of the floodwall barrier across the marsh at alignment 3, the lack of a gate structure in the marsh because this alignment does not cross Bayou Bienvenue, and the need to construct in conjunction with this alternative a new control structure on the Bayou Bienvenue channel 300 ft to the protected-side of the existing structure. Under alternative 3a, the floodwall would be west of the proposed action alignment, resulting in a shorter barrier and a smaller footprint in aquatic (marsh and open water) habitats, approximately 89.8 acres versus 125.3 acres for the proposed action (table 6). The area of open water habitat within this footprint also would be reduced relative to the proposed action. As a result, there would be a corresponding decrease in direct impacts on the manatee, Gulf sturgeon, and sea turtles from the loss of available habitat in the Golden Triangle. Thus, impacts on these species under this alternative would be smaller than but similar to the minimal impacts from the proposed action and would not adversely affect these species.

Indirect Impacts to Threatened or Endangered Species

Indirect impacts on manatees, Gulf sturgeon, or sea turtles from alternative 3a are expected to be smaller than but similar to those described for the proposed action, and they would not adversely affect these species.

Cumulative Impacts to Threatened or Endangered Species

Cumulative impacts on manatees, Gulf sturgeon, or sea turtles from alternative 3a are expected to be essentially the same as those described for the proposed action, and they would not adversely affect these species.

Alternative 3b – MRGO Structure, GIWW Gate, and Geotextile Levee Barrier in Alignment

Direct Impacts to Threatened or Endangered Species

The principal difference between alternative 3a and alternative 3b is that the barrier would be a geotextile levee, which would have a larger footprint than the floodwall used in alternative 3a. Under alternative 3b, the levee would be west of the proposed action alignment, resulting in a shorter barrier but an aquatic (saline marsh and open water) footprint only slightly smaller than the proposed action (15.5 acres; table 6) due to the greater width of the levee versus the floodwall. Thus, direct impacts on the manatee, Gulf sturgeon, and Kemp's ridley, loggerhead, and green sea turtles under this alternative would be very similar to but smaller than the minimal impacts from the proposed action, and they would not adversely affect these species.

Indirect Impacts to Threatened or Endangered Species

Indirect impacts on manatees, Gulf sturgeon, or sea turtles from alternative 3b would be very similar to the indirect impacts from the proposed action, and they would not adversely affect these species.

Cumulative Impacts to Threatened or Endangered Species

Cumulative impacts on manatees, Gulf sturgeon, or sea turtles from alternative 3b would be very similar to the cumulative impacts from the proposed action, and they would not adversely affect these species.

Alternative 5a – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Structural Wall Barrier in Alignment 5

Direct Impacts to Threatened or Endangered Species

The principal difference between the alternative 5a and the proposed action is the greater length of the floodwall barrier across the marsh at alignment 5. Under alternative 5a, the floodwall would be east of the proposed action alignment, resulting in a longer barrier and a larger aquatic footprint. The aquatic habitat (mainly marsh and open water) impacted by this alternative would be approximately 23 acres greater than under the proposed action (table 6). Thus, the increased area of open water affected, which is the type of habitat principally used by the five listed species, is relatively small and would result in correspondingly small increases in impacts on these species from habitat loss. Other potential effects on these species would be similar to those described for the proposed action. As a result, the direct impacts on the manatee, Gulf sturgeon, and Kemp's ridley, loggerhead, and green sea turtles under this alternative would be slightly larger but very similar to the minimal impacts from the proposed action and would not adversely affect these five species.

Indirect Impacts to Threatened or Endangered Species

Indirect impacts on manatees, Gulf sturgeon, or sea turtles from alternative 5a would be slightly larger but very similar to the indirect impacts from the proposed action, and they would not adversely affect these species.

Cumulative Impacts to Threatened or Endangered Species

Cumulative impacts on manatees, Gulf sturgeon, or sea turtles from alternative 5a would be slightly larger but very similar to the cumulative impacts from the proposed action, and they would not adversely affect these species.

Alternative 5b – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Geotextile Levee Barrier in Alignment 5

Direct Impacts to Threatened or Endangered Species

The principal difference between alternative 5b and alternative 5a is that the barrier would be a geotextile levee, which would have a greater width and larger footprint than the floodwall used in alternative 5a and the proposed action. The potential open water habitat that could be lost under this alternative would be greater than under alternative 5a. This additional area of impact includes about 21 acres of open water habitat (table 6), so the increased impact to habitat used by the five listed species would result in corresponding increase in impacts from habitat loss on these species. Other potential effects on these species would be similar to those described for the proposed action. Thus, direct impacts on the manatee, Gulf sturgeon, and Kemp's ridley, loggerhead, and green sea turtles under this alternative would be slightly larger but very similar to the minimal impacts from alternative 5a and the proposed action, and they would not adversely affect these five species.

Indirect Impacts to Threatened or Endangered Species

Indirect impacts on manatees, Gulf sturgeon, or sea turtles from alternative 5b would be very similar to but greater than the indirect impacts from the proposed action and alternative 5a.

Cumulative Impacts to Threatened or Endangered Species

Cumulative impacts on manatees, Gulf sturgeon, or sea turtles from alternative 5b would be very similar to but greater than the cumulative impacts from the proposed action and alternative 5a.

3.2.9 Upland Resources

Existing Conditions

Terrestrial and upland resources are considered to occur in areas of the project area that are not wetlands or open waters. Such areas exist in limited locations where dredging spoils from construction of the GIWW, the MRGO, and Michoud Canal and Slip have been deposited and where fill has been used to build levees and floodwalls. Each of the five alignments would utilize limited upland areas where the alignments cross shorelines and connect to existing floodwalls and levees.

North of the GIWW, each of the five alignments would require the use of a staging and access area on the east side of the Michoud Canal on property that currently is used for industrial purposes and roads (figure 2). Alignments 1 and 2 also would require expansions of the footprints of the existing levees and floodwalls in already developed areas along the GIWW and the Michoud Canal, and, for Alignment 1, the Michoud Slip.

South of the GIWW, Alignments 1 and 2 would use a 12-acre staging area to be established on the south bank of the GIWW between the two alignments. Alignments 3, 4, and 5 would use a 16-acre staging area to be established on the west bank of the MRGO immediately north of Bayou Bienvenue. Both of these staging areas cross the Chalmette Loop levee and encompass the upland fill and spoil associated with the levee. These areas are grassed and periodically mowed. The majority of the areas other than the levees are covered by scrub-shrub, and the area on the protected side of the levee within the 12-acre staging area for Alignments 1 and 2 is mainly scrub-shrub wetland that may grade into bottomland hardwood swamp.

Discussion of Impacts

Proposed Action and All Alternatives

Direct, Indirect, and Cumulative Impacts to Upland Resources

North of the GIWW, each of the five alignments would require the use of a staging and access area on the east side of the Michoud Canal on property that currently is used for industrial purposes and roads. Alignments 1 and 2 also would require expansions of the footprints of the existing levees and floodwalls in already developed areas along the GIWW and the Michoud Canal, and, for alignment 1, the Michoud Slip.

South of the GIWW, Alignments 1 and 2 would use a 12-acre staging area to be established on the south bank of the GIWW between the two alignments. Alignments 3, 4, and 5 would use a 16-acre staging area to be established on the west bank of the MRGO immediately north of

Bayou Bienvenue. Both of these staging areas cross the Chalmette Loop levee and encompass the upland fill and spoil associated with the levee. These areas are grassed and periodically mowed. The majority of the areas other than the levees are covered by scrub-shrub, and the area on the protected side of the levee within the 12-acre staging area for Alignments 1 and 2 is mainly scrub-shrub wetland that may grade into bottomland hardwood swamp.

The upland areas that potentially would be affected by use as staging and access areas or for increasing the height of existing levees and floodwalls under any of the alignments are currently in use as industrial properties, roads, levees, and floodwalls and do not support substantial natural communities. Other than the spoils deposition areas and man-made earthen levees along the GIWW and the MRGO, there are no substantial uplands in the project area. The non-wet terrestrial areas in the project vicinity occur in these deposition and levee areas. These areas do not represent significant, native uplands.

3.2.10 Cultural Resources

Existing Conditions

Records on file at the Louisiana Division of Archaeology and the New Orleans District indicate numerous previously recorded archaeological and historic properties are located within, and immediately adjacent to, the Borgne 1 study area. Site forms and archaeological investigation reports describe these known properties. Prehistoric shell midden sites tend to be located on bayou levees in the marsh and along beach ridges adjacent to the Lake Borgne shoreline. Due to recent geologic development of the Mississippi delta and the age of the deposits within the Borgne 1 study area, the earliest known archaeological sites in the region date to the Poverty Point period (1700 – 500 B.C.). Similarly, historic period sites and structures, such as forts, plantations, residential neighborhoods, bridges, and industrial facilities are primarily located on relatively high natural levee areas adjacent to waterways and in urban areas. Historic period watercraft are recorded in the bayou and river channels and lakes in the region. The reader may wish to refer to the following report summarized below for specific historical information on the Borgne 1 study area (Heller et al. 2008).

CEMVN contracted R. Christopher Goodwin and Associates, Inc. to conduct cultural resources investigations of the Borgne 1 study area, which includes a remote sensing survey of Bayou Bienvenue from the MRGO to Lake Borgne (Heller et al. 2008). The Borgne 1 study area is situated primarily within the Golden Triangle marsh. The study boundaries extend 500 ft to the protected side of the existing levees that border the north bank of the GIWW and the southwest bank of the MRGO. The western boundary is located approximately 1,500 ft west of the Paris Road Bridge. The eastern boundary extends across the Golden Triangle marsh in a straight line due south from the Maxent Canal. The Borgne 1 study area encompasses approximately 6,422 acres and contains all proposed action and alternative rights-of-way (ROWs).

Researchers utilized background research, previous cultural resources investigations review, historic map analysis; topographic analysis; and reconnaissance, Phase 1, and Phase 2 level field data to confirm known archaeological site locations, identify and test high potential areas for cultural resources, evaluate National Register of Historic Places (NRHP) site eligibility, and identify remote sensing targets exhibiting cultural resources characteristics.

Background research identified three known archaeological sites in the Borgne 1 study area. Site 16OR40 (Linsley Site) was recorded in 1960 as a re-deposited shell midden extending 500 ft along the spoil bank of the GIWW. Shell, large quantities of vertebrate faunal material, Poverty Point objects, and other cultural materials were recovered. Four radiocarbon dates ranging from 2490-1590 BC were obtained from organic samples. Investigators at that time concluded that the site was buried under marsh and cultural deposits from the site were dredged and placed on the spoil bank during the construction of the GIWW. Additional testing in 1982 suggests widening of the GIWW may have destroyed additional portions of the site.

Site 16OR41 (Paris Road) was originally recorded in 1964 as a buried midden deposit exposed during drag line operations for the construction of the Paris Road Bridge. Cultural material recovered from the site dated exclusively to the Tchefuncte Period (circa 500 BC – AD 100). In 1984, a portion of the recorded site location was auger tested to a depth of 17 ft with negative results. Researchers concluded that the tested portion of the site had been destroyed.

Site 16OR55 (Atlatl Weight Site) was recorded in 1975 as a scatter of prehistoric midden material located on a spoil bank adjacent to the GIWW. Although no temporally diagnostic artifacts have been reported from the site, additional investigations have been recommended by researchers. There is a discrepancy in the site records showing two separate locations for the site, one north and one south of the GIWW.

Two known historic properties are recorded in the Borgne 1 study area. Site 16SB84 (Battery Bienvenue) is situated at the confluence of Bayou Villeré and Bayou Bienvenue. The site is the remains of an early nineteenth century military fortification constructed to protect New Orleans from an enemy invasion entering through Lake Borgne and Bayou Bienvenue. Although visual reconnaissance and archival studies of the site were conducted in 1976 and 1992, research conducted as part of this study utilized archival research, site mapping, subsurface testing, and architectural evaluation to assess the site's eligibility for listing on the NRHP.

Structural remains visible at the site today consist of a brick defensive wall facing east and northeast, seven piles of brick rubble, two cisterns, a shell topped magazine, and the possible remains of three residential quarters. Currently the magazine, quarters, and four of the rubble piles are situated in inundated marshland. Twelve gun emplacements are present above the defensive wall and six of these presently hold cannons which have been remounted on concrete slabs. Twenty-eight shovel tests were excavated along two transects and within the southern portion of the site and the officer's quarters. No cultural material was found in the shovel tests. Due to alluvial deposition across the site surface and the effects of subsidence, researchers surmise buried cultural deposits, if present, are located below 60 cm shovel test depths. Although structural remains at the site probably do not retain sufficient integrity necessary for listing on the NRHP under Criterion C and the presence of significant archaeological material could not be confirmed, researchers believe the site is eligible for NRHP listing under Criterion A. The site is related to significant historical events associated with 19th century New Orleans military defenses and clearly possesses substantive historical research value.

The second historic property is the National Aeronautics and Space Administration (NASA) Michoud Assembly Facility (MAF) located immediately north of and adjacent to the GIWW between the Michoud Slip and Michoud Canal. The area was first owned by French settler Gilbert Antione de St. Maxent in 1763 and later was purchased by Antoine Michoud. The brick smokestacks from Michoud's sugar mill still exist at the entrance to the NASA facility. Beginning in 1941, Higgins Industries built Liberty ships and later wooden cargo planes at the facility. In 1961, NASA chose the Michoud facility for the production of the first stages of the Saturn rocket and continues to use the facility to the present day. A recent architectural survey of the facility determined that three buildings associated with the space program and ten buildings associated with World War II activities are eligible for listing on the NRHP.

Researchers conducted a boat survey within the Borgne 1 study area marsh along the banklines of the GIWW, the MRGO, Bayou Bienvenue, Cutoff Bayou, Bayou Leche, Bayou Daytoe, Fourth Island Bayou, Third Island Bayou, and portions of Bayou Ducros, Bayou Villeré, Bayou Mercier, and Bayou Pollet. During the survey, banklines were examined for cultural material and for evidence of intact cultural deposits. Wherever possible, pedestrian survey, shovel test excavations, and/or probing were also conducted in high probability areas located on dry, high ground. In total, approximately 40 miles of bankline was examined. Only one new archaeological site, Locus 11-01 was identified in the Borgne 1 study area.

Locus 11-01 consists of one heavily wave-washed, grog-tempered prehistoric ceramic sherd found in 6 inches of water along the north bank of the MRGO. Probing found no buried shell deposits and no other cultural material was identified. Due to low research potential, low artifact density, and lack of integrity, researchers determined that the locus was not significant and recommended no further work.

Researchers also evaluated the potential for submerged cultural resources in the Borgne 1 study area. Background research identified seven previously reported shipwreck locations in the area. Confirmed sites are modern vessels located in the channels of the MRGO and the GIWW. The likelihood for significant historic period shipwrecks and other nautical cultural resources is considered extremely low in these man-made and maintained channels. One shipwreck location is recorded south of the study area in Lake Borgne.

Researchers determined Bayou Bienvenue was the only high potential area for submerged cultural resources in the Borgne 1 study area. The bayou provided a navigable channel into New Orleans from Lake Borgne during the historic period and has never been dredged. A nautical remote sensing survey of the Bayou Bienvenue channel was conducted between the MRGO and the mouth of the bayou at Lake Borgne, a distance of approximately 5.5 miles. Two anomaly clusters exhibiting cultural resource characteristics were identified during the survey. Target 1 is located at the confluence of Bayou Bienvenue and the MRGO channel and Target 2 is located approximately 2700 ft north of the Bayou Villeré confluence. No acoustic signatures were identified at these target locations and suggest that the sites are buried. Researchers recommend these two targets be avoided.

The CEMVN held meetings with State Historic Preservation Office (SHPO) staff and Tribal governments to discuss the emergency alternative arrangements approved for NEPA project review and the development of a Programmatic Agreement (PA) to tailor the Section 106 consultation process under the alternative arrangements. The CEMVN formally initiated Section 106 consultation for the LPV Hurricane Protection Project (100-year), which includes IER # 11, in a letter dated 9 April 2007, and emphasized that standard Section 106 consultation procedures would be implemented during PA development. A public meeting was held on 18 July 2007, to discuss the working draft PA. CEMVN anticipates the PA will be executed in the near future.

The following discussion of impacts is based on the information provided in the cultural resources investigation management summary prepared by R. Christopher Goodwin and Associates, Inc. (Heller et al. 2008).

Discussion of Impacts

Proposed Action: Alternative 4a - MRGO Structure, GIWW and Bayou Bienvenue Gates, and Structural Wall Barrier in Alignment 4

Direct Impacts to Cultural Resources

Based on a review of the information summarized in the existing conditions section, the proposed action alternative would have no adverse impact on cultural resources. Known archaeological and historic properties identified in the Borgne 1 study area, including Site 16OR40 (Linsley Site), Site 16OR41 (Paris Road), Site 16OR55 (Atlatl Weight Site), Site 16SB84 (Battery Bienvenue)Locus 11-01, Target 1, Target 2, and the NASA MAF, are all located well outside of the proposed action ROW and would not be impacted by proposed construction.

Researchers evaluated the potential for undiscovered cultural resources within the Borgne 1 study area, including the Golden Triangle marsh area as well as a 500 ft corridor on the protected side of the levee center line along the GIWW and the MRGO. High probability areas for cultural resources within the ROW of the proposed action were identified along bayou banklines and these areas were surveyed by boat. No new archaeological sites were identified (Heller et al. 2008). Recent remote sensing survey in Bayou Bienvenue identified two targets exhibiting cultural resources characteristics that are located outside of the proposed action ROW and would not be impacted by proposed construction.

In letters to the SHPO and Indian Tribes dated 19 May 2008, the CEMVN provided project documentation, evaluated cultural resource investigation results, and found that proposed construction of the proposed action would have no adverse impacts on cultural resources. The SHPO concurred with our "no adverse effect" finding a letter dated June 17, 2008. The Choctaw Nation of Oklahoma, Alabama Coushatta Tribe of Texas, and the Caddo Nation of Oklahoma concurred with our effect determination in letters and an email dated May 29, 2008, June 16, 2008, and May 20, 2008, respectively. No other Indian Tribes responded to our requests for comment. Section 106 consultation for the proposed action is concluded. However, if any unrecorded cultural resources are determined to exist within the proposed action alternative, then no work will proceed in the area containing these cultural resources until a CEMVN archaeologist has been notified and final coordination with the SHPO and Indian Tribes has been completed.

Indirect Impacts to Cultural Resources

Erosion of ground deposits during flood events can result in severe damage and destruction of archaeological sites. Implementation of the proposed action would provide an added level of flood protection to significant historic properties located in the immediate project vicinity, including the Bywater and Holy Cross Historic Districts and archaeological sites located at the southern end of the IHNC.

Cumulative Impacts to Cultural Resources

Implementation of the proposed action would have beneficial cumulative impacts on cultural resources in the New Orleans metropolitan area. This alternative is part of the ongoing Federal effort to reduce the threat to property posed by flooding. The combined effects from construction of the multiple projects underway and planned for the GNOHSDRRS would reduce flood risk and storm damage to significant archaeological sites, individual historic properties, engineering structures and nineteen historic districts.

Alternative 4b – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Geotextile Levee Barrier in Alignment 4

Direct, Indirect and Cumulative Impacts to Cultural Resources

Implementation of Alternative 4b would be the same as the proposed action except in this alternative an earthen levee on a 3 ft deep sand pad over geotextile fabric would be placed across the marsh instead of a concrete floodwall. Direct, indirect and cumulative impacts to cultural resources would be the same as those discussed for the proposed action.

Alternative 1 – Deep Draft Gate in Alignment 1

Direct Impacts to Cultural Resources

Although previous construction of the GIWW and existing flood protection measures has severely impacted the proposed Alignment 1 ROW, preliminary background review indicates that one previously recorded archaeological site deposit may be buried within the alignment ROW.

As discussed in the existing conditions, Site 16OR40 (Linsley Site) was first recorded in 1960 as a re-deposited shell midden extending 500 ft along the south spoil bank of the GIWW. An extensive collection of artifacts was recovered from the surface. Investigators surmise that the site was originally buried under marsh and cultural deposits from the site were dredged up and placed on the spoil bank during the construction of the GIWW. Although additional testing in 1982 suggests widening of the GIWW had destroyed the majority of the site, portions may still be located in buried deposits located within the Alignment 1 footprint and proposed staging area.

Implementation of this alternative would require additional consultation with the SHPO and Indian Tribes and may require additional cultural resources investigations. If required, appropriate measures will be initiated under the Section 106 review process to ensure that impacts to significant cultural resources are avoided, minimized, or mitigated prior to project construction.

Indirect and Cumulative Impacts to Cultural Resources

Indirect and cumulative impacts from this alternative would be essentially the same as those described for the proposed action.

Alternative 2 – Deep Draft Gate in Alignment 2

Direct Impacts to Cultural Resources

The reported eastern portion of Site 16OR40 (Linsley Site) is located within the alternative 2 staging area. Although proposed staging activities may not impact deeply buried archaeological material possibly associated with Site 16OR40, implementation of this alternative will require additional consultation with the SHPO and Indian Tribes and could include additional archaeological investigations. If required, appropriate measures would be initiated under the Section 106 review process to ensure that impacts to significant cultural resources are avoided, minimized, or mitigated prior to project construction.

Indirect and Cumulative Impacts to Cultural Resources

Indirect and cumulative impacts from this alternative would be essentially the same as those described for the proposed action.

Alternative 3a – MRGO Structure, GIWW Gate, and Structural Wall Barrier in Alignment 3

Direct Impacts to Cultural Resources

Recent cultural resources investigations in the Borgne 1 study area show two cultural resources sites are in the immediate vicinity of this alternative. Locus 11-01 is a single prehistoric artifact found at the confluence of the GIWW and the MRGO and is not historically significant. The artifact location would not be directly impacted by alternative 3. Recent remote sensing surveys identified a magnetic anomaly exhibiting shipwreck characteristics at the mouth of Bayou Bienvenue and the MRGO. Target 1 is located immediately south of alignment 3 and would not be directly impacted by proposed construction. However, if this alternative is implemented, additional consultation with the SHPO and Indians Tribes will be required to ensure that adequate measures are taken to avoid this target location.

Indirect and Cumulative Impacts to Cultural Resources

Indirect and cumulative impacts from this alternative would be essentially the same as those described for the proposed action.

Alternative 3b – MRGO Structure, GIWW Gate, and Geotextile Levee Barrier in Alignment

Direct, Indirect and Cumulative Impacts to Cultural Resources

Direct, indirect and cumulative impacts from this alternative would be essentially the same as those described for alternative 3a.

Alternative 5a – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Structural Wall Barrier in Alignment 5

Direct, Indirect, and Cumulative Impacts to Cultural Resources

Direct, indirect, and cumulative impacts from this alternative would be essentially the same as those described for the proposed action.

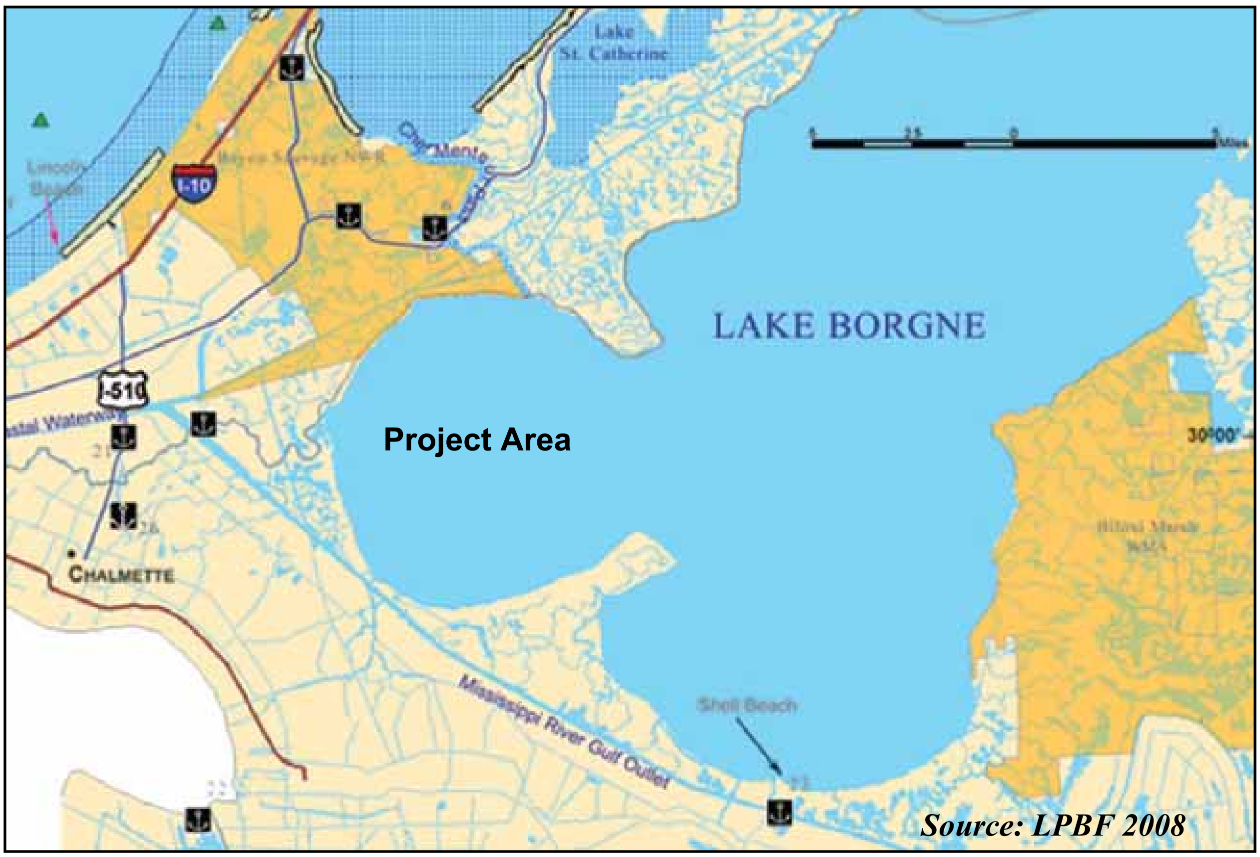

Figure 29. Boating and Angling Sites in the Project Vicinity

Alternative 5b – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Geotextile Levee Barrier in Alignment 5

Direct, Indirect and Cumulative Impacts to Cultural Resources

Direct, indirect and cumulative impacts from this alternative would be essentially the same as those described for alternative 5a.

3.2.11 Recreational Resources

Existing Conditions

Recreational and visual resources are broadly described in Section 3.3.2.10 of the *Final Individual Environmental Report #11 Improved Protection on the Inner Harbor Navigation Canal Orleans and St. Bernard Parishes, Louisiana* (USACE 2008b). The following additional discussion is provided for this location-specific analysis of the alternatives with respect to recreational resources.

Bayou Bienvenue is recognized as a local recreational resource and supports local recreational opportunities typically associated with wetland ecosystems such as fishing, canoeing, and wildlife observation. Bayou Bienvenue is noted as an Impaired Waterbody by the U.S. Environmental Protection Agency (EPA), as discussed in the Water Quality section of this IER 11 Tier 2 document. It is designated as "fully supporting" fish and wildlife propagation, primary contact recreation, and secondary contact recreation; but "not supporting" oyster propagation due to probable cause of fecal coliform impairment due to wildlife other than waterfowl as a probable source. The project area is therefore not used for oyster production operations.

As shown in figure 29 (LPBF 2008), there are several boat launches located in the project area including the Gulf Outlet Boat Launch, Eddie Pinto's Boat Launch, S&L Marina, and the Bayou Bienvenue Boat Launch. With respect to the project area, many of the of these boat launch facilities are on the protected side of the existing levee system and use the existing Bayou Bienvenue gate structure to access recreational fishing spots in the Golden Triangle area. Other facilities are located to the east of the project site.

The project area is in the vicinity of the saltwater/freshwater line as designated by the LDWF (LDWF 2008). However, the LDWF classifies the boat launches in the project area as marine boat launches and not freshwater launches.

Recreational uses of this area are not limited to water-based activities such as fishing. Organizations such as the Holy Cross Neighborhood Association (HCNA) of the Lower Ninth Ward and the Sierra Club New Orleans Group have invested resources in clean-ups and have planned additional recreational opportunities along other portions of the Bayou, such as a dock and a jogging path (UW 2007).

Passive recreational opportunities are also afforded by wetlands areas such as those in the project vicinity that are currently under review for restoration opportunities.

As a designated Natural and Scenic River (figure 30), a portion of Bayou Bienvenue is protected by the Louisiana Natural and Scenic River Act as administered by the LDWF. Although none of the alternative alignments would cross Bayou Bienvenue in the portion designated as scenic, other potential impacts are discussed in this section.

As shown in figure 31, the Bayou Sauvage NWR is located partially within the project area. It contains 23,000 acres of fresh and brackish marsh and supports a well-known bird rookery from May through July. Peak waterfowl populations of 75,000 use the wetland areas during the fall, winter, and early spring months (USFWS 2007d). However, the Bayou Sauvage NWR is not listed as an Important Birding Area (IBA) by the National Audubon

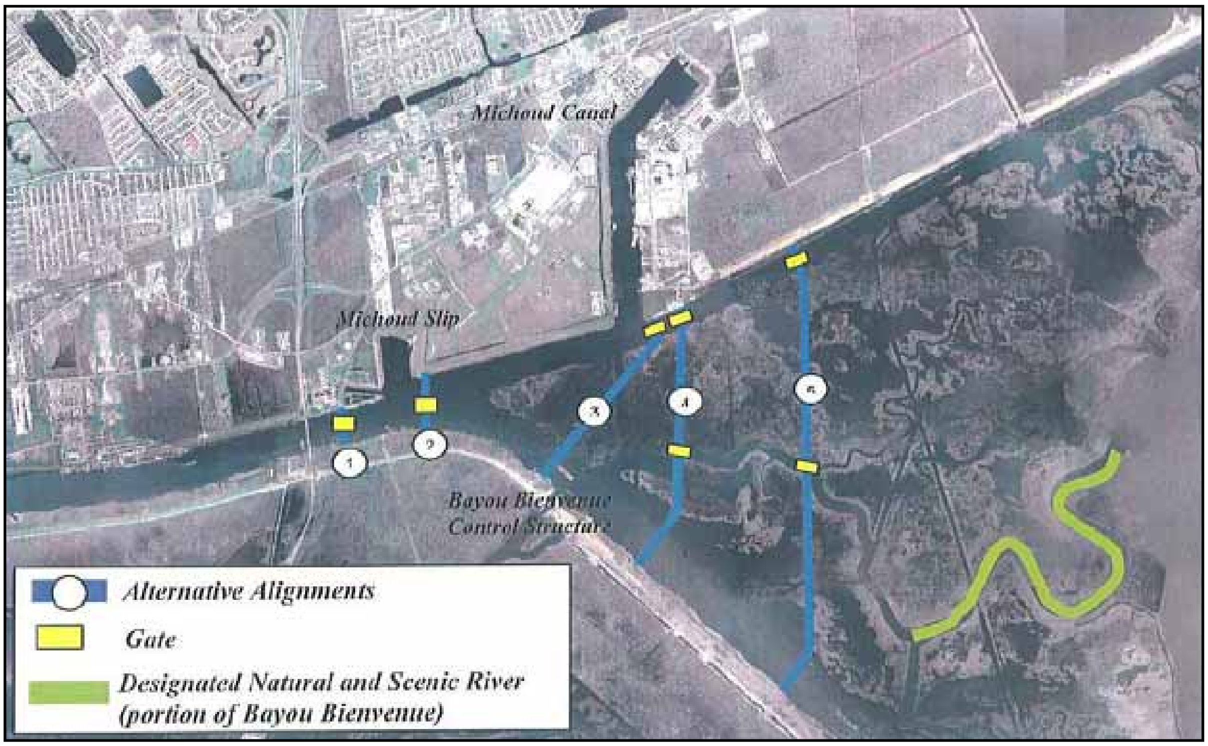

Figure 30. Natural and Scenic River Designation for Portion of Bayou Bienvenue

Society (Audubon 2008). No active swamp tours have been offered since Hurricane Katrina. The nearest readily-accessible public access point within the NWR with respect to the project location is the Joe Madere Marsh Unit, which is accessible from U.S. Hwy 90 to the east of the project site. Coordination with USFWS and the LDWF has been initiated and will continue throughout the project.

The outer reaches of the project vicinity approach the Fort Villeré site, which was built in approximately 1828 near the confluence of Bayou Bienvenue and Villeré Bayou in St. Bernard Parish (USDOI 2008). Other historic forts are also located to the east of the project location, and are beyond the area of potential effects for the actions proposed in this IER.

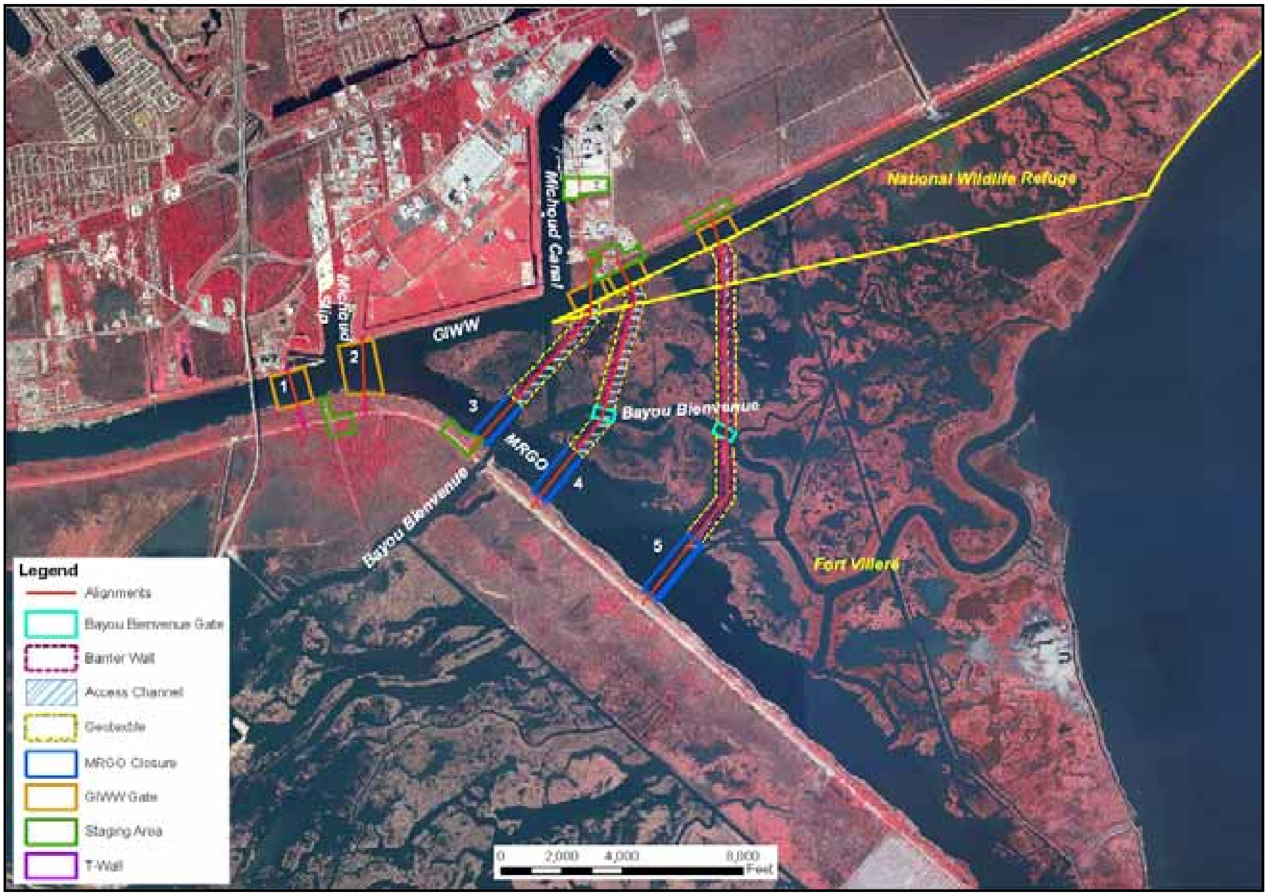

Figure 31. National Wildlife Refuge, Fort Villeré, and Proposed Alignments

The project area does not contain any designated bicycle paths. According to the Louisiana Department of Transportation, the closest bike path includes the Paris Road Bridge as part of a cross-state bicycle route (LADOT 2008a). No portion of the Mississippi River Bike Trail is located in the vicinity of the proposed action (MRT 2008).

<u>Discussion of Impacts</u>

Proposed Action: Alternative 4a - MRGO Structure, GIWW and Bayou Bienvenue Gates, and Structural Wall Barrier in Alignment 4

Direct Impacts to Recreational Resources

Direct impacts to recreational resources from the footprint of the proposed action through the Golden Triangle are similar to the possible direct impacts to fishery resources that were discussed in section 3.2.5. Additionally, direct impacts to recreational boating could occur along Bayou Bienvenue. The bayou will be temporarily closed to boat traffic at the location of the structure control gate during construction, which could last as long as two years. While the proposed construction would not preclude access, it would result in the need for boats to take alternative routes from the existing Bayou Bienvenue gate to reach Lake Borgne. Navigational access would remain available through the GIWW during construction. Following construction, recreational boaters could continue to use Bayou Bienvenue east of the proposed gate to gain access into Lake Borgne through the Bayou Bienvenue sector gate.

The proposed action would directly affect approximately 19 acres of the 23,000-acre Bayou Sauvage NWR. The National Wildlife Refuge System Improvement Act of 1997 authorized that no new or expanded use of a refuge may be allowed unless it is first deemed to be compatible. The proposed action would require the Army Corps to obtain an easement from USFWS. Mitigation of unavoidable losses of emergent marsh on Bayou Sauvage NWR would need to be mitigated on the refuge (USFWS 2008). Coordination for real estate acquisition has been initiated and is ongoing.

With respect to visual impacts affecting the recreational resources including the NWR, the new floodwalls would be approximately 26 ft above the water level across a distance of approximately 2 miles, including the approximately 740 ft width of the GIWW. While only approximately 19 acres of the 23,000-acre NWR would be affected under alignment 4, as shown in figure 31, from the perspective of a person in a recreational boat such as a canoe or other small boat, the floodwall would obscure some line-of-sight viewing at the surface. The proposed action would impact up to 13 acres in the NWR for construction of the GIWW Gate, 4 acres for an access channel, and up to 6 acres for the floodwall. This proposed action includes the addition of man-made structures in a natural area where few man-made structures are currently present. The existing view to the west includes the Paris Road Bridge and the numerous industrial users along the Michoud Canal and Slip. Alternatively, the view to the east includes the open waters of the designated scenic portion of Bayou Bienvenue and beyond to the open waters of Lake Borgne. This view, however, experiences frequent introduction of human elements in the form of shallow-draft-vessel shipping traffic along the GIWW.

A direct (but temporary) visual impact would occur with the addition of construction equipment. For construction of Alignment 4, the following types of equipment could be seen at the construction sites: hydraulic and cutterhead dredges, barge-mounted ringer cranes, barge-mounted pile driving equipment, supply barges and tugs, concrete mixers and trucks.

Direct (but temporary) impacts would occur from general construction noise such as dredging and pile-driving and lighting associated with any night-time construction. While necessary for the successful and timely completion of the project, the noise from construction operations would affect the generally placid environmental conditions that may be enjoyed by recreational boaters or bird watchers. Any construction activities occurring between May and July could have adverse impacts on the seasonal bird rookery. Although no threatened and endangered species of birds have been identified, temporary impacts may be experienced and could adversely impact passive recreational activities such as bird watching.

As shown in figure 30, a portion of Bayou Bienvenue is a state-designated Scenic River. However, the proposed action would not cross the designated Scenic portion of the bayou. Therefore, no direct impacts to the Scenic portion of Bayou Bienvenue are anticipated.

Indirect Impacts to Recreational Resources

Construction in wetlands could cause an increase in turbidity and sedimentation outside of the immediate project area thereby affecting recreational fishing. However, once the material is placed in the marsh area, sediment would settle, benthos would repopulate and other mobile aquatic species would return, thereby restoring recreational fishing opportunities to preconstruction conditions.

Indirect visual impact could occur during construction as the construction cranes and equipment could be visible from the Scenic River portion of Bayou Bienvenue when looking back to the west. Following construction, the flood control device would also be visible from a canoe or boat on the designated Scenic portion of the river when looking back to the west.

Analysis of the hydroperiod for three locations in the Bayou Bienvenue channel showed no differences for the tidal phase, tidal amplitude, and duration of inundation for any of these three locations when comparing the base conditions including the closure of the MRGO at Bayou LaLoutre to the proposed action. Therefore, indirect impacts to recreation in the Scenic portion of Bayou Bienvenue are not anticipated.

Cumulative Impacts to Recreational Resources

In general, impacts to fishery resources would occur due to changes in estuarine substrate and open water within the footprint of the floodwall and other structures.

With construction of the proposed action, a large surrounding upland area would be provided a greater degree of storm protection. With respect to recreational amenities, the proposed action would provide enhanced protection for the boat launches / marina facilities previously described.

Completion of this project in conjunction with other 100-year GNOHSDRRS projects would be consistent with the goals of the Louisiana Comprehensive Master Plan for a Sustainable Coast, Objective 1, *"Reduce economic losses from storm based flooding to residential, public, industrial, and commercial infrastructure, assuring that assets are protected, at a minimum, from a storm surge that has a 1% chance of occurring in any given year."*

Alternative 4b – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Geotextile Levee Barrier in Alignment 4

Direct, Indirect, and Cumulative Impacts to Recreational Resources

Direct, indirect and cumulative impacts from this alternative would be similar to those for the proposed action. Alternative 4b would impact 10 acres in the NWR for construction of the levee.

Alternative 1 – Deep Draft Gate in Alignment 1

Direct Impacts and Indirect Impacts to Recreational Resources

Impacts to fishing in the project area during construction of alternative 1 would be expected to be short-lived and would only occur during construction of the project. Alternative 1 is expected to have little impact on recreational resources in the project area since the footprint of the levee would not change substantially. This alternative would have less direct impacts to estuarine substrate and open water habitat than the other alternatives. Although access to fishing and hunting areas in the area could be affected during the construction of the replacement gate at the existing Bayou Bienvenue control structure, these impacts would be short-term and would occur only during construction of the project

Alternative 1 does not cross the Golden Triangle marsh located between the GIWW and the MRGO; therefore, it would not directly impact or enclose marsh and tidally influenced streams. Only fringe marsh would be impacted by alternative 1. Recreational opportunities could remain similar current conditions. No direct impacts to the Bayou Sauvage NWR would be experienced under this Alignment.

Cumulative Impacts to Recreational Resources

Impacts to fishing in the project area during construction of the project would be expected to be short-lived. The GNOHSDRRS would benefit recreation infrastructure on the protected side of the system during storm surge events. Recreational resources would be protected from tropical storm surge events by this and other proposed 100-year level of protection projects.

Alternative 2 – Deep Draft Gate in Alignment 2

Direct, Indirect, and Cumulative Impacts to Recreational Resources

Direct, indirect and cumulative impacts to recreational resources from this alternative would be similar to those for alternative 1. No direct impacts to the Bayou Sauvage NWR would be experienced under this Alignment.

Alternative 3a – MRGO Structure, GIWW Gate, and Structural Wall Barrier in Alignment 3

Direct Impacts and Indirect Impacts to Recreational Resources

Alternative 3a has a greater distance between the hydrologic connections in comparison to the proposed action resulting in less hydrologic exchange between the flood side and protected side of the marsh. This impact is expected to be confined to small localized areas furthest from the gate (hydrologic connections).

Additionally, Alignment 3 requires the relocation of a pipeline, for which a new channel would have to be excavated through the marsh. Therefore Alignment 3 would have additional wetland impacts above those impacted by the barrier itself. In addition, a replacement gate at the existing

Bayou Bienvenue control structure would also be constructed. All of these factors result in additional impacts to recreational resources within the project area.

Alternative 3a would also limit recreational access into the Golden Triangle from points west and north. Access into Bayou Bienvenue from the areas west and north of the triangle would be via the GIWW since access via the MRGO would be blocked under this alternative.

Alternative 3a would impact up to 3 acres in the NWR for construction of the floodwall and 2 acres for the access channel.

Cumulative Impacts to Recreational Resources

Cumulative impacts from this alternative would be similar to those for the proposed action.

Alternative 3b – MRGO Structure, GIWW Gate, and Geotextile Levee Barrier in Alignment

Direct, Indirect, and Cumulative Impacts to Recreational Resources

Direct, indirect and cumulative impacts to recreational resources from this alternative would be similar to those for alternative 3a. Alternative 3b would impact 5 acres in the NWR for construction of the levee.

Alternative 5a – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Structural Wall Barrier in Alignment 5

Direct, Indirect, and Cumulative Impacts to Recreational Resources

Direct, indirect and cumulative impacts to recreational resources from this alternative would be similar to those for the proposed action but more extensive since the alignments pass through more wetlands and therefore impact a larger area of recreational resources.

The alignment for alternative 5 could approach the peripheral area of the Fort Villeré; however, this location is neither an active nor readily accessible recreational resource. The alignment would likely not directly affect this resource, but would introduce a new visual component in the vicinity.

Alternative 5a would impact 12 acres in the NWR for construction of the floodwall and 7 acres for the access channel.

Alternative 5b – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Geotextile Levee Barrier in Alignment 5

Direct, Indirect, and Cumulative Impacts to Recreational Resources

Direct, indirect and cumulative impacts to recreational resources from this alternative would be similar to those for the proposed action but more extensive since the alignments pass through more wetlands and therefore impact a larger area of recreational resources. Alternative 5b would impact 20 acres in the NWR for construction of the levee.

3.2.12 Aesthetic (Visual) Resources

Existing Conditions

This resource's institutional significance is derived from laws and policies that affect visual resources, most notably NEPA and the 1976 Louisiana Natural and Scenic Rivers Act (Louisiana Scenic Rivers Act), as amended. The USACE Visual Resources Assessment Procedure (Smardon et al. 1988) provides a technical basis for identifying the project's visual resources. Public significance is based on public perceptions and professional analysis of the project area.

Visually, the project area is a contrast of natural and urban landscapes. Primary viewpoints, via Bayou Bienvenue, into the project area's natural landscape highlight coastal marsh, low lying natural levees, and small ponds and bayous. The natural landscape is contrasted by unnaturally straight channels and spoil banks cutting through the coastal marsh, which were most likely caused by navigation and petroleum related exploration. Flood control measures such as earthen berm levees, floodwalls and water control structures are also evident as one travels the GIWW or MRGO. The area is also characterized by the large industrial buildings and operations along the GIWW, and the Michoud Canal and Slip, such as the large NASA Assembly Facility, and other large man-made structures such as the Paris Road Bridge communications towers, and overhead utility facilities.

A portion of Bayou Bienvenue is protected under the Louisiana Scenic Rivers Act. This corridor segment is largely undeveloped and provide open vistas of solid and broken marshes interspersed with natural levees and spoil banks which support woody vegetation. The relatively unobstructed panoramas contribute to the stream and river wilderness quality and high scenic value.

Discussion of Impacts

Proposed Action: Alternative 4a - MRGO Structure, GIWW and Bayou Bienvenue Gates, and Structural Wall Barrier in Alignment 4

Direct and Indirect Impacts to Aesthetic Resources

As a designated Natural and Scenic River, a portion of Bayou Bienvenue is protected by the Louisiana Natural and Scenic River Act as administered by the LDWF. None of the alternative alignments would cross Bayou Bienvenue in the portion designated as Scenic, however, the proposed new construction would be visible to a user on the Scenic portion. LDWF has reviewed the proposed action and, in correspondence on 22 July 2008, agreed with CEMVN's conclusion that no significant change in the Scenic portion of Bayou Bienvenue's hydrology is anticipated. Therefore, no adverse impacts to the portion of Bayou Bienvenue that is designated Scenic are anticipated.

Additional visual impacts are disclosed in section 3.2.11.

Cumulative Impacts to Aesthetic Resources

Cumulatively, the visual impacts caused by the GNOHSDRRS both regionally and nationwide may be considered significant. Flood prone natural landscapes protected by unnatural visual conditions similar to the proposed project may be increasingly converted to developable land. Land development may be considered visually distressing depending on the complexity of natural elements lost.

Alternative 4b – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Geotextile Levee Barrier in Alignment 4

Direct, Indirect, and Cumulative Impacts to Aesthetic Resources

The effects on visual resources from this alternative would be similar to those described above for the Proposed Action.

Alternative 1 – Deep Draft Gate in Alignment 1

Direct, Indirect, and Cumulative Impacts to Aesthetic Resources

The effects on visual resources from this alternative are insignificant as this alternative's project area visually contains similar development.

Alternative 2 – Deep Draft Gate in Alignment 2

Direct, Indirect, and Cumulative Impacts to Aesthetic Resources

The effects on visual resources from this alternative are insignificant as this alternative's project area visually contains similar development.

Alternative 3a – MRGO Structure, GIWW Gate, and Structural Wall Barrier in Alignment 3

Direct, Indirect, and Cumulative Impacts to Aesthetic Resources

The effects on visual resources from this alternative would be similar to those described for the Proposed Action.

Alternative 3b – MRGO Structure, GIWW Gate, and Geotextile Levee Barrier in Alignment

Direct, Indirect, and Cumulative Impacts to Aesthetic Resources

The effects on visual resources from this alternative would be similar to those described above for the Proposed Action.

Alternative 5a – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Structural Wall Barrier in Alignment 5

Direct, Indirect, and Cumulative Impacts to Aesthetic Resources

The effects on visual resources from this alternative would be similar to those described for the Proposed Action.

Alternative 5b – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Geotextile Levee Barrier in Alignment 5

Direct, Indirect, and Cumulative Impacts to Aesthetic Resources

The effects on visual resources from this alternative would be similar to those described for the Proposed Action.

3.2.13 Air Quality

The USEPA, under the requirements of the Clean Air Act of 1963 (CAA), has established National Ambient Air Quality Standards (NAAQS) for six contaminants, referred to as criteria pollutants (40 CFR 50). These are carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (less than 10 microns in diameter [PM_{10}] and particulate matter less than 2.5 microns in diameter [$PM_{2.5}$]), lead (Pb), and sulfur dioxide (SO_2). The NAAQS standards include primary and secondary standards. The primary standards were established at levels sufficient to protect public health with an adequate margin of safety. The secondary standards were established to protect the public welfare from the adverse effects associated with pollutants in the ambient air. The primary and secondary standards are presented in table 10a.

National Ambient Air Quality Standard Attainment Status

Areas that meet the NAAQS for a criteria pollutant are designated as being “in attainment;” areas where a criteria pollutant level exceeds the NAAQS are designated as being “in non-attainment.” The proposed action and alternative actions evaluated in this document would occur in Orleans and St. Bernard Parishes, Louisiana, an area that is currently designated as in attainment for all criteria pollutants. Therefore, further analysis required by the CAA general conformity rule (GCR; Section 176(c)) would not be required. However, CEMVN calculated annual emissions for the likely on-site construction activity for Alternatives 4a, 5a and 5b because of the extent of the construction projected for these alternatives. The analysis of construction-related emissions focused on these alternatives because they represent the preferred alternative (i.e., Alternative 4a) and potential worst-case alternative given the scale of construction. Appendix C describes the air emissions analysis in more detail.

National Ambient Air Quality Standard Attainment Status

Areas that meet the NAAQS for a criteria pollutant are designated as being “in attainment;” areas where a criteria pollutant level exceeds the NAAQS are designated as being “in non-attainment.”

Table 10a National Ambient Air Quality Standards				
Pollutant and Averaging Time	**Primary Standard**		**Secondary Standard**	
	µg/m^3	**parts per million (ppm)**	**µg/m^3**	**ppm**
Carbon monoxide 8-hour concentration 1-hour concentration	 10,000[1] 40,000[1]	 9[1] 35[1]	 - -	
Nitrogen dioxide Annual Arithmetic Mean	 100	 0.053	 Same as primary	
Ozone 8-hour concentration	 147	 0.08[2]	 Same as primary	
Particulate matter PM$_{2.5}$: Annual Arithmetic Mean 24-hour Maximum PM$_{10}$: Annual Arithmetic Mean 24-hour concentration	 15[3] 65[4] 50 150[1]	 - - - -	Same as primary	
Lead Quarterly Arithmetic Mean	 1.5	 -	 Same as primary	
Sulfur Dioxide Annual Arithmetic Mean 24-hour concentration 3-hour concentration	 80 365[1] -	 0.03[1] 0.14[1] -	 - - 1300[1]	 - - 0.50[1]
Notes: [1] Not to be exceeded more than once per year. [2] 3-year average of the 4th highest daily maximum 8-hour concentration may not exceed 0.075 ppm, effective as of March 27, 2008. [3] Based on 3-year average of annual averages. [4] Based on 3-year average of annual 98th percentile values. Source: *40 CFR 50*.				

The proposed action and alternative actions evaluated in this document would occur in Orleans and St. Bernard Parishes, Louisiana, an area that is currently designated as in attainment for all criteria pollutants. Therefore, further analysis required by the CAA general conformity rule (GCR; Section 176(c)) would not be required. However, CEMVN calculated annual emissions for the likely on-site construction activity for Alternatives 4a, 5a and 5b because of the extent of the construction projected for these alternatives. The analysis of construction-related emissions focused on these alternatives because they represent the preferred alternative (i.e., Alternative

4a) and potential worst-case alternative given the scale of construction. Appendix C describes the air emissions analysis in more detail.

Discussion of Impacts

Proposed Action: Alternative 4a - MRGO Structure, GIWW and Bayou Bienvenue Gates, and Structural Wall Barrier in Alignment 4

Direct Impacts to Air Quality

Increases in air emissions in the project area would be expected during the construction period for the proposed action. These emissions would include 1) exhaust emissions from operations of various types of non-road construction equipment such as loaders, excavators, cranes, generators, etc., 2) fugitive dust due to earth disturbance, and 3) exhaust emissions from water craft required to complete construction in the waterways. The exhaust emissions would be from mobile sources for which performance standards are applicable to manufacturers of the sources and they are not regulated under the CAA air permit regulations. If the project were to occur in a "non-attainment" area it would be subject to compliance with the GCR. As previously discussed, the IER #11 project area is within an attainment area, but an evaluation of air emissions related to the construction of the project was conducted using GCR guidance to provide the forecasted annual emissions levels for the proposed action.

The evaluation of construction related air emissions for the proposed action indicated that an increase in criteria pollutant emissions at and near the proposed project sites would result from the proposed action. These effects would be temporary; related to construction. Dust emissions would be controlled by natural conditions (most of the project would occur in wet areas, which would help control dust) and by standard BMPs. The emissions estimates for the proposed action are summarized in Table 10b for priority pollutants.

Indirect Impacts to Air Quality

Potential for indirect impacts to air quality could include visual impairments created by airborne dust and vehicle and construction equipment emissions. These impacts would only occur during the construction period and are expected to be controlled with the use of BMPs during construction.

Cumulative Impacts to Air Quality

The principal air quality concern associated with the proposed action would be construction related emissions of priority pollutants and of fugitive dust near construction areas. These impacts would be temporary in nature, but are expected to occur concurrently or near the same time as other projects for the GNOHSDRRS, for transportation and infrastructure projects and for numerous other reconstruction projects to repair damage from Hurricanes Katrina and Rita within the Greater New Orleans area. The concurrent timing of many of these projects in conjunction with the relative large scale of much of the construction repair would represent a cumulative impact to air quality within the region. These impacts would be limited to the construction periods for these projects and may be countered to some extent by the decreased population since Hurricanes Katrina and Rita, which would reduce vehicle and household-related emissions. Air quality data since Hurricanes Katrina and Rita are still in attainment even given the level of clean-up and reconstruction activity for the region.

Table 10b
Total Annual Emissions Levels for Alternative 4a

Emission Source	Pollutant (tons/year)					
	VOC	**NO_X**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**
2008 - 2009						
Construction Diesel Equipment	2.52	47.77	13.46	2.06	2.00	25.65
Construction Motor Vehicles	0.13	0.11	1.33	0.00	0.00	0.00
Total Annual Emissions	**2.65**	**47.88**	**14.79**	**2.06**	**2.00**	**25.65**
2010						
Construction Diesel Equipment	0.76	13.12	3.58	0.61	0.60	10.74
Construction Motor Vehicles	0.31	0.27	3.18	0.01	0.00	0.00
Total Annual Emissions	**1.07**	**13.39**	**6.76**	**0.62**	**0.60**	**10.74**

Alternative Actions 4a, 1, 2, 3a, 3b, 5a, and 5b

Direct, Indirect and Cumulative Impacts to Air Quality

The impacts to air quality under these alternative actions would be similar to those described for the proposed action. The impacts for alternative actions 4a, 1, 2, 3a, and 3b would all be less than those estimated for the proposed action based on the amount of construction area and nature of construction activities involved in those alternatives. Emissions levels estimated for alternatives 5a and 5b would be higher than those for the proposed action. The emissions estimates for priority pollutants for the alignment 5 alternatives are summarized in Tables 10c and 10d and are an indication that these alternatives would have greater direct, indirect and cumulative impacts than the proposed action.

Table 10c
Total Annual Emissions Levels for Alternatives 5a

Emission Source	Pollutant (tons/year)					
	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$	SO_2
2008 – 2009						
Construction Diesel Equipment	9.31	130.15	39.13	5.87	5.70	34.25
Construction Motor Vehicles	0.15	0.13	1.53	0.00	0.00	0.00
Total Annual Emissions	**9.46**	**130.28**	**40.66**	**5.87**	**5.70**	**34.25**
2010						
Construction Diesel Equipment	0.87	14.02	3.96	0.69	0.67	10.75
Construction Motor Vehicles	0.38	0.33	3.88	0.01	0.01	0.00
Total Annual Emissions	**1.25**	**14.35**	**7.84**	**0.70**	**0.68**	**10.75**

Table 10d
Total Annual Emissions Levels for Alternatives 5b

Emission Source	Pollutant (tons/year)					
	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$	SO_2
2008-2009						
Construction Diesel Equipment	2.70	36.30	11.33	2.07	2.01	21.31
Construction Motor Vehicles	0.33	0.28	3.34	0.01	0.00	0.00
Total Annual Emissions	**3.03**	**36.58**	**14.67**	**2.08**	**2.01**	**21.31**
2010						
Construction Diesel Equipment	0.40	10.09	2.31	0.35	0.34	10.69
Construction Motor Vehicles	0.08	0.07	0.84	0.00	0.00	0.00
Total Annual Emissions	**0.48**	**10.16**	**3.15**	**0.35**	**0.34**	**10.69**

3.2.14 Noise

Noise is generally described as unwanted sound, which can be based either on objective effects (hearing loss, damage to structures, etc.) or subjective judgments (such as community annoyance). Sound is usually represented on a logarithmic scale with a unit called the decibel (dB). Sound on the decibel scale is referred to as sound level. The threshold of human hearing is approximately 0 dB, and the threshold of discomfort or pain is around 120 dB.

Noise levels are computed over a 24-hour period and adjusted for nighttime annoyances to produce the day-night average sound level (DNL). DNL is the community noise metric recommended by the USEPA and has been adopted by most Federal agencies (USEPA 1974). A DNL of 65 dBA (The A-weighted sound level, used extensively in this country for the measurement of community and transportation noise, represents the approximate frequency response characteristic of the average young human ear) is the level most commonly used for noise planning purposes and represents a compromise between community impact and the need for activities like construction. Areas exposed to a DNL above 65 dBA are generally not considered suitable for residential use. A DNL of 55 dBA was identified by USEPA as a level below which there is no adverse impact (USEPA 1974).

Noise levels occurring at night generally produce a greater annoyance than do the same levels occurring during the day. It is generally agreed that people perceive intrusive noise at night as being 10 dBA louder than the same level of noise during the day. This perception is largely because background environmental sound levels at night in most areas are about 10 dBA lower than those during the day.

Areas surrounding IER # 11 Tier 2 Borgne are primarily undeveloped wetlands with minimal noise generated by recreational users. Higher levels of noise are generated by commercial waterborne traffic along the GIWW, the MRGO, Bayou Bienvenue, and Bayou Dupre. No major roadways, railways or runways are present adjacent to IER # 11 Tier 2 Borgne that would contribute to ambient noise levels in the area.

<u>Discussion of Impacts</u>

Proposed Action: Alternative 4a - MRGO Structure, GIWW and Bayou Bienvenue Gates, and Structural Wall Barrier in Alignment 4

Direct Noise Impacts

Table 11 lists noise emission levels for construction equipment expected to be used during the proposed construction activities. As can be seen from this table, the anticipated noise levels at 50 ft range from 75 dBA to 101 dBA based on data from the Federal Highway Administration ([FHWA] 2006).

Table 11
Weighted (dBA) Sound Levels of Construction Equipment and Modeled Attenuation at Various Distances[1]

Noise Source	50 ft	100 ft	200 ft	500 ft	1000 ft
Backhoe	78	72	68	58	52
Crane	81	75	69	61	55
Dump Truck	76	70	64	56	50
Excavator	81	75	69	61	55
Front end loader	79	73	67	59	53
Concrete mixer truck	79	73	67	59	53
Auger drill rig	84	78	72	64	58
Dozer	82	76	70	62	56
Pile driver	101	95	89	81	75

Source: FHWA 2006. "Highway Construction Noise Handbook".
[1] The dBA at 50 ft is a measured noise emission. The 100- to 1,000-ft results are modeled estimates.

Assuming the worst case scenario of 101 dBA, as would be the case during pile driving, all areas within 1,000 ft of the project area would experience noise levels exceeding 65 dBA. Most of the project area is undeveloped and only a few commercial/industrial areas on the north side of the GIWW would be within a 1000 ft of construction occurring within any of the five alignments. Watercraft near the project during construction may be exposed to the noise levels, but would be able to avoid the area until construction was completed. Construction noise levels would attenuate to 75 dBA at a distance of 350 ft from construction activities. The effects of construction noise to aquatic life and terrestrial wildlife was discussed previously as part of the evaluation for these resources.

The construction activities would be expected to create temporary noise impacts above 65 dBA to the limited number of receptors within 1,000 ft of the north end of the project area. The opportunities for noise mitigation would be limited because much of the construction activity would occur at the control structure locations. Following construction, noise levels would return to existing conditions.

Indirect Noise Impacts

No indirect impacts would be expected to result from the proposed action.

Cumulative Noise Impacts

Noise resulting from ongoing and planned construction activities in the IER # 11 Tier 2 Borgne study area as a result of GNOHSDRRS projects and rebuilding and restoration following Hurricanes Katrina and Rita would not likely generate noise levels in the project area to surpass the maximum levels of noise described previously under direct impacts. Concurrent projects would likely extend the amount of time people are exposed to the increased noise levels resulting from construction activities. However, the lack of residential homes near the project area would reduce the time people could be exposed to unwanted sound from construction, day or night.

Alternative Actions 4b, 1, 2, 3a, 3b, 5a, and 5b

Direct, Indirect and Cumulative Noise Impacts

Future conditions under the alternative actions would be similar to those described under the proposed action.

3.2.15 Transportation

Existing Conditions

The project lies in a wetland area between Lake Pontchartrain to the north and the Lake Borgne to the east. North and west of the project lies Orleans Parish, south and west of the project is St. Bernard Parish. Orleans and St. Bernard Parishes are densely developed with residential, commercial, and light to medium industrial land uses. To the west, the Port of New Orleans is one of the world's busiest ports with many transportation modes intersecting: river and sea vessels, rail, and highway (Port of New Orleans 2007). A more detailed discussion of navigation transportation infrastructure and impacts can be found in Socioeconomics section 3.3. Baton Rouge is a major traffic generator to the west. The Louis Armstrong New Orleans International Airport lies west of the project on the west side of New Orleans. The airport is the primary commercial airport for the New Orleans metropolitan area and southeast Louisiana. Light to heavy industrial land uses are located along the Mississippi River and the IHNC and GIWW.

There are several rail lines in the New Orleans metropolitan area. There is a major rail line that runs parallel to Interstate 10 (I-10). Several rail spurs are located in the area. There are several dock facilities on the Mississippi River, the IHNC, the GIWW, and the Michoud Canal that would be capable of handling ocean vessels.

I-10 and US-90 are the only major east-west highways that cross this area (figure 32). I-10 is a 6-lane divided freeway. It connects the New Orleans metropolitan area with Baton Rouge to the west and Mississippi to the east. In addition, I-10 is a major east-west route along the northern Gulf Coast. US-90 is a 4-lane divided highway with no access control. It runs parallel to I-10 in this area; it primarily serves local travel, while I-10 serves regional travel. SR-47 (principle arterial) runs across Orleans and Plaquemines Parishes, connecting into I-10 via I-510 in New Orleans East. SR-47 is a 4-lane divided highway with partial access control. It primarily serves as a connector for Plaquemines Parish to I-10 (Louisiana Department of Transportation and Development [LADOTD] 2006). Along with I-510, SR-47 is the most likely route into the project area (figure 32).

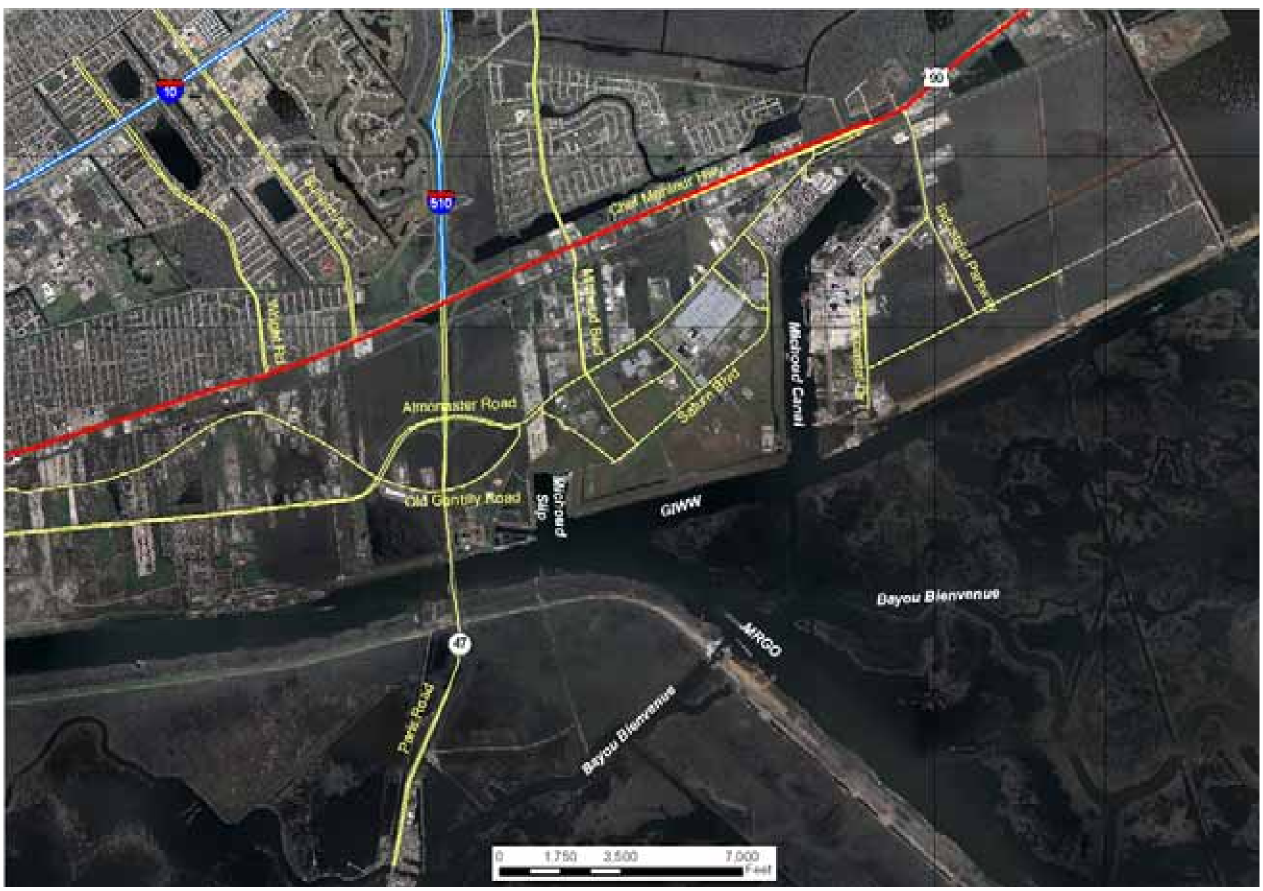

Figure 32. Major Roads and Highways near the Tier 2 Borgne Project Area

The most recent traffic volumes available from the LADOTD are from 2004 (LADOTD 2008b). Due to population shift and additional construction activity that occurred in the aftermath of Hurricane Katrina in 2005, these traffic volumes may not be suitable for finitely determining the existing level of service (LOS) of area highways. However, they provide an order-of-magnitude baseline for comparison when trucks associated with the levee construction are added. The latest traffic count for I-510/SR-47 is 24,000 vehicles.

Based on field observations (Schrohenloher 2007), traffic flow on highways in the project area is poor during morning and evening peak hours, while vehicles are able to travel at the posted speed limits during off-peak times. The area does have a large amount of truck traffic due to nearby shipping and manufacturing industries. In addition, additional truck traffic is associated with rebuilding efforts from the destruction caused by Hurricane Katrina.

Discussion of Impacts

Proposed Action and All Alternatives

Two primary staging areas have been proposed for the project area: an area north of the GIWW and east of the Michoud Canal, and a site along the MRGO north of the existing Bayou Bienvenue gate structure.

Road access to the Michoud Canal staging areas would be from US-90, Industrial Parkway and Intracoastal Drive. In addition, these sites can be accessed from water using the GIWW.

Road access to the MRGO staging area would be from SR-47 and a service road along the GIWW and MRGO. In addition, these sites can be accessed from water using the GIWW.

Direct Impacts to Transportation

A significant amount of construction equipment would be required to conduct the work, including, but not limited to, generators, barges, boats, cranes, trucks, bulldozers, excavators, pile hammers, graders, tractors, and front-end loaders. The staging areas are located away from heavily populated areas. There are no residential areas directly served by the available local haul routes north of the staging areas. There are residential communities south of the staging areas on SR-47, Paris Road/I-510 and the Mississippi River.

Construction traffic would likely not use SR-47 south of the staging areas, because the use of the GIWW, I-10, and US-90 are more economically attractive transportation facilities for hauling equipment and materials than any facilities south of the staging areas. Equipment and materials would most likely come from outside the study area. The only major roads that connect the study area to the outside are I-10, US-90, and SR-47 north of the GIWW. Any materials and equipment shipped to the staging areas and construction sites via the Mississippi River would likely go directly to the staging areas and construction sites via the GIWW, instead of unloading in the Chalmette area and hauling by truck up to the staging areas.

To quantify potential impacts to area highways, a worst case was assumed for a concrete pour. It was assumed that all concrete would be coming from an outside source and would use I-510/SR-47. The peak hour traffic was analyzed.

Concrete Truck Rate = 30 trucks per hour

I-510/SR-47 Peak Hour Traffic = 1,440 (10 percent of 24,000 vehicles per day with 60 percent of the traffic going in one direction)

Normal Truck Traffic in the Peak Hour = 10 percent

I-510/SR-47 is expected to operate at a LOS "B" during the peak hour without construction traffic (concrete trucks). With the addition of the concrete trucks, I-510/SR-47 is expected to operate at a LOS "B". No substantial impacts to area highways are expected.

Local streets would be used to access work sites from the arterials. These access roads (e.g., work site access, staging areas) used by the trucks may have substantial changes in their traffic flow. The local roads at the Michoud Canal staging areas consist of industrial-related traffic. Although there would be an adverse impact to the traffic flow on roads, the composition of the traffic would not substantially change. Construction traffic would access Bayou Bienvenue staging area by a service road that is not signed or used as a public road.

Indirect Impacts to Transportation

Heavy trucks would be the primary loading source of pavement degradation. The additional truck traffic resulting from the proposed action could contribute to additional wear-and-tear of pavement on roads within the project's vicinity.

Depending on whether or not construction efforts would be considered during hurricane evacuation planning, the increased level of truck traffic within the project vicinity may contribute to delays experienced during hurricane evacuations, since the roads within the vicinity of the project would be used for hurricane evacuation routes. There would be no impact to hurricane evacuation if construction-related traffic was halted during an evacuation.

Cumulative Impacts to Transportation

As discussed previously, additional wear-and-tear of pavement on roads within the project's vicinity could occur due to increased truck traffic under the proposed action. On-going construction related to other reconstruction projects in the project vicinity could also contribute to the increase of truck traffic and could therefore increase the wear-and-tear on the pavement of the roads and add to area congestion.

3.3 SOCIOECONOMIC RESOURCES

Existing Conditions

The socioeconomic conditions of the project area are broadly described in section 3.3 of the IER # 11 Tier 1. These data are summarized and incorporated by reference. Additional data and discussion are provided based on new information that has been made available since IER # 11 Tier 1 was finalized from sources such as the following:

- The Brookings Institution Metropolitan Policy Program and Greater New Orleans Community Data Center, *The New Orleans Index* (GNOCDC 2008a).

- University of New Orleans Division of Business and Economic Research, *Metropolitan Report: Economic Indicators for the New Orleans Area* (UNO 2008).

Demographics of Project Area: Orleans and St. Bernard Parishes

The proposed action is geographically located between Orleans and St. Bernard Parishes. Both are briefly described below for the purposes of describing the potential socioeconomic impacts of this action.

In the early 20th century, residential development began to spread into eastern Orleans Parish from the neighboring Gentilly area. However, the construction of the Industrial Canal (IHNC) physically separated this New Orleans East area from the rest of New Orleans. It is now essentially surrounded on all sides by water. Most of the growth in this area occurred following World War II with new post-war subdivisions in the northern portions of New Orleans East. Additional development was planned in the late 1970s including a large planned development to be known as "New Orleans East." However, only a portion was built before a declining oil economy slowed economic development in the area.

Most of St. Bernard Parish is surrounded by and composed of water and is generally bounded by the MRGO and the Mississippi River. The urbanized portions are located adjacent to New Orleans along the banks of the Mississippi River within the levee system. At the project location and vicinity, St. Bernard Parish consists of marshlands and is transected by the MRGO. Providing an early home to the Isleños (Spanish Canary Islanders in the 1780s), neighborhood development in the Parish increased in the 1940s due to urbanization from neighboring New Orleans. Neighborhoods developed in the upper portion of the parish with communities such as Arabi, Chalmette, Meraux, Violet, and Poydras (St. Bernard 2008). St. Bernard Parish provides strong connections to local fishing and boating with many local marinas and public boat launches. Like Orleans Parish, St. Bernard has been heavily impacted by hurricane and flood events such as the Great Mississippi Flood of 1927 and Hurricanes Betsy and Katrina.

The U.S. Census provides an estimate of populations as of 2007 with approximately 300,000 people in Orleans and St. Bernard Parishes combined. It is noted that both Orleans and St. Bernard Parish have officially challenged this 2007 Census estimate as too low. These Parishes believe the post-Katrina population recovery has been greater than the Census was able to estimate (GNOCDC 2008a; 2008b). The most recent data based on postal mail delivery indicates a total of 152,778 addresses receiving mail as of February 2008 for both Orleans and St. Bernard Parishes (GNOCDC 2008c). The Louisiana Department of Labor, through the Louisiana Occupational Information System (LOIS), estimates a population of 264,124 for both Parishes (LDOL 2007 and LDOL 2008) as shown in figure 33.

Project Area at-a-Glance: 2007-2008 Population and Labor Statistics

St. Bernard Parish

- The 2007 population of St. Bernard Parish was estimated at 25,009. This represents a 62.6 percent decrease from 1997.
- The total civilian labor force for March 2008 was 7,682 of which 7,278 were employed and 404 were unemployed. The unemployment rate was 5.3 percent.
- The average weekly wage in 3rd Quarter 2007 was $850. This would be equivalent to $21.25 per hour or $44,200 per year, assuming a 40-hour week.

Orleans Parish

- The 2007 population of Orleans Parish was estimated at 239,115. This represents a 49.4 percent decrease from 1997.
- The total civilian labor force for March 2008 was 100,029 of which 95,122 were employed and 4,907 were unemployed. The unemployment rate was 4.9 percent.
- The average weekly wage in 3rd Quarter 2007 was $887. This would be equivalent to $22.18 per hour or $46,124 per year, assuming a 40-hour week worked the year around.

(LDOL 2007 and LDOL 2008)

Figure 33. Population and Labor Information for St. Bernard and Orleans Parishes

Figure 34. Planning Areas in Project Vicinity

The broad demographics of the project area and vicinity can be described in terms of the New Orleans Planning Districts and ZIP Codes. Planning Districts and ZIP codes in the project area, as provided by the Greater New Orleans Community Data Center, are shown in figures 34 and 35 respectively. Planning District 9 (New Orleans East) is predominantly African American population. Planning District 10 (Village de L'Est) has a large Vietnamese community and is home to the NASA MAF and other industry in the Almonaster-Michoud Industrial Park, now known as the New Orleans Business and Industrial District (NOBID). Planning Districts 10 and 11 generally equate to Zip Code 70129 which includes the portion of the project area within St. Bernard Parish and the project area. Planning District 11 (Venetian Isles), sometimes referred to as the "Far East" by locals, and is typified by fishing villages, small residential areas, and a variety of marinas. Sport and commercial fishermen are a primary resident of this area, many of which live seasonally in camps, or modest single-family structures for weekend/getaway housing. Live-work commercial fisheries are intermingled within the subdivisions and the camps. Prior to Katrina, approximately 75 commercial fishermen operated out of District 11. The District is entirely outside of the levee system (GNOCDC 2008d; 2008e; 2008f).

Although the New Orleans area continues to repopulate as shown in figure 36, the rate has slowed and the labor force has declined. Current estimates show New Orleans is now home to 71.5 percent of the number of households it had pre-Katrina (GNOCDC 2008a; 2008c) with both population and employment at about 86 percent of pre-Katrinan values (UNO 2008). New Orleans lost about 30 years of population growth due to Katrina (UNO 2008). However, the

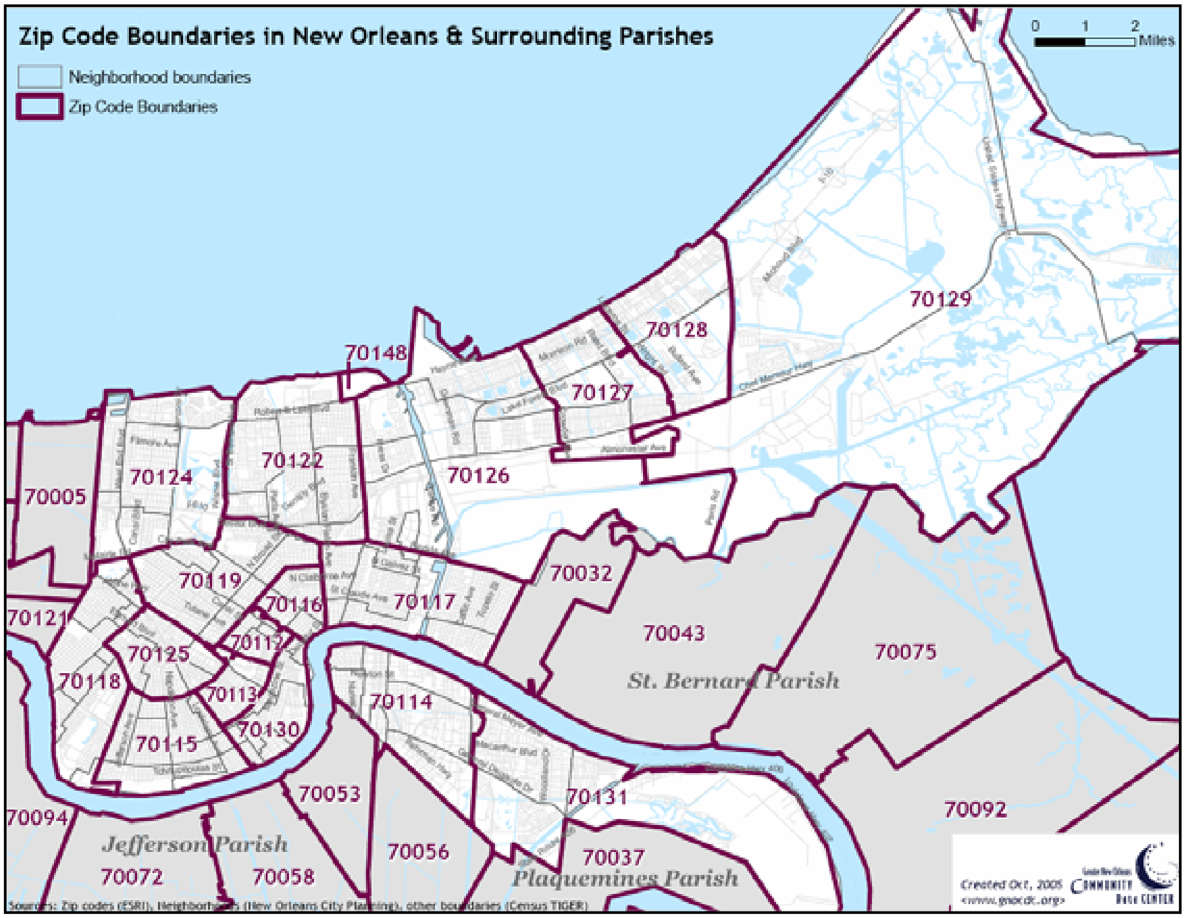

Figure 35. ZIP Codes in the Project Vicinity

Figure 36. New Orleans Metro Economic Indicators

existing population is stronger in civic participation with 28 new civic organizations formed post-Katrina with an increase by over 70 percent in membership (Cohen 2008a). In the project area vicinity of New Orleans East, at least 24 neighborhood/business associations exist (City-Works 2008).

Overall, the New Orleans metropolitan area continues a positive economic recovery trend as shown in figure 36 and table 12. Employment in the project area remains tight with overall unemployment rates at 3.1 percent as of February 2008 (UNO 2008). In May 2008, the rate rose slightly to 3.3 percent (Orleans Parish). St. Bernard Parish posted a 4.5 percent unemployment rate in May 2008 (LDOL 2008). Cumulative net change in employees has not yet returned to pre-Katrina levels. However, weekly wages continue to be much higher than the state average.

<table>
<tr><th colspan="5">Table 12. Economic Indicators</th></tr>
<tr><td colspan="5">Average Weekly Wage, All Industries
(U.S. Bureau of Labor Statistics) Numbers in Dollars</td></tr>
<tr><td></td><td>2005, Q1</td><td>2006, Q1</td><td colspan="2">2007, Q1</td></tr>
<tr><td>RLMA1 [a]</td><td>$684</td><td>$834</td><td colspan="2">$841</td></tr>
<tr><td>State</td><td>$619</td><td>$697</td><td colspan="2">$730</td></tr>
<tr><td colspan="5">Net Change in Total Employers, by Parish
(Greater New Orleans Community Data Center)</td></tr>
<tr><td rowspan="2">Parish</td><td colspan="3">Year</td><td rowspan="2">Cumulative net change in employers since storm (2007)</td></tr>
<tr><td>2005 (Q4)</td><td>2006 (Q1)</td><td>2007 (Q1)</td></tr>
<tr><td>Orleans</td><td>7,011</td><td>6,641</td><td>7,336</td><td>-2,256</td></tr>
<tr><td>St. Bernard</td><td>451</td><td>429</td><td>534</td><td>-517</td></tr>
<tr><td colspan="5">Income
(Greater New Orleans, Inc Regional Economic Alliance)</td></tr>
<tr><td rowspan="2">Parish</td><td colspan="4">Type</td></tr>
<tr><td>Median Household Income</td><td>Average Household Income</td><td colspan="2">Per Capita Income</td></tr>
<tr><td>Orleans</td><td>$32,959</td><td>$47,929</td><td colspan="2">$18,901</td></tr>
<tr><td>St. Bernard</td><td>$33,087</td><td>$47,929</td><td colspan="2">$18,325</td></tr>
<tr><td colspan="5">Labor Force, 2007</td></tr>
<tr><td rowspan="2">Parish</td><td colspan="4">Type</td></tr>
<tr><td>Civilian Labor Force</td><td>Number Employment</td><td>Number Unemployment</td><td>Unemployment Rate</td></tr>
<tr><td>Orleans</td><td>99,718</td><td>95,199</td><td>4,519</td><td>4.5</td></tr>
<tr><td>St. Bernard</td><td>7,599</td><td>7,284</td><td>315</td><td>4.1</td></tr>
<tr><td colspan="5">[a] RLMA1: Regional Labor Market Area 1 (New Orleans Region), includes Jefferson, Orleans, Plaquemines, St. Bernard, St. Charles, St. James, St. John the Baptist, and St. Tammany Parishes.

Source: Louisiana Department of Labor, Labor Market Statistics, Local Area Unemployment Statistics Program. Louisiana Occupational Information System (LOIS).
http://www.voshost.com/analyzer/default.asp</td></tr>
</table>

Housing Resources

According to the U.S. Department of Housing and Urban Development (HUD), more than 114,600 rental housing units in the New Orleans – Metairie – Kenner Metropolitan Statistical Area (MSA) were destroyed in the hurricanes with the majority of those (93,000) in Orleans Parish (HUD 2006). Insurance premiums have increased 400 percent. Additional rental units are anticipated to come online as insurance claims are settled and as the Federal Emergency Management Agency (FEMA) elevation guidelines are implemented.

Fair Market rent data have been established by HUD as compiled by the Greater New Orleans Community Data Center. As shown in figure 37, since before Katrina, the average rent has increased by more than 46 percent. Efficiency units have risen from $365 to $764; one-bedroom units from $418 to $846; and two-bedroom units from $521 to $990; although actual amounts paid have been higher (GNOCDC 2008g). HUD anticipates the rental market to ease into more balanced conditions as new and renovated units re-enter the market over the next several years (HUD 2008).

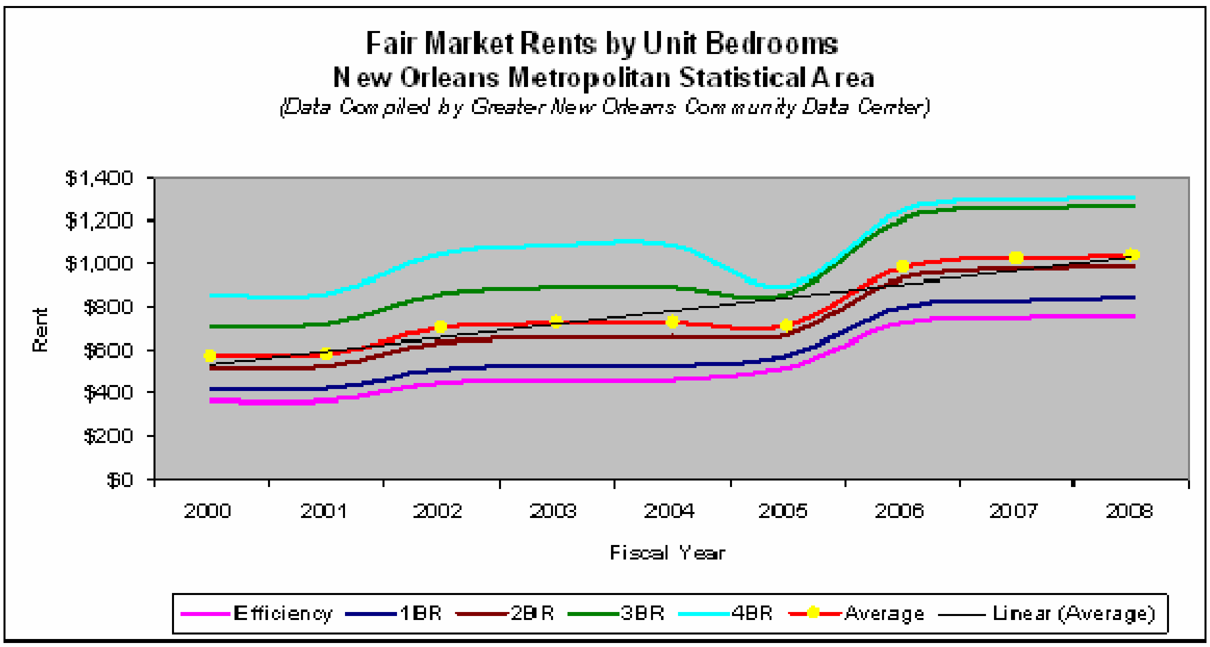

Figure 37. Fair Market Rents

Rental vacancy rates for the broader Metropolitan Statistical Area have been in decline since 1990 (figure 38). The Apartment Association of Greater New Orleans and Louisiana estimates the current vacancy rate of 13 percent for Orleans Parish and 20 percent for St. Bernard Parish (Gentilly) (AAGNO 2008). Approximately 35,000 of the 48,000 pre-hurricane rental housing units are back on-line (HUD 2008).

Five of the metro area's 14 apartment complexes with 150 or more units being built or undergoing renovation are in eastern New Orleans, according to the spring 2008 Greater New Orleans Multi-Family Report. The Walnut Square, Hidden Lake, Willows, Chenault Creek and Pirogue Cove developments account for 1,817 or 43 percent of the 4,269 units being built in the metro area (Cohen 2008b).

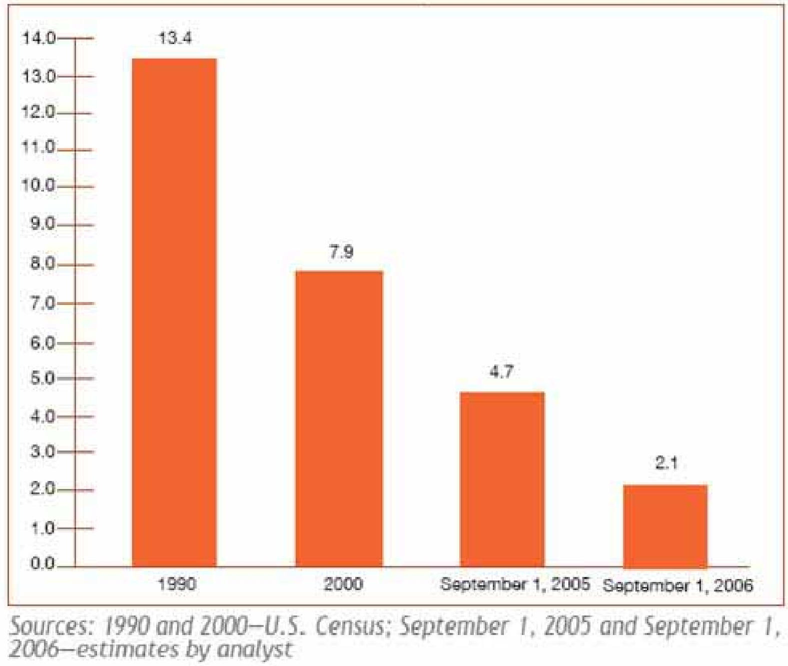

Figure 38. Trends in Rental Vacancy Rates (New Orleans – Metairie – Kenner Metropolitan Statistical Area (MSA) From HUD Comprehensive Housing Market Analysis, September 2006

Single-family housing prices for 2007 averaged \$207,039 (figure 39), up from \$200,892 in 2005 (UNO 2008). In New Orleans East, there remains a larger gap between active listing of single-family residences versus numbers sold. As of the first quarter of 2008, with both indicators trending downward, New Orleans East had approximately 400 single-family homes listed, but fewer than half of those had sold.

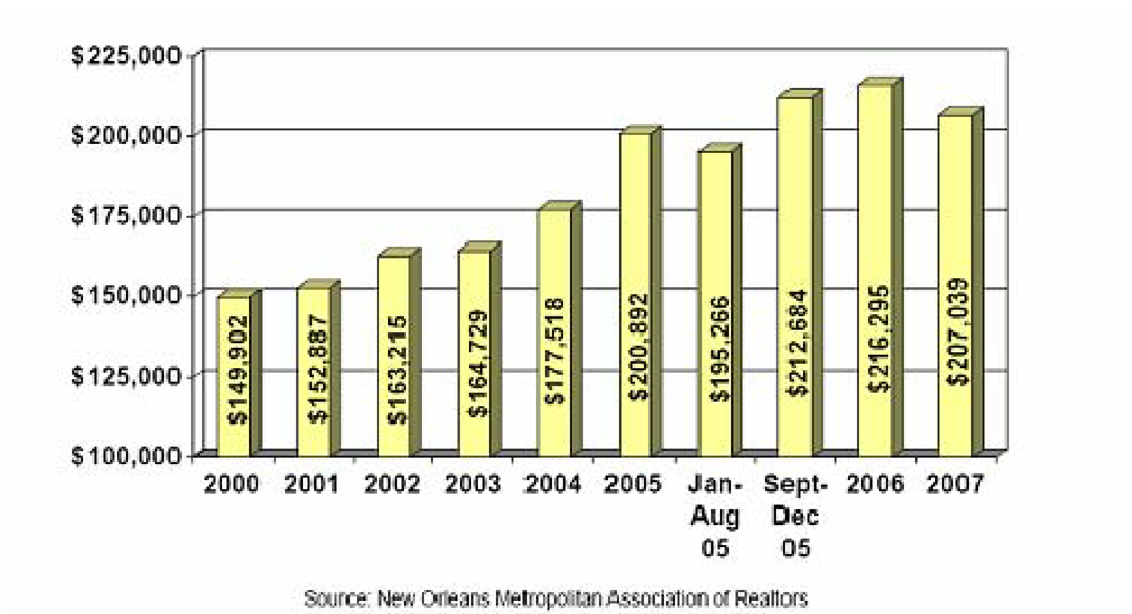

Figure 39. Single Family Average House Prices for the New Orleans Metro Area, 2000-2007

Industrial and Commercial Resources

The Brookings Institution Metropolitan Policy Program and Greater New Orleans Community Data Center periodically publish *The New Orleans Index*, which is a compilation of statistical data marking recovery progress since Hurricane Katrina (GNOCDC 2008a). The most recent data from April 2008[3] is summarized in the following text for the purpose of leading to a discussion of potential impacts.

- Sales tax revenue in December 2007 through February 2008 rose by 8 percent since the same months last year. Hotel and motel tax revenues rose by 34 percent and are now at 98 percent of the same period pre-Katrina, although occupancy was at only 63 percent average in 2007.
- The number of employers across the five-parish area fell from 93 percent of pre-Katrina levels in the fourth quarter of 2006 to 91 percent by the second quarter 2007. The region continues to experience unsettled economic environment as some firms close and other start up. As of the second quarter of 2007, a total of 9,368 employers had closed or moved out since Katrina, while only 6,093 firms started up or moved in. The labor market has tightened with unemployment rate of 3.1 percent reflecting that some employers are still unable to fill job vacancies.

- Total non-farm employment in the New Orleans MSA as of March 2008 was 525,000 representing an increase of 9,800 jobs over the year.

Several industrial/commercial resources exist within the project vicinity and as part of the New Orleans Business and Industrial District (NOBID). These businesses account for a substantial portion of the regional employment. The following primary operations are located on the GIWW or the Michoud Canal or Slip.

- NASA MAF
- Air Products and Chemicals
- Folger's Coffee Company
- Entergy Michoud Steam Electric Station

The NASA MAF is located at 13800 Old Gentilly Road. The MAF is a government-owned, contractor-operated assembly facility primarily associated with the assembly of the Space Shuttle External Tank. According to a recent EIS (the NASA Constellation Programmatic Environmental Impact Statement, NASA 2008), the facility occupies 833 acres with 3.8 million square feet (sq ft) of infrastructure within Orleans Parish on the GIWW and Michoud Canal, bordered by the energy production plant and the New Orleans Fire Training Academy to the west. The Assembly Facility is one of the largest employers in New Orleans area with more than 4,200 employees on site. It also hosts the U.S. Department of Agriculture National Finance Center, and the U.S. Coast Guard Integrated Support Command (ISC). The Assembly Facility continues to be a major economic player in the regional economy and recently broke ground for a new $40 million Research and Development Administration Building, which would provide

[3] The next data update is scheduled for July 2008.

350 offices, a conference center, and a collaborative research and development facility scheduled to open in December 2010 (NASA 2007).

The Air Products facility is located at 14700 Intracoastal Drive. It employs about 150 employees and contractors. Hurricane Katrina significantly impacted Air Products operations and employees in the New Orleans area. The plant produces about one-third of the North American industrial hydrogen for the production of fuel for the NASA space shuttle program and oil refineries.

The Folger's plant is located at 14601 Old Gentilly Road. It produces roasted coffee bean products. This facility receives coffee from around the world for roasting. The Entergy Michoud Steam Electric Station is located at 3601 Paris Road. The natural gas-fired electric generation facility has produced electricity for the region since 1957. A cement plant is located at 13201 Old Gentilly Road.

Navigational Resources

Navigational resources in the project area are composed of the MRGO, the GIWW, the IHNC, and the Michoud Canal and Slip.

Mississippi River Gulf Outlet (MRGO)

The project area is at MRGO Mile 60 where the MRGO connects with the GIWW (figure 40) and the two run contiguously westward for six miles to the IHNC. This stretch of the MRGO is also referred to as the GIWW reach.

Traffic records from the Waterborne Commerce Statistics Center (WCSC) show MRGO utilization steadily increasing until reaching a peak tonnage in 1978 and a peak vessel trip in 1982. Both tonnage and total vessels have decreased since that time with 1,475 thousand short tons of cargo through the MRGO in 2006 (USACE 2006d and 2007i).

USACE has concluded that no navigation function on the MRGO between the GIWW and the Gulf of Mexico is economically justified. USACE suspended all dredging of the MRGO in November 2005. The MRGO was deauthorized in June 2008 between mile 60 and the Gulf of Mexico.

This aerial photo shows the confluence of the Gulf Intracoastal Waterway (GIWW) and the Mississippi River Gulf Outlet (MRGO), the general location of the Corps' proposed surge protection project. (USACE Photo)

Figure 40. Project Area Navigational Resources

Gulf Intracoastal Waterway (GIWW)

Traffic records from the WCSC show 18,885 thousand short tons of cargo through the GIWW in 2006 from Mobile Bay, AL to New Orleans, LA. This portion includes the GIWW to the IHNC. Of that amount, total petroleum products (the largest commodity category) accounts for 8,326 thousand short tons (44 percent) (USACE 2006d and 2007i). .

Inner Harbor Navigation Canal (IHNC)

Traffic records from the WCSC show 17,228 thousand short tons of cargo through the IHNC in 2006. The IHNC Lock is an obstacle for most of the deep-draft ships using the Mississippi River and the IHNC. The IHNC lock dimension is 74.5 ft in width, 640 ft in length, and 31.5 ft in depth. The IHNC Lock dimensions are smaller than the dimensions of the Panama Canal and cannot accommodate the "panamax vessels" designed to navigate the Panama Canal. Anything larger than a "panamax vessel" (depth limit of 36.9 ft) cannot transit past mile 66 of the MRGO due to IHNC Lock restriction (USACE 2006d and 2007i).

Michoud Canal and Slip

The Michoud Canal and Slip are accessible from the GIWW and are used by adjacent industries for shipping operations along the GIWW. The canal is 28 ft by 250 ft (NOAA Navigational Chart 11367, updated 19 April 2008) with an approximately 800 by 800-ft turning basin. The NASA MAF utilizes the Canal for barges to ferry their large space shuttle and other program components. Preliminary communications with the MAF Chief Operating Officer indicate no navigation concerns by construction of the proposed flood control structure (Jones 2008).

The U.S. Coast Guard operates its ISC along the GIWW at the Michoud Slip as a tenant of the MAF. The ISC at this location provides industrial services, health services, personnel services, and engineering services among other functions. Preliminary communications with the ISC indicate no navigational concerns by construction of the proposed flood control structure.

Commercial Fishing

The project area is in the vicinity of the saltwater/freshwater line as designated by the LDWF (LDWF 2008). The LDWF identifies two commercial marine boat launches in the project area:

- Bayou Bienvenue Boat Launch
- Bayou Bienvenue Marina, 2001 Paris Road

The following facilities also exist in the vicinity:

- Gulf Outlet Marina Boat Launch, 316 Marina Road (off Paris Road)
- Bait Incorporated, 2001 Paris Road

The state estimates that Hurricanes Katrina and Rita destroyed more than $528 million in fisheries infrastructure in Louisiana's fishing communities with millions more in losses to supporting industries. Studies conducted by the National Oceanic and Atmospheric Administration estimate that Hurricane Katrina alone generated more than $1.3 billion of economic loss on Louisiana's fishing industry. The Louisiana Recovery Authority (LRA) is providing nearly $19 million of funding for 15 infrastructure improvement projects to repair the heavily damaged fisheries industry across South Louisiana (LRA 2008). In addition Louisiana fishermen may be eligible for grants, loans and direct aid to assist in recovering from hurricanes Katrina and Rita through programs sponsored by The Louisiana Recovery Authority, Louisiana Economic Development and Louisiana Department of Wildlife and Fisheries (LRA 2008).

According to the Louisiana Seafood Promotion and Marketing Board, there are approximately 24 seafood suppliers in Orleans and St. Bernard Parishes. Nineteen facilities are in Orleans Parish and five are in St. Bernard Parish. There are approximately 15 additional suppliers in surrounding areas such as Jefferson Parish (LSPMB 2008).

According to the Louisiana Department of Wildlife and Fisheries, there are over 700 resident commercial fishermen licenses issued for St. Bernard Parish with over 750 resident vessel licenses (LDWF 2008b). Additional permit data are provided in table 13.

Table 13: Commercial Licenses, State of New Orleans

Parish	*Permit Type*						
	Resident Commercial Fisherman	Resident Vessel License	Resident Shrimp Trawl	Resident Oyster Harvester	Resident Crab Trap	Resident Skimmer Net	Resident Shrimp Gear Fee
Orleans	330	303	285	6	94	156	225
St. Bernard	733	757	285	200	280	463	443

Source: Louisiana Department of Wildlife and Fisheries 2008c.
(Note: Data for year 2005. Data post 2005 not made available from LDWF).

Within the State of Louisiana, recreational and commercial fishing provide substantial economic impact. The Louisiana Department of Wildlife and Fisheries estimates the state-wide economic impact of recreational fishing in 2006 resulted in $1.71 billion total economic effect, with commercial fishing resulting in $2.4 billion total economic effect (LDWF 2008d). Additional data are presented in table 14.

Table 14: Economic Benefit of Fisheries in State of Louisiana, 2006				
Activity	Retail Sales	Total Economic Effect	Jobs Supported	State and Local Tax Revenues
Recreational Fishing	1.06 billion	$1.71 billion	18,122	$114.1 million
Wildlife Viewing, Photography, and Feeding.	312.4 million	$517.1 million	6,199	$32.3 million
Recreational Boating	981.6 million	$1.33 billion	14,959	$80.8 million
Commercial Fisheries	1.8 billion	$2.4 million	26,915	$170.5 million
Source: Louisiana Department of Wildlife and Fisheries 2008d				

The GMFMC identifies the project area as containing EFH (as discussed in the EFH section 3.2.6). EFH is identified for postlarval, juvenile, and sub-adult stages of brown shrimp, white shrimp, and red drum, as well as for adult stages of those species in the nearshore and offshore reaches. Commercially important estuarine and marine species of red drum, spotted seatrout, Gulf menhaden, brown shrimp, and white shrimp are found in the project area (USFWS 2008). Additional discussion on fishery resources is provided in the Fisheries section 3.2.5 of this document including a discussion of the commercial species in the area, and landings data for 2005 and 2006 for the state.

There are no oyster leases in Bayou Bienvenue. There are productive oyster leases in Lake Borgne, but they end at the Lake Borgne shoreline.

<u>Discussion of Impacts</u>

Proposed Action: Alternative 4a - MRGO Structure, GIWW and Bayou Bienvenue Gates, and Structural Wall Barrier in Alignment 4

Direct Impacts to Socioeconomics

The cost of constructing the proposed action would be approximately $828 million with approximately 350 jobs at construction peak. Construction activities would have impacts to industrial property owners around the Michoud Canal ranging from temporary construction impacts, to loss of land due to the need to acquire additional ROW. All of the alignments would need to tie into the existing levee system. Construction access would require laydown areas and staging areas totaling approximately 45 acres of land. Alignment 4 could adversely affect operations of the Cashman Scrap and Salvage operations which has a yard with water access along the GIWW.

Barge traffic along the GIWW would remain functional during construction. Temporary construction impacts could be reasonably foreseeable; therefore, CEMVN is cognizant of the need to minimize any operational impacts to barge traffic. The GIWW would remain operational during construction. On-site construction management would be coordinated closely with the Coast Guard and GIWW navigators to minimize operational impacts. With the MRGO closure at Bayou La Loutre, deep draft navigation would remain functional for uses such as the Port of New Orleans up to the Michoud Canal on the GIWW.

Because construction activity would be occurring through at least two hurricane seasons, storm impacts to navigation would be avoided through implementation of project safety plans to be put into place to secure construction equipment such as barges and cranes during a hurricane.

The GIWW sector gate is designed to open and close within 30 minutes. This operational time would allow a reasonable LOS to accommodate barge traffic. The proposed new sector gate would remain in an open position except when closed due to hurricane conditions and maintenance activities. The GIWW sector gates could be re-opened within 30 minutes to allow barge traffic to move through the GIWW to help distribute supplies which might be needed for recovery operations. The GIWW sector gate would be installed in the area of the cofferdam adjacent to the GIWW bypass swing gate to provide a 150 ft wide navigation pass. The bypass gate could be operated under a number of scenarios after completion of the final configuration sector gate, which would involve varying degrees of economic and labor burden on the non-Federal sponsor. The bypass gate could remain closed at all times, except during times in which the sector gate is closed for maintenance and the bypass would serve as a navigational bypass. This would minimize the operational costs of the structure. The bypass gate could instead remain open all of the time to provide maximum navigational use, except during storm events or maintenance activities. The gate could also be operated seasonally to optimize navigation and operational costs, leaving the gate open during non-hurricane season and closing it for the entire hurricane season.

Impacts to local commercial and recreational fishing operations could be more pronounced. The proposed action could temporarily restrict access along Bayou Bienvenue during construction (a duration of approximately two years). While the project would not preclude recreational and commercial fishing, it would affect access, and as such, could adversely affect operations of local marinas positioned inland in areas of St. Bernard Parish. For example, during construction, fisherman may elect alternative entry points to avoid the in-water construction. Although only a temporary impact due to construction, it could lead to loss of localized business and longer-term economic impact to the localized marinas.

In order to further evaluate potential impacts to local commercial fishermen, the CEMVN conducted focused outreach with known local marina operators with input from the Louisiana Department of Wildlife and Fisheries to seek to understand localized impacts of the alternatives, specifically associated with the temporary construction impacts at Bayou Bienvenue (USACE 2008e and LDWF 2008b).

In summary, CEMVN recognizes a localized, temporary, but important impact, especially for operators who are located in inland St. Bernard Parish and depend on access through the existing Bayou Bienvenue gate. While the proposed construction would not preclude access, it would result in the need for fishing boats to take alternative routes from the existing Bayou Bienvenue gate to reach Lake Borgne given the closure of the MRGO. Navigational access would remain available through the GIWW during construction. Following construction, local fishing boats would need to navigate two gates on Bayou Bienvenue.

At least two local operators indicated that a temporary construction closure along Bayou Bienvenue would have little impact on their fishing operations. Vessels using these facilities include shrimp boats and recreational boats with drafts ranging up to 5 ft. Such vessels could divert around the construction area but would experience an additional passage time of approximately an hour. Actual additional mileage varies based on the alternate route selected by the vessel operators. However, neither of these two operators believed that to be a substantial economic impact given that this would be a temporary condition.

At least one local operator believes impacts would be more adverse given the existing loss of business since Hurricane Katrina. Approximately half of their business has been lost. Vessels using this facility include recreational vessels, flatboats and double riggers, with depths ranging from 1 to 5 ft. Vessel traffic from this marina seeks a route to Lake Borgne and would likewise require diversion along the GIWW during the time required for construction of the new gate on Bayou Bienvenue. This would add an approximate additional one hour of travel time. However, this operator believes that this incremental impact could be sufficient to cause fishermen to seek other marinas for launch points closer to Lake Borgne that would not have this delay. This operator believes that his business might be reduced to the point of necessitating closure of his operation.

Indirect Impacts to Socioeconomics

The local economy could see direct beneficial impacts in terms of use of local materials and human resources and an overall beneficial impact to reconstruction efforts in New Orleans. However, due to a relatively tight labor market, there may not be adequate local human resources for the construction activities and some construction workers may need to be brought in from other areas. This could be beneficial for the local economy in terms of short-term housing. However, due to the current limited supply of short-term housing, it could also adversely affect residents looking for rental housing while recovery efforts are underway. Additional demand could drive up rental prices which are already high. Overall, however, the influx of additional construction workers would be expected to provide positive economic benefits to area support services such as food, lodging, and entertainment venues.

The project design and construction team has a goal to use approximately 40 percent local small business to enhance the local economic impact estimated at approximately $186M. The project design/construction team includes the following local contractors: INCA Gerwick (Metairie), Linfield Hunter and Junis, Eustis Engineering (Metairie), Boh Bros. (New Orleans), Canjun Constructors (Baton Rouge), M.R. Pittman (Harahan), and J. Ray McDermott (New Orleans).

Cumulative Impacts to Socioeconomics

The proposed action is only part of the broader GNOHSDRRS which includes, among other actions, IER 4 (Orleans East Bank Lakefront Levees), IER 5 (Permanent Protection for the 17th

Street, Orleans Avenue and London Avenue Canals), IER 6 and 7 (Citrus Lakefront Levee and New Orleans East Levee, Maxent Canal to Michoud Slip) IER 8 (Bayou Dupre Flood Control Structure), IER 9 (Caernarvon Floodwall) and IER 10 (providing protection along the MRGO in St. Bernard Parish). Taken together, the USACE Comprehensive Hurricane Protection Plan for Coastal Louisiana has an objective to build hurricane resistant communities in Southeast Louisiana. The completed GNOHSDRRS will consist of a combination of floodwalls, levees, gates, pump stations and closure structures. The Corps estimates the total cost at approximately $14.6 billion. The GNOHSDRRS plan will provide a 100-year Level of Protection and involves many projects all working towards a common goal. When the GNOHSDRRS is completed, the elevations will provide the levels of protection necessary for certification in the National Flood Insurance Program (NFIP). This would provide a positive economic impact for all of New Orleans area including St. Bernard Parish and Orleans Parish. This project will provide protection for the residential areas of St Bernard Parish, New Orleans East, Orleans East Bank and the associated industrial and commercial uses in these areas. Given the proposed level of 100-year protection, it is reasonably foreseeable that the cumulative impacts of all of these actions could result in future commercial/industrial expansion around the IHNC.

To achieve this level of protection, however, cumulative impacts will result over the course of the entire GNOHSDRRS. With respect to socioeconomic impacts, perhaps the most notable cumulative impact would be temporary closures of navigation routes currently used, such as the Bayou Dupre Control Structure. While these closures would not be permanent, they could be affected for two or more years. During this time, fishermen would need to seek alternate routes which could have temporary economic impacts to marina operators and fishermen.

Alternative 4b – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Geotextile Levee Barrier in Alignment 4

Direct, Indirect and Cumulative Impacts to Socioeconomics

With respect to socioeconomic resources, the primary difference among alternatives 4a and 4b would be the length of construction time. A construction project that takes a longer time would mean longer-term presence of construction workers in the local vicinity, but a longer time to reach the overall 100-year level of protection for the broader area.

Alternative 1 – Deep Draft Gate in Alignment 1

Direct Impacts to Socioeconomics

The project cost for the in-water construction, raising the existing levees and floodwalls, and replacing Bayou Bienvenue Control Structure could range from $2 billion to $2.24 billion.

Construction activities would have impacts to industrial property owners around the Michoud Canal ranging from temporary construction impacts, to loss of land due to the need to acquire additional ROW. All of the alignments would need to tie into the existing levee system which would impact adjacent industries. Access could result in impacts primarily to the Entergy electric station.

Other direct impacts would be as described previously for alternative 4.

Indirect Impacts to Socioeconomics

Alignments 1 and 2 are the only options that allow for deep draft navigation. However, with the MRGO closure at Bayou La Loutre, future deep draft along this portion of the GIWW would be limited to deep draft vessels accessing Michoud Canal. No additional indirect impacts have been identified other than as previously described for alternative 4.

Cumulative Impacts to Socioeconomics

No additional cumulative impacts have been identified other than as previously described for alternative 4.

Alternative 2 – Deep Draft Gate in Alignment 2

Direct Impacts to Socioeconomics

The project cost for the in-water construction, raising the existing levees and floodwalls, and replacing Bayou Bienvenue Control Structure could range from $1.77 billion to $1.84 billion.

Construction activities would have impacts to industrial property owners around the Michoud Canal ranging from temporary construction impacts, to loss of land due to the need to acquire additional ROW. All of the alignments would need to tie into the existing levee system which would impact adjacent industries. Access routes to the site could result in impacts primarily to the NASA facility.

Indirect Impacts to Socioeconomics

Alignments 1 and 2 are the only options that allow for deep draft navigation. However, with the MRGO closure at Bayou La Loutre, very limited deep draft navigation is reasonably foreseeable along this portion of the GIWW. No additional indirect impacts have been identified other than as previously described for the proposed action. The location at the confluence of the MRGO and GIWW has potential for cross-flow currents making it difficult to navigate safely through the structure at this location. The proximity to the Michoud Slip makes the tight turn difficult for navigation.

Cumulative Impacts to Socioeconomics

No additional cumulative impacts have been identified other than as previously described for the proposed action.

Alternative 3a – MRGO Structure, GIWW Gate, and Structural Wall Barrier in Alignment 3

Direct Impacts to Socioeconomics

The project cost for this alternative could range from $688 million to $722 million.

Alignment 3 presents adverse operational impacts to the existing Air Products hydrogen pipeline. A description of the activities associated with relocation is provided in section 2.4 of this document (Alternatives). This supply line would need to be relocated resulting in additional cost and schedule impacts for the project and also possibly affecting supply and distribution of this pipeline which has important implications for homeland security. The outage would be approximately four to ten days due to purging, plant shutdown, and tie-in work. It would have adverse production and economic impacts on the plant itself as well as the Murphy and Chalmette refineries. In case of an outage due to relocation, the estimated economic loss to the Air Products facility would be approximately $750,000 per day. Estimated economic loss to the Chalmette refinery would be approximately $2,000,000-per day and to Murphy Oil would be approximately $1,000,000 per day.

The cost of directionally drilling the lines under that navigational canals and trenching through the marsh would be approximately $7M. It would take approximately six months to one year for Air Products to perform land acquisition, acquire ROW, conduct parish reviews, and complete the permit process. The construction time of the relocation would be four to six weeks.

None of the other alternatives would adversely affect the Air Products pipeline or its operations.

Alignment 3 could result in a tight turning radius to move up the Michoud Canal once passing through the GIWW gate.

Indirect Impacts to Socioeconomics

No additional indirect impacts have been identified other than as previously described for the proposed action.

Cumulative Impacts to Socioeconomics

No additional cumulative impacts have been identified other than as previously described for the proposed action.

Alternative 3b – MRGO Structure, GIWW Gate, and Geotextile Levee Barrier in Alignment

For the purposes of the socioeconomic analysis, there is no appreciable difference between alternatives 3a and 3b.

Alternative 5a – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Structural Wall Barrier in Alignment 5

Direct Impacts to Socioeconomics

The project cost for this alternative could range from $1 billion to $1.1 billion. Construction activities under alternative 5a would have impacts to industrial property owners around the Michoud Canal ranging from temporary construction impacts, to loss of land due to the need to acquire additional ROW. All of the alignments would need to tie into the existing levee system.

Indirect Impacts to Socioeconomics

No additional indirect impacts have been identified other than as previously described for the proposed action.

Cumulative Impacts to Socioeconomics

No additional cumulative impacts have been identified other than as previously described for the proposed action.

Alternative 5b – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Geotextile Levee Barrier in Alignment 5

For the purposes of the socioeconomic analysis, there is no appreciable difference between alternatives 5a and 5b. Additional time and materials would be required for construction of alternative 5b resulting in a higher project cost, but increased indirect benefits to the local economy due to a longer presence of construction contractors.

3.4 ENVIRONMENTAL JUSTICE

The impacts to EJ from the proposed and alternative actions were evaluated in accordance with the following:

- Executive Order 12898 ("Federal Actions to Address Environmental Justice in Minority Population and Low-Income Populations," 1994) and
- "Department of Defense's Strategy on Environmental Justice" (24 March 1995).

Per the above directives, the EJ analysis evaluated, as appropriate, disproportionate and adverse human health or environmental effects of the project on minority and low-income populations. The methodology to accomplish this includes identifying low-income and minority populations within the study area, as well as community outreach activities such as small neighborhood focus meetings. Identification of minority and low-income population commences with analysis of demographic data, followed by drive by surveys and small neighborhood focus meetings.

Census Block Group statistics from the 2000 Census and Environmental Systems Research Institute (ESRI) estimates were utilized for environmental justice data analysis. Detailed discussion of demographic and income data along with pertinent maps, tables and photographs are available for review.

Existing Conditions

According to the 2000 Census and 2007 ESRI estimates, the area within a one-mile radius of the project's footprint, in various reaches of the project work, includes low-income or minority communities. The minority population is greater than 50 percent, and is not substantially different than the percentage of minorities within Orleans Parish, the primary project area. Similarly, the percentage of the population living below the poverty line was comparable to the Parish figure and significantly lower than the State figure for 2000. Areas in St. Bernard Parish within a one-mile radius of the project footprint are uninhabited. Based on the available descriptions of the project and work site locations, the area within a one-mile radius of the project's footprint, in various reaches of the work in Orleans Parish and St. Bernard Parish, are either primarily industrial in nature or are uninhabited.

Analysis of Environmental Justice Impacts

Some reaches of this project, particularly adjacent to the proposed action and alternative 5a and 5b, include uninhabited land only in both Orleans and St. Bernard Parishes. However, it is noted that both 2000 Census data and 2007 ESRI estimate show presence of significant minority and low-income population within the project area of the IHNC and GIWW and vicinity in Orleans Parish.

Aerial photos were utilized to confirm the presence or absence of habitation in the various reaches, and are utilized in environmental justice analysis. Therefore, environmental justice impacts are being considered in the area of concern shown by 2007 ESRI estimate.

Discussion of Impacts

Proposed Action: Alternative 4a - MRGO Structure, GIWW and Bayou Bienvenue Gates, and Structural Wall Barrier in Alignment 4

Direct, Indirect and Cumulative Impacts to Environmental Justice

The north end of this alignment abuts an industrial area, while the remaining portion of barrier, gate, and closure structure are located in and around uninhabited land. Therefore, this alternate is not anticipated to exert any direct, indirect or cumulative impacts on low-income and minority populations. CEMVN has made a determination of no disproportional impacts to minority or low income populations under the proposed action.

Alternative 4b – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Geotextile Levee Barrier in Alignment 4

Direct, Indirect, and Cumulative Impacts to Environmental Justice

The impacts from this alternative would be similar to those described above for the proposed action.

Alternative 1 – Deep Draft Gate in Alignment 1

Direct, Indirect, and Cumulative Impacts to Environmental Justice

The impacts from this alternative would be similar to those described above for the proposed action.

Alternative 2 – Deep Draft Gate in Alignment 2

Direct, Indirect, and Cumulative Impacts to Environmental Justice

The impacts from this alternative would be similar to those described above for the proposed action.

Alternative 3a – MRGO Structure, GIWW Gate, and Structural Wall Barrier in Alignment 3

Direct, Indirect, and Cumulative Impacts to Environmental Justice

The impacts from this alternative would be similar to those described above for the proposed action.

Alternative 3b – MRGO Structure, GIWW Gate, and Geotextile Levee Barrier in Alignment

Direct, Indirect, and Cumulative Impacts to Environmental Justice

The impacts from this alternative would be similar to those described above for the proposed action.

Alternative 5a – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Structural Wall Barrier in Alignment 5

Direct, Indirect, and Cumulative Impacts to Environmental Justice

This alignment is located in and around uninhabited areas. Therefore, this alternate is not anticipated to exert any direct and indirect impacts on low-income and minority populations.

Alternative 5b – MRGO Structure, GIWW and Bayou Bienvenue Gates, and Geotextile Levee Barrier in Alignment 5

Direct, Indirect, and Cumulative Impacts to Environmental Justice

The impacts from this alternative would be similar to those described above for Alternative 5a.

3.5 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE

The USACE is obligated under 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 the proposed action. ER 1165-2-132 identifies CEMVN HTRW policy to avoid the use of project funds for HTRW removal and remediation activities. Costs for necessary special handling or remediation of wastes (e.g., Resource Conservation and Recovery Act [RCRA] regulated), pollutants, and other contaminants, which are not regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), will be treated as project costs if the requirement is the result of a validly promulgated Federal, state, or local regulation.

An American Society for Testing and Materials (ASTM) International E 1527-05 Phase I Environmental Site Assessment (ESA) was completed for the project area(s). A copy of the Phase I ESA will be maintained on file at CEMVN. The Phase I ESA documented the Recognized Environmental Conditions (RECs) for the proposed project areas, and a Phase II was conducted to further analyze suspected contaminants. If a REC cannot be avoided, due to construction requirements, CEMVN may further investigate the REC to confirm the presence or absence of contaminants, and actions to avoid possible contaminants. Federal, state, or local coordination may be required.

An ASTM E 1903-97 Phase II ESA was completed to further verify the nature of sediments at proposed construction footprint(s) of the closure gates in the proposed action area(s). The Phase I and Phase II ESAs referenced below will be maintained on file at CEMVN and are incorporated herein by reference. Copies of the reports are available by requesting them from CEMVN, or accessing them at www.nolaenvironmental.gov.

The following Phase I and Phase II ESAs were prepared for CEMVN in November 2006 (Phase I ESAs) and December 2007 (Phase II ESA) in accordance with ASTM International E 1527-05, ASTM E 1903-97 and USACE ER 1165-2-131 (Materials Management Group 2006a; 2006b; 2006c; 2007):

- Final Phase I ESA – GIWW and MRGO Option 1 Corridor (East of Michoud Canal and East of Bayou Bienvenue), New Orleans, Louisiana.

- Final Phase I ESA – GIWW and MRGO Option 2 Corridor (Chef Menteur Area and East of Bayou Dupre), New Orleans, Louisiana.

- Final Phase II ESA – Proposed Closure Structures – Seabrook, GIWW-MRGO, Michoud Slip, New Orleans, Louisiana.

These ESAs are located within the study area. Relevant and significant findings and recommendations are summarized below.

Final Phase I ESA – Option 1 Corridor

The site investigated under this ESA includes locations of proposed gate east of the Michoud Canal and closure east of Bayou Bienvenue as well as the corridor connecting these two proposed gates. The Phase 1 ESA revealed one REC including five barges (with two sunken) located approximately 200 yards east of the Michoud Canal at the Borgne 1 proposed action area. At the time of site investigation in October 2006, one barge was surrounded by a boom.

Any contamination associated with the barges at their location within the GIWW has been investigated and results are included in the Final Phase II ESA discussion below.

Final Phase I ESA – Option 2 Corridor

The site investigated under this ESA includes locations of proposed gate at the Chef Menteur area along GIWW and closure at the Bayou Dupre along the MRGO. The site investigation also includes the corridor between Chef Menteur. By following the USEPA's All Appropriate Inquiry (AAI) and ASTM Phase 1 guidelines, the ESA revealed no evidence of RECs that could potentially impact the project area.

Final Phase II ESA – Proposed Closure Structures – Seabrook, GIWW-MRGO, Michoud Slip

The possible construction sites of the proposed action(s) investigated under this ESA are: (a) at the confluence of the IHNC and Lake Pontchartrain (near Seabrook Bridge); (b) at the confluence of the MRGO and the GIWW (east of the Bayou Bienvenue-Michoud Canal corridor) as well as the former barge area near the Michoud Canal; and (c) east of the Michoud Slip. The Phase II ESA investigated baseline conditions of the project area.

Based on sampling and testing of sediment collected from a total of 21 boring locations, if sediment at possible construction footprints of the proposed action or closure gates were excavated or dredged, and subject to land management and disposal, only one location with unacceptable concentrations of contaminants was located. Concentrations of all contaminants tested on the Borgne 1 area including but not limited to volatiles, semi-volatiles, polychlorinated biphenyls (PCBs), herbicides and pesticides are below risk levels.

Phase I Environmental Site Assessment Update Reports

In accordance with USACE HTRW Guidance for Civil Works Projects (ER-1165-2-132) and American Society for Testing Materials Standard for Phase I ESA Investigations (ASTM E 1527-05), a site inspection, interviews, and review of environmental data was performed. The site was inspected to assess the current conditions and determine if any changes have occurred since the March 2007 Phase I ESA.

In July 2008 a limited Phase II ESA was conducted on the subject site. Because the proposed work site had some potential for contaminants, the work area was further assessed, first to minimize the possible health and safety risks to construction personnel on the project, and second, to facilitate the proper disposal of any excavated material. Two RECs had been identified on adjacent properties that had the potential to influence the subject site, which the Corps plans to use for construction material and equipment staging. The BOC Gas site is considered a Historical REC and the US Filter site is considered a REC.

BOC Gases was a leaking underground storage tank (LUST) facility that is adjacent to the site from both the north and the east. The tank leak was from an area approximately a hundred feet from either site border. The facility was been given a No Further Action Required (NFA) status from the Louisiana Department of Environmental Quality (LDEQ). The potential migration of contamination off-site is not currently a concern, but past impacts from the adjacent site may still be a concern at the subject site, so BOC Gas is considered a Historic REC.

The US Filter site was also identified as containing a LUST. The site operators reported a release from a drain line in April 2003. Subsequent soil and groundwater sampling and monitoring from July 2003 to the present identified and confirmed the presence of concentrations of diesel range organics, gas range organics, benzene, xylenes, 2-methylnaphthalene, and poly-aromatic hydrocarbons (PAHs), exceeding the LDEQ Risk Evaluation/Corrective Action Program (RECAP) standard under Management Option 1 (MO-1) for soil. Monitoring is on-going at the site. In addition to the above release, the site was assessed during the Hurricane Katrina emergency response and multiple releases were observed from point sources of contamination at the site due to the effects of the Hurricane Katrina. Post-assessment at the site identified five areas of concern that were remediated by source removal. No further contamination was identified after the soils were removed. Based on the information reviewed, the site is considered a REC impacting the subject site.

The soil sampling effort conducted at the subject site were aimed at addressing the two identified environmental concerns, specifically that contaminants had not migrated onto the site from either US Filter or BOC Gas. The effort provided results on the chemical composition of the staging area soil, which were evaluated, with consideration to the anticipated land-use (industrial - construction), to ensure that the material does not pose unacceptable risk. The evaluation was based upon a comparison of the analytical results with applicable screening standards under the 2003 LDEQ RECAP.

With the exception of one low level concentration of benzene, no chemicals of concern were found to exist at the site above RECAP Screening Standards. The benzene was detected in one composite sample. The concentration did not exceed the RECAP screening standard for non-industrial exposure (protective of direct contact with the soil). However, the concentration was just above the limiting RECAP standard for soil protective of groundwater (0.091 mg/kg and 0.051 mg/kg, respectively). Benzene was not detected in a split sample that was collected from the same composite sample. Therefore, it is likely that the low level benzene contamination is in an extremely localized area and does not present a potential impact to groundwater.

Based on the results of the investigation contaminants have not migrated onto the site from either US Filter or BOC Gas. The site does not present an unacceptable risk to construction personnel or to the environment. Further environmental investigation of this site is not warranted at this time.

4.0 CUMULATIVE IMPACTS

NEPA requires a Federal agency to consider not only the direct and indirect impacts of a proposed action, but also the cumulative impacts of the action. Direct, indirect and cumulative impacts of the proposed action are evaluated specifically for each IER, but will also be addressed within the draft CED that is being prepared by the CEMVN. A cumulative impact is defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions (40 CFR 1508.7)." Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Cumulative impacts were addressed for each alternative and resource in the preceding sections.

4.1 METHODOLOGY

To successfully assess cumulative impacts, a broad range of activities and patterns of environmental changes that are occurring in the vicinity of the project were considered. The following items were guidelines for the cumulative impact analyses in this document:

- the proximity of the projects to each other either geographically or temporally.

- the probability of actions affecting the same environmental resource, especially systems that are susceptible to development pressures.

- the likelihood that the project will lead to a wide range of effects or lead to a number of associated projects.

- whether the effects of other projects are similar to those of the project under review the likelihood that the project will occur.

- temporal aspects, such as the project being imminent.

4.2 DESCRIPTIONS OF PROJECTS CONSIDERED

Rebuilding efforts as a result of Hurricane Katrina are taking place throughout southeast Louisiana and along the Mississippi and Alabama Gulf Coast. The Insurance Information Institute (III) has estimated that the total insured losses from Hurricane Katrina were $40.6 billion in six states, and in Louisiana the insured losses are estimated at $25.3 billion (III 2007); much of those insured losses would be a component of the regional rebuilding effort. Although the full extent of construction in Orleans and St. Bernard Parishes and throughout the Gulf Coast over the next 5 to 10 years is unknown, a large-scale rebuilding effort is underway.

The Water Resources Development Act of 2007 (WRDA 07) became law in November 2007. This bill authorized several additional projects and studies in the general vicinity of the IER # 11 Tier 2 Borgne project area and could contribute to cumulative impacts. WRDA 07 included authorization of the LPV and WBV GNOHSDRRS projects to raise protection levels to 100-year levels, as well as coastal restoration projects, Morganza-to-the-Gulf hurricane protection, hurricane protection in Jean Lafitte and lower Jefferson Parish, a study of coastal area damage that could be attributable to the Army Corps of Engineers, the MRGO deep-draft deauthorization, an EIS for the IHNC lock, and the formation of a Coastal Louisiana Ecosystem Protection and Restoration Task Force (Alpert 2007). The majority of these projects or studies still require specific appropriations. The WRDA does not guarantee financing of these projects, but does allow Congress to allocate money for them in future spending bills (Alpert 2007). These additional projects could contribute to resource impacts, either adversely or with long-term positive impacts.

As indicated previously, in addition to this IER, the CEMVN is preparing a draft CED that will describe the work completed and the work remaining to be constructed. The purpose of the draft CED will be to document the work completed by the USACE on a system-wide scale. The draft CED will describe the integration of individual IERs into a systematic planning effort. Overall cumulative impacts, a finalized mitigation plan, and future operations and maintenance requirements will also be included. The following discussion describes an overview of other actions, projects, and occurrences that may contribute to the cumulative impacts previously discussed.

4.2.1 CEMVN GNOHSDRRS IERs

Federal hurricane damage risk reduction for the greater New Orleans area is referred to as the GNOHSDRRS and is divided into three USACE authorized projects: 1) LPV; 2) WBV; and 3) New Orleans to Venice (NOV). The NOV and WBV projects have no or limited discussion in this IER because their alignments are not located within the project region and, with the exception of some positive cumulative impacts to socioeconomics, these projects would not greatly increase cumulative impacts. The various projects that make up the LPV projects include the construction of 125 miles of levees, concrete floodwalls and other structures. Many of these projects are broken out by area and referred to by their IER document number. Figure 41 shows LPV and WBV IER projects. A summary of the projects that fall within the New Orleans Metropolitan area is provided below:

- **IER #1, LPV, La Branche Wetlands Levee St. Charles Parish, Louisiana** – evaluates the potential impacts associated with raising approximately 9 miles of earthen levees; replacing over 3,000 ft of floodwalls; rebuilding, modifying or closing five drainage structures; and modifying one railroad gate along the existing levee system on the north side of U.S. 61 (Airline Hwy) between the Bonnet Carré Spillway and the northwest end of the Louis Armstrong New Orleans International Airport near the St. Charles/Jefferson Parish line. A Decision Record was signed for this project on 9 June 2008.

- **IER #2, LPV, West Return Floodwall Jefferson and St. Charles Parishes, Louisiana** – evaluates the potential impacts associated with the proposed replacement of 17,900 ft (3.4 miles) of floodwalls along the line between Jefferson Parish and St. Charles Parish in the northeastern portion of the Mississippi River deltaic plain. The project area is adjacent to the Parish Line Canal from the north side of the Louis Armstrong New Orleans International Airport to the south shore of Lake Pontchartrain. A Decision Record was signed for this project on 18 July 2008.

- **IER #3, LPV, Jefferson East Bank, Jefferson Parish, Louisiana** – evaluates the potential impacts associated with the proposed rebuilding of 9.5 miles of earthen levees, upgrading of the foreshore protection, the replacement of two floodgates, and the construction of fronting protection and construction or modification of breakwaters at four pumping stations just east of the St. Charles Parish and Jefferson Parish line to the western side of the 17th St. Canal. A Decision Record was signed for this project on 25 June 2008.

- **IER #4 , LPV, New Orleans Lakefront Levee, West of the IHNC Orleans Parish, Louisiana** – evaluates the potential impacts associated with the replacement of 15 vehicle access gates, and one sector and one pedestrian gate located along the south shore of Pontchartrain in Orleans Parish between the 17th Street Canal and the IHNC.

- **IER #5, LPV, New Orleans East, New Orleans Lakefront Levee to Citrus Lakefront Levee, N.O. Airport Floodwall to Paris Road, Orleans Parish, Louisiana** – investigates a range of alternatives to protect Orleans and Jefferson Parish from storm surge induced flooding through the 17th Street, Orleans Avenue, and London Avenue Outfall Canals, while not impeding the ability of the area's internal drainage system to remove stormwater. The alternatives under evaluation include improvement of floodwalls along these canals to the 100-year level of protection or providing a closure structures and pump stations at or near Lake Pontchartrain. Some possible locations being considered for these pump stations could include construction in Lake Pontchartrain.

- **IER #6, LPV, New Orleans East, New Orleans Lakefront Levee to Citrus Lakefront Levee, N.O. Airport Floodwall to Paris Road, Orleans Parish, Louisiana** – investigates improvement of approximately six miles of levees, floodwalls, and floodgates that extend from the IHNC and the New Orleans Lakefront Airport east to Paris Road – locally known as the Citrus Lakefront. Foreshore protection enhancements along this reach could include the dredging of access channels in Lake Pontchartrain.

- **IER #7, LPV, New Orleans East, New Orleans East Lakefront Levee to New Orleans East Back Levee, Paris Road to East bank of Michoud Canal, Orleans Parish, Louisiana** – investigates improvement of approximately 19.3 miles of levee and three floodgates stretching from the New Orleans East Lakefront Levee to New Orleans East Back Levee – CSX Railroad to Michoud Canal. This portion of the LPV HPS encompasses a large portion of the Bayou Sauvage NWR. Alternative alignments under consideration include realignment along the Maxent Canal east of Bayou Sauvage NWR. The northern portion of this reach could include foreshore protection enhancements requiring dredged access channels in Lake Pontchartrain.

- **IER #8, LPV, Bayou Dupre Control Structure, St. Bernard Parish, Louisiana** – involves improvement or replacement of the Bayou Dupre Floodgate. Alternatives under consideration include the construction of new structures on either the flood side or protected side of the existing floodgate.

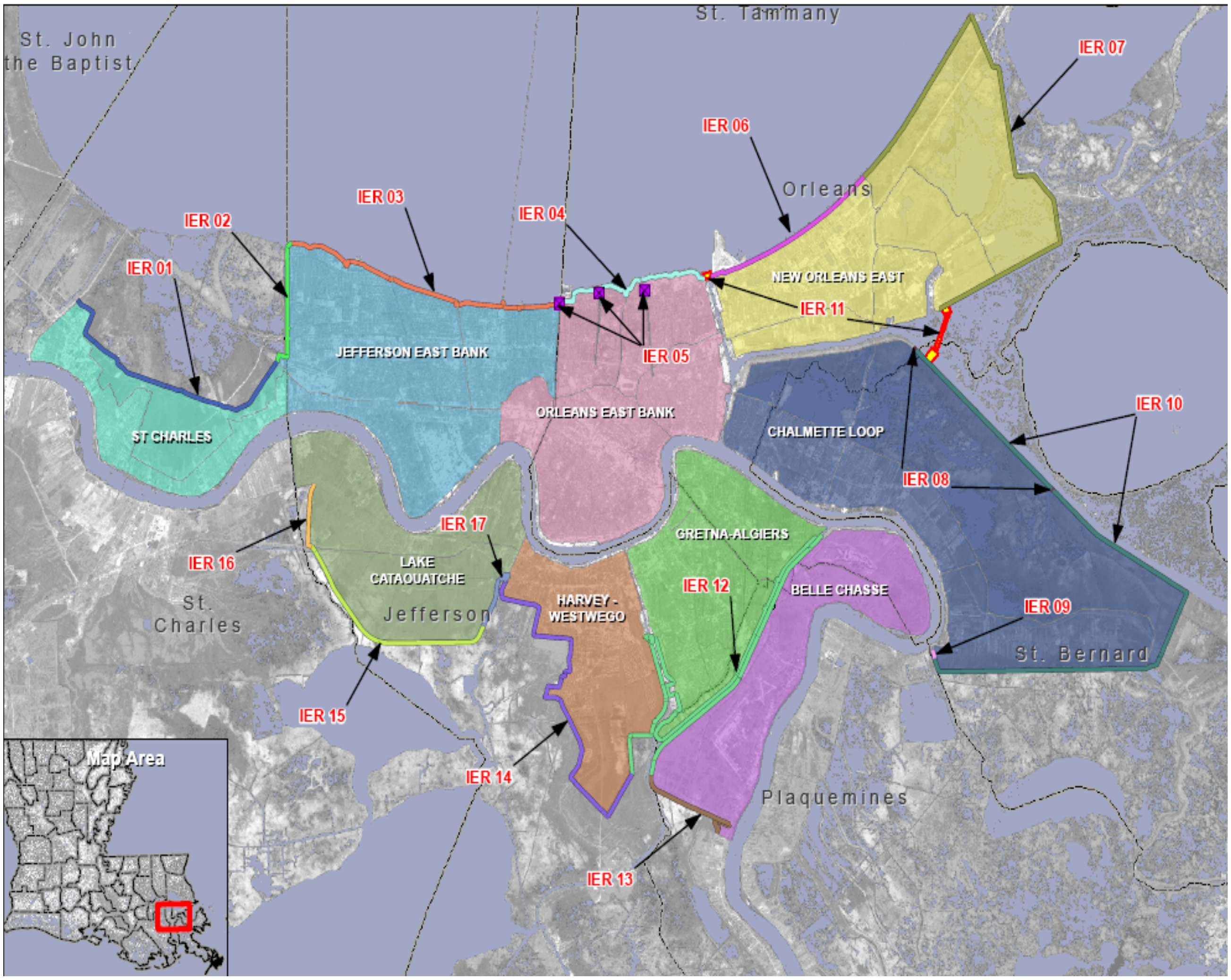

Figure 41. GNOHSDRRS Lake Pontchartrain and Vicinity and West Bank and Vicinity IER Projects

- **IER #9,LPV, Caernarvon Floodwall, St. Bernard Parish, Louisiana** – evaluates a range of alignments as part of improvements to the Caernarvon floodwall. Depending on the chosen alignment there could be major impacts to infrastructure, residences, and wetlands; however, the proposed action alignment would seek to minimize these impacts.

- **IER # 10, LPV, Chalmette Loop Levee, St. Bernard Parish, Louisiana** – evaluates alternatives for improving the Chalmette Loop HPS.

- **IER # 11 Tier 2 Lake Pontchartrain, LPV, IHNC, Orleans Parish, Louisiana** – evaluates a new structure proposed within the Pontchartrain 2 location range which extends from the Seabrook Bridge to 2,500 ft south of the bridge on the IHNC. This is the Tier 2 review for alternatives to protect against storm surge from the IHNC originating from Lake Pontchartrain. This project was initially evaluated in IER # 11, Tier 1 (USACE 2008b). A Decision Record was signed for this project on 14 March 2008.

- **IER # 12, WBV, Harvey and Algiers Canal Levee and Floodwall, Jefferson, Orleans, and Plaquemines Parishes, Louisiana** – evaluates 31 miles of levee modifications, construction of 18,800 LF of floodwalls, modifications to 18 existing gates, and fronting protection modifications to nine pump stations west of the Mississippi River.

- **IER # 13, WBV, Hero Canal Levee and Eastern Terminus, Plaquemines Parish, Louisiana –** evaluates 22,000 LF of levee improvements and the construction of 1,500 LF of floodwalls.

- **IER # 14, WBV, Harvey-Westwego Levee, Jefferson Parish, Louisiana –** evaluates 12 miles of levee, construction of 7,013 LF of floodwalls, and modifications to three pump stations.

- **IER # 15, WBV, Lake Cataouatche Levee, Jefferson Parish, Louisiana –** evaluates 8 miles of levee and fronting protection modifications for one pump station. A Decision Record was signed for this project on 12 June 2008.

- **IER # 16, WBV, Western Terminus Levee, Jefferson Parish, Louisiana –** evaluates construction of a new levee section to complete the western terminus of the West Bank Hurricane Protection Project.

- **IER # 17, WBV Company Canal Floodwall, Jefferson Parish, Louisiana –** evaluates 442 LF of floodwalls and fronting protection modifications to two pump stations.

- **IER # 18 - Government Furnished Borrow Material (GFBM), Jefferson, Orleans, Plaquemines, St. Charles and St. Bernard Parishes, Louisiana and IER # 19 - Contractor Furnished Borrow Material (CFBM), Jefferson, Orleans, St. Bernard, Iberville, and Plaquemines Parishes, Louisiana, and Hancock County, Mississippi** - The purpose of these two IERs is to identify borrow areas that contain suitable material that can be excavated to supply clay material to Federal HPS levee and floodwall projects. A

Decision Record was signed for IER #18 on 21 February 2008. A Decision Record was signed for IER #19 on 14 February 2008.

- **IER # 20, LPV Hurricane Protection Project – Mitigation: Manchac Wildlife Management Area Shoreline Protection Modification, St. John the Baptist Parish, Louisiana**. This mitigation IER will be completed when unavoidable impacts are identified within the study area from the resulting actions of the aforementioned IERs 1 – 10, as well as IER 11.

- **IER # 21, WPV Hurricane Protection Project – Mitigation.** This mitigation IER will be completed when unavoidable impacts are identified within the study area from the resulting actions of the aforementioned IERs 12-17.

- **IER # 22, Government Furnished Borrow Material # 2, Jefferson and Plaquemines Parishes, Louisiana** – evaluates the potential impacts associated with the actions taken by the USACE while excavating borrow areas for use in construction of the GNOHSDRRS. A Decision Record was signed for this project on 30 May 2008.

- **IER # 23, Pre-Approved Contractor Furnished Borrow Material # 2, St. Bernard, St. Charles, Plaquemines Parishes, Louisiana, and Hancock County, Mississippi** – evaluates the potential impacts associated with the actions taken by commercial contractors as a result of excavating borrow areas for use in construction of the GNOHSDRRS. A Decision Record was signed for this project on 5 June 2008.

- **IER # 24, Stockpile Sites for Borrow Material, Orleans and St. Bernard Parishes, Louisiana**– evaluates the potential impacts associated with the actions taken by commercial contractors as a result of stockpiling borrow material for use in construction of the GNOHSDRRS.

- **IER # 25, Government Furnished Borrow Material, Orleans, Jefferson and St. Bernard Parishes, Louisiana** – evaluates the potential impacts associated with the actions taken by the USACE while excavating borrow areas for use in construction of the GNOHSDRRS.

- **IER # 26, Pre-Approved Contractor Furnished Borrow Material, Jefferson, Plaquemines and St. John Parishes, Louisiana, and Hancock County, Mississippi** – evaluates the potential impacts associated with the actions taken by commercial contractors as a result of excavating borrow areas for use in construction of the GNOHSDRRS.

A discussion of habitat restoration, stabilization, and creation projects that would contribute to cumulative impacts to resources in the IER #11, Tier 2 Borgne study area are discussed in the following section.

Table 15 provides a summary of the cumulative impacts to be mitigated for the GNOHSDRRS projects completed (draft or final) to date. In addition to the impacts shown in table 15, approximately 170.5 acres of impacts to forested habitats, requiring mitigation would occur as part of projects for the raising of the Mississippi River Levee.

Table 15. GNOHSDRRS Impacts and Compensatory Mitigation to be Completed

IER	Parish		Non-wet BLH (acres)	Non-wet BLH AAHUs	BLH (acres)	BLH AAHUs	Swamp (acres)	Swamp AAHUs	Marsh (acres)	Marsh AAHUs	EFH (acres)
1 LPV, La Branche Wetlands Levee	St. Charles	Protected Side	-	-	-	-	137	74	-	-	-
		Flood Side	-	-	11	8	144	111	-	-	-
2 LPV, Western Return Floodwall	Jefferson, Orleans	Protected Side	-	-	-	-	-	-	-	-	-
		Flood Side	-	-	-	-	-	-	33	9	33
3 LPV, Lakefront Levee	Jefferson	Protected Side	-	-	-	-	-	-	-	-	-
		Flood Side	-	-	-	-	-	-	-	-	26
15 WBV, Lake Cataouatche Levee	Jefferson	Protected Side	-	-	24	6	-	-	-	-	-
		Flood Side	-	-	4	1	-	-	-	-	-
18 GFBM	Jefferson, Plaquemines, St. Charles	Protected Side	-	-	-	-	-	-	-	-	-
		Flood Side	-	-	-	-	-	-	-	-	-
18 GFBM	Orleans	Protected Side	226	69	-	-	-	-	-	-	-
		Flood Side	-	-	-	-	-	-	-	-	-
18 GFBM	St. Bernard	Protected Side	74	44	-	-	-	-	-	-	-
		Flood Side	-	-	-	-	-	-	-	-	-
19 CFBM	Hancock County, MS; Iberville; Orleans; Plaquemines; St. Bernard	Protected Side	-	-	-	-	-	-	-	-	-
		Flood Side	-	-	-	-	-	-	-	-	-
19 CFBM	Jefferson	Protected Side	7*	N/A	-	-	-	-	-	-	-
		Flood Side	-	-	-	-	-	-	-	-	-
22 GFBM	Jefferson	Protected Side	158	90	-	-	-	-	-	-	-
		Flood Side	-	-	-	-	-	-	-	-	-
22 GFBM	Plaquemines	Protected Side	87	29	-	-	-	-	-	-	-
		Flood Side	-	-	-	-	-	-	-	-	-
23 CFBM	Hancock County, MS; Plaquemines; St. Bernard; St. Charles	Protected Side	-	-	-	-	-	-	-	-	-
		Flood Side	-	-	-	-	-	-	-	-	-
Totals		Protected Side	552	232	24	6	137	74	-	-	-
		Flood Side	-	-	15	9	144	111	17	9	59
		Both	552	232	39	15	281	185	17	9	59

* Impacts not related to Federal action – already mitigated for through the 404 program (Section 404 of the Clean Water Act [33 USC 1344]).
- Not applicable to the IER or number impacted is 0.
AAHU – average annual habitat unit, BLH – bottomland hardwood, CFBM – contractor-furnished borrow material, GFBM – government-furnished borrow material

4.2.2 Habitat Restoration, Creation, and Stabilization Projects

4.2.2.1 Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) Program Projects

The CEMVN and other Federal and State agencies participate in coastal restoration projects through the Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA; also known as the Breaux Act). These are specific prioritized restoration projects implemented coast-wide by the USACE in cooperation with Louisiana Department of Natural Resources (LDNR), Coastal Restoration Division and other Federal agencies. Within the Lake Pontchartrain Basin, there are 14 projects proposed or constructed under CWPPRA that are designed to restore, enhance, or build marsh habitat and prevent erosion of marsh habitat. The projects involve numerous protection and restoration methods, including rock armored shoreline protection breakwaters, dredged material marsh construction, marsh terracing and planting, fresh water and sediment diversion projects, and modification or management of existing structures. Figure 42 indicates the locations of and table 16 lists and provides additional detail for CWPPRA projects near the study area.

Three federally sponsored shoreline restoration projects on Lake Borgne and the MRGO (project numbers PO 30-32) are a few of the larger CWPPRA projects within the IER #11, Tier 2 Borgne project area. The Lake Borgne and MRGO shoreline restoration projects would maintain the integrity of existing marsh that would also help preserve the existing shorelines in this area. Two projects are currently under construction, and an EIS is being developed for the remainder of the proposed work. One of the projects under construction provides a breakwater along the southern Lake Borgne shoreline from Doullut's Canal to Jahnke's Ditch. The second project under construction involves foreshore protection along the north bank of the MRGO between river miles 39.9 and 44.4. Future projects could involve wetland creation through the placement of material dredged from the water bottoms of Lake Borgne and the construction of retention dikes, where needed, to contain the hydraulically dredged material and facilitate stacking to an elevation supportive of wetland vegetation while minimizing adverse impacts to water quality.

4.2.2.2 Mississippi River Gulf Outlet Deep-Draft Deauthorization

The WRDA 07 provided for the deauthorization of the MRGO upon the submission of the USACE Chief's Report, Legislative EIS and signed ROD to Congress. On June 5, 2008, the Assistant Secretary of the Army for Civil Works forwarded said Report, LEIS and ROD to Congress. The Report recommended deauthorization of the MRGO and construction of a closure structure across the MRGO just south of Bayou La Loutre. Therefore, the MRGO Federal navigation channel between Mile 60 at the southern bank of the GIWW to the Gulf of Mexico at Mile -9.4 is deauthorized.

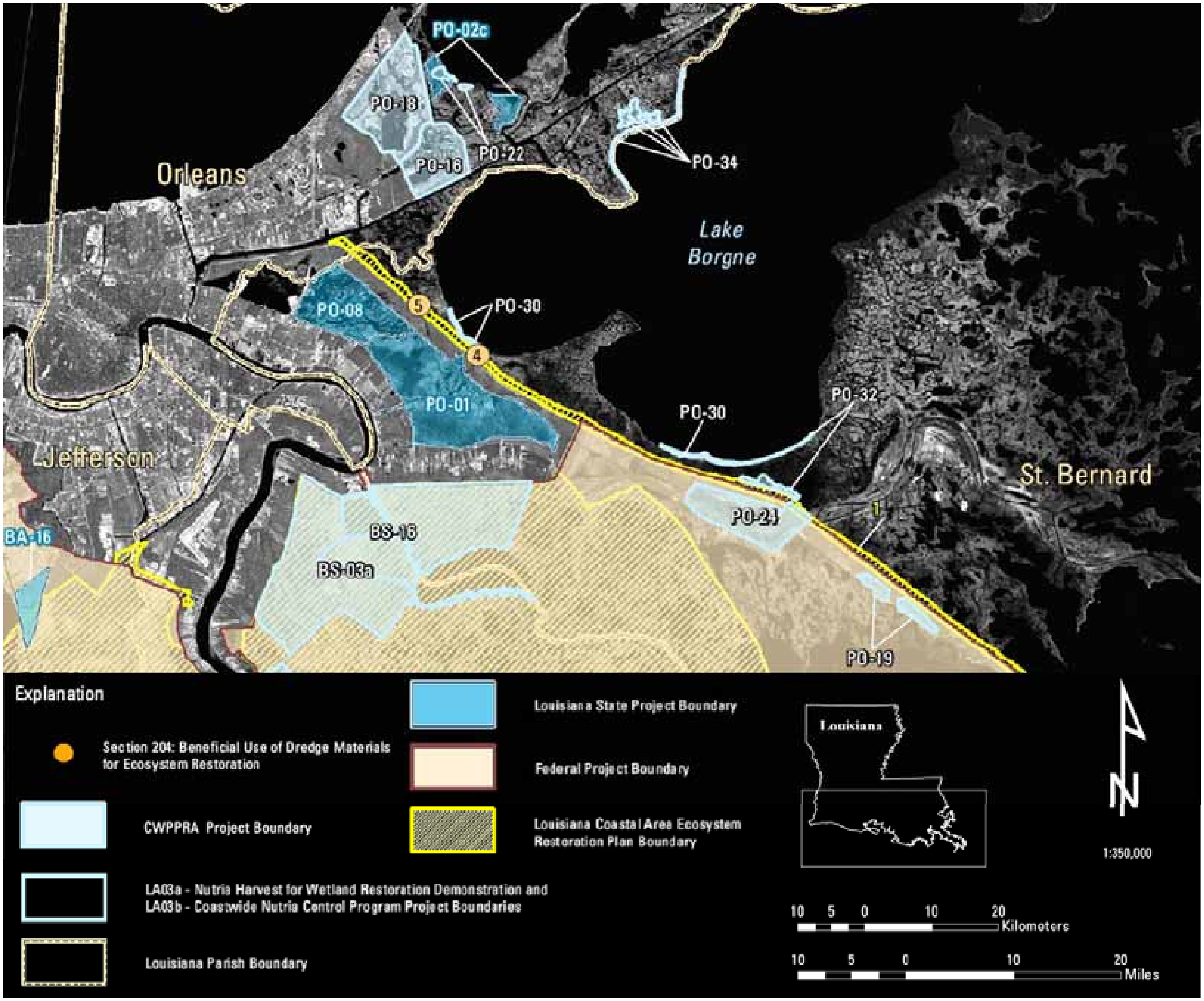

Figure 42. CWPPRA Restoration, Stabilization, and Creation Projects Near the Tier 2 Borgne Project Area

Table 16. Selected CWPPRA Projects Near the IER # 11 Tier 2 Borgne Project Area

State Number	PPL	Agency	Project Name	Project Area	AAHU	Acres Created/ Restored	Acres Protected	Total Net Acres	Construction Date	Status
BS-03a	2	NRCS	Caernarvon Diversion Outfall Management	15,556	504	802	0	802	6/1/2001	Complete
BS-10	10	USACE	Delta Building Diversion North of Fort St. Phillip	2,254	157	501	0	501		Engineering and Design
BS-11	10	USFWS	Delta Management at Fort St. Phillip	1,305	77	267	0	267	6/19/2006	Construction
BS-12	14	NRCS	White Ditch Resurrection and Outfall Management	8,224	107	42	147	189		Engineering and Design
BS-13	15	USACE	Bayou Lamoque Freshwater Diversion	9,435	560	620	0	620		Engineering and Design
BS-15	17	EPA	Bohemia Mississippi River Reintroduction	5,210	989	637	0	637		
BS-16	17	USFWS	Caernarvon Outfall Management/Lake Lery SR	16,260	302	268	384	652		
PO-06	2	NRCS	Fritchie Marsh Restoration	5,924	201	0	1,040	1,040	11/1/2000	Completed Feb. 2001
PO-16	1	USFWS	Bayou Sauvage National Wildlife Refuge Hydrologic Restoration, Phase 1	3,800	520	1,050	500	1,550	6/1/1995	Completed May 1996
PO-17	1	USACE	Bayou LaBranche Wetland Creation	487	191	203	0	203	1/6/1994	Completed April 1994
PO-18	2	USFWS	Bayou Sauvage National Wildlife Refuge Hydrologic Restoration, Phase 2	5,475	584	750	530	1,280	4/15/1996	Completed May 1997
PO-19	3	USACE	Mississippi River Gulf Outlet (MRGO) Disposal Area Marsh Protection	855	435	0	755	755	1/25/1999	Completed Jan. 1999
PO-22	5	USACE	Bayou Chevee Shoreline Protection	212	42	0	75	75	8/25/2001	Construction
PO-24	8	NMFS	Hopedale Hydrologic Restoration	3,805	269	0	134	134	1/10/2004	Construction
PO-26	9	USACE	Opportunistic Use of the Bonnet Carre Spillway	13,583	121	0	177	177		Engineering and Design
PO-27	9	NMFS	Chandeleur Islands Marsh Restoration	504	194	220	0	220	6/1/2001	Completed July 2001
PO-28	9	NMFS	LaBranche Wetlands Terracing, Planting, and Shoreline Protection	4,505	198	374	115	489		
PO-29	11	EPA	River Reintroduction into Maurepas Swamp	36,121	8,486	0	5,438	5,438		Engineering and Design
PO-30	10	EPA	Lake Borgne Shoreline Protection	192	61	0	165	165	8/1/2007	Construction
PO-31	11	EPA	Lake Borgne Shoreline Protection at Bayou Dupre	98	29	27	56	83		Engineering and Design
PO-32	12	USACE	Lake Borgne and MRGO Shoreline Protection	465	70	17	249	266		Engineering and Design
PO-33	13	USFWS	Goose Point/Pointe Platte Marsh Creation	1,384	297	424	12	436		Engineering and Design
PO-34	16	USACE	Alligator Bend Marsh Restoration and Shoreline Protection	584	166	285	45	330		
Summary Acres for All Approved Projects (including those not shown):				**1,488,841**		**51,829**	**69,890**	**121,719**		

Notes:

Agency/Sponsor: EPA=Environmental Protection Agency; NMFS=National Marine Fisheries Service; NRCS=Natural Resources Conservation Service; NWRC=National Wetlands Research Center; USFWS=U.S. Fish and Wildlife Service; USACE=U.S. Army Corps of Engineers; PCWRP = Parish Coastal Wetlands Restoration Program.

PPL - Priority Project List

Project Area - the benefitted area as determined by the Environmental Work Group for purposes of conducting Wetland Value Assessments.

AAHU - Average Annual Habitat Units as determined by the Environmental Work Group.

Habitat Units represent a numerical combination of habitat quality (Habitat Suitability Index) and habitat quantity (acres) within a given area at a given point in time. Average Annual Habitat Units represent the average number of Habitat Units within any given area.

Acres Created/Restored - The acres of emergent marsh created or restored as a result of project implementation.

Acres Protected - The acres of emergent marsh protected from loss as a result of project implementation.

Total Net Acres - The net gain in emergent marsh as a result of project implementation as determined by the Environmental Work Group. This figure includes acres of emergent marsh protected, created, and restored as a result of project implementation.

The deauthorization and plug to be constructed in the MRGO and the impacts of such an action were disclosed in a final Legislative EIS (January 2008). Because of its closer proximity to the Gulf of Mexico and that it is scheduled to be constructed before the IER 11 Tier 2 Borgne crossing of the MRGO, the MRGO closure structure at La Loutre would be primarily responsible for the impacts associated with salinity change and any resultant species shift or alteration of habitats within the study area. The cumulative impact of a second closure on the MRGO as part of the storm surge barrier proposed in this document would be comparatively small. Shifts and changes in habitats occur naturally as part of the deltaic processes where land is built and then erodes as the river shifts it course over thousands of years. Over time, species adapt and change with these shifting habitats.

4.2.2.3 Coastal Impact Assistance Program

The Energy Policy Act of 2005 (Public Law 109-58) was signed into law by President Bush on August 8, 2005. Section 384 of the Act establishes the Coastal Impact Assistance Program (CIAP) which authorizes funds to be distributed to Outer Continental Shelf (OCS) oil and gas producing states to mitigate the impacts of OCS oil and gas activities. Pursuant to the Act, a producing state or coastal political subdivision can use all amounts received for projects and activities for the conservation, protection, or restoration of coastal areas, including wetlands and for mitigation of damage to fish, wildlife, or natural resources. Amounts awarded under the provisions of the Act can also be used to develop a comprehensive conservation management plan.

The state worked with the coastal parishes to prepare a draft Louisiana Coastal Impact Assistance Plan that identifies restoration, conservation, and infrastructure projects to be supported by the State and each coastal parish for the four years of CIAP funding. This plan included projects for the enhanced management of Mississippi River water and sediment, protection and restoration of critical land bridges, barrier shoreline restoration and protection, interior shoreline protection, marsh creation with dredged material and a coastal forest conservation initiative.

4.2.2.4 State Coastal Planning and Restoration

The State of Louisiana has initiated a series of programs to offset the catastrophic loss of coastal wetlands. The Louisiana State and Local Coastal Resources Management Act was passed in 1978 to regulate the developmental activities that affect wetland loss. The resulting Louisiana Coastal Resources Program became a federally approved coastal zone management program in 1980. The Louisiana Legislature passed Act 6 in 1989 (R.S.49:213-214), and a subsequent constitutional amendment which created the Coastal Restoration Division within the LDNR, as well as the Wetlands Conservation and Restoration Authority (Wetlands Authority).

In the First Extraordinary Session, 2005 of the Louisiana Legislature, which ended on November 22, 2005, Senate Bill No. 71 (Act No. 8), which provided for the new 16-member panel, called the Coastal Protection and Restoration Authority, which is a broader version of the previous board that was named the Wetlands Conservation and Restoration Authority. In addition, Senate Bill No. 71 also provided for the establishment of the Coastal Protection and Restoration

Fund, previously named the Wetlands Conservation and Restoration Fund. The Fund is used for coastal wetlands conservation, coastal restoration, hurricane and storm damage risk reduction, and infrastructure impacted by coastal wetland losses.

The Louisiana Coastal Protection and Restoration (LACPR) project, a joint project between the Coastal Protection and Restoration Authority and the CEMVN, was established to identify risk reduction measures that can be integrated to form a system that will provide enhanced protection of coastal communities and infrastructure, as well as for restoration of coastal ecosystems. The project will address the full range of flood control, coastal restoration, and hurricane and storm damage risk reduction measures available, including those needed to provide comprehensive Category 5-Hurricane protection. This project is a study that will produce a technical document with recommendations related to enhanced hurricane protection and restoration of coastal ecosystems.

The LDNR Office of Coastal Restoration and Management is responsible for the maintenance and protection of the state's coastal wetlands. The Coastal Restoration and Engineering Divisions are responsible for the construction of projects aimed at creating, protecting and restoring the state's wetlands. These divisions are divided further and provide ongoing management and restoration of resources in the Louisiana coastal zone. The LDNR is involved in several major programs that are working to save Louisiana's coastal wetlands. These programs include the Breaux Act, Coast 2050, the Louisiana Coastal Area (LCA) Ecosystem Restoration Plan, and the Coastal Impact Assistance Plan of 2005. Other programs include state restoration projects, Parish Coastal Wetlands Restoration Program, Vegetation Plantings, Section 204/1135, and WRDA.

The LCA Ecosystem Restoration Study (2004) was a comprehensive report that identified the most critical human and natural ecological needs of the coastal area. The study presented and evaluated conceptual alternatives for meeting the most critical needs; identified the kinds of restoration features that could be implemented in the near-term (within 5 to 10 years) that address the most critical needs, and proposed to address these needs through features that would provide the highest return in net benefits per dollar of cost. The study also established priorities among the identified near-term restoration features, described a process by which the identified priority near-term restoration features could be developed, approved, and implemented, identified the key scientific uncertainties and engineering challenges facing the effort to protect and restore the ecosystem, and proposed a strategy for resolving them and identified, assessed and recommended feasibility studies that should be undertaken within the next 5 to 10 years to fully explore other potentially promising large-scale and long-term restoration concepts. The study concluded by presenting a strategy for addressing the long-term needs of coastal Louisiana restoration beyond the near-term focus of the LCA Plan.

4.2.2.5 Violet Freshwater Diversion Project

One of the larger restoration projects that could influence the IER #11 project area is the recently authorized, Violet Diversion. Authorized under the provisions of the WRDA, the Violet Diversion would divert freshwater from the Mississippi River east across the wetland areas from the Mississippi River to Lake Borgne. The purpose of this diversion is to reduce the salinity in the western Mississippi Sound by diverting freshwater from the Mississippi River to the Biloxi

Marshes and Lake Borgne. This diversion project could greatly increase fine sediment transport and deposition into the marshes located between the Mississippi River and the MRGO. It is unlikely that sediments would be transported across the MRGO into Lake Borgne and the Biloxi Marshes because the deep water MRGO would trap most of these sediments.

4.2.2.6 Miscellaneous Wetland Restoration Projects

A feasibility study is being conducted to evaluate the potential discharge of treated effluent from the East Bank Sewer Treatment Plant (EBSTP), located off Florida Avenue and Dubreuil St. in the Ninth Ward Basin, into wetlands to provide water quality improvement, solids handling, hazard mitigation, and coastal wetland restoration.

4.2.3 Other Agency Projects

Local sponsors are initiating or considering initiating other actions related to the proposed actions. The East Jefferson Levee District is placing more than 1,000 3-ton highway traffic barriers along the Lake Pontchartrain shoreline to help slow the rate of erosion in East Jefferson Parish. The Southeast Louisiana Flood Protection Authority-East is planning on constructing a new breakwater along portions of the IER # 3 project area. Over 100,000 tons of rock will be used, primarily along Reach 1 (the Recurve I-wall in Northwest Kenner to the Duncan Pumping Station) and Reach 4 (Suburban Canal to Bonnabel Canal), with another 8,000 tons of rock used along the remaining reaches in the IER # 3 project area. The Greater New Orleans Expressway Commission (GNOEC) is also considering additional Causeway improvements associated with the USACE GNOHSDRRS project at the Causeway. These improvements could include roadway modification to maintain the new ramp height of 16.5 ft from the GNOHSDRRS levee out onto the Causeway itself as well as additional roadway modifications. Although these projects could contribute to adverse impacts for some of the resources, several of them would have long-term positive impacts, including improved hurricane, storm, and flood damage protection.

4.3 SUMMARY OF CUMULATIVE IMPACTS

The magnitude and significance of cumulative impacts were evaluated by comparing the existing environment with the expected impacts of the proposed action when combined with the impacts of other proximate actions. Projects that occur within the greater New Orleans area, within the Lake Pontchartrain Basin, and within the designated coastal zone for Louisiana were considered collectively (as appropriate) for the evaluation of cumulative impacts.

All of the GNOHSDRRS projects are currently in the construction, planning and design stages, and impacts from these component projects will be addressed in separate IERs. Construction of levees, gates, and onshore breakwaters throughout the region could cause direct marsh, upland, and terrestrial habitat loss. The beneficial use of dredged material for nearby marshes could eventually offset some of the damages to marsh from construction. However, construction damage as part of the 100 year hurricane and storm damage risk reduction projects to other quality habitats would be fully mitigated through formal mitigation planning; the beneficial use of dredge material for this project would not be used as mitigation credit to mitigate impacts from this project. A future project to introduce freshwater from the Mississippi River as part of the Violet Canal Freshwater Diversion along with the closure structure on the MRGO could potentially lower salinity and increase biological productivity within the study area. Depending on the velocity of the water discharged and where the available sediment load deposits, these projects could produce a shift in habitat type for the study area from saline and brackish marsh to brackish and freshwater marsh. The Violet Canal Freshwater Diversion is expected to have a significant effect on the large-scale water quality conditions in the study area through increased fine sediment transport and deposition into the marshes located between the Mississippi River and the MRGO, substantially lowering salinity in the CWA west of the MRGO. The closing of the MRGO with a plug at Bayou La Loutre prevents deep draft vessels from navigating on this canal, this action will decrease waves and wakes generated by vessels which has contributed to the erosion of marsh in the project area. The cessation of dredging and maintaining the MRGO to allow for deep draft navigation will also have an impact to the water quality and availability of dredged material for beneficial use in the project area with the eventual result of the channel silting in over time.

The primary hydrologic impact of the GNOHSDRRS projects would be reduced storm surge inundation impacts for low-lying areas on the protected side of the GNOHSDRRS. In addition to the CWPPRA projects being designed and constructed, another future project currently being developed in an EIS by CEMNV is the MRGO and Lake Borgne Wetland Creation and Shoreline Stabilization. These projects could alter sheet flows from Lake Borgne into adjacent emergent wetlands with minimal impact to existing natural channels. Additionally, existing CWPPRA and other foreshore protection projects on Lake Borgne and the MRGO are expected to reduce erosion in those vicinities and could encourage some sediment deposition in those areas.

Depending on design and maintenance shoreline stabilization measures could alter existing shoreline habitat and block access to interior wetlands. Impacts to EFH could occur as a result of construction activities and access dredging but should return to pre-construction levels once those activities have ceased. Marsh areas with greater heterogeneity and interspersion and lower salinity levels could be a byproduct of implementing the Violet Canal Freshwater Diversion, MRGO-Lake Borgne Wetland Creation and Shoreline Protection projects, and the MRGO closure structure. These changes could greatly benefit some wildlife, fishery, and aquatic resources in the long-term, however, with a habitat shift to a fresher environment there are impacts to existing resources such as oysters in Lake Borgne and the fish and plant species that inhabit the study area.

The proposed actions are not anticipated to have any impacts on the presence of HTRW in the study area. The cumulative affect of these projects could provide long-term and sustainable beneficial impacts to the communities within the study area by reducing the risk of damage within flood-prone areas and by generating economic growth. Economic growth could attract displaced residents and new workers, and encourage repopulation within the New Orleans metropolitan area.

Cumulative adverse impacts to human populations within the study area are not expected to be permanent; however, there would be temporary adverse impacts from the increased traffic, detours, road closures, and noise associated with construction activities that could occur 24 hours a day, seven days a week for several years. It is expected that the temporary cumulative impacts to social and community facilities would result in permanent benefits because the threat to flood-prone areas would be reduced by the increased flood protection provided by area projects. Construction of these projects could cause temporary and localized decreases in air quality that would mainly result from the emissions of construction equipment during dredging and construction. However, these changes in air quality should return to pre-construction conditions shortly after construction completion and these changes in air quality would not be expected to change the areas attainment status.

The proposed action would have cumulative beneficial impacts to socioeconomic resources in the New Orleans Metropolitan area. It is part of the ongoing Federal effort to reduce the threat to life, health, and property posed by flooding. The LPV project would be improved to provide additional hurricane, storm, and flood damage protection, reducing the threat of inundation of infrastructure due to severe tropical storm events. The combined effects from construction of the multiple projects underway and rebuilding the GNOHSDRRS in the area would reduce flood risk and storm damage to residences, businesses, and other infrastructure from storm-induced and tidally-driven flood events and, thereby, would encourage recovery. Providing 100-year level of protection within all reaches of the LPV allows for FEMA certification of that level of protection. Improved hurricane, storm, and flood damage protection would benefit all residents, regardless of income or race, increase confidence, reduce insurance rates, and allow for development and redevelopment of existing urban areas.

The purpose of the proposed project is to provide hurricane and storm damage risk reduction that would protect the lives, properties, businesses, and to some extent the existing natural habitat of the region. It was authorized and funded in a response to the devastation and flooding that occurred as a result of Hurricanes Katrina and Rita. The proposed project is not a habitat restoration project, however, as part of the design criteria in the request for proposal efforts to minimize impacts to the environment were incorporated such as the beneficial use of dredged material for marsh enhancement. In addition, the impacts to wetlands as result of the footprint of this project will be mitigated in a large scale mitigation project to produce a beneficial cumulative impact.

In conclusion, although there are many ongoing and planned projects that would similarly impact resources in the Lake Pontchartrain Basin portion of Louisiana, most of the resulting impacts would be temporary. Those adverse impacts that would not be temporary in nature would be directly mitigated or would be indirectly mitigated by other projects in the region that would provide positive long-term impacts to the same resource (e.g., wetlands or EFH). Cumulative impacts to social and economic resources would not only be beneficial, but are considered essential.

5.0 SELECTION RATIONALE

The proposed action consists of two miles of new flood protection extending from the Michoud floodwall north of GIWW to the levee on the west (New Orleans) side of the MRGO. The GNOHSDRRS would cross the GIWW, Bayou Bienvenue, the MRGO, and the Golden Triangle marsh. The proposed project would consist of a flood control sector gate and bypass gate at the

GIWW (approximately 1,150 ft east of the Michoud Canal), a new navigable flood control sector gate at Bayou Bienvenue (56 ft by 8 ft), a braced concrete wall across the MRGO (approximately 2,700 ft southeast of the existing Bayou Bienvenue flood control structure), and a concrete floodwall across the marsh between the GIWW and MRGO.

The proposed action, alternative 4a, balances the necessity for better protection of life and property from hurricane and storm related flooding with engineering costs, feasibility and practicality as well as with the objectives of preservation and sustainability of the natural environment. However, it is anticipated that approximately 80.3 acres of wetland (mostly salt marsh) and 45 acres of open water habitat could be permanently impacted as well as additional impacts that could occur from habitat changes related to changes in salinity, dissolved oxygen, and hydrology.

These environmental impacts were considered along with traditional engineering criteria that included risk and reliability, constructability, construction schedule, operation and maintenance, real estate requirements, and cost:

Risk and Reliability: An important component of risk considerations for this project is the relative speed by which the various alternatives can be built and, conversely, how long a given alternative will leave the areas surrounding the IHNC at their current level of risk. Various USACE studies were undertaken as part of the overall IHNC project, and numerous alternatives were investigated as means to provide "advanced measures" to reduce risk to the project area prior to the completion of the 100-year level of protection project (see Conceptual Study for the Interim Protection of Inner Harbor Navigation Canal, July 2007; Inner Harbor Navigation Canal Flood Protection Brainstorming Workshop, June 2007; IHNC Interim Floodgates Value Engineering Study, June 2007). Many of these studies focused on providing a gated or otherwise constrictive structure or structures within the GIWW west of its confluence with the MRGO in the vicinity of alignments 1 and 2. Although these studies and workshops developed numerous feasible advance measures proposals in this vicinity, none could cost-effectively become part of the permanent 100-year protection system, and were therefore deemed unreasonable.

Furthermore, because the existing levees and floodwalls east of an alignment 1 or 2 structure would still need to be brought up to the 100-year design height, there could be more risk because no reasonable advance measures are available at these alignments because only a limited amount of construction could be completed prior to the 2009 hurricane season.

Alignments 3, 4 and 5 would reduce the risk associated with exposure of the Michoud Slip and Michoud Canal levees and floodwalls. Another important component of risk, as recognized by the IPET, is the length of the overall risk reduction system. A basic underlying principle of risk reduction is that by reducing the length of a risk reduction system, the opportunities for failure can be reduced. Based on this principle, the more eastern the alignment for this project, the shorter the overall risk reduction system would be.

The relative speed at which the barrier on alternatives 3a, 3b, 4a, 4b, 5a and 5b could be constructed would be proportional to their respective lengths and the barrier type selected. However, because a pipeline of national importance crosses alignment 3, the pipeline would have to be relocated prior to construction of the structural wall across the marsh. Therefore, the time savings afforded by alignment 3's shorter barrier length would be lost. Relocation of the pipeline would preclude any advanced measures in 2009 and would most likely delay completion of the advanced measures until late 2010. Thus, of the five alternative alignments, the proposed action provides the opportunity for the fastest provision of reasonable advance measures for the project area.

Alternatives 3a, 3b, 4a, 4b 5a and 5b have the fewest openings that directly face the storm surge when considering the numerous gates along the Michoud Canal that would be removed from the primary protection system; therefore, they have the fewest points of failure. Every gate, valve, or flow through structure has to be maintained and exercised and inherently has a greater chance of failure than a wall or levee; therefore, any alignment that has the fewest openings has the least chance of failure.

Constructability: All of the alternative alignments consist of construction that must be barge-based, making construction more difficult and complex than land-based activities on all of the alignments. Weak subsurface conditions present in the area also make construction of all of the alternatives inherently difficult.

The MRGO/GIWW is underlain by very weak foundation soils which require excavation to remove weak soils for foundation construction. Such excavation and construction is more difficult in a deep draft channel (-40 ft) than it would be in a shallow draft channel (-16 ft). Thus, alternatives 1 and 2 have more constructability issues associated with water depth than alternatives 3a, 3b, 4a, 4b 5a and 5b.

Construction in deep draft conditions also poses safety risks greater than those that are found in a shallow draft environment. Construction of cofferdams would be the most practical and cost effective means of constructing any gate structure on any of the alignments. However, construction and maintenance of a cofferdam cell in a deep draft environment, particularly at the convergence of two waterways, has more inherent safety risks due to pressure on the cofferdam walls which could result in catastrophic failure of the cell. These constructability issues make alternatives 3a, 3b, 4a, 4b, 5a and 5b more favorable than 1 and 2 from a safety standpoint.

The construction of a barrier in alternatives 3a, 3b, 4a, 4b 5a and 5b presents constructability issues associated with soil conditions and "in-the-wet" construction that could be considered more difficult than the improvement of existing land-based levees and floodwalls in alternatives 1 and 2. However, this difficulty may be outweighed by the relative difficulty of building in the deep draft environment of alternatives 1 and 2.

Operations and Maintenance: Although this project is 100 percent federally-funded, operations and maintenance (O&M) remains the responsibility of the non-Federal sponsor. There are several trade-offs that must be considered between the advantages and disadvantages of each of these alternatives. First, the relative ease of O&M of the new structures is an important consideration. Alternatives 4a, 4b, 5a and 5b require the O&M of three shallow draft gates, whereas alternatives 3a and 3b requires two new shallow draft gates, and the Bayou Bienvenue existing gate would have to be replaced, and both gates would be part of the primary protection system, yielding the exact same number of gates directly facing the storm surge. Shallow draft gates are inherently easier to operate and maintain than deep draft structures, making alternatives 3a, 3b, 4a, 4b, 5a and 5b more advantageous than alternatives 1 or 2. Moreover, alternatives 3a, 3b, 4a, 4b, 5a and 5b place the gates located along the Michoud Canal on the protected side of the GNOHSDRRS which would ease the local sponsor's operation and maintenance burden of these floodgates. Closure time for the total number of gates is greatest in alternatives 1 and 2 as there will be many more openings in the protection system due to the Michoud Canal. Closure time for alternatives 3a, 3b, 4a, 4b, 5a and 5b is the same.

Real Estate Requirements: Real estate requirements must be taken into account given the impact they can have on the speed by which hurricane and storm risk reduction can be provided to the project area. The number of properties to be acquired can influence the real estate acquisition schedule. Although the new structures to be built in each of the alignments all encompass just a few properties, alternatives 1 and 2 could also require the acquisition of several industrial properties, or relocation of structures within these properties, impacted by the raising of existing levees and floodwalls surrounding Michoud Canal.

Cost: Two primary cost exercises were conducted in support of this project. Although the first cost exercise (Arcadis 2006) considered inclusion of a navigable structure on the MRGO rather than a complete closure, it demonstrated that there are considerable costs savings realized by an alignment east of Michoud Canal, avoiding the need to raise the miles of levees of the Michoud Slip. However, it also demonstrated diminishing returns in cost savings for an alignment that is moved even further east than adjacent to the Michoud Canal. These findings are supported by the more recent cost exercise conducted on each of the alignments under consideration. As described in Section 3.3, alternatives 1 and 2 were both more expensive than alternatives 3a, 3b, 4a, 4b, 5a and 5b. The relative costs of alternatives 3a, 3b, 4a, 4b, 5a and 5b increase, in general, from west to east.

Gate Selection: Because the footprints and costs of the three gate types are similar, the selection of gate type was based largely on technical advantages and disadvantages, including ease of operation and maintenance. For example, sector gates provide unlimited vertical clearance and require less foundation requirements than vertical lift gates. Vertical lift gates are also subject to wind load, whereas sector gates are not.

Selection Rationale Summary: Considering all the criteria, the proposed action was selected because it minimizes uncertainty and risk to acceptable levels in a reasonable period of time. This solution minimizes impacts to existing industrial complexes, and minimizes the encroachment on existing transportation infrastructure and would be possible within the time constraints and technology available. Finally, the proposed action is compatible and works in concert with other projects that have been completed, are in progress, or will be implemented to improve the damage reduction provided by the GNOHSDRRS.

6.0 COORDINATION AND CONSULTATION

6.1 PUBLIC INVOLVEMENT

Extensive public input has been sought in preparing this report. The proposed project analyzed in this IER was publicly introduced in the Federal Register on 13 March 2007 and further described on the website www.nolaenvironmental.gov. As they were developed, alternatives to the proposed action were made public on the website and through the public meeting process. Scoping for this project was initiated on 12 March 2007 through placing advertisements and public notices in *USA Today* and *The New Orleans Times-Picayune*. Nine public scoping meetings were held between 27 March and 12 April 2007 throughout the New Orleans Metropolitan Area to explain the NEPA process and the Alternative Arrangements for implementing it. After the scoping meetings, a 30-day period was open for public comment submission. Additional public meetings were held in March 2007 through January 2008 regarding improved protection specific to the IHNC and the Draft IER # 11 (Tier 1 document), which detailed the impacts from the proposed actions. The Draft IER # 11 Tier 1 document was released for public review on 31 January 2008, and stakeholders had until 29 February 2008, to comment on the document. Comments were received from governmental agencies, non-governmental organizations, and citizens. The Decision Record for the Tier 1 document was signed on 14 March 2008. Since then, CEMVN has continued to host monthly public meetings to keep the stakeholders advised of project status. The public is able to provide verbal comments during the meetings and written comments after each meeting in person, by mail, and via www.nolaenvironmental.gov.

This Draft IER # 11 Tier 2 Borgne document will be distributed for a 30-day public review and comment period. A public meeting specific to the proposed action will be held if requested by a stakeholder during the review period. Any comments received during this public meeting will be considered part of the official record. After the 30-day comment period, and public meeting if requested, the CEMVN District Commander will review all comments received during the review period and make a determination if they rise to the level of being substantive in nature. If comments are not considered to be substantive, the District Commander will make a decision on the proposed action. This decision will be documented in an IER Decision Record. If a comment(s) is determined to be substantive in nature, an Addendum to the IER will be prepared and published for an additional 30-day public review and comment period. After the expiration of the public comment period the District Commander will make a decision on the proposed action. The decision will be documented in an IER Decision Record.

6.2 AGENCY COORDINATION

The following agencies, as well as other interested parties, are receiving copies of this draft IER:

U.S. Department of the Interior, Fish and Wildlife Service
U.S. Department of the Interior, National Park Service
U.S. Environmental Protection Agency, Region VI
U.S. Department of Commerce, NOAA National Marine Fisheries Service
U.S. Natural Resources Conservation Service
Governor's Executive Assistant for Coastal Activities
Louisiana Department of Wildlife and Fisheries
Louisiana Department of Natural Resources, Coastal Management Division
Louisiana Department of Natural Resources, Coastal Restoration Division
Louisiana Department of Environmental Quality
Louisiana State Historic Preservation Officer

The USFWS reviewed the proposed action to see if it would affect any threatened or endangered species, or their critical habitat. The USFWS concurred with the CEMVN in a letter dated June 27, 2008 that the proposed action would not have adverse impacts on threatened or endangered species (appendix F).

The NMFS reviewed the proposed action to see if it would affect any threatened or endangered species, or their critical habitat. The NMFS concurred with the CEMVN in a letter dated August 12, 2008], that the proposed action would not have adverse impacts on threatened or endangered species or their critical habitat (appendix F).

The LDNR reviewed the proposed action for consistency with the Louisiana Coastal Resources Program (LCRP). The proposed action was found to be consistent with the LCRP, as per a letter dated August 1, 2008 (appendix F).

Water Quality certification (WQC 080616-01/AI 158513/CER 20080001) for the proposed project was received from LDEQ on June 17, 2008.

Section 106 of the National Historic Preservation Act, as amended, requires consultation with the Louisiana SHPO and Native American tribes. Eleven Federally-recognized tribes that have an interest in the region were given the opportunity to review the proposed action. The SHPO concurred with the CEMVN “no historic properties affected” finding in a letter dated June 17, 2008. The Choctaw Nation of Oklahoma, Alabama Coushatta Tribe of Texas, and the Caddo Nation of Oklahoma concurred with our effect determination in letters and an email dated May 29, 2008, June 16, 2008, and May 20, 2008, respectively. No other Indian Tribes responded to the request for comments.

CEMVN formally initiated Section 106 consultation for the LPV Hurricane Protection Project (100-year), which includes IER # 11, in a letter dated 9 April 2007. SHPO staff and Tribal governments met with CEMVN to discuss the development of a PA [Programmatic Agreement] to tailor the Section 106 consultation process under the Alternative Arrangements for implementing NEPA. A public meeting was held on 18 July 2007, to discuss the working draft PA. It is anticipated that the PA will be executed in the near future.

Coordination with the USFWS on the Alternative Arrangements process was initiated by letter on 13 March 2007, and concluded on 6 August 2007. The CEMVN received a draft programmatic Fish and Wildlife Coordination Act (FWCA) Report from the USFWS on 26 November 2007. A draft FWCA Report was provided by the USFWS on June 27, 2008 for IER # 11 Tier 2. This report's recommendations are addressed below. The draft programmatic FWCA Report and the FWCA Report specific to the Tier 2 Borgne project provide fish and wildlife conservation recommendations that would be implemented concurrently with project implementation. In addition, as discussed previously in section 3.2.6, measures recommended by the USFWS in their letter dated 22 February 2008, for protection of the manatee would be followed during construction of the proposed action. A copy of the draft FWCA Report for IER # 11 Tier 2 is provided in appendix F.

The USFWS' programmatic recommendations applicable to this project will be incorporated into project design studies to the extent practicable, consistent with engineering and public safety requirements. The USFWS' programmatic recommendations, and the CEMVN's response to them, are listed below:

> Programmatic Recommendation 1: To the greatest extent possible, situate GNOHSDRRS so that destruction of wetlands and non-wet bottomland hardwoods are avoided or minimized.
>
> CEMVN Programmatic Response 1: CEMVN has evaluated five potential alignments to provide the necessary level of protection and considered a variety of critical considerations in the selection rationale. The proposed action would result in greater overall impacts to wetlands than alignments 1 and 2, but less overall impacts to wetlands than alignment 3 (would require relocation of pipelines through the marsh) and alignment 5 (longer barrier through marsh than the proposed action). In order to minimize impacts on wetlands, the project intends to provide for excavated material to be used beneficially, rather than moving it to an excavation disposal site that would cause bottomland hardwood impacts. Proposed staging areas were selected based on the least potential for damage to the surrounding habitats. However, some impacts would be unavoidable because of the logistical requirements associated with movement of the large amount of materials required for project construction. Non-forested upland areas would be used for construction staging where practicable.
>
> Programmatic Recommendation 2: Minimize enclosure of wetlands with new levee alignments. When enclosing wetlands is unavoidable, acquire non-development easements on those wetlands, or maintain hydrologic connections with adjacent, un-enclosed wetlands to minimize secondary impacts from development and hydrologic alteration.
>
> CEMVN Programmatic Response 2: See CEMVN Response 1. Because the partially enclosed wetlands would remain subject to tidal influence through the GIWW, Bayou Bienvenue and Lake Pontchartrain, development would not be feasible. Therefore a non-development easement is not needed.

Programmatic Recommendation 3: Avoid adverse impacts to bald eagle nesting locations and wading bird colonies through careful design project features and timing of construction.

CEMVN Programmatic Response 3: Concur. No bald eagle nests or wading bird colonies have been recorded in or near the project area. Project areas adjoining forested habitats will be surveyed for eagle nests or wading bird colonies within buffer distances prior to beginning construction in those limited areas.

Programmatic Recommendation 4: Forest clearing associated with project features should be conducted during the fall or winter to minimize impacts to nesting migratory birds, when practicable.

CEMVN Programmatic Response 4: No or negligible forest clearing will occur with implementation of the proposed action.

Programmatic Recommendation 5: The project's first Project Cooperation Agreement (or similar document) should include language that includes the responsibility of the local-cost sharer to provide operational, monitoring, and maintenance funds for mitigation features.

CEMVN Programmatic Response 5: Corps Project Partnering Agreements (PPA) do not contain language mandating the availability of funds for specific project features, but require the non-Federal Sponsor to provide certification of sufficient funding for the entire project. Further, mitigation components are considered a feature of the entire project. The non-Federal Sponsor is responsible for Operation, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) of all project features in accordance with the OMRR&R manual that the Corps provides upon completion of the project.

Programmatic Recommendation 6: Further detailed planning of project features (e.g., Design Documentation Report, Engineering Documentation Report, Plans and Specifications, or other similar documents) should be coordinated with the USFWS, NMFS, LDWF, USEPA, and LDNR. The USFWS shall be provided an opportunity to review and submit recommendations on all the work addressed in those reports.

CEMVN Programmatic Response 6: Concur.

Programmatic Recommendation 7: The CEMVN should avoid impacts to public lands, if feasible. If not feasible, the CEMVN should establish and continue coordination with agencies managing public lands that may be impacted by a project feature until construction of that feature is complete and prior to any subsequent maintenance. Points of contacts for the agencies overseeing public lands potentially impacted by project features are: Kenneth Litzenberger, Project Leader for the USFWS' Southeast National Wildlife Refuges, and Jack Bohannan (985) 822-2000, Refuge Manager for the Bayou Sauvage NWR, Office of State Parks contact Mr. John Lavin at 1-888-677-1400, National Park Service (NPS) contact Superintendent David Luchsinger, (504) 589-3882, extension 137 (david_luchsinger@nps.gov), or Chief of Resource Management David Muth (504) 589-3882, extension 128 (david_muth@nps.gov) and for the 404(c) area contact the previously mentioned NPS personnel and Ms. Barbara Keeler (214) 665-6698 with the USEPA.

CEMVN Programmatic Response 7: Approximately 19 acres of the Bayou Sauvage NWR would be impacted by the proposed action. Coordination with the Refuge Manager has been initiated and will continue during the real estate acquisition process.

Programmatic Recommendation 8: If applicable, a General Plan should be developed by the CEMVN, the USFWS, and the managing natural resource agency in accordance with Section 3(b) of the FWCA for mitigation lands.

CEMVN Programmatic Response 8: Concur, to the extent allowed by law.

Programmatic Recommendation 9: If mitigation lands are purchased for inclusion within a NWR, those lands must meet certain requirements; a summary of some of those requirements is provided in appendix A to the draft FWCA Report (appendix F). Other land-managing natural resource agencies may have similar requirements that must be met prior to accepting mitigation lands; therefore, if they are proposed as a manager of a mitigation site, they should be contacted early in the planning phase regarding such requirements.

CEMVN Programmatic Response 9: Concur. In order to minimize impacts on wetlands, the project intends to provide for excavated material to be used beneficially, rather than moving it to an excavation disposal site that would cause bottomland hardwood impacts.

Programmatic Recommendation 10: If a proposed project feature is changed significantly or is not implemented within one year of the date of the Endangered Species Act consultation letter, the USFWS recommended that the Corps reinitiate coordination to ensure that the proposed project would not adversely affect any Federally-listed threatened or endangered species or their habitat.

CEMVN Programmatic Response 10: Concur.

Programmatic Recommendation 11: In general, larger and more numerous openings in a protection levee better maintain estuarine-dependent fishery migration. Therefore, as many openings as practicable, in number, size, and diversity of locations should be incorporated into project levees.

CEMVN Programmatic Response 11: The proposed action has two openings (flood gates) within 2 miles of new GNOHSDRRS.

Programmatic Recommendation 12: GNOHSDRRS water control structures in any watercourse should maintain pre-project cross-sections in width and depth to the maximum extent practicable, especially structures located in tidal passes.

CEMVN Programmatic Response 12: The proposed action has two openings (flood gates) within 2 miles of new GNOHSDRRS, on the GIWW and Bayou Bienvenue. It also would include a structure across the MRGO, which is a man-made watercourse that altered the natural hydrology of the area when it was constructed. Secondly, this waterway has been deauthorized. The design width of the gate on the GIWW is based on the authorized channel dimensions. The design width of the Bayou Bienvenue gate is based on the dimensions of the existing Bayou Bienvenue Control Structure.

Programmatic Recommendation 13: GNOHSDRRS water control structures should remain completely open except during storm events. Management of those structures should be developed in coordination with the USFWS, NMFS, LDWF, and LDNR.

CEMVN Programmatic Response 13: In order to provide some level of GNOHSDRRS prior to the 2009 hurricane season, this project is being proposed in two phases. The first phase, called "advanced measures," would be in place by June 2009 in preparation for the 2009 hurricane season. In order to provide GNOHSDRRS prior to the 2009 hurricane season, some of the "advanced measures" would result in partial closure of open areas. Upon completion of construction a sector gate that would comply with this recommendation would be in-place. Upon completion of final construction of the GIWW sector gate, the GIWW bypass gate installed as part of the "advanced measures" could be operated under a number of scenarios, which would involve varying degrees of economic and labor burden on the non-Federal sponsor. The bypass gate could remain closed at all times, except during times in which the sector gate is closed for maintenance and the bypass would serve as a navigational bypass. This would minimize the operational costs of the structure. The bypass gate could instead remain open all of the time to provide maximum navigational use, expect during storm events or maintenance activities. The gate could also be operated seasonally to optimize navigation and operational costs, leaving the gate open during non-hurricane season and closing it for the entire hurricane season. Under this last scenario, the bypass gate could be closed at the time the first hurricane of the season enters the Gulf. The gate would remain closed for the remainder of the season in the floating position, allowing water flow through the system, and sunk into the sealed position when a storm is approaching. However, management plans for the structures will be developed by the local sponsor in coordination with the USFWS, NMFS, LDWF, and LDNR.

Programmatic Recommendation 14: Any GNOHSDRRS water control structure sited in canals, bayous, or a navigation channel which does not maintain the pre-project cross-section should be designed and operated with multiple openings within the structure. This should include openings near both sides of the channel as well as an opening in the center of the channel that extends to the bottom.

CEMVN Programmatic Response 14: See CEMVN Programmatic Response 12. The proposed action would include two shallow draft gates on the GIWW and one on Bayou Bienvenue.

Programmatic Recommendation 15: The number and siting of openings in GNOHSDRRS levees should be optimized to minimize the migratory distance from the opening to enclosed wetland habitats.

CEMVN Programmatic Response 15: The design-build solicitation included design parameters to minimize migratory distance from openings to enclosed wetland habitats. The proposed action would include three flood gate structures within its 2-mile length.

Programmatic Recommendation 16: GNOHSDRRS structures within a waterway should include shoreline baffles and/or ramps (e.g., rock rubble, articulated concrete mat) that slope up to the structure invert to enhance organism passage. Various ramp designs should be considered.

CEMVN Programmatic Response 16: The design-build solicitation included design parameters to minimize the creation of steep environmental gradients. The gates within the GIWW and Bayou Bienvenue would have a base of sand, gravel, and riprap sloping up to the gate foundation, with guide walls on each side of the channel.

Programmatic Recommendation 17: To the maximum extent practicable, structures should be designed and/or selected and installed such that average flow velocities during peak flood or ebb tides do not exceed 2.6 ft/s. However, this may not necessarily be applicable to tidal passes or other similar major exchange points.

CEMVN Programmatic Response 17: Hydrologic modeling indicates that water velocities would increase in the GIWW and Bayou Bienvenue. The existing average velocities within Bayou Bienvenue are 1 to 3 ft/s. After construction of the sector gate, the velocity is expected to be in the range of about 2.4 to 2.6 ft/s during the months of March and September and expected velocities within the GIWW would be approximately 0.6 ft/s. These velocities diminish within approximately 300 feet of either side of the gate structures.

Programmatic Recommendation 18: To the maximum extent practicable, culverts (round or box) should be designed, selected, and installed such that the invert elevation is equal to the existing water depth. The size of the culverts selected should maintain sufficient flow to prevent siltation

CEMVN Programmatic Response 18: Culverts will be installed in Bayou Bienvenue during construction of the project to maintain a limited amount of flow while the Bayou Bienvenue cofferdam is in place. The culverts will be placed at varied heights and spread throughout the channel to the maximum extent practicable. These culverts will restrict flow by 90%; however they will be removed once the sector gate is in place.

Programmatic Recommendation 19: Culverts should be installed in construction access roads unless otherwise recommended by the natural resource agencies. At a minimum, there should be one 24-inch culvert placed every 500 ft and one at natural stream crossings. If the depth of water crossings allow, larger-sized culverts should be used. Culvert spacing should be optimized on a case-by-case basis. A culvert may be necessary if the road is less than 500 ft long and an area would hydrologically be isolated without that culvert.

CEMVN Programmatic Response 19: Concur.

Programmatic Recommendation 20: Water control structures should be designed to allow rapid opening in the absence of an offsite power source after a storm passes and water levels return to normal.

CEMVN Programmatic Response 20: Concur. The gates are designed to allow rapid opening in absence of an offsite power source.

Programmatic Recommendation 21: Levee alignments and water control structure alternatives should be selected to avoid the need for fishery organisms to pass through multiple structures (i.e., structures behind structures) to access an area.

CEMVN Programmatic Response 21: CEMVN has evaluated five potential alignments to provide the necessary level of protection and considered a variety of critical considerations in the selection rationale. Although the proposed action could require that fishery organisms pass through multiple structures (e.g. both Bayou Bienvenue gates to access the Central Wetlands Area), it was selected over Alternatives 1, 2, 3a and 3b for technical reasons such as cost, constructability, and risk and reliability.

Programmatic Recommendation 22: Operational plans for water control structures should be developed to maximize the cross-sectional area open for as long as possible. Operations to maximize freshwater retention or redirect freshwater flows could be considered if hydraulic modeling demonstrates that is possible and such actions are recommended by the natural resource agencies.

CEMVN Programmatic Response 22: See CEMVN Response to Recommendation 13.

Programmatic Recommendation 23: The CEMVN shall fully compensate for any unavoidable losses of wetland habitat or non-wet bottomland hardwoods caused by project features.

CEMVN Programmatic Response 23: CEMVN shall compensate for unavoidable losses of direct wetland habitat or non-wet bottomland hardwoods caused by project features. This compensation will be documented in a mitigation IER.

Programmatic Recommendation 24: Acquisition, habitat development, maintenance and management of mitigation lands should be allocated as first-cost expenses of the project, and the local project-sponsor should be responsible for operational costs. If the local project-sponsor is unable to fulfill the financial mitigation requirements for operation, then the CEMVN shall provide the necessary funding to ensure mitigation obligations are met on behalf of the public interest.

CEMVN Programmatic Response 24: See CEMVN Programmatic Response 5.

Programmatic Recommendation 25: Any proposed change in mitigation features or plans should be coordinated in advance with the USFWS, NMFS, LDWF, USEPA, and LDNR.

CEMVN Programmatic Response 25: Mitigation for the impacts caused by this project will be coordinated through a Mitigation IER. Any changes to the mitigation plan in this IER would be coordinated in advance.

Programmatic Recommendation 26: A report documenting the status of mitigation implementation and maintenance should be prepared every three years by the managing agency and provided to the CEMVN, USFWS, NMFS, USEPA, LDNR, and LDWF. That report should also describe future management activities, and identify any proposed changes to the existing management plan.

CEMVN Programmatic Response 26: Corps PPAs do not contain language mandating the preparation of the specified report every three years. The PPA requires the non-Federal Sponsor to provide certification of sufficient funding for the entire project. Further, mitigation components are considered a feature of the entire project. The non-Federal Sponsor is responsible for Operation, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) of all project features in accordance with the OMRR&R manual that the Corps provides upon completion of the project.

The USFWS project-specific recommendations for the IER # 11 Tier 2 Borgne proposed action are listed below. Each recommendation is followed by the CEMVN response.

Recommendation 1: Situate the flood protection barrier and associated structures so that destruction and enclosure of emergent wetlands are avoided or minimized, to the greatest extent possible.

CEMVN Response 1: See CEMVN Programmatic Response 1.

Recommendation 2: The width of the construction and maintenance access channel and the plunge pool should be minimized, to the greatest extent practicable, to reduce direct impacts to estuarine wetlands.

CEMVN Response 2: Concur. The proposed 250 ft wide construction access channel is the minimum width proposed for the floodside channel to safely construct the project. Because of the expedited schedule of this project the Corps plans to have multiple barges in the channel for cranes driving piles, material storage and staging, and the moving of materials to various work locations. There will be multiple pile driving crews working on the face of the wall at all times. Multiple supply barges may need to be towed to the working barges in order to continue operations without stopping work. There will also be similar operations going on in the canal at 2-3 locations, requiring the passage of large crane barges and other equipment side-by-side. This means that it would not be feasible to limit the channel strictly to one way traffic.

Recommendation 3: The Corps shall fully compensate for any unavoidable losses of estuarine wetland habitat, forested wetland habitat and non-wet bottomland hardwoods caused by project features.

CEMVN Response 3: Concur. See CEMVN Programmatic Response 23.

Recommendation 4: Ensure impacts and encroachments onto public lands are avoided. Unavoidable impacts and encroachments when permissible by the appropriate managing agency should be minimized and appropriately mitigated.

CEMVN Response 4: Concur. Impacts and encroachment onto public lands will be avoided to the extent possible. Direct impacts to wetlands and bottomland hardwoods will be mitigated.

Recommendation 5: The project's first Project Cooperation Agreement (or similar document) should include language that specifies the responsibility of the local-cost sharer to provide operational, monitoring, and maintenance funds for mitigation features, as well as shoreline protection features.

CEMVN Response 5: See CEMVN Programmatic Response 5.

Recommendation 6: Acquisition, habitat development, maintenance and management of mitigation lands should be allocated as first-cost expenses of the project, and the local project-sponsor should be responsible for operational costs. If the local project-sponsor is unable to fulfill the financial mitigation requirements for operation, then the Corps should provide the necessary funding to ensure mitigation obligations are met on behalf of the public interest.

CEMVN Response 6: See CEMVN Programmatic Response 24.

Recommendation 7: Further detailed planning and design of project features (e.g., Design Documentation Report, Engineering Documentation Report, Plans and Specifications, or other similar documents) should be coordinated with the Service, including refuge personnel, NMFS, LDWF, Environmental Protection Agency (EPA) and Louisiana Department of Natural Resources (LDNR). The Service shall be provided an opportunity to review and submit recommendations on all the work addressed in those reports.

CEMVN Response 7: See CEMVN Programmatic Response 6.

Recommendation 8: The Corps should avoid impacts to Bayou Savage NWR, when feasible. If not feasible, the Corps should continue to coordination with Refuge personnel during planning and compatibility determination processes. A Special-Use Permit should be obtained prior to any entrance onto the refuge. Coordination should continue until construction of the flood protection barrier and marsh enhancement project are complete and prior to any subsequent maintenance. Points of contacts for the refuge are Kenneth Litzenberger, Project Leader for the Service's Southeast National Wildlife Refuges and Jack Bohannan (985) 822-2000, Refuge Manager for the Bayou Sauvage NWR. The Corps should not sign the Decision Record until a Compatibility Determination is complete.

CEMVN Response 8: See CEMVN Programmatic Response 7.

Recommendation 9: If a proposed project feature is changed significantly or is not implemented within one year of the date of our Endangered Species Act consultation letter, we recommend that the Corps reinitiate coordination with each office (i.e., NMFS in St. Petersburg, Florida, and the Service's Lafayette, Louisiana, Field Office) to ensure that the proposed project would not adversely affect any Federally listed threatened or endangered species or their habitat.

CEMVN Response 9: See CEMVN Programmatic Response 10.

Recommendation 10: Continued coordination should be conducted with the Louisiana Department of Wildlife and Fisheries, Scenic Rivers Program (504/765-2334) regarding any additional permits or conditions that may be required to perform work in Bayou Bienvenue.

CEMVN Response 10: Concur.

Recommendation 11: Guidance for avoiding and minimizing impacts to existing marsh within the enhancement area and to adequately offset conversion of water bottoms with successful marsh creation (Appendix B) should be incorporated into construction design.

CEMVN Response 11: Concur.

Recommendation 12: Should pre- and post-construction surveys indicate that the enhancement area resulted in negative impacts, remediation and/or mitigation may be required.

CEMVN Response 12: Concur.

Recommendation 13: Deposition of dredge material on Bayou Savage NWR should adhere to the following additional guidelines to avoid adverse impacts on that NWR:
a. Containment dikes should be located in open water areas with minimal marsh disturbance;
b. Material for containment dikes should be dredged from within the containment area;
c. Containment dikes should be degraded to marsh elevation following completion of disposal;
d. Dewatering/overflow pipes and breaches should be discharged and directed into degraded marsh for marsh nourishment purposes;
e. A maximum pump elevation of +4 NGVD with final settling height of +2.5 NGVD should not be exceeded (these elevations may be adjusted based on engineering surveys and calculated settling rates);
f. All marsh creation material should be tested for contaminants prior to placement and a contaminant report provided to the Refuge;
g. Following degradation of containment dikes, a 20-foot-wide vegetated buffer should be planted along the marsh edge. Container-grown *Spartina alterniflora* (oystergrass, smooth cordgrass) should be planted within this buffer on 3-foot centers; and,
h. Should 80% survival of planted material not be achieved at the end of one growing season, additional plantings may be necessary.

CEMVN Response 13: CEMVN concurs with guidelines a-f. Guideline g and h will be addressed as part of the mitigation planning which will be documented in a mitigation IER.

Recommendation 14: Culverts installed within Bayou Bienvenue during advance measures should be placed to allow as much opening as practicable, in number, size, and diversity. To facilitate estuarine access, culverts should be placed near both sides of the channel as well as within the center of the channel that extends to the bottom.

CEMVN Response 14: The placement of the culverts has been designed to facilitate estuarine access to the maximum extent practicable. It is not possible to construct the sector gates with a culvert running through the center of the channel; however, the culverts have been placed at varied heights and spread throughout the channel to the maximum extent practicable.

Recommendation 15: Flood protection water control structures in any watercourse should maintain pre-project cross section in width and depth to the maximum extent practicable, especially structures located in tidal passes.

CEMVN Response 15: See CEMVN Programmatic Response 12.

Recommendation 16: Flood protection water control structures should remain completely open except during storm events. The GIWW by-pass swing gate structure should be positioned in the floating position during non-storm operating conditions, to allow for maximum flows through the structure.

CEMVN Response 16: See CEMVN Programmatic Response 13.

Recommendation 17: The number and sitting of openings in flood protection levees should be optimized to minimize the migratory distance from the opening to the enclosed wetland habitats.

CEMVN Response 17: See CEMVN Programmatic Response 12 and 14.

Recommendation 18: Structures should include shoreline baffles and/or ramps (e.g., rock rubble, articulated concrete mat) that slope up to the structure invert to enhance organism passage. Various ramp designs should be considered.

CEMVN Response 18: Concur.

Recommendation 19: To the maximum extent practicable, structures should be designed and/or culverts selected such that average flow velocities during peak flood or ebb tides do not exceed 2.6 feet/second. This may not necessarily be applicable to tidal passes or other similar major exchange points.

CEMVN Response 19: See CEMVN Programmatic Response 17

Recommendation 20: To the maximum extent practicable, culverts (round or box) should be designed, selected, and installed such that the invert elevation is equal to the existing water depth. The size of the culverts should be selected that would maintain sufficient flow to prevent siltation.

CEMVN Response 20: See CEMVN Programmatic Response 18

Recommendation 21: Water control structures should be designed to allow rapid opening in the absence of an offsite power source after a storm passes and water levels return to normal.

CEMVN Response 21: Acknowledged.

Recommendation 22: Operational plans should be developed to maximize the cross-sectional area open for as long as possible. Operations to maximize freshwater retention or redirect freshwater flows could be considered if hydraulic modeling demonstrates that it is possible and such actions are recommended by the natural resource agencies.

CEMVN Response 22: See CEMVN Response 16.

Recommendation 23: Shoreline protection features should be constructed along the eastern shoreline of the maintenance channel and along the western shoreline of the protected side plunge pool to maintain the shoreline integrity and minimize shoreline erosion.

CEMVN Response 23: Concur. Shoreline protection would be provided along the entire length of the maintenance/access channel. Shoreline protection would consist of riprap, concrete slope paving, geotextiles, or other means. The protection would extend approximately 30 ft along the channel bottom. Additionally, the scour pad associated with the plunge pool on the protected side of the floodwall would provide shoreline protection as well.

Recommendation 24: Plugs should be installed where the proposed channel intersects with natural and manmade waterways to minimize recreational boating access and reduce wave-induced erosion.

CEMVN Response 24: Concur. Engineered barriers (plugs) will be installed at the ends of the maintenance/access channel and plunge pool.

Recommendation 25: To further minimize recreational boater access and associated marsh impacts, signs indicated restricted-access should be posted around the maintenance channel, channel plugs, and adjacent marsh.

CEMVN Response 25: Concur. Restricted-access signs will be posted around the maintenance/access channel, channel plugs, and adjacent marsh.

Recommendation 26: Forest clearing associated with project features should be conducted during the fall or winter to minimize impacts to nesting migratory birds, when practicable.

CEMVN Response 26: Concur. No or negligible forest clearing will occur with implementation of the proposed action

7.0 MITIGATION

Quantitative analysis utilizing existing methodologies for water resource planning has identified the acreages and habitat type for the direct or indirect impacts of implementing the proposed action. Although the proposed action is not the alternative that would have the least amount of impact on the existing natural resources, it was selected because it would minimize impacts to the surrounding environment while meeting the social objectives and engineering constraints. It is anticipated that approximately 101 acres of wetland (mostly salt marsh) and 108 acres of open water habitat would be acquired for the construction of the proposed action. Additional adverse impacts could occur from changes to salinity, water quality, and hydrology.

Best management practices to reduce sediment loading to the surface water of the project area would be used and could reduce effects on water quality and aquatic life, specifically EFH. Permanent removal of EFH would be mitigated.

A habitat evaluation was conducted by the USFWS using habitat assessment models developed by LDNR and USFWS for the proposed action. The habitat evaluation was conducted for the entire right-of-way to be acquired for this project (figure 43), which is an area larger than the actual footprint of direct impact. The final acreage to be mitigated for this project will be decided in a separate mitigation IER. The habitat assessment methodology (HAM) was used to quantify the impacts of the proposed action to bottomland hardwood habitat and the wetland value assessment (WVA) methodology was utilized to quantify impacts on emergent wetlands. These assessments were conducted independently of this IER by USFWS and other resource agencies to determine the changes in fish and wildlife habitat that would be projected to occur as a result of the proposed action. The results of this evaluation were reported in the draft letter FWCA Report from USFWS to CEMVN dated June 27, 2008. The habitat evaluations identified the quality and quantity of available habitat for selected wildlife species under existing conditions and predict the future habitat suitability for those species without the proposed action (without the project) and as a result of the unavoidable impacts from the proposed action (with project).

Figure 43. Right-of-Way to be Acquired for Proposed Action

The evaluations were performed for three habitats within the project area; bottomland hardwood, emergent marsh and open water. The USFWS estimated approximately 15 acres of bottomland hardwood and 186 acres of brackish marsh and open water habitat for use in the HAM and WVA, respectively. The results of the evaluations are expressed in habitat units (HUs), representing the acreage and quality of the habitat. HUs were calculated for the two scenarios (without project and with the project) from the current time to 50 years into the future, the assumed life of the proposed action.

The HUs were summed to determine the total number of HUs gained or lost without the project and as a result of the proposed action. These cumulative HU values were then divided by the life of the action (50 years) to determine the average annual habitat unit (AAHU) value. Finally, in order to obtain an estimate of the impact of the proposed action on the fish and wildlife habitat, the AAHU value for the future with the project was subtracted from the AAHU value for the future without the project. A positive AAHU indicates that the proposed action would result in an increase in the "value" of the wetland habitat, while a negative result indicates that the proposed action would result in a decrease in the wetland habitat "value."

The results of the HAM and WVA indicate that the impact on wetlands by the proposed action would decrease the wetland habitat value of bottomland hardwood, brackish open water and emergent marsh habitat. Bottomland hardwood habitat would have a net change of -2.59 AAHUs and brackish open water and marsh habitat would have a net change in AAHUs of -

18.12 if the proposed project were constructed. The total loss of habitat would be 20.71 AAHUs. These AAHUs will be used to adequately mitigate the loss of these habitats by the proposed action. The draft FWCA Report for the IER # 11, Tier II Borgne project, which contains a discussion of the WVA, is included in appendix F of this document**.**

Habitat impact estimates determined as part of the HAM/WVA used habitat data based on the FWS methodology, which used recently published habitat data from Barras et. al. (2008). The estimates of impacts to the different habitats discussed for the significant resources sections in this IER relied on GIS data for the footprints of the alternatives and construction ROW of the proposed action, and a GIS habitat data layer (LDWF 2001). The different methodologies and data used to determine habitat impacts may result in a slight shift or difference in habitat or marsh type classification.

The Corps will not use the nourishment areas as compensatory mitigation for wetland impacts resulting from activities described in this IER. Compensatory mitigation for wetland impacts from this project will be described in a separate mitigation IER. All the wetland benefits from the beneficial use of dredge material activities described in IER 11 Tier II will be above and beyond the compensatory mitigation that will be described and implemented separately.

Mitigation for unavoidable impacts to the human and natural environment described in this and other IERs will be addressed in separate mitigation IERs. The CEMVN has partnered with Federal and state resource agencies to form an interagency mitigation team that is working to assess and verify these impacts, and to look for potential mitigation sites in the appropriate hydrologic basin. This effort is occurring concurrently with the IER planning process in an effort to complete mitigation work and construct mitigation projects expeditiously. As with the planning process of all other IERs, the public will have the opportunity to give input about the proposed work. These mitigation IERs will, as described in section 1 of this IER, be available for a 30-day public review and comment period.

These forthcoming mitigation IERs will implement compensatory mitigation as early as possible. Construction of this vital GNOHSDRRS project is not being delayed pending final mitigation plans. All mitigation activities would be consistent with standards and policies established in the Clean Water Act Section 404 and the appropriate USACE policies and regulations governing this activity.

8.0 COMPLIANCE WITH ENVIRONMENTAL LAWS AND REGULATIONS

Construction of the proposed action would not commence until the proposed action achieves environmental compliance with all applicable laws and regulations, as described in this section.

Environmental compliance for the proposed action will be achieved upon coordination of this IER with appropriate agencies, organizations, and individuals for their review and comments; the USFWS and NMFS confirmation that the proposed action would not be likely to adversely affect any endangered or threatened species or completion of ESA section 7 consultation; LDNR concurrence with the determination that the proposed action is consistent, to the maximum extent practicable, with the Louisiana Coastal Resources Program; receipt of a Water Quality Certificate from the State of Louisiana; public review of the Section 404(b)(1) Public Notice and signature of the Section 404(b)(1) Evaluation; coordination with the Louisiana SHPO; receipt and acceptance or resolution of all FWCA recommendations; receipt and acceptance or resolution of all LDEQ comments on the air quality impact analysis documented in the IER; and receipt and acceptance or resolution of all EFH recommendations.

9.0 CONCLUSIONS

9.1 INTERIM DECISION

The proposed action consists of 2 miles of new GNOHSDRRS extending from the Michoud floodwall north of the GIWW to the levee on the west side of the MRGO. The GNOHSDRRS would cross the GIWW, Bayou Bienvenue, the MRGO, and the Golden Triangle marsh (including the Bayou Sauvage NWR). The proposed action would consist of a flood control sector gate and bypass gate at the GIWW, a new navigable flood control sector gate at Bayou Bienvenue, a braced concrete wall across the MRGO, and a concrete floodwall across the marsh between these waterways.

The CEMVN has assessed the environmental impacts of the proposed action and has determined that the proposed action would have the following impacts:

Hydrology

Modeling results for an opening of 56 ft width on Bayou Bienvenue predict flows more than 2.4 ft/s through Bayou Bienvenue 50 percent of the time during the wet period (March) in an area approximately twice the distance from the gate. Expected velocities within the GIWW would be approximately 0.6 ft/s. During construction, when the cofferdam on Bayou Bienvenue is in place, the proposed action generally results in an increase in maximum tidal depth of about 0.3 ft on the flood (east) side of the proposed barrier and maximum water levels are lowered by 0.15 ft or less on the protected side (west) of the barrier. This equates to interior marsh areas being wetted by more than 2 hours less than baseline conditions.

Upon completion of the final configuration, the proposed action generally results in lower maximum tidal elevations in the protected side of the marsh. Surface elevations are expected to be lower by generally 0.20 ft or less. The maximum water surface elevation is raised by 0.20 ft or less in the flood side of the marsh and in the MRGO. Tidal phase would remain unchanged in some portions of both the protected and floodside marsh, although these portions could experience as much as +/- 2.4 inches change in the amount of water on the marsh. Other portions of the protected and flood side marsh would experience some change in tidal phase, remaining wet for +/- 1-2 hours a day. The worst case scenario for the flood side shows a single location with continuous flooding of 3 inches or less; i.e. no wetting/drying cycle. The worst case scenario for the protected side shows two locations with continuous flooding of 3 inches or less.

Water Quality

Construction activities associated with the proposed action would result in localized, temporary adverse impacts to water quality. Water quality certification (WQC 080616-01/AI 158513/CER 20080001) for the proposed project was issued by LDEQ on June 17th, 2008.

Wetlands

Direct wetland impacts associated with both construction of the proposed action and construction of the alternatives would total 80 acres. Additional wetlands could be impacted from scour of increased water flows from the new gate structures. However, project-related dredged material would be used beneficially in 205 acres of open water east of the proposed project. Loss of wetland habitat would be mitigated based upon USACE plan completed in consultation with the Federal and state resource agencies. The permit required for dredge and fill in these wetlands was submitted.

Aquatic Resources

Direct impacts to aquatic resources would occur due to changes in estuarine substrate, estuarine open water, and wetlands within the footprint of the floodwall and other structures.

Fisheries

A loss of approximately 125 acres of wetland and open water habitat and changes to salinity and water quality would occur from the proposed action. These changes could adversely impact fisheries resources. However, long term benefits from the beneficial use of dredge material would lead to long term beneficial effects for fisheries resources.

EFH

Approximately 125 acres of wetland and open water (bottoms and water surface area) would be permanently impacted by the proposed action, which would adversely affect EFH. Additionally, beneficial use of project related dredge material could potentially enhance 205 acres of open water east of the proposed project. Loss of EFH would be mitigated based on consultation with the NMFS.

Wildlife

The relatively small areas of terrestrial habitat potentially affected by the project are adjacent to large areas of similar habitat. The proposed action alignment would cross saline marsh habitat that is within the perimeter of the Bayou Sauvage NWR; however, construction of the proposed action in this narrow corner of the refuge would not substantially adversely impact wildlife within the refuge.

The presence of construction-related activity, machinery, and noise would be expected to cause most wildlife, terrestrial and aquatic, to avoid the construction area and adjacent habitats during the construction period.

Endangered or Threatened Species

The potential for any impacts to any threatened and endangered species as a result of the construction of the proposed action appears to be minimal. Procedures for preventing disturbance to the manatee would be employed during construction, further minimizing the potential for the manatee to be affected by the proposed action. Therefore, these endangered and threatened species would be unlikely to be adversely affected by direct impacts from the proposed action.

Upland Resources

The upland areas that would be impacted by the proposed project do not support substantial natural communities; therefore, upland habitats would not be substantially impacted under the proposed action.

Cultural Resources

Based on a review of the information summarized in the existing conditions section, the proposed action alternative would have no adverse impact on cultural resources. The SHPO and Indian Tribes concurred with a "no adverse effect" finding. Cumulative impacts would be beneficial because cultural resources are often destroyed by flooding.

Recreation

Direct temporary impacts to recreational boating could occur along Bayou Bienvenue under the proposed action. The bayou will be temporarily closed to boat traffic at the location of the structure control gate during construction. Additionally, approximately 19 acres would be replaced in the NWR for construction of the proposed action.

Aesthetic (Visual) Resources

Adverse impacts to visual resources would occur by placement of the proposed action in an open area with little man-made structures.

Air Quality

Temporary impacts to air quality would be expected from the generation of airborne dust and emissions of equipment used during construction of the proposed action. Air quality impacts from the proposed action would be temporary.

Noise

Adverse impacts from construction-related noise would occur within 1,000 ft of construction.

Transportation

The impacts from the proposed action on transportation would occur primarily during the construction period.

Socioeconomic Resources

Beneficial impacts on socioeconomic resources throughout the greater New Orleans area would result from the work generated by construction of the proposed action, as well as through the increased GNOHSDRRS provided by the proposed action.

Potential localized adverse impacts on navigation and businesses adjacent to the Michoud Canal and the GIWW would occur during the construction period. The proposed action could result in adverse impacts to the local fishing industry and marinas beyond the 3-year construction period.

Environmental Justice

No disproportional impacts were identified.

9.2 PREPARED BY

The point of contact for this IER is Laura Lee Wilkinson, USACE, New Orleans District Hurricane Protection Office. Table 17 lists the preparers of relevant sections of this report. Ms. Wilkinson can be reached at the U.S. Army Corps of Engineers, New Orleans District; Hurricane Protection Office, P.O. Box P.O. Box 60267, 7400 Leake Avenue; New Orleans, Louisiana 70118.

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16 USC 1531. United States Code, Title 16, *Conservation*, Chapter 35, "Endangered Species."

33 USC 1344. United States Code, Title 33, *Navigation and Navigable Waters*, Chapter 26, "Water Pollution Prevention and Control," Section 1344, Permits for Dredged or Fill Material.

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APPENDIX A

LIST OF ABBREVIATIONS AND ACRONYMS

AAHU	average annual habitat unit
AAI	All Appropriate Inquiry
ACB	articulated concrete blocks
ASTM	American Society for Testing and Materials
BLH	bottomland hardwood
BMP	Best Management Practices
BOD	biological oxygen demand
°C	degree Celsius
CAA	Clean Air Act
CED	Comprehensive Environmental Document
CEMVN	Corps of Engineers, Mississippi Valley Division, New Orleans District
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CO	carbon monoxide
COD	chemical oxygen demand
CPT	cone penetrometer test
CWA	Central Wetlands Area
CWPPRA	Coastal Wetlands Planning, Protection, and Restoration Act
cy	cubic yard
dB	decibel
dBA	A-weighted decibel
DNL	day-night average sound level
DO	dissolved oxygen
EA	Environmental Assessment
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EJ	Environmental Justice
EPA	Environmental Protection Agency
ER	Engineering Regulation
ESA	Environmental Site Assessment
ESRI	Environmental Systems Research Institute
°F	degree Fahrenheit
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
ft	feet
ft/century	feet per century
ft/yr	feet per year
ft/s	feet per second
FONSI	Finding of No Significant Impact
FWCA	Fish and Wildlife Coordination Act
GIWW	Gulf Intracoastal Waterway
GMFMC	Gulf of Mexico Fishery Management Council
GNOCDC	Greater New Orleans Community Data Center

GNOHSDRRS	Greater New Orleans Hurricane and Storm Damage Risk Reduction System
HAM	habitat assessment methodology
HCNA	Holy Cross Neighborhood Association
HPS	Hurricane Protection System
HTRW	hazardous, toxic, and radioactive waste
HU	habitat unit
HUD	U. S. Department of Housing and Urban Development
Hwy	Highway
IBA	Important Birding Area
I-10	Interstate 10
IER	Individual Environmental Report
IHNC	Inner Harbor Navigation Canal
III	Insurance Information Institute
IPET	Interagency Performance Evaluation Task Force
ISC	Integrated Support Command
LACPR	Louisiana Coastal Protection and Restoration
LADOTD	Louisiana Department of Transportation and Development
LCA	Louisiana Coastal Area
LCRP	Louisiana Coastal Resource Program
LCWCRTF	Louisiana Coastal Wetlands Conservation and Restoration Task Force
LDEQ	Louisiana Department of Environmental Quality
LDNR	Louisiana Department of Natural Resources
LDWF	Louisiana Department of Wildlife and Fisheries
LEIS	Legislative Environmental Impact Statement
LF	linear feet
LOIS	Louisiana Occupational Information System
LOS	level of service
LPV	Lake Pontchartrain and Vicinity
LRA	Louisiana Recovery Authority
MAF	Michoud Assembly Facility
mg/L	milligram per liter
mm	millimeter
mph	miles per hour
MRGO	Mississippi River Gulf Outlet
MSA	Metropolitan Statistical Area
NAAQS	National Ambient Air Quality Standard
NASA	National Aeronautics and Space Administration
NAVD88	North American Vertical Datum of 1988
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NGVD29	National Geodetic Vertical Datum of 1929
NMFS	National Marine Fisheries Service
NOV	New Orleans to Venice
NRHP	National Register of Historic Places
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NOBID	New Orleans Business and Industrial District
NWR	National Wildlife Refuge

O_3	ozone
PA	Programmatic Agreement
Pb	lead
PCB	polychlorinated biphenyl
PDT	Project Delivery Team
PL	Public Law
PM	particulate matter
ppm	parts per million
ppt	parts per thousand
RCRA	Resource Conservation and Recovery Act
REC	recognized environmental condition
SAV	submerged aquatic vegetation
SHPO	State Historic Preservation Office
SIR	Supplemental Information Report
SO_2	sulfur dioxide
sq ft	square feet
SWPPP	Storm Water Pollution Prevention Plan
TMDL	Total Maximum Daily Load
TRB	Transportation Research Board
UNO	University of New Orleans
U.S.	United States
USC	United States Code
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
vlf	volume per linear foot
WBV	West Bank and Vicinity
WCRA	Wetlands Conservation and Restoration Authority
WCSC	Waterborne Commerce Statistics Center
WIC	Waterbody Impairment Combination
WRDA	Water Resources Development Act
WVA	wetland value assessment

APPENDIX B

MODELING REPORTS

- **Hydroperiod Modeling Study, Inner Harbor Navigation Canal Proposed Barrier, Golden Triangle Marsh, 26 June 2008**

- **Floodgate analysis of the Mississippi River Gulf Outlet and Gulf Intracoastal Waterway, ERDC/CHL TR-08-X, May 2008**

- **Reconnaissance study of fish passage impacts resulting from structures in the MRGO, IHNC and GIWW- Letter Report, 2008**

- **Estimation of Bottom Water Dissolved Oxygen in the Mississippi River Gulf Outlet and Gulf Intracoastal Waterway Resulting from Proposed Structures, 2008**

To access these studies electronically, go to http://www.nolaenvironmental.gov

To request a hardcopy, contact Gib Owen at 504-862-1337

APPENDIX C

AIR EMISSIONS ANALYSIS

1. Introduction

The 1990 amendments to the Clean Air Act (CAA) require federal agencies to ensure that their actions conform to the appropriate State Implementation Plan (SIP) in a nonattainment area. The SIP is a plan that provides for implementation, maintenance, and enforcement of the National Ambient Air Quality Standards (NAAQS), and it includes emission limitations and control measures to attain and maintain the NAAQS. Conformity to a SIP, as defined in the CAA, means conformity to a SIP's purpose of reducing the severity and number of violations of the NAAQS to achieve attainment of such standards. The federal agency responsible for an action is required to determine if its action conforms to the applicable SIP.

The US Environmental Protection Agency (USEPA) has developed two sets of conformity regulations, and federal actions are appropriately differentiated into transportation projects and non-transportation-related projects:

- Transportation projects are governed by the "transportation conformity" regulations (40 CFR Parts 51 and 93), which became effective on December 27, 1993 and were revised on August 15, 1997;
- Non-transportation projects are governed by the "general conformity" regulations (40 CFR Parts 6, 51 and 93) described in the final rule for *Determining Conformity of General Federal Actions to State or Federal Implementation Plans*. These regulations were published in the *Federal Register* on November 30, 1993. The general conformity rule became effective January 31, 1994 and has not been updated since.

The proposed action to improve storm and flood protection on the Inner Harbor Navigation Canal (IHNC) would be governed by the general conformity regulation if it occurred in a "non-attainment" area because it is a non-transportation project. The proposed IER #11 - Tier 2 Borgne project would occur within Orleans and St. Bernard Parishes, Louisiana. These areas are currently in attainment for all criteria pollutants, so adherence to the general conformity rule (GCR) is not required. However, the changes in annual emissions resulting from the proposed action were quantified and disclosed in the IER for the purpose of full and complete analyses of potential impacts related to the proposed action. The air emissions analysis described in this appendix was conducted by following the requirements established in the GCR.

The conformity analysis for a Federal action examines the impacts of the reasonably foreseeable direct and indirect net emissions from mobile and stationary sources. Direct emissions are emissions of a criteria pollutant or its precursors that are caused or initiated by a Federal action and occur at the same time and place as the action. Indirect emissions, occurring later in time and/or further removed in distance from the action itself, must be included in the determination if both of the following apply:

- The Federal agency can practicably control the emissions and has continuing program responsibility to maintain control;
- The emissions caused by the Federal action are reasonably foreseeable.

Under the Proposed Action, the CEMVN is proposing several alternatives that have potential to include a combination of the following main construction elements:

- Deep and/or shallow draft gates,
- Bypass gates,
- Flood walls and/or levee along various alignments.

The construction activities are assumed to take place from 2008 to 2010 with the advanced measures phase occurring between 2008 and 2009 and the final configuration phase occurring between 2009 and 2010. Increased direct and indirect criteria pollutant emissions would result from the following activities:

- Use of diesel-powered construction equipment including tug boat operations,
- Movement of trucks containing construction materials,
- Construction-workers commute.

In estimating criteria pollutant emissions, the usage of equipment and the duration of activities for construction activities were evaluated first. The increased emissions were then calculated using the USEPA guidance and emission factors. The typical criteria pollutants associated with the proposed action include ozone (O_3), carbon monoxide (CO), and particulate matter smaller than 10 microns and smaller than 2.5 microns (PM_{10} and $PM_{2.5}$) and sulfur dioxide (SO_2). O_3 is principally formed from nitrogen oxides (NO_x) and volatile organic compounds (VOCs) through chemical reactions in the atmosphere. Therefore both NO_x and VOC emissions were calculated.

2. Emissions Determination

A construction estimate to identify equipment, material and manpower requirements for the proposed construction program associated with the IER #11 - Tier 2 Borgne project for IHNC in Orleans and St. Bernard Parishes, Louisiana was completed. The estimate was further used for predicting construction emissions on an annual basis assuming that emissions for the advance measures would be emitted evenly over 2008 and 2009 while emissions for the final configuration phase would occur in 2010.

2.1 Construction Activities

Estimates as to construction crew and equipment requirements and productivity are based on data presented in

- "2003 RSMeans Facilities Construction Cost Data", R.S. Means Co., Inc., 2002
- "2006 RSMeans Heavy Construction Cost Data", R.S. Means Co., Inc., 2005
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Specific information regarding the sizes of specific construction elements and types of construction are based on the descriptions contained in the draft IER #11 – Tier 2 Borgne document and best professional judgment.

Seven alternatives were retained for detailed evaluation in the IER #11 – Tier 2 Borgne document. These alternatives included:

Alignment 1 Deep draft gate (350 feet [ft] by 40 ft) on the GIWW east of Paris Road Bridge and west of Michoud Slip. This would include the replacement and/or modification of approximately 39,000 linear ft (lf) of floodwalls and levees along the GIWW, Michoud Canal, and MRGO, and 21 gates, including the existing Bayou Bienvenue Control Structure.

Alignment 2 Deep draft gate (350 ft by 40 ft) on the GIWW immediately east of Michoud Slip. This would include the replacement and/or modification of approximately 28,000 lf of floodwalls and levees along the GIWW, Michoud Canal, and the MRGO and 21 gates including the existing Bayou Bienvenue Control Structure.

Alignment 3 Shallow draft gate and bypass gate (150 ft by 16 ft each) on the GIWW approximately 500 ft east of the Michoud Canal; closure structure on the Mississippi River Gulf Outlet (MRGO) just north of the existing Bayou Bienvenue flood control gate; connected by either a floodwall (Alternative 3a) or a levee (Alternative 3b) across the marsh. This alignment and alternatives would include the rebuilding of the existing Bayou Bienvenue flood control gate and require relocation of two pipelines. Construction of an access channel would yield approximately 630,000 to 900,000 cubic yards (cy) of dredge material for beneficial marsh nourishment.

Alignment 4	Shallow draft gate and bypass gate on the GIWW (150 ft by 16 ft each) approximately 1,150 ft east of the Michoud Canal; closure structure on the MRGO approximately 2,700 ft southeast of the existing Bayou Bienvenue flood control structure; connected by either a floodwall (Alternative 4a) or a levee (Alternative 4b) across the marsh, with a navigable gate at the crossing of Bayou Bienvenue (56 ft by 8 ft). Construction of an access channel would yield approximately 910,000 to 1,300,000 cy of dredge material for beneficial marsh nourishment.
Alignment 5	Shallow draft gate and bypass gate (150 ft by 16 ft each) on the GIWW approximately 5,100 ft east of the Michoud Canal; closure structure on MRGO approximately 7,000 ft southeast of the existing Bayou Bienvenue flood control gate; connected by either a floodwall (Alternative 5a) or a levee (Alternative 5b) across the marsh, with a navigable gate at the crossing of Bayou Bienvenue (56 ft by 8 ft). Construction of an access channel would yield approximately 4,700,000 to 6,700,000 cy of dredge material for beneficial marsh nourishment.

Alternative 4a was selected as the proposed action. Alignments 3, 4 and 5 involve similar construction, varying significantly only in the length of floodwall or levee construction and associated dredging. All three alternatives propose to construct a shallow draft gate and bypass gate at the GIWW and a closure structure on the MRGO. The proposed action (Alternative 4a) would construct approximately 2 miles of new floodwall or levee, Alternative 3 would construct approximately 1.5 miles, and Alternative 5 would construct 2.6 miles. The only significant difference between these three alternatives that was not related to length of construction involves a gate at Bayou Bienvenue and pipeline relocation. In Alternative 3, the existing flood control gate would be reconstructed, and two pipelines relocated; in Alternatives 4 and 5, a new gate would be provided at the crossing of Bayou Bienvenue, and no pipeline relocation work would be required.

Alternative 5a was assumed to be the "worst-case" alternative from the perspective of air emissions because it would involve the greatest amount of construction activities and differs from the Alternative 4a in the length of floodwall or levee to be constructed. The difference in work effort required for rehabilitation of the existing Bayou Bienvenue (i.e., Alternative 3) versus construction of a new gate (i.e., Alternatives 4 and 5) is assumed to be negligible. Therefore, the estimate considers only Alignment 4a in depth, and scaled proportionally to provide an assessment of the impacts of Alignments 3 and 5. While significantly different in terms of construction activity, Alignments 1 and 2 are not considered for detailed analysis since they were not selected as the proposed action and also would have less air emissions impact given the scale of construction.

The major construction components required for alternatives in alignments 3, 4 or 5 include two marsh protection options (floodwall or levee), a GIWW gate and bypass gate, two MRGO closure options (structural wall or cellular closure structure), and a navigable gate at Bayou Bienvenue. The construction of these various components is described as follows:

Marsh Protection Option A – Floodwall

Plumb concrete or steel piles jet-grouted together would create an impervious barrier. Crushed stone and riprap would be placed on both sides of the floodwall to provide protection to the structure from waves that may overtop the wall. The final height of the piling would be 20.75 ft above mean sea level. Construction pile lengths would vary from 90 to 250 ft. For the purpose of this evaluation, an average pile height of 100 ft was assumed for floodwall piles, of which 60 ft would be embedded. As part of the floodwall construction, dredging of a 350-ft wide channel would be required, providing a 250-foot wide access waterway to access the completed wall after construction, and a 90-ft wide plunge pool on the protected side of the wall. The dredging and piling installation would occur immediately as part of the "advanced measures," while installation of 5.25-ft tall cast-in-place concrete panels on top of the wall, bringing the protected level up to 26 ft above mean sea level, would occur during the second stage of the project. Other assumptions made regarding the equipment required for the floodwall option included:

- Excavation of 1.4 million cy of sediment for a dredge channel in preparation of floodwall construction would require:
    - a 2,822 HP 24 inch (") dredge with a 2,822 HP booster pump (5,644 total HP) is used, capable of dredging 1,200 cy of fine sand (0.1 mm average particle size) per hour at a depth of up to 20 ft;
    - 6 hours of production per shift;
    - two workers per shift on dredge;
    - 195 dredge shifts (1.4 million cy with an average dredge production of 21,600 cy per dredge day).
- Installation of the floodwalls would require:
    - 1,920 piles for an assumed wall length of 2 miles and a pile width of 66 inches;
    - 115,200 lf of pile driven for an assumed 60-ft driving depth (40 ft left as stickup to form the wall);
    - 384 crew days for 115,200 lf at 300 lf per crew per day, based on items in the 02455-450 series in the Means guide, assumed that a B-19A crew would have a productivity of 300 lf per day (Means guide goes up to 24" square, solid pile and a corresponding production rate of 440 lf; 66" precast concrete piles would be hollow, and therefore somewhat heavier than a 24" solid pile). The assumed 300 lf per day reflects added weight plus a penalty for waterborne work;
    - 817,920 cf of jet grouting was assumed based on filling a column equivalent to a 3-ft diameter column to the full depth of the floodwall at each joint between piles (115,200 lf of columns x 7.1 square feet [sf] = 817,920 cf grouting). Note: Means guide does not have a jet grouting system of this scale so, an estimate of 241 days of jet grouting crews using a 350 horse power pumping system and a barge-mounted batching plant and 6 laborers was used (based on professional experience assuming a production rate of 3,400 cf/day, which can be readily accomplished with a large rig).
- For final configuration phase work, the quantities provided in the IER #11 – Tier 2 Borgne document were used. These quantities were:
    - 100,900 cy of concrete assuming RSMeans item 03310-240-1950, elevated slabs, including forms, steel & placement for 50.99 cy/d production, or 1,978 C-14B crew days;

- 86,000 cy of crushed stone assuming RSMeans item 02390-110-6000 with crushed stone placed behind bulkhead by clam bucket using values for "crew B-12H" modified to use 10 cy bucket as opposed to 1 cy bucket so production was adjusted from 120 cy to 800 cy to yield 108 days required for the modified B-12H crew;
- 80,800 cy of sand fill assuming same item and production rate as used for crushed stone - 101 days of modified B-12H crew;
- 86,000 cy of riprap assuming RSMeans item 02370-450-0370, dumped riprap, 300 lb average using the B-12H crew as above (instead of Means-specified B-11A crew with a dozer) due to barge-borne nature of work and productivity was assumed to be one-half of the crushed stone placement work - 215 days of modified B-12H crew.

Marsh Protection Option B – Levee

Earthen levee with geotextile fabric and mixed soil-cement columns would be similar to a traditional earthen levee, but would incorporate mixed soil-cement columns and geotextile fabric to increase the load bearing capacity of the underlying soils and reduce the required stability berm width. The geometry of the stability berm for a given design load is dependent on the load-bearing capacity of the underlying soils. The geotextile fabric with a sand pad would be 600 ft wide. The entire 600 ft footprint would be under laid by cement columns extending to elevation -75 ft at every 6 ft along the alignment. There would be approximately 283 columns for every 6 ft of levee. Assumptions made regarding the equipment required for the levee work included:

- For soil-cement columns, 283 columns per 6 ft of levee for a total of 10,560 columns. The RSMeans guide does not have relevant soil-cement items so item 02465-800-1300, open-style machine drilled caisson in wet ground, 18" diameter was used as an approximate substitute, with 160 lf per day productivity from a B-48 crew. 75 lf per column x 10,560 columns = 792,000 lf of column for a total of 4,950 installation days;
- RSMeans item 02340-300-1510, heavy-duty woven geotextile with 2,400 SY production per day from 2 laborers was used for installation of the geotextile fabric. Productivity was reduced to 1,800 square yards (sy) to account for difficult working conditions. The total levee area is 704,000 sy, so 391 days of geotextile placement would be required;
- Placement of fill would be by clamshell from barges. 10 cy buckets with an average cycle time of 2 minutes would yield 2,400 cy of fill placed per shift. With the average berm width of 600-ft wide and average height of 30-ft a total volume of 3,520,000 cy or 1,467 placement crew days was used;
- Levee armoring work would be equivalent to rip-rap placement for the floodwall alternative and would be accomplished with a B-12H crew. 550 lf of levee face (nearly the entire face of the levee) would be armored, with an average depth of 6 inches a total volume is 107,556 cy of rip rap would be required, which would result in 134 crew days (at 800 cy production per crew day).

GIWW Gate and Bypass

Although the three different gate types were described in the IER, the sector gate was the only type considered for this estimate, assuming that all the gates would require similar construction time, materials, and equipment. A sector gate and floating swing bypass gate would be installed at the crossing of the new installation and the GIWW. Construction would involve the installation of a floating swing bypass gate and cofferdam allowing for installation of the sector gate during the “advanced measures” stage. The sector gate itself would be installed in the second stage of construction. It was assumed that approximately 1,200 lf of fendering constructed of 36-inch precast concrete piles would be required. It was also assumed that the fendering piles would be the same length as the general floodwall piling (i.e., 100 ft.), and that half would be installed as advanced measures and half would be installed during the final configuration phase.

As with the floodwall construction quantity estimates for the pile-related aspects of the construction were estimated, while other quantities were taken from those described in the IER document for all other aspects of construction. It was assumed that half of all material quantities (other than sheetpiling) would be installed as part of the advanced measures, and half would be installed during the final configuration phase of the project. Sheetpiling would be installed during the advanced measures phase, and removed during the final configuration phase. It is assumed that both the bypass gate (a swing-type barge gate) and the sector gates would predominantly be pre-fabricated units requiring only placement-type work on-site. Assumptions made regarding the equipment required for gate construction included:

- 111 crew days of pile driving was assumed, half for advanced measures and half for the final configuration, for installation of 400, 36” precast pilings (with an assumed length of 100 ft for a total piling length of 40,000 lf). The RSMeans guide does not have an entry for 36” piles; based on items in the 02455-450 series so it was assumed that a B-19A crew will have a productivity of 360 lf per day for this item;
- A total of 33,900 cy of concrete would be required for the entire project and was, split evenly between advanced measures and the final configuration phases of work. RSMeans item 03310-240-3850, footings over 5 cy, including forms, steel & placement, 81.04 cy/d production, or 419 C-14B crew days was used.
- A total 38,000 cy of sand fill, 6,000 cy of riprap and 2,500 cy of crushed stone would be required and was split evenly between advanced measures and the second phase of work;
    - RSMeans item 02390-110-6000 was used for crushed stone placed behind bulkhead by clam bucket, crew B-12H modified to use 10 cy bucket (as opposed to 1 cy bucket; production adjusted from 120 cy to 800 cy accordingly) for a total of 4 days of modified B-12H crew;
    - Sand placement would be the same item and production rate as crushed stone requiring an estimated 48 days of modified B-12H crew;
    - RSMeans item 02370-450-0370 was used for dumped riprap (300 lb average) but the B-12H crew described earlier was assumed instead of RSMeans-specified B-11A crew with a dozer to account for the barge-borne nature of work. Also, productivity would be one-half that of the crushed stone placement work for a required 15 days of modified B-12H crew;
- 110,500 sf of sheeting installation was estimated using RSMeans item 02250-400-1900 for 25’ deep drive, extract and salvage for an estimated total of 553 SF per day - using 200 B-40 crew days split evenly between the two phases of the project;
- Both gate types would be fabricated off-site, and on-site work would be limited to hoisting and placing units;
- A barge-mounted crawler-mounted lattice crane with 350-tons of capacity requiring 10 crew members;

- A full-time support tug crew along with 4 shifts per each of the three major item installations (barge swing gate, and each half of the sector gate) for a total of 12 shifts.

MRGO Closure Option A – Structural Wall

The structural wall across MRGO would be a braced concrete wall structure which would consist of concrete plumb piles jet-grouted together to create an impervious barrier. The floodwall would also be supported by battered steel piles placed on every other 66 inch plumb pile. Additional rock/sand backfill and riprap would be placed on both the flood and protected sides for additional structural stability and to resist erosion and scour from waves and overtopping. Pre-formed cast-in-place panels would be installed on the top of the concrete cap to complete the structural wall. Also, a concrete roadway would be built on top of the panels to provide long term maintenance access for the system. The length of the MRGO closure is approximately 2,400 ft, and the bottom width of the completed structural wall would be approximately 550 ft at its widest point.

Except for the addition of battered bracing piles, this is essentially the same construction as for the structural floodwall, except that the plumb pile length is assumed to be 150 ft due to the depth of the channel. The following assumptions were made regarding floodwall installation:

- A wall length of 2,400 ft and a pile width of 66" for a total of 437 piles with a 150-ft depth of which 90 ft is driven and 60 ft is stickup forming the wall yielding a total of 39,330 lf of pile that would have to be driven;
- Based on items in the 02455-450 series in the RSMeans guide, a B-19A crew would have productivity of 300 lf per day (Means guide goes up to 24" square, solid pile and a corresponding production rate of 440 lf; 66" precast concrete piles would be hollow, and therefore somewhat heavier than a 24" solid pile), which reflects added weight plus a penalty for waterborne work. 65,500 lf at 300 lf per crew per day requires 132 crew days.
- 219 battered steel bracing piles would be required;
- RSMeans item 02455-600-4200, steel pipe piles 18" diameter, concrete filled with a B-19 crew at 305 lf per battered pile for 66,795 lf.
- B-19 crew at 310 lf productivity with a concrete pump and 2 concrete trucks;
- Jet grouting would occur by filling a 3-ft diameter column to the full depth of the floodwall at each joint between piles (39,330 lf of columns x 7.1 sf = 279,243 cf grouting) for 83 days of jet grouting crews using a 350 HP pumping system and a barge-mounted batching plant and 6 laborers at a 3,400 cf/day production rate;

For final configuration phase work, the quantities provided in the IER #11 – Tier 2 Borgne e document were used. These quantities were:

- 23,000 cy of concrete for 452 C-14B crew days based on RSMeans item 03310-240-1950, elevated slabs, incl. forms, steel & placement, 50.99 cy/d production;
- 140,000 cy of sand fill, 74,000 cy of riprap and 74,000 cy of crushed stone
    - RSMeans item 02390-110-6000 was used for crushed stone that would be placed behind bulkhead by clam bucket using crew B-12H (modified to use 10 cy bucket as opposed to 1 cy bucket and adjusting production from 120 cy to 800 cy accordingly) for an estimated 93 days of modified B-12H crew;

- For sand placement the same item and production rate as crushed stone applies - 175 days of modified B-12H crew;
- For riprap, RSMeans item 02370-450-0370, dumped riprap, 300 lb average was used but the B-12H crew described above would be used (instead of Means-specified B-11A crew with a dozer) due to barge-borne nature of work and productivity would be one-half of that for the crushed stone placement work resulting in 185 days of a modified B-12H crew

MRGO Closure Option B – Cellular Closure Structure

The cellular structure across MRGO would be a barrier of interlocked steel sheet piles filled with compacted sand fill and flanked by rock and sand. The sheet piles would be configured to make a series of adjacent 50 ft diameter cells. The cells would be connected by interlocked sheet pile arches on both the flood and protected side of the cells. The sheet pile cells would be flanked on either side by a massive sand and rock plug. The width of the completed sheet pile cell wall would be approximately 585 ft. The following assumptions were made regarding the cellular closure structure:

- 12 cells would be required, each with a diameter of 50 ft and a perimeter of 157 ft
- cofferdams would be 75 ft tall (45-ft embedment, 30-ft stickup)
- The total sheeting per cofferdam would be 11,775 sf (each connecting arch pair length for each cofferdam would be 80 ft, so 6,000 sf)
- 12 cells X 11,775 sf = 213,300 sf for all cells resulting in 214, B-40 crew days (with RSMeans item 02250-400-1800 for 25' deep drive, 1,000 SF per day)
- Volume of compacted sand fill would be 40' above existing grade (to allow for settlement) with a 1,963 sf cross-sectional area for each cofferdam
- 30% increase added to allow for filling of arch areas, so 2,550 sf per cofferdam x 40' = 102,000 cf of compacted sand fill
- 12 units at 102,000 cf = 1,224,000 cf, or 45,333 cy of compacted sand fill
- RSMeans item 02390-110-6000 was used for crushed stone - placed behind bulkhead by clam bucket with the modified B-12H crew
- 57 days of modified B-12H crew
- Outside stone and sand placement was not calculated because it is incidental to the main filling operations

Bayou Bienvenue Gate and Bypass

A sector gate similar to the GIWW gate would be installed at the Crossing of Bayou Bienvenue. In the advanced measures stage, a cofferdam would be installed at the site of the crossing. The sector gate itself would be installed during the final configuration of work. Approximately 600 lf of fendering constructed of 36-inch precast concrete piles that would be of the same length as the general floodwall piling (i.e., 100 ft) was assumed for estimating equipment and work for the evaluation of air emissions.

Quantities given in the IER document are used for all aspects of construction where applicable. It was assumed that all material quantities (other than sheetpiling) are installed as part of the final configuration, as installation of the cofferdam is the only advanced measure. It was assumed that the sector gates would be predominantly pre-fabricated units requiring only placement-type work on-site. Other assumptions made regarding the equipment required for the Bayou Bienvenue gate included:

- 54,700 sf of sheeting installation (RSMeans item 02250-400-1800, 25' deep drive, extract and salvage, 553 sf per day)
- Sheeting installation requires 100 B-40 crew days split evenly for the in advanced measures and final configuration
- Installation of 200 36" precast piles (600 lf of fendering comprised of 36" units)
- With an assumed length of 100 ft, the total piling length is 20,000 lf
- 56 crew days of pile driving is required (RSMeans guide does not have an entry for 36" piles so it was assumed that a B-19A crew would have a productivity of 360 lf per day)
- A total of 9,600 cy of concrete is required, all in the final configuration phase
- RSMeans item 03310-240-3850, footings over 5 cy, including forms, steel & placement for 81.04 cy/d production or 119 C-14B crew days would be required for concrete work
- A total 17,000 cy of sand fill, 3,200 cy of riprap and 1,000 cy of crushed stone is required, all in the final configuration phase
    - RSMeans item 02390-110-6000 used for crushed stone placemnt behind bulkhead by clam bucket with 2 days of a modified B-12H crew (as previously described)
    - Crushed stone item and production were used for sand placement - 22 days of modified B-12H crew
    - RSMeans item 02370-450-0370, dumped riprap, 300 lb average was used for riprap but with the modified B-12H crew with one-half of the crushed stone placement work productivity for 8 days of modified B-12H crew
- Gate would be fabricated off-site, and on-site work is limited to hoisting and placing units
- Barge-mounted crawler-mounted lattice crane with a 350-ton capacity, requiring 10 crew members.
- A full-time support tug crew
- 4 shifts per each of 2 major item installations (each half of the sector gate) for 8 total shifts

Tug Support

In addition to the equipment described above, the work would require tug boat support throughout. It was assumed that the construction schedule would require 24-hour/7-day per week work. Assuming work begins in October and continues through May 2009, 240 working days with a total of 720 8-hour shifts will occur in the advanced measures stage. Assuming an average of 1.5 tug boats are assigned full time to support work throughout the project area, 1,080 tug shifts are required. These shifts are assigned to the Bayou Bienvenue gate, as it is a common element and carries through in all computations. It was assumed that half as many (540) tug shifts would be required for the final configuration phase of work. These shifts are also assigned to the Bayou Bienvenue project.

2.2 Equipment Operational Emissions

The emissions estimates were made for Alternatives 4 and 5 that cover both the Proposed Action and the potential worst-case scenarios given the length of construction alignment. All equipment was assumed to be diesel-powered. The pieces of equipment to be used include, but are not limited to:

- Cement mixer
- Compressor
- Concrete pump
- Various cranes
- Various hammers
- Gas engine vibrator
- Grout batch plant
- Various pumps
- Trencher
- Tug boat

The equipment listed above reflects potential maximum equipment requirements, and is not necessarily representative of equipment that would be required on any given day. The length of time any particular piece of equipment is required is ultimately a function of the final construction schedule. For the purposes of calculating emissions, the precise scheduling and the actual number of pieces of each equipment type is not a critical factor; rather, the total operating hours for each piece of equipment is the relevant metric.

A variable that may significantly alter emissions calculations is the final selection of equipment. The equipment list presented above, and the equipment days and hours were predicted based on the crew-types identified in RSMeans, 2003, which reflects the equipment necessary to complete each individual task. For efficiency, the contractor is likely to minimize the number of different pieces of equipment necessary.

Estimates of equipment emissions were based on the estimated hours of usage and emission factors for each motorized source for the project. Emission factors related to heavy-duty diesel equipment were obtained from – *Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling – Compression-Ignition* (USEPA, 2004). Tug boat emission were calculated using emission factors obtained from *Analysis of Commercial Marine Vessel Emissions and Fuel Consumption Data* (USEPA, February 2000). Tug boat emission factors and load factors for slow cruise and maneuvering modes were used for predicting tugboat emissions.

Emission factors in grams of pollutant per hour per horsepower were multiplied by the estimated running time and equipment associated average horsepower provided by the USEPA to calculate total grams of pollutant from each piece of equipment. Average horsepower values were obtained from *Nonroad Engine and Vehicle Emission Study – Report* (USEPA, 1991). Finally, these total grams of pollutant were converted to tons of pollutant.

The USEPA recommends the following formula to calculate hourly emissions from nonroad engine sources including cranes, backhoe, etc.:

$$M_i = N \times HP \times LF \times EF_i$$

where:

M_i = mass of emissions of ith pollutants during inventory period;
N = source population (units);
HP = average rated horsepower;
LF = typical load factor; and
EF_i = average emissions of ith pollutant per unit of use (e.g., grams per horsepower-hour).

Typical load factor values for each equipment were obtained from *Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling* (USEPA, 2004). The equipment types and composite operational hours, estimated emissions are summarized in Tables E-1 through E-4.

2.3 Motor Vehicle Operations and Emissions

Truck and commuting vehicle operations would result in indirect emissions. However, the on-site truck activities were considered negligible since it is assumed that it will more efficient to use barge to transport material in and out of the site as compared to truck operations. Moreover, only activities that are subject to the general conformity determination include vehicle operations within the project site, for which the federal agency (i.e., ACE) would have control over. Motor vehicle operations within the site are assumed and summarized as follows:

- Each worker's commuter vehicle would take a 20-minute round trip to commute within the site at an average speed of 25 mph.

Emission factors for motor vehicles were determined for commuter vehicles (modeled as light duty gasoline vehicles) using the USEPA Mobile6 mobile source emission factor model associated with the national default model input parameters. These emission factors were then multiplied by the vehicle operational hours to determine motor vehicle annual emissions (Table E-5).

Table C-1
Annual Construction Equipment Emissions Worksheet for Alternative 4a

Equipment Type/Activity	Number of Units	Weeks	Hours	Horsepower (hp)	Load Factor (%)	Emission Factor (grams/hp-hour)						Emission Rate (tons)					
						VOC	NO_x	CO	PM_{10}	$PM_{2.5}$	SO_2	VOC	NO_x	CO	PM_{10}	$PM_{2.5}$	SO_2
Advance Stage: 2008 – 2009																	
Cement mixer, 2 cy	1	83	2490	11	43	0.99	8.30	3.49	0.72	0.70	0.14	0.01	0.11	0.05	0.01	0.01	0.00
Compressor, 600 cfm	1	36	1080	37	43	0.99	8.30	3.49	0.72	0.70	0.14	0.02	0.16	0.07	0.01	0.01	0.00
Concrete pump, small	1	70	2100	80	59	0.99	8.30	3.49	0.72	0.70	0.14	0.11	0.91	0.38	0.08	0.08	0.02
Crane, 90-ton	1	200	6000	80	59	0.99	8.30	3.49	0.72	0.70	0.14	0.31	2.59	1.09	0.23	0.22	0.04
Crane, 40-ton	1	40	1200	80	59	0.99	8.30	3.49	0.72	0.70	0.14	0.06	0.00	0.22	0.05	0.04	0.01
Vibratory hammer and generator	1	27	810	200	59	0.68	8.38	2.70	0.40	0.39	0.13	0.07	0.88	0.28	0.04	0.04	0.01
Diesel hammer, 41k ft-lb	1	93	2790	120	43	0.68	8.38	2.70	0.40	0.39	0.13	0.11	1.33	0.43	0.06	0.06	0.02
Gas engine vibrator	1	46	1380	8	43	0.99	8.30	3.49	0.72	0.70	0.14	0.01	0.04	0.02	0.00	0.00	0.00
Grout batch plant	1	36	1080	11	43	0.99	8.30	3.49	0.72	0.70	0.14	0.01	0.05	0.02	0.00	0.00	0.00
Pump, pressure grouting, 350 HP	1	36	1080	350	59	0.68	8.38	2.70	0.40	0.39	0.13	0.17	2.06	0.66	0.10	0.10	0.03
Pump, dredge primary, 2,822 HP	1	22	660	2,822	59	0.68	8.38	2.70	0.40	0.39	0.13	0.82	10.14	3.27	0.49	0.47	0.15
Pump, dredge booster, 2,822 HP	1	22	660	2,822	59	0.68	8.38	2.70	0.40	0.39	0.13	0.82	10.14	3.27	0.49	0.47	0.15
Trencher, 12HP	1	36	1080	12	59	0.99	8.30	3.49	0.72	0.70	0.14	0.01	0.07	0.03	0.01	0.01	0.00
Tug boat, 1,600 HP	1	149	4470	1600	30	0.19	8.17	1.56	0.21	0.20	10.66	0.46	19.30	3.68	0.49	0.48	25.20
Total Annual Emissions												**2.52**	**47.77**	**13.46**	**2.06**	**2.00**	**25.65**
Stage 2: 2010																	
Concrete pump, small	1	281	8430	80	59	0.99	8.30	3.49	0.72	0.70	0.14	0.43	3.64	1.53	0.32	0.31	0.06
Crane, 90-ton	1	13	390	80	59	0.99	8.30	3.49	0.72	0.70	0.14	0.02	0.17	0.07	0.01	0.01	0.00
Crane, 350 ton crawler	1	2	60	80	59	0.99	8.30	3.49	0.72	0.70	0.14	0.00	0.03	0.01	0.00	0.00	0.00
Crane, 40-ton	1	17	510	80	59	0.99	8.30	3.49	0.72	0.70	0.14	0.03	0.22	0.09	0.02	0.02	0.00
Vibratory hammer and generator	1	17	510	200	59	0.68	8.38	2.70	0.40	0.39	0.13	0.05	0.56	0.18	0.03	0.03	0.01
Diesel hammer, 41k ft-lb	1	6	180	120	43	0.68	8.38	2.70	0.40	0.39	0.13	0.01	0.09	0.03	0.00	0.00	0.00
Gas engine vibrator	1	281	8430	8	43	0.99	8.30	3.49	0.72	0.70	0.14	0.03	0.27	0.11	0.02	0.02	0.00
Tug boat, 1,600 HP	1	63	1890	1600	30	0.19	8.17	1.56	0.21	0.20	10.66	0.19	8.16	1.56	0.21	0.20	10.65
Total Annual Emissions												**0.76**	**13.12**	**3.58**	**0.61**	**0.60**	**10.74**

Table C-2
Annual Construction Equipment Emissions Worksheet for Alternative 4b

Equipment Type/Activity	Number of Units	Weeks	Hours	Horsepower (hp)	Load Factor (%)	Emission Factor (grams/hp-hour)						Emission Rate (tons)					
						VOC	NO_x	CO	PM_{10}	$PM_{2.5}$	SO_2	VOC	NO_x	CO	PM_{10}	$PM_{2.5}$	SO_2
Advance Stage: 2008 - 2009																	
Cement mixer, 2 cy	1	57	1710	11	43	0.99	8.30	3.49	0.72	0.70	0.14	0.01	0.07	0.03	0.01	0.01	0.00
Centrif. water pump, 6"	1	545	16350	23	43	0.99	8.30	3.49	0.72	0.70	0.14	0.18	1.48	0.62	0.13	0.12	0.03
Compressor, 600 cfm	1	9	270	37	43	0.99	8.30	3.49	0.72	0.70	0.14	0.00	0.04	0.02	0.00	0.00	0.00
Concrete pump, small	1	70	2100	80	59	0.99	8.30	3.49	0.72	0.70	0.14	0.11	0.91	0.38	0.08	0.08	0.02
Crane, 90-ton	1	302	9060	80	59	0.99	8.30	3.49	0.72	0.70	0.14	0.47	3.91	1.64	0.34	0.33	0.07
Crane, 350 ton crawler	1	1.0	30	80	59	0.99	8.30	3.49	0.72	0.70	0.14	0.00	0.01	0.01	0.00	0.00	0.00
Crane, 40-ton	1	40	1200	80	59	0.99	8.30	3.49	0.72	0.70	0.14	0.06	0.52	0.22	0.05	0.04	0.01
Vibratory hammer and generator	1	40	1200	200	59	0.68	8.38	2.70	0.40	0.39	0.13	0.11	1.31	0.42	0.06	0.06	0.02
Diesel hammer, 41k ft-lb	1	51	1530	120	43	0.68	8.38	2.70	0.40	0.39	0.13	0.06	0.73	0.23	0.03	0.03	0.01
Drill rig & augers	1	545	16350	83	59	0.99	8.30	3.49	0.72	0.70	0.14	0.87	7.32	3.08	0.64	0.62	0.13
Gas engine vibrator	1	46	1380	8	43	0.99	8.30	3.49	0.72	0.70	0.14	0.01	0.04	0.02	0.00	0.00	0.00
Grout batch plant	1	9	270	11	43	0.99	8.30	3.49	0.72	0.70	0.14	0.00	0.01	0.00	0.00	0.00	0.00
Pump, pressure grouting, 350 HP	1	9	270	350	59	0.68	8.38	2.70	0.40	0.39	0.13	0.04	0.51	0.17	0.02	0.02	0.01
Trencher, 12HP	1	9	270	12	59	0.99	8.30	3.49	0.72	0.70	0.14	0.00	0.02	0.01	0.00	0.00	0.00
Tug boat, 1,600 HP	1	124	3720	1600	30	0.19	8.17	1.56	0.21	0.20	10.66	0.38	16.06	3.06	0.41	0.40	20.97
Total Annual Emissions												**2.30**	**32.94**	**9.91**	**1.78**	**1.73**	**21.25**
Stage 2: 2010																	
Concrete pump, small	1	63	1890	80	59	0.99	8.30	3.49	0.72	0.70	0.14	0.10	0.82	0.34	0.07	0.07	0.01
Crane, 90-ton	1	13	390	80	59	0.99	8.30	3.49	0.72	0.70	0.14	0.02	0.17	0.07	0.01	0.01	0.00
Crane, 350 ton crawler	1	2	60	80	59	0.99	8.30	3.49	0.72	0.70	0.14	0.00	0.03	0.01	0.00	0.00	0.00
Crane, 40-ton	1	17	510	80	59	0.99	8.30	3.49	0.72	0.70	0.14	0.03	0.22	0.09	0.02	0.02	0.00
Vibratory hammer and generator	1	17	510	200	59	0.68	8.38	2.70	0.40	0.39	0.13	0.05	0.56	0.18	0.03	0.03	0.01
Diesel hammer, 41k ft-lb	1	6	180	120	43	0.68	8.38	2.70	0.40	0.39	0.13	0.01	0.09	0.03	0.00	0.00	0.00
Gas engine vibrator	1	63	1890	8	43	0.99	8.30	3.49	0.72	0.70	0.14	0.01	0.06	0.02	0.01	0.01	0.00
Tug boat, 1,600 HP	1	63	1890	1600	30	0.19	8.17	1.56	0.21	0.20	10.66	0.19	8.16	1.56	0.21	0.20	10.65
Total Annual Emissions												**0.40**	**10.09**	**2.31**	**0.35**	**0.34**	**10.69**

Table C-3
Annual Construction Equipment Emissions Worksheet for Alternative 5a

Equipment Type/Activity	Number of Units	Weeks	Hours	Horsepower (hp)	Load Factor (%)	Emission Factor (grams/hp-hour)						Emission Rate (tons)					
						VOC	NO_x	CO	PM_{10}	$PM_{2.5}$	SO_2	VOC	NO_x	CO	PM_{10}	$PM_{2.5}$	SO_2
Advance Stage: 2008 - 2009																	
Cement mixer, 2 cy	1	91	2730	11	43	0.99	8.30	3.49	0.72	0.70	0.14	0.01	0.12	0.05	0.01	0.01	0.00
Compressor, 600 cfm	1	44	1320	37	43	0.99	8.30	3.49	0.72	0.70	0.14	0.02	0.19	0.08	0.02	0.02	0.00
Concrete pump, small	1	70	2100	80	59	0.99	8.30	3.49	0.72	0.70	0.14	0.11	0.91	0.38	0.08	0.08	0.02
Crane, 90-ton	1	226	6780	80	59	0.99	8.30	3.49	0.72	0.70	0.14	0.35	2.93	1.23	0.25	0.25	0.05
Crane, 350 ton crawler	1	1.0	30	80	59	0.99	8.30	3.49	0.72	0.70	0.14	0.00	0.01	0.01	0.00	0.00	0.00
Crane, 40-ton	1	40	1200	80	59	0.99	8.30	3.49	0.72	0.70	0.14	0.06	0.52	0.22	0.05	0.04	0.01
Vibratory hammer and generator	1	40	1200	200	59	0.68	8.38	2.70	0.40	0.39	0.13	0.11	1.31	0.42	0.06	0.06	0.02
Diesel hammer, 41k ft-lb	1	106	3180	120	43	0.68	8.38	2.70	0.40	0.39	0.13	0.12	1.51	0.49	0.07	0.07	0.02
Gas engine vibrator	1	46	1380	8	43	0.99	8.30	3.49	0.72	0.70	0.14	0.01	0.04	0.02	0.00	0.00	0.00
Grout batch plant	1	44	1320	11	43	0.99	8.30	3.49	0.72	0.70	0.14	0.01	0.06	0.02	0.00	0.00	0.00
Pump, pressure grouting, 350 HP	1	44	1320	350	59	0.68	8.38	2.70	0.40	0.39	0.13	0.20	2.52	0.81	0.12	0.12	0.04
Pump, dredge primary, 2,822 HP	1	103	3090	2,822	59	0.68	8.38	2.70	0.40	0.39	0.13	3.85	47.48	15.30	2.28	2.21	0.73
Pump, dredge booster, 2,822 HP	1	103	3090	2,822	59	0.68	8.38	2.70	0.40	0.39	0.13	3.85	47.48	15.30	2.28	2.21	0.73
Trencher, 12HP	1	44	1320	12	59	0.99	8.30	3.49	0.72	0.70	0.14	0.01	0.09	0.04	0.01	0.01	0.00
Tug boat, 1,600 HP	1	193	5790	1600	30	0.19	8.17	1.56	0.21	0.20	10.66	0.59	24.99	4.77	0.64	0.62	32.64
Total Annual Emissions												**9.31**	**130.15**	**39.13**	**5.87**	**5.70**	**34.25**
Stage 2: 2010																	
Concrete pump, small	1	346	10380	80	59	0.99	8.30	3.49	0.72	0.70	0.14	0.53	4.48	1.88	0.39	0.38	0.08
Crane, 90-ton	1	13	390	80	59	0.99	8.30	3.49	0.72	0.70	0.14	0.02	0.17	0.07	0.01	0.01	0.00
Crane, 350 ton crawler	1	2	60	80	59	0.99	8.30	3.49	0.72	0.70	0.14	0.00	0.03	0.01	0.00	0.00	0.00
Crane, 40-ton	1	17	510	80	59	0.99	8.30	3.49	0.72	0.70	0.14	0.03	0.22	0.09	0.02	0.02	0.00
Vibratory hammer and generator	1	17	510	200	59	0.68	8.38	2.70	0.40	0.39	0.13	0.05	0.56	0.18	0.03	0.03	0.01
Diesel hammer, 41k ft-lb	1	6	180	120	43	0.68	8.38	2.70	0.40	0.39	0.13	0.01	0.09	0.03	0.00	0.00	0.00
Gas engine vibrator	1	346	10380	8	43	0.99	8.30	3.49	0.72	0.70	0.14	0.04	0.33	0.14	0.03	0.03	0.01
Tug boat, 1,600 HP	1	63	1890	1600	30	0.19	8.17	1.56	0.21	0.20	10.66	0.19	8.16	1.56	0.21	0.20	10.65
Total Annual Emissions												**0.87**	**14.02**	**3.96**	**0.69**	**0.67**	**10.75**

Table C-4
Annual Construction Equipment Emissions Worksheet for Alternative 5b

Equipment Type/Activity	Number of Units	Weeks	Hours	Horsepower (hp)	Load Factor (%)	Emission Factor (grams/hp-hour)						Emission Rate (tons)					
						VOC	NO_x	CO	PM_{10}	$PM_{2.5}$	SO_2	VOC	NO_x	CO	PM_{10}	$PM_{2.5}$	SO_2
Advance Stage: 2008 – 2009																	
Cement mixer, 2 cy	1	57	1710	11	43	0.99	8.30	3.49	0.72	0.70	0.14	0.01	0.07	0.03	0.01	0.01	0.00
Centrif. water pump, 6"	1	708	21240	23	43	0.99	8.30	3.49	0.72	0.70	0.14	0.23	1.92	0.81	0.17	0.16	0.03
Compressor, 600 cfm	1	9	270	37	43	0.99	8.30	3.49	0.72	0.70	0.14	0.00	0.04	0.02	0.00	0.00	0.00
Concrete pump, small	1	70	2100	80	59	0.99	8.30	3.49	0.72	0.70	0.14	0.11	0.91	0.38	0.08	0.08	0.02
Crane, 90-ton	1	359	10770	80	59	0.99	8.30	3.49	0.72	0.70	0.14	0.55	4.65	1.95	0.40	0.39	0.08
Crane, 350 ton crawler	1	1.0	30	80	59	0.99	8.30	3.49	0.72	0.70	0.14	0.00	0.01	0.01	0.00	0.00	0.00
Crane, 40-ton	1	40	1200	80	59	0.99	8.30	3.49	0.72	0.70	0.14	0.06	0.52	0.22	0.05	0.04	0.01
Vibratory hammer and generator	1	40	1200	200	59	0.68	8.38	2.70	0.40	0.39	0.13	0.11	1.31	0.42	0.06	0.06	0.02
Diesel hammer, 41k ft-lb	1	51	1530	120	43	0.68	8.38	2.70	0.40	0.39	0.13	0.06	0.73	0.23	0.03	0.03	0.01
Drill rig & augers	1	708	21240	83	59	0.99	8.30	3.49	0.72	0.70	0.14	1.13	9.51	4.00	0.83	0.80	0.16
Gas engine vibrator	1	46	1380	8	43	0.99	8.30	3.49	0.72	0.70	0.14	0.01	0.04	0.02	0.00	0.00	0.00
Grout batch plant	1	9	270	11	43	0.99	8.30	3.49	0.72	0.70	0.14	0.00	0.01	0.00	0.00	0.00	0.00
Pump, pressure grouting, 350 HP	1	9	270	350	59	0.68	8.38	2.70	0.40	0.39	0.13	0.04	0.51	0.17	0.02	0.02	0.01
Trencher, 12HP	1	9	270	12	59	0.99	8.30	3.49	0.72	0.70	0.14	0.00	0.02	0.01	0.00	0.00	0.00
Tug boat, 1,600 HP	1	124	3720	1600	30	0.19	8.17	1.56	0.21	0.20	10.66	0.38	16.06	3.06	0.41	0.40	20.97
Total Annual Emissions												**2.70**	**36.30**	**11.33**	**2.07**	**2.01**	**21.31**
Stage 2: 2010																	
Concrete pump, small	1	63	1890	80	59	0.99	8.30	3.49	0.72	0.70	0.14	0.10	0.82	0.34	0.07	0.07	0.01
Crane, 90-ton	1	13	390	80	59	0.99	8.30	3.49	0.72	0.70	0.14	0.02	0.17	0.07	0.01	0.01	0.00
Crane, 350 ton crawler	1	2	60	80	59	0.99	8.30	3.49	0.72	0.70	0.14	0.00	0.03	0.01	0.00	0.00	0.00
Crane, 40-ton	1	17	510	80	59	0.99	8.30	3.49	0.72	0.70	0.14	0.03	0.22	0.09	0.02	0.02	0.00
Vibratory hammer and generator	1	17	510	200	59	0.68	8.38	2.70	0.40	0.39	0.13	0.05	0.56	0.18	0.03	0.03	0.01
Diesel hammer, 41k ft-lb	1	6	180	120	43	0.68	8.38	2.70	0.40	0.39	0.13	0.01	0.09	0.03	0.00	0.00	0.00
Gas engine vibrator	1	63	1890	8	43	0.99	8.30	3.49	0.72	0.70	0.14	0.01	0.06	0.02	0.01	0.01	0.00
Tug boat, 1,600 HP	1	63	1890	1600	30	0.19	8.17	1.56	0.21	0.20	10.66	0.19	8.16	1.56	0.21	0.20	10.65
Total Annual Emissions												**0.40**	**10.09**	**2.31**	**0.35**	**0.34**	**10.69**

Table C-5
Construction Commuting Vehicle Emissions

					Emission Factor (lb/hr)						Emissions (tpy)					
Stage	No. of days	Cars/ Day	Minutes/Day/Car	Hours	VOC	NO_x	CO	PM_{10}	$PM_{2.5}$	SO_2	VOC	NO_x	CO	PM_{10}	$PM_{2.5}$	SO_2
Alternative 4a																
2008 – 2009																
Advance	322	50	20	5,367	0.05	0.04	0.50	0.00	0.00	0.00	0.13	0.11	1.33	0.00	0.00	0.00
2010																
Stage2	769	50	20	12,817	0.05	0.04	0.50	0.00	0.00	0.00	0.31	0.27	3.18	0.01	0.00	0.00
Alternative 4b																
2008 – 2009																
Advance	680	50	20	11,333	0.05	0.04	0.50	0.00	0.00	0.00	0.28	0.24	2.81	0.01	0.00	0.00
2010																
Stage2	203	50	20	3,383	0.05	0.04	0.50	0.00	0.00	0.00	0.08	0.07	0.84	0.00	0.00	0.00
Alternative 5a																
2008 – 2009																
Advance	370	50	20	6,167	0.05	0.04	0.50	0.00	0.00	0.00	0.15	0.13	1.53	0.00	0.00	0.00
2010																
Stage2	939	50	20	15,650	0.05	0.04	0.50	0.00	0.00	0.00	0.38	0.33	3.88	0.01	0.01	0.00
Alternative 5b																
2008 - 2009																
Advance	808	50	20	13,467	0.05	0.04	0.50	0.00	0.00	0.00	0.33	0.28	3.34	0.01	0.00	0.00
2010																
Stage2	203	50	20	3,383	0.05	0.04	0.50	0.00	0.00	0.00	0.08	0.07	0.84	0.00	0.00	0.00

3. Summary

The annual emissions increases potentially resulting from the proposed action are summarized in Tables E-6 and E-7. These estimates include both direct and indirect emissions associated with the proposed construction activities.

Table C-6
Total Annual Emissions Levels for Alternative 4

Emission Source	Pollutant (tons/year)					
	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$	SO_2
Alternative 4a						
2008 - 2009						
Construction Diesel Equipment	2.52	47.77	13.46	2.06	2.00	25.65
Construction Motor Vehicles	0.13	0.11	1.33	0.00	0.00	0.00
Total Annual Emissions	**2.65**	**47.88**	**14.79**	**2.06**	**2.00**	**25.65**
2010						
Construction Diesel Equipment	0.76	13.12	3.58	0.61	0.60	10.74
Construction Motor Vehicles	0.31	0.27	3.18	0.01	0.00	0.00
Total Annual Emissions	**1.07**	**13.39**	**6.76**	**0.62**	**0.60**	**10.74**
Alternative 4b						
2008-2009						
Construction Diesel Equipment	2.30	32.94	9.91	1.78	1.73	21.25
Construction Motor Vehicles	0.28	0.24	2.81	0.01	0.00	0.00
Total Annual Emissions	**2.58**	**33.18**	**12.72**	**1.79**	**1.73**	**21.25**
2010						
Construction Diesel Equipment	0.40	10.09	2.31	0.35	0.34	10.69
Construction Motor Vehicles	0.08	0.07	0.84	0.00	0.00	0.00
Total Annual Emissions	**0.48**	**10.16**	**3.15**	**0.35**	**0.34**	**10.69**

Table C-7
Total Annual Emissions Levels for Alternative 5

Emission Source	Pollutant (tons/year)					
	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$	SO_2
Alternative 5a						
2008 – 2009						
Construction Diesel Equipment	9.31	130.15	39.13	5.87	5.70	34.25
Construction Motor Vehicles	0.15	0.13	1.53	0.00	0.00	0.00
Total Annual Emissions	**9.46**	**130.28**	**40.66**	**5.87**	**5.70**	**34.25**
2010						
Construction Diesel Equipment	0.87	14.02	3.96	0.69	0.67	10.75
Construction Motor Vehicles	0.38	0.33	3.88	0.01	0.01	0.00
Total Annual Emissions	**1.25**	**14.35**	**7.84**	**0.70**	**0.68**	**10.75**
Alternative 5b						
2008-2009						
Construction Diesel Equipment	2.70	36.30	11.33	2.07	2.01	21.31
Construction Motor Vehicles	0.33	0.28	3.34	0.01	0.00	0.00
Total Annual Emissions	**3.03**	**36.58**	**14.67**	**2.08**	**2.01**	**21.31**
2010						
Construction Diesel Equipment	0.40	10.09	2.31	0.35	0.34	10.69
Construction Motor Vehicles	0.08	0.07	0.84	0.00	0.00	0.00
Total Annual Emissions	**0.48**	**10.16**	**3.15**	**0.35**	**0.34**	**10.69**

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APPENDIX D

PUBLIC COMMENT AND RESPONSES SUMMARY

To be added after 30 day public comment period

APPENDIX E

MEMBERS OF INTERAGENCY ENVIRONMENTAL TEAM

Rick Hartman	National Marine Fisheries Service
John Ettinger	Environmental Protection Agency
Christina Hunnicutt/ Molly Reif	U.S. Geological Survey
Brian Lezina	Louisiana Department of Wildlife and Fisheries
Tim Killeen/ Brian Marcks	Louisiana Department of Natural Resources
Renee Sanders/ Mandy Green/ Ismail Merhi	Coastal Restoration and Protection Authority
Jamie Phillipe	Louisiana Department of Environmental Quality

APPENDIX F

INTERAGENCY CORRESPONDENCE

Wilkinson, Laura L MVN

From: Michon, Carolyn [cmichon@wlf.louisiana.gov]
Sent: Tuesday, May 20, 2008 3:21 PM
To: Wilkinson, Laura L MVN
Subject: RE: IER #11 Alignment 4 staging areas and BLH of special concern?

The Louisiana Natural Heritage Program community ecologist, Patti Faulkner stated that there may be some remnants of bottomland hardwood forest left in those areas, but there are probably not in good condition. So the staging areas of the Levee Project will not impact bottomland hardwood forests of special concern.

Carolyn Michon, Assistant Data Manager

Louisiana Natural Heritage Program

Dept. of Wildlife and Fisheries

P.O. Box 98000; 2000 Quail Dr.

Baton Rouge, LA 70898

225-765-2357

FAX 225-765-2452

cmartin@wlf.louisiana.gov

From: Wilkinson, Laura L MVN [mailto:Laura.L.Wilkinson@usace.army.mil]
Sent: Tuesday, May 20, 2008 1:33 PM
To: Michon, Carolyn
Subject: IER #11 Alignment 4 staging areas and BLH of special concern?

Greetings,
The project is being documented and the impacts evaluated in Individual Environmental Report #11 Tier 2 Borgne. The project proposes to protect the Inner Harbor Navigation Canal and the communities surrounding it (City of New Orelans, New Orleans East, Chalmette/St. Bernard) by providing 100 year level of protection. Attached is a figure of the proposed alignment for construction of a barrier in the golden triangle marsh and gates on the Gulf Intracoastal Waterway and Bayou Bienvenue, please note the areas in green are proposed staging areas. Could you please look them over and check if any of these staging areas have bottomland hardwoods of special concern.

Thanks, <<IER 11 Tier 2 Borgne Alignment 4 and staging areas.doc>> Laura Lee Wilkinson Environmental Coordinator U.S. Army Corps of Engineers New Orleans District 504-862-1212

United States Department of the Interior

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506

June 27, 2008

Colonel Alvin B. Lee
District Engineer
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Colonel Lee

Please reference the Individual Environmental Report (IER) 11, Tier 2 Borgne, for the Improved Protection on the Inner Harbor Navigation Canal (IHNC), Orleans and St. Bernard Parishes, Louisiana. That IER is being prepared under the approval of the Council on Environmental Quality (CEQ) that will partially fulfill the U.S. Army Corps of Engineers (Corps) compliance with the National Environmental Policy Act (NEPA) of 1969 (83 Stat. 852, as amended; 42 U.S.C. 4321- 4347). IERs are a CEQ approved alternative arrangement for compliance with NEPA that would allow expedited implementation of improved hurricane protection measures. Work proposed in IERs would be conducted under the authority of Public Law 109-234, Emergency Supplemental Appropriations Act for Defense, the Global War on Terror, and Hurricane Recovery, 2006 (Supplemental 4) and Public Law 110-28, U.S. Troop Readiness, Veterans' Care, Katrina Recovery, and Iraq Accountability Appropriations Act, 2007 (5th Supplemental). Those laws authorized the Corps to upgrade two existing hurricane protection projects [i.e., Westbank and Vicinity of New Orleans (WBV) and Lake Pontchartrain and Vicinity (LPV)] in the Greater New Orleans area in southeast Louisiana. This draft report contains a description of resources in the project area and provides planning objectives and recommendations to minimize project impacts on those resources.

The proposed project was authorized by Supplemental 4 which instructed the Corps to proceed with engineering, design, and modification (and construction where necessary) of the LPV and the WBV Hurricane Protection Projects so those projects would provide 100-year hurricane protection. Procedurally, project construction has been authorized in the absence of the report of the Secretary of the Interior that is required by Section 2(b) of the Fish and Wildlife Coordination Act (FWCA) (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). In this case, the authorization process has precluded the normal procedures for fully complying with the FWCA. The FWCA requires that our Section 2(b) report be made an integral part of any report supporting further project authorization or administrative approval. Therefore, to fulfill the coordination and reporting requirements of the FWCA, the Service will be providing post-authorization 2(b) reports for each IER.

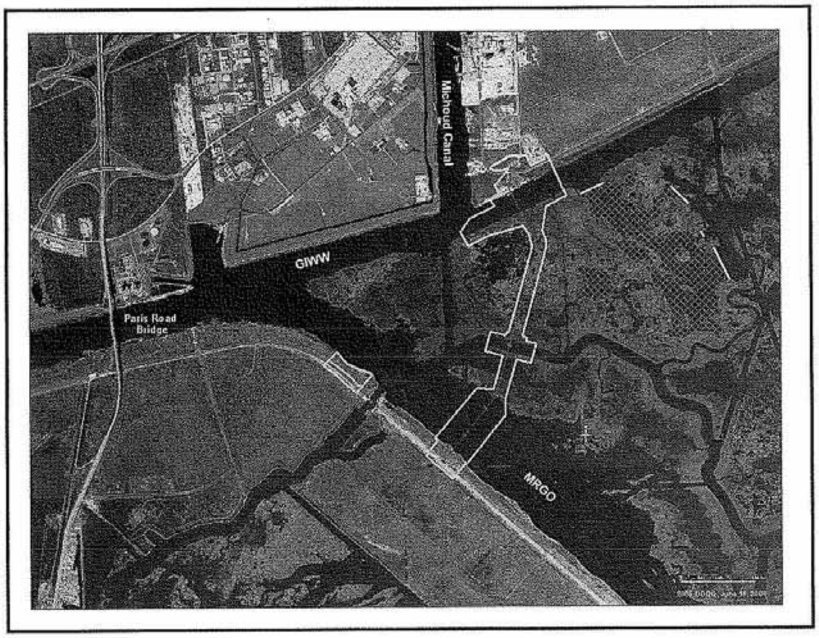
This draft report incorporates and supplements our FWCA Reports that addressed impacts and mitigation features for the WBV of New Orleans (dated November 10, 1986, August 22, 1994, November 15, 1996, and June 20, 2005) and the LPV (dated July 25, 1984 and January 17, 1992) Hurricane Protection projects and the November 26, 2007, Draft Programmatic FWCA Report that addresses the hurricane protection improvements authorized in Supplemental 4. However, this report does not constitute the report of the Secretary of the Interior as required by Section 2(b) of the FWCA. Furthermore, additional comments are provided in accordance with provisions of the Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) This report has been provided to the Louisiana Department of Wildlife and Fisheries and the National Marine Fisheries Service; their comments will be incorporated into our final report.

DESCRIPTION OF THE STUDY AREA

The IER 11 study area includes the Orleans East Bank, New Orleans East, and Chalmette Loop sub-basins along the east bank of the Mississippi River in Orleans and St. Bernard Parishes, Louisiana. Lake Pontchartrain borders the study area to the north. Reaches 148 and 147, and portions of Reach 146 of the LPV Hurricane Protection Levee that parallel the Mississippi River Gulf Outlet (MRGO) make up the study area's southern boundary. The eastern boundary extends along the eastern edge of Lake Borgne.

Two areas have been selected as the preferred location for the storm surge protection barrier to protect the IHNC from storm surges coming from Lakes Pontchartrain and Borgne. The Borgne 1 location alternative, which would reduce storm surge from Lake Borgne and surrounding areas, extends from west of the Parish Road Bridge on the Gulf Intracoastal Waterway (GIWW) to east of the Michoud Canal on the GIWW and south of Bayou Bienvenue on the MRGO, and includes a portion of the emergent marsh area referred to as the "golden triangle" (Figure 1). The other preferred location alternative is the Pontchartrain 2 location alternative which extends from the Seabrook Bridge to 2,500 feet south of that bridge on the IHNC. The Pontchartrain 2 location alternative would protect the IHNC against storm surge coming from Lake Pontchartrain. The Tier 2, Borgne IER evaluates alternative designs and alignments within the Borgne 1 location alternative; this report focuses on that alternative location alignment.

Figure 1. Individual Environmental Report, Lake Pontchartrain and Vicinity (LPV), IHNC, Tier 2 Borgne study area and selected alternative alignment, Orleans and St. Bernard Parishes, Louisiana (IER 11).



FISH AND WILDLIFE RESOURCES

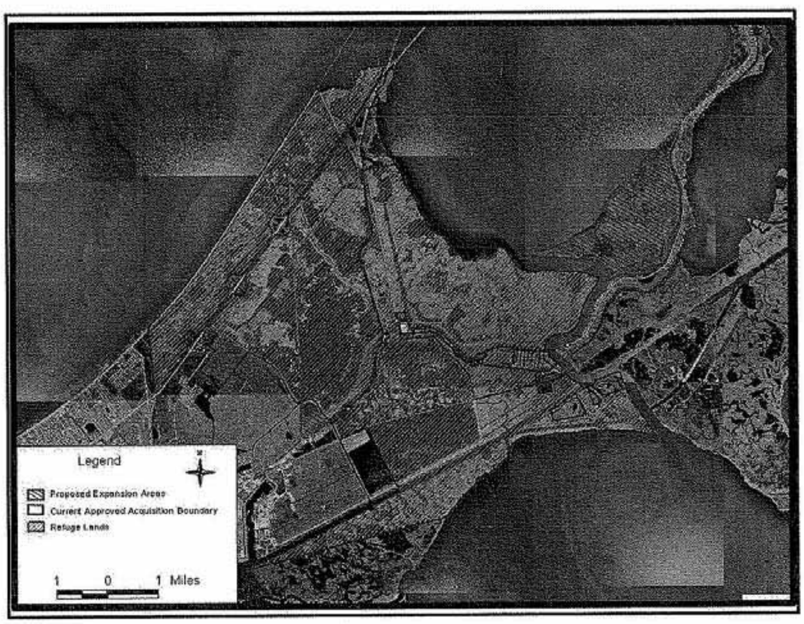
Habitat types in the project area include wet and non-wet bottomland hardwood habitat, early successional stage bottomland hardwood habitat (i.e., scrub-shrub), marsh, open water, and developed areas. Open water areas associated with the GIWW, MRGO, Bayou Bienvenue, and interspersed open water areas within emergent marsh habitat make up a large portion of the study area. Due to urban development and a forced-drainage system, the hydrology of most of the forested habitat within the levee system has been altered. The forced-drainage system has been in operation for many years, and subsidence is evident throughout the areas enclosed by levees.

Wetlands (forested, marsh, and scrub-shrub) within the study area provide plant detritus to adjacent coastal waters and thereby contribute to the production of commercially and recreationally important fishes and shellfishes. They also provide valuable water quality functions such as reduction of excessive dissolved nutrient levels, filtering of waterborne contaminants, and removal of suspended sediment. In addition, coastal wetlands buffer storm surges reducing their damaging effect to man-made infrastructure within the coastal area. Factors that will strongly influence future fish and wildlife resource conditions outside of the protection levees include freshwater and sediment input and loss of coastal wetlands. Regardless of which of the above factors ultimately has the greatest influence, emergent wetlands within, and adjacent to, the project area will probably experience losses due to subsidence, erosion, and relative sea-level rise.

The Service has provided FWCA Reports for the authorized hurricane protection projects. Those reports contain a through discussion of the significant fish and wildlife resources (including those habitats) that occur within the study area. For brevity, that discussion is incorporated by reference herein but the following information is provided to update the previously mentioned reports and provide IER specific information and recommendations.

The northern portion of the proposed structural barrier and portions of the open water disposal areas (i.e., marsh enhancement areas) are located on the Service's Bayou Sauvage National Wildlife Refuge (NWR) (Figure 2). The National Wildlife Refuge System Improvement Act of 1997 authorized that no new or expanded use of a refuge may be allowed unless it is first determined to be compatible. A compatibility determination is a written determination signed and dated by the Refuge Manager and Regional Refuge Chief, signifying that a proposed or existing use of a NWR is a compatible use or is not a compatible use. A compatible use is defined as a proposed or existing wildlife-dependent recreational use or any other use of a NWR that, based on sound professional judgment, will not materially interfere with or detract from the fulfillment of the National Wildlife Refuge System mission or the purposes of the NWR. A compatibility determination is only required when the Service has jurisdiction over the use. For example, proposed uses that deal exclusively with air space, navigable waters or overly refuges where another Federal agency has primary jurisdiction over the area, would not be subject to compatibility.

Figure 2. Bayou Savage NWR Boundaries.



Federal agencies proposing a project that includes features on a NWR are encouraged to contact the Refuge Manager early in the planning process. The Refuge Manager will work with the project proponent to determine if the proposed project constitutes a "refuge use" subject to a compatibility determination. If the proposed project requires a compatibility determination, a concise description of the project (refuge use) including who, what, where, when, how and why will be needed to prepare the compatibility determination. In order to determine the anticipated impacts of use, the project proponent may be required to provide sufficient data and information sources to document any short-term, long-term, direct, indirect or cumulative impacts on refuge resources. Compatibility determinations will include a public review and comment before issuing a final determination.

All construction or maintenance activities (e.g., surveys, land clearing, etc.) on a NWR will require the Corps to obtain a Special Use Permit from the Refuge Manager; furthermore, all activities on that NWR must be coordinated with the Refuge Manager. Therefore, we recommend that the Corps request issuance of a Special Use Permit well in advance of conducting any work on the refuge. Please contact Kenneth Litzenberger, Project Leader for the Service's Southeast National Wildlife Refuges and Jack Bohannan (985) 822-2000, Refuge Manager for the Bayou Sauvage National Wildlife Refuge for further information on compatibility of flood control features, and for assistance in obtaining a Special Use Permit. Close coordination by both the Corps and its contractor must be maintained with the Refuge Manager to ensure that construction and maintenance activities are carried out in accordance with provisions of any Special Use Permit issued by the NWR.

If mitigation lands are purchased for inclusion within a NWR, those lands must meet certain requirements; a summary of some of those requirements is provided in Appendix A. Other land-managing natural resource agencies may have similar requirements that must be met prior to accepting mitigation lands; therefore if they are proposed as a manager of a mitigation site they should be contacted early in the planning phase regarding such requirements.

The following is provided in accordance with the ESA of 1973, as amended. Please reference the Service's December 6, 2007, letter concurring with your previous determination that the proposed project is not likely to adversely affect the West Indian manatee (*Trichechus manatus*), federally listed as an endangered species. That concurrence was based on information provided to the Service in a November 7, 2007, letter stating that the Corps will incorporate the standard manatee protective measures into their construction contracts.

Your June 12, 2008, letter requested the Service's updated concurrence with the Corps' determination that proposed project features described in IER 11, IHNC Tier 2 Borgne are not likely to adversely affect the West Indian manatee. An updated concurrence is requested because of the availability of more detailed project designs and features and was prepared in conjunction with IER 11, IHNC, Tier 2 Borgne. According to that letter, the standard manatee protection measures will continue to be included in the Corps' construction contracts; therefore, the Service concurs that the proposed project is not likely to adversely affect the West Indian manatee. No further endangered species consultation will be required for IER 11, IHNC, Tier 2 Borgne, unless there are changes in the scope or location, or project construction has not been initiated within one year. If construction has not been initiated within one year, follow-up consultation should be accomplished with this office prior to making expenditures for construction.

The threatened Gulf sturgeon (*Acipenser oxyrhynchus desotoi*), is known to occur in the study area. As you are aware, the NOAA's National Marine Fisheries Service (NMFS), in St. Petersburg, Florida is responsible for consultations regarding impacts to the Gulf sturgeon and its critical habitat with the Corps in estuarine habitats, and as we understand the Corps is coordinating with that office.

Estuarine emergent wetlands, estuarine water column, and estuarine water bottoms within the project area have been identified as Essential Fish Habitat (EFH) for both postlarval, juvenile and sub-adult stages of brown shrimp, white shrimp, and red drum, as well as the adult stages of those species in the nearshore and offshore reaches. Commercially important estuarine and marine species such as red drum, spotted seatrout, Gulf menhaden, brown shrimp, and white shrimp are found in the project area. EFH requirements vary depending upon species and life stage.

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act; P.L. 104-297) set forth a new mandate for NOAA's NMFS, regional fishery management councils (FMC), and other federal agencies to identify and protect important marine and anadromous fish habitat. The EFH provisions of the Magnuson-Stevens Act support one of the nation's overall marine resource management goals of maintaining sustainable fisheries. Essential to achieving this goal is the maintenance of suitable marine fishery habitat quality and quantity. Detailed information on Federally-managed fisheries and their EFH is provided in the 1999 generic amendment of the Fishery Management Plans (FMP) for the Gulf of Mexico prepared by the Gulf of Mexico FMC (GMFMC). The generic FMP subsequently was updated and revised in 2005 and became effective in January 2006 (70 FR 76216). NMFS administers EFH regulations. Categories of EFH in the project area include the estuarine waters and substrates of the MRGO channel. Estuarine categories include estuarine emergent wetlands and estuarine water column, mud, sand, and shell water bottoms, and rock substrates.

Coastal wetlands also provide nursery and foraging habitat that supports economically important marine fishery species such as spotted seatrout, sand seatrout, southern flounder, Atlantic croaker, spot, gulf menhaden, striped mullet, white mullet, silversides, killifish, kingfish, pompano, scaled sardines, anchovies, and blue crab. Some of these species serve as prey for other fish species managed under the Magnuson-Stevens Act by the GMFMC (e.g., mackerels, snappers, and groupers) and highly migratory species managed by NMFS (e.g., billfishes and sharks). Under future without project conditions there would be no change to EFH.

Portions of Bayou Bienvenue are designated as a Louisiana Natural and Scenic River. Please contact the Louisiana Department of Wildlife and Fisheries, Scenic Rivers Program (504/765-2334) for further information regarding any additional permits or conditions that may be required to perform work on the above referenced river.

ALTERNATIVES UNDER CONSIDERATION

During the initial IER, Tier 1 analysis, the no-action alternative and the alternative to raise the existing Hurricane Protection System to a 100-year level of protection were considered. The location alternatives (i.e., Borgne 1 and Pontchartrain 2) selected for the construction of storm surge protection structures were considered by the Corps to be most responsive to the project's purpose and need, and would be an effective engineering solution that minimizes uncertainty and risk to acceptable levels on a reasonable period of time.

The Borgne 1 location alternative includes a storm surge protection barrier which would be built to protect the IHNC and surrounding areas from storm surges coming from Lake Borgne. The study area extends from west of the Parish Road Bridge on the GIWW to east of the Michoud Canal on the GIWW and south of Bayou Bienvenue on the MRGO. IER 11, Tier 2 Borgne is evaluating the five following alternative alignments within the selected Borgne 1 location range to improve protect within the IHNC/Lake Borgne area:

1. Deep draft gate on the GIWW east of the Parish Road bridge and west of the Michoud slip;
2. A deep draft gate on the GIWW immediately east of the Michoud slip;
3. A shallow draft gate on the GIWW approximately 500 feet east of the Michoud Canal, a closure structure on the MRGO immediately northwest of the existing Bayou Bienvenue flood control gate, and a barrier (e.g. floodwall of levee) across the marsh connecting the two gates (this alignment would require the rebuilding of Bayou Bienvenue flood control gate); and,
4. A shallow draft gate on the GIWW approximately 1,150 feet east of the Michoud Canal, a closure structure on the MRGO approximately 2,700 feet southeast of the existing Bayou Bienvenue flood control gate, and a barrier (e.g. floodwall of levee) across the marsh connecting the two waterway structures with a gate at the crossing of Bayou Bienvenue.

DESCRIPTION OF SELECTED PLAN

The proposed alternative (i.e., Alternative 4) consists of two miles of new flood protection extending from the Michoud floodwall north of the GIWW to the levee on the west (New Orleans) side of the MRGO. The flood protection would cross the GIWW, Bayou Bienvenue, the MRGO, and the interspersed "golden triangle" marsh including some lands within the Bayou Savage NWR. The proposed overall excavated width for installation of this structural wall would be 350 feet.

In order to provide some level of flood protection prior to the 2009 hurricane season, this project is being proposed in two phases. The first phase, called "advanced measures", would be in place by June 2009 in preparation for the 2009 hurricane season. The second phase, "final configuration", should be completed by 2011. The paragraphs below describe the advanced measures and final configuration phases of construction for each component.

Advanced Measures

As part of the advanced measures phase of the project, a bypass swing gate structure would be constructed on the GIWW with a sill elevation of -16 feet National American Vertical Datum 88 (NAVD 88) to provide a 150-foot-wide navigation channel opening. A cofferdam would be installed in the area adjacent to the GIWW bypass swing gate structure to provide preliminary protection, during the construction phases, prior to the installation of the GIWW sector gate. The cofferdam would temporarily restrict flow at this point in the GIWW to the 150-foot-wide GIWW bypass swing gate structure. Once the adjacent primary GIWW sector gate is complete, the bypass gate could be used as a secondary navigation gate, or could be left in the closed position to minimize maintenance and operation costs, which is the sole responsibility of the non-federal sponsor after construction is complete. Therefore, the post-construction operational plan for this bypass gate is unknown at this time. The scenario most likely to have the highest level of adverse impacts (i.e., the gate remaining in a closed position after construction of the primary GIWW sector gate) will be evaluated during this IER process.

At Bayou Bienvenue, a sector gate structure would be constructed to provide a 56-foot-wide permanent navigational passage with a sill elevation of -12 feet (NAVD 88). During the two-year construction phase, a temporary cofferdam would be installed in the area of the Bayou Bienvenue sector gate structure. This cofferdam would have approximately four, 4-foot-diameter culverts to allow some flow in this portion of Bayou Bienvenue. The width of Bayou Bienvenue in this area is approximately 400 feet.

The MRGO crossing would be a braced concrete floodwall, which would provide protection to an elevation of +20.75 feet (NAVD 88) when advanced measures are complete. The MRGO crossing area would be filled with rock/sand to an elevation of -15 feet (NAVD 88) prior to installation of the floodwall structure; after installation is complete, additional rock/sand backfill and riprap would be placed to an elevation of +5 feet (NAVD 88) for additional structural stability. The overall MRGO crossing length would be approximately 2,400 feet, and the bottom width of the structure is estimated to be 550 feet at its widest point.

The advanced measures would include a concrete floodwall that would provide protection to an elevation of +20.75 feet (NAVD 88) across the wetlands area between the GIWW and MRGO. The barrier wall would have a 15-foot-deep plunge pool with scour mats on the protected side to absorb impact from overtopping and would be plugged at both ends to prevent navigational access.

During construction, a 17-foot-deep channel, approximately 350 feet wide, would be dredged by a cutterhead dredge from the MRGO to the GIWW for construction access. Approximately 1,400,000 cubic yards of material dredged to create this channel would be used beneficially to enhance marsh on the flood side of the barrier within a designated 705-acre area (i.e., Bayou Bienvenue – Proposed Disposal Area) in the "golden triangle" marsh. Material would be pumped in 205 acres of open water within this designated area in an effort to create marsh. The placement of dredged material for wetland enhancement would occur concurrently with construction of the proposed action. Earthen and sheet pile dikes would be constructed to an elevation of +4 feet (NAVD 88) to semi-contain the dredge material within the open water ponds and prevent dredge material slurry from entering existing pipeline canals or the GIWW. The initial fill elevation is expected to be no more than approximately +4 feet (NAVD 88) and settlement is estimated to be approximately +2-3 feet (NAVD 88). Portions of the 705-acre designated area and open water disposal area, and proposed containment dikes are located on Bayou Savage NWR.

Following construction, the construction/maintenance access channel would be closed to navigation and water flow by an engineered plug. Use of the channel would be limited to floodwall operation and maintenance activities, such as floodwall integrity inspection. Restricting navigation to only operation and maintenance on this channel also reduces potential shoreline erosion of the eroding "golden triangle" marsh by limiting large wake-producing traffic in the channel. In addition, shoreline protection (e.g., riprap, concrete slope paving, or geotextile tubes) would be provided along the entire length of the flood side maintenance channel. The protection would extend approximately 30 feet into the channel.

Final Configuration

The final configuration would include the addition of a sector gate across the GIWW, installation of a sector gate at Bayou Bienvenue, modifications to the concrete floodwall, and other additional features to increase the protection and structural resilience of the components constructed during advanced measures to the 100-year level of protection.

The GIWW sector gate would be installed in the area of the cofferdam adjacent to the GIWW bypass swing gate to provide a 150-foot-wide navigation pass with protection to an elevation of +26 feet. The bypass gate could be operated under a number of scenarios after completion of the final configuration sector gate, which would involve varying degrees of economic and labor burden on the non-federal sponsor. In order to analyze and disclose the impacts of this range of operational scenarios, the impacts analysis will consider both a scenario in which both gates normally remain open and a scenario in which only one gate normally remains open.

For the proposed final configuration of the concrete floodwall and the MRGO crossing, 5.25-foot-high cast-in place panels would be placed on top of the concrete cap installed during the advanced measures, bringing the protection to an elevation of +26 feet. A permanent access concrete roadway for maintenance traffic will be included in the concrete cap design on the protected side of the structural barrier. Based on anticipated sea level rise and subsidence in the local area, the design of the structure incorporates 2 feet of structural superiority to account for these changes. The overall excavated width would be approximately 350 feet, which includes a 200-foot inspection channel flood side of the concrete floodwall.

The Bayou Bienvenue sector gate would be installed in the area of the cofferdam to provide a 56-foot-wide area for navigational passage with protection to an elevation of +26 feet. The Bayou Bienvenue sector gate would, in general, remain open once the final configuration is complete.

FISH AND WILDLIFE CONCERNS IN THE STUDY AREA

Since 1930, Louisiana has lost over 1,500 square miles of marsh, and is still losing 25-30 square miles each year (LCWCR Task Force and WCR Authority 1998). Erosion, subsidence, and relative sea level rise continue to contribute to Louisiana's coastal land loss. The MRGO navigation channel was dredged through the Breton Sound Basin in 1963. Saltwater intrusion facilitated by the MRGO killed thousands of acres of freshwater wetland forests and transformed intermediate and brackish marshes into more saline habitats. Wave-induced shoreline erosion associated with vessel traffic along the MRGO has also contributed to marsh loss in the area. In accordance with the Water Resources Development Act of 2007, approval by the Secretary of the Army and submittal of the June 5, 2008, Chief's Report to Congress by the Assistant Secretary of the Army deauthorized the MRGO channel from mile 60 to the Gulf of Mexico resulting in no further actions to maintain that portion of the MRGO navigation project.

Given the adverse impacts of continued coastal wetland loss, the Service strongly supports strategies and projects designed to address those losses. To comply with Section 303 (d) of Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA), the Corps must implement and operate project features consistent with the Louisiana Coastal Wetlands Restoration Plan. That plan, developed by the Corps, the Service, and other Federal and State agencies, identified strategies to protect and restore Louisiana's coastal wetlands. Several Region 1 strategies include diverting Mississippi River water through Violet Canal to sustain the Central Wetlands and Biloxi Marshes, dedicated delivery of sediment for marsh building, as well as closure of the MRGO.

EVALUATION METHOD

Alternative Plan Selection Process
Selection criteria were developed by the Corps for use in selecting a proposed action based on criteria traditionally used during engineering alternatives evaluation as well as NEPA evaluations. The selection criteria include constructability, operations and maintenance, risk and reliability, impacts to significant resources (i.e., navigation, wetlands and other fish and wildlife habitats, hydrology, and socioeconomic and human environment), real estate requirements, and cost. The significant resources outlined above serve as overarching significant resources for the purposes of preliminarily selecting a proposed action, in part because of their relationship and associated direct and indirect impacts on other resources such as species protected under ESA, fisheries, EFH, air quality, noise, aesthetics, cultural resources, and water quality.

Habitat Assessment Methodology
Direct impacts to bottomland hardwood and emergent marsh habitats were quantified by acreage and habitat quality (i.e., average annual habitat unit or AAHUs) and are presented in Table 1. The Service and other resource agencies used the Habitat Assessment Methodology (HAM) (Louisiana Department of Natural Resources 1994) to quantify the impacts of proposed project features on bottomland hardwood habitat and used the Wetland Value Assessment (WVA) (U.S. Fish and Wildlife Service 2007) methodology for brackish marsh to quantify the impacts on

emergent wetlands. The habitat assessment models for bottomland hardwoods within the Louisiana Coastal Zone utilized in this evaluation were modified from those developed in the Service's Habitat Evaluation Procedures (HEP) (U.S. Fish and Wildlife Service 1980). For each habitat type, those models define an assemblage of variables considered important to the suitability of an area to support a diversity of fish and wildlife species. The HAM, however, is a community-level evaluation instead of the species-based approach used with HEP. The WVA is used evaluate proposed CWPPRA projects, and is similar to the Service's HEP, in that habitat quality and quantity (acreage) are measured for baseline conditions, and predicted for future without-project and future with-project conditions. As with HEP, the WVA provides a quantitative estimate of project-related impacts to fish and wildlife resources; however, the WVA is based on separate models for fresh/intermediate marsh, brackish marsh, and saline marsh. Further explanation of how impacts/benefits are assessed with the HAM and WVA and an explanation of the assumptions affecting habitat suitability (i.e., quality) index (HSI) values for each target year for impacts to bottomland hardwood habitat are available for review at the Service's Lafayette, Louisiana, field office. An explanation of the assumptions affecting HSI values for each target year for impacts to emergent marsh are available for review at the NOAA, NMFS office in Baton Rouge, Louisiana.

Table 1: Impacts from Improved Protection on the IHNC (IER 11), Tier 2 Borgne

Habitat Type	Parish	Impacted (acres)	AAHUs
Brackish Marsh	Orleans	64	-18.12
Brackish Water	St. Bernard	122	
Bottomland Hardwood Habitat [1]	Orleans	15	-2.59
Total	--	201	-20.71

[1]Young successional bottomland hardwood (i.e., scrub/shrub habitat)

As indicated in Table 1, impact analyses conducted indicate that project implementation would result in the direct loss of 186 and 15 acres and 18.12 and 2.59 AAHUs of emergent marsh and bottomland hardwood habitat, respectively.

POTENTIAL SIGNIFICANT IMPACTS

Direct impacts to 186 acres of emergent wetlands, of which 20 acres are on Bayou Savage NWR lands, would occur as a result of alternative alignment 4, i.e., the installation of a concrete floodwall (i.e., barrier) across approximately 2 miles of the "golden triangle" wetlands. The installation right-of-way (ROW) would include a 200-foot inspection and maintenance channel on the flood side of the barrier. Approximately 1,400,000 cubic yards of material dredged from the proposed channel and ROW would be pumped in 205 acres of open water within a 700-acre designated area in an effort to create marsh. The placement of dredged material for wetland enhancement would occur concurrently with construction of the proposed alternative. Initial fill elevation is expected to be no more than approximately +4 feet (NAVD 88) and settlement is estimated to be +2 to +3 feet (NAVD 88). These elevations were selected by the engineers in order to discharge at full production capacity and to maintain the expected construction schedule. Elevations greater than existing marsh elevations could potentially create supratidal marsh and replace existing intertidal habitats. Of the 705-acre designated marsh enhancement area, 113 acres are designated on Bayou Savage NWR, and approximately 15 acres of that area is open water in which the Corps intends to direct dredge material.

For the most part, construction staging areas would be sited in cleared areas and on existing levees; however, a marginal amount of early-successional stage forest (i.e., scrub-shrub stage) that provides medium to low habitat value for diverse fish and wildlife resources would also be directly impacted as a result of the construction staging areas. These areas would be allowed to revert back to an early succession hardwood forest after construction is complete, and will likely be dominated by the exotic Chinese tallow tree for part of the project life.

Development is ongoing within the hurricane protection levees; therefore, the Service has assumed that, for this specific IER, project-induced development within enclosed wetlands will be insignificant. However, project impacts to non-wet bottomland hardwoods as a result of flood protection improvements should be mitigated.

Indirect impacts would be associated with bisecting the "golden triangle" wetland complex with a structure. The construction of a barrier across the "golden triangle" marsh and associated waterways and bayous would fragment the emergent marsh complex, thereby disrupting natural hydrologic sheet flow, sedimentation processes, and organism access within this estuarine habitat. Altered hydrologic flow could exacerbate localized erosion rates especially along the shoreline of the proposed maintenance channel and along the protected side of the barrier (i.e., plunge pool) should shoreline protection and plugs not be imposed.

During construction of advanced measures, hydrologic flow and estuarine organism access between the flood side and protected side marsh would be reduced to 4, 48-inch culverts in the Bayou Bienvenue (400-foot-wide channel at this location) and to the 150-foot-wide barge swing gate on the GIWW where the barrier traverses these channels. After final configuration is complete, estuarine access between the fragmented marsh complexes would be limited to both the GIWW (i.e., 150-foot-wide navigation channel as a worst-case-scenario) and Bayou Bienvenue (i.e., 56- foot-wide sector gate structure) structures.

In an effort to more thoroughly analyze and disclose potential impacts associated with constructing a barrier across the "golden triangle" marsh, the Corps conducted several modeling investigations on project effects on hydroperiod, salinity, velocity, dissolved oxygen, and fish passage. Hydroperiod modeling indicated that areas of the interior (protected side of the floodwall levee) marsh could experience less tidal inundation, while portions of the exterior marsh could experience greater tidal inundation. Complete closure at Bayou Bienvenue exasperated these conditions. Modeling results also indicated that a tidal phase shift would occur for most of the modeled scenarios throughout the study area by one-half hour. Moreover, modeling results also indicate that closure of the MRGO at Bayou La Loutre produced noticeable reductions in monthly average bottom salinity (i.e., 3-4 parts-per-thousand(ppt)) within the study area waterways and the Lake Borgne area. Decreased inundation periods coupled with the potential decrease in salinity, could convert the interior marsh vegetation community to one that is less tolerant of inundation and higher salinities.

As indicated the access channel shoreline would be protected with shoreline protection (e.g., riprap, concrete slope paving, or geotextile tubes) extending out 30 feet from the shoreline. Without this protection, the shoreline would be exposed to wave-induced erosion associated with the proposed maintenance channel. Because of high subsidence rates, shoreline protection projects in the area have required numerous lifts to maintain the designed elevations, and therefore, have experienced greater operation and maintenance costs.

FISH AND WILDLIFE CONSERVATION MEASURES

The President's Council on Environmental Quality defined the term "mitigation" in the National Environmental Policy Act regulations to include:

(a) avoiding the impact altogether by not taking a certain action or parts of an action; (b) minimizing impacts by limiting the degree or magnitude of the action and its implementation; (c) rectifying the impact by repairing, rehabilitating, or restoring the affected environment; (d) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and (e) compensating for the impact by replacing or providing substitute resources or environments.

The Service supports and adopts this definition of mitigation and considers its specific elements to represent the desirable sequence of steps in the mitigation planning process. Based on current and expected future without-project conditions, the planning goal of the Service is to develop a balanced project, i.e., one that is responsive to demonstrated hurricane protection needs while addressing the co-equal need for fish and wildlife resource conservation.

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 emergent marsh for fish and wildlife and the relative scarcity of that habitat type, those wetlands are usually designated as Resource Category 2 habitat, the mitigation goal for which is no net loss of in-kind habitat value. Project impacts to wetlands will be minimized to some extent by implementing a structural barrier as opposed to constructing a traditional earthen levee which would require a wider ROW. Also, the preferred alignment location, one of five evaluated alignments, was selected in part because wetlands enclosed by the proposed structure as well as wetlands directly impacted by the ROW footprint have been minimized to the greatest extent practicable. Therefore, remaining direct project impacts should be mitigated via in-kind compensatory replacement of the habitat values lost. The scrub-shrub habitat that may be impacted, however, is placed in Resource Category 3 due to their reduced value to wildlife, fisheries and degraded wetland functions. The mitigation goal for Resource Category 3 habitats is no net loss of habitat value.

Mitigation for unavoidable losses of wetland habitat and non-wet bottomland hardwoods caused by project features will be evaluated through a complementary comprehensive mitigation IER. Several large scale studies and programs [e.g., Louisiana Coastal Protection and Restoration Plan (LaCPR), Louisiana Coastal Area (LCA) Ecosystem Restoration Study, CWPPRA, and Louisiana's Comprehensive Master Plan for a Sustainable Coast] have identified and prioritized proposed restoration plans important for coastal protection and restoration. The East Orleans Landbridge and Biloxi Marshes, two areas prioritized in the LaCPR plan, are essential components of the Louisiana coastal landscape and are important geomorphic barriers for providing protection against storm events and maintaining a sustainable ecosystem. The Service recommends that these and other large scale restoration plans, and their system-wide strategic goals, should be evaluated and considered when developing the comprehensive mitigation IER.

The Corps does not intend to use the proposed marsh creation and nourishment areas as compensatory mitigation for wetland impacts for activities described in this IER. As previously mentioned, compensatory mitigation will be evaluated through a complementary comprehensive mitigation IER. The Corps will, in coordination with the resource agencies, assess the marsh creation areas one year after placement of fill to determine whether there is the potential to use some portion of the enhancement area as compensatory mitigation. If so, a complete compensatory mitigation plan will be developed and implemented for those areas which will be used as compensatory mitigation. This plan will be described in a separate IER. Given the difficulty in accurately quantifying the potential beneficial effects of marsh nourishment in this case, only the marsh creation areas would be considered as potential compensatory mitigation.

Appendix B provides guidance for avoiding and minimizing impacts to existing marsh and to adequately offset conversion of water bottoms with successful marsh creation. As indicated, to ensure that marsh elevations are achieved, pre- and post-construction surveys should be conducted. Should elevations exceed averaged intertidal marsh elevations and the resource agency post-construction evaluation determine that adverse impacts have occurred, remediation and/or mitigation may be required.

Mitigation for unavoidable losses of emergent marsh on Bayou Savage NWR would need to be mitigated on that Refuge. Portions of the proposed marsh enhancement area are located on the Refuge. Provided that marsh elevations and design criteria recommended by the natural resource agencies, including the Refuge, are achieved, habitat values gained through the marsh enhancement project could be evaluated as compensatory mitigation for impacts to estuarine habitats on the Refuge. The Corps has an opportunity to use dredge material beneficially, in a cost-effective manner, to restore marsh on Bayou Savage NWR and provide compensatory mitigation for project-induced impacts. The Corps should consider designing marsh enhancement areas located on the Refuge in a manner that concurrently mitigates for impacts associated with the construction of the proposed hurricane protection barrier on that Refuge. Coordination regarding this should continue with the Lafayette Field Office and Kenneth Litzenberger, Project Leader for the Service's Southeast National Wildlife Refuges and Jack Bohannan (985) 822-2000, Refuge Manager for the Bayou Sauvage NWR.

Furthermore, deposition of dredge material on Bayou Savage NWR should adhere to the following additional guidelines to avoid adverse impacts on that NWR:

1. Containment dikes should be located in open water areas with minimal marsh disturbance;

2. Material for containment dikes should be dredged from within the containment area;

3. Containment dikes should be degraded to marsh elevation following completion of disposal;

4. Dewatering/overflow pipes and breaches should be discharged and directed into degraded marsh for marsh nourishment purposes;

5. A maximum pump elevation of +4 NGVD with final settling height of +2.5 NGVD should not be exceeded (these elevations may be adjusted based on engineering surveys and calculated settling rates);

6. All marsh creation material should be tested for contaminants prior to placement, and a contaminant report provided to the Refuge;

7. Following degradation of containment dikes, a 20-foot-wide vegetated buffer should be planted along the marsh edge. Container-grown smooth cordgrass (*Spartina alterniflora)* should be planted within this buffer on 3-foot centers.

9. Should 80% survival of planted material not be achieved at the end of one growing season, additional plantings may be necessary.

Reduction in the cross-sectional width of the project area channels combined with the fragmentation of the marsh complex will impact the functioning capacity (e.g., tidal exchange and estuarine organism access) of that marsh complex. As proposed, Bayou Bienvenue, a 400-foot-wide channel, would be reduced to 4, 46-inch culverts for two years, with a final configuration consisting of a 56-foot-wide passage. While installing culverts on Bayou Bienvenue is intended to maintain hydrologic connectivity, there will be impacts associated with reducing the tidal exchange and minimizing the channel width and geomorphology for both the advanced measure and final configuration designs. To minimize impacts, as many culverts as feasible should be placed strategically within the water column to facilitate estuarine access during advanced measures, and to the greatest extent practicable, a maximum cross-sectional width should be designed for the final configuration.

Impacts associated with reducing tidal exchange and minimizing the channel width and geomorphology would also occur as a result of constructing a flood protection structure in the GIWW. As a worse-case-scenario, the GIWW would be reduced from a 600 to 700-foot-wide channel to a 150-foot-wide channel. However, the final configuration proposed would consist of two, 150-foot-wide passages within the channel. Operational plans and design configurations should be developed to maximize the cross-sectional area for the advance measures and final configuration. The Corps should coordinate with the natural resource agencies during ongoing development of the structure designs to ensure that fish and wildlife conservation measures are incorporated. Furthermore, NMFS' guidance document titled "Fisheries Friendly Design and Operation Considerations for Hurricane and Flood Protection Water Control Structures" provided in our November 26, 2007, Draft Programmatic FWCA Report should assist in the design of flood protection features while incorporating estuarine habitat conservation measures.

Shoreline protection features implemented along the eastern shoreline of the maintenance channel will help to maintain the shoreline integrity. Plugs installed where the proposed channel intersects with natural and manmade waterways will also help to reduce wave-induced erosion associated with recreational boating access by restricting access. Restricting access may also help to minimize associated operation and maintenance of the shoreline protection features. Additional measures such as posting signage around the structure restricting access would ensure the safety of recreational boaters and ensure unintentional damage to the structures and adjacent marsh caused by boaters attempting to gain access around the plugs and structures.

SERVICE POSITION AND RECOMMENDATIONS

The Service does not object to providing improved hurricane protection to the Greater New Orleans area provided the following fish and wildlife conservation recommendations are incorporated into future project planning and implementation:

1. Situate the flood protection barrier and associated structures so that destruction and enclosure of emergent wetlands are avoided or minimized, to the greatest extent possible.

2. The width of the construction and maintenance access channel and the plunge pool should be minimized, to the greatest extent practicable, to reduce direct impacts to estuarine wetlands.

3. The Corps shall fully compensate for any unavoidable losses of estuarine wetland habitat, forested wetland habitat and non-wet bottomland hardwoods caused by project features.

4. Ensure impacts and encroachments onto public lands are avoided. Unavoidable impacts and encroachments when permissible by the appropriate managing agency should be minimized and appropriately mitigated.

5. The project's first Project Cooperation Agreement (or similar document) should include language that specifies the responsibility of the local-cost sharer to provide operational, monitoring, and maintenance funds for mitigation features, as well as shoreline protection features.

6. Acquisition, habitat development, maintenance and management of mitigation lands should be allocated as first-cost expenses of the project, and the local project-sponsor should be responsible for operational costs. If the local project-sponsor is unable to fulfill the financial mitigation requirements for operation, then the Corps should provide the

necessary funding to ensure mitigation obligations are met on behalf of the public interest.

7. Further detailed planning and design of project features (e.g., Design Documentation Report, Engineering Documentation Report, Plans and Specifications, or other similar documents) should be coordinated with the Service, including refuge personnel, NMFS, LDWF, Environmental Protection Agency (EPA) and Louisiana Department of Natural Resources (LDNR). The Service shall be provided an opportunity to review and submit recommendations on the all work addressed in those reports.

8. The Corps should avoid impacts to Bayou Savage NWR, when feasible. If not feasible, the Corps should continue to coordination with Refuge personnel during planning and compatibility determination processes. A Special-Use Permit should be obtained prior to any entrance onto the refuge. Coordination should continue until construction of the flood protection barrier and marsh enhancement project are complete and prior to any subsequent maintenance. Points of contacts for that refuge are Kenneth Litzenberger, Project Leader for the Service's Southeast National Wildlife Refuges and Jack Bohannan (985) 822-2000, Refuge Manager for the Bayou Sauvage NWR. The Corps should not sign the Decision Record until a Compatibility Determination is complete.

9. If a proposed project feature is changed significantly or is not implemented within one year of the date of our Endangered Species Act consultation letter, we recommend that the Corps reinitiate coordination with each office (i.e., NMFS in St. Petersburg, Florida, and the Service's Lafayette, Louisiana, Field Office) to ensure that the proposed project would not adversely affect any Federally listed threatened or endangered species or their habitat.

10. Continued coordination should be conducted with the Louisiana Department of Wildlife and Fisheries, Scenic Rivers Program (504/765-2334) regarding any additional permits or conditions that may be required to perform work in Bayou Bienvenue.

11. Guidance for avoiding and minimizing impacts to existing marsh within the enhancement area and to adequately offset conversion of water bottoms with successful marsh creation (Appendix B) should be incorporated into construction design.

12. Should pre- and post-construction surveys indicate that the enhancement area resulted in negative impacts, remediation and/or mitigation may be required.

13. Deposition of dredge material on Bayou Savage NWR should adhere to the following additional guidelines to avoid adverse impacts on that NWR:

    a. Containment dikes should be located in open water areas with minimal marsh disturbance;
    b. Material for containment dikes should be dredged from within the containment area;

c. Containment dikes should be degraded to marsh elevation following completion of disposal;
d. Dewatering/overflow pipes and breaches should be discharged and directed into degraded marsh for marsh nourishment purposes;
e. A maximum pump elevation of +4 NGVD with final settling height of +2.5 NGVD should not be exceeded (these elevations may be adjusted based on engineering surveys and calculated settling rates);
f. All marsh creation material should be tested for contaminants prior to placement, and a contaminant report provided to the Refuge;
g. Following degradation of containment dikes, a 20-foot-wide vegetated buffer should be planted along the marsh edge. Container-grown *Spartina alterniflora* (oystergrass, smooth cordgrass) should be planted within this buffer on 3-foot centers; and,
h. Should 80% survival of planted material not be achieved at the end of one growing season, additional plantings may be necessary.

14. Culverts installed within Bayou Bienvenue during advance measures should be placed to allow as much opening as practicable, in number, size, and diversity. To facilitate estuarine access, culverts should be placed near both sides of the channel as well as within in the center of the channel that extends to the bottom.

15. Flood protection water control structures in any watercourse should maintain pre-project cross section in width and depth to the maximum extent practicable, especially structures located in tidal passes.

16. Flood protection water control structures should remain completely open except during storm events. The GIWW by-pass swing gate structure should be positioned in the floating position during non-storm operating conditions, to allow for maximum flows through the structure.

17. The number and siting of openings in flood protection levees should be optimized to minimize the migratory distance from the opening to enclosed wetland habitats.

18. Structures should include shoreline baffles and/or ramps (e.g., rock rubble, articulated concrete mat) that slope up to the structure invert to enhance organism passage. Various ramp designs should be considered.

19. To the maximum extent practicable, structures should be designed and/or culverts selected such that average flow velocities during <u>peak</u> flood or ebb tides do not exceed 2.6 feet/second. This may not necessarily be applicable to tidal passes or other similar major exchange points.

20. To the maximum extent practicable, culverts (round or box) should be designed, selected, and installed such that the invert elevation is equal to the existing water depth. The size

of the culverts should be selected that would maintain sufficient flow to prevent siltation.

21. Water control structures should be designed to allow rapid opening in the absence of an offsite power source after a storm passes and water levels return to normal.

22. Operational plans should be developed to maximize the cross-sectional area open for as long as possible. Operations to maximize freshwater retention or redirect freshwater flows could be considered if hydraulic modeling demonstrates that is possible and such actions are recommended by the natural resource agencies.

23. Shoreline protection features should be constructed along the eastern shoreline of the maintenance channel and along the western shoreline of the protected side plunge pool to maintain the shoreline integrity and minimize shoreline erosion.

24. Plugs should be installed where the proposed channel intersects with natural and manmade waterways to minimize recreational boating access and reduce wave-induced erosion.

25. To further minimize recreational boater access and associated marsh impacts, signs indicating restricted-access should be posted around the maintenance channel, channel plugs, and adjacent marsh.

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

Should you or your staff have any questions regarding this letter and our attached report, please contact Angela Trahan (337/291-3137) of this office.

Sincerely,

James F. Boggs
Supervisor
Louisiana Field Office

Attachments

cc: Southeast LA Refuge Complex, Lacombe, LA
NMFS, Baton Rouge, LA
EPA, Dallas, TX
LDWF, Baton Rouge, LA
LDWF, NHP, Baton Rouge, LA
LDWF, Scenic Rivers Program, Baton Rouge, LA
LDNR, CMD/CRD, Baton Rouge, LA
LA Dept. of Natural Resources, CRD, Baton Rouge, LA

LITERATURE CITED

Louisiana Coastal Wetland Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority. 1998. Coastal 2050: Toward a Sustainable Coastal Louisiana. Louisiana Department of Natural Resources. Baton Rouge, LA. 70898.

APPENDIX A

Summary of Basic Mitigation Land Requirements before Land is Transferred to the U.S. Fish and Wildlife Service

SUBJECT: Revised Basic Mitigation Land Requirements before Land is Transferred to Basic Mitigation Land Requirements before Land is Transferred to the Service.

The following represents a summary of basic mitigation land requirements before land is transferred over to the Service. This does not necessarily represent a comprehensive list, but does represent our best effort to identify all land requirements within reason.

1. For inclusion into the National Wildlife Refuge (NWR) system the lands must be located within a refuge's acquisition boundary.

2. The Service must be provided copies of any easements/agreements for right-of-way on the property especially as it pertains to maintenance of such right-of-way, frequency of maintenance and costs associated with that maintenance if the maintenance is to be preformed by the landowner.

3. The area must be surveyed prior to acquisition by the United States or transfer to the Fish and Wildlife Service. The survey will be conducted by the Corps of Engineers (Corps) or an approved contractor. Boundaries must be marked and permanent monuments set at all corners. Copies of the surveyor notes, plats, etc. resulting from such survey must be provided to Service.

4. Language must be placed in the deed dedicating the mitigation land to fish and wildlife conservation in perpetuity.

5. When possible any restrictive covenants or liens shall be removed, especially if they could interfere with mitigation implementation, operation and/or maintenance.

6. Completion of a Level 1 survey for hazardous, toxic, and/or radioactive wastes with a copy being provided to the Service. If the Level 1 survey indicates the need for further investigations/surveys, those investigations/surveys must be completed and a copy provided to the Service. Lands having unremediated hazardous, toxic, and/or radioactive wastes present may not be accepted into a NWR. Remediated sites will be assessed for inclusion on a case-by-case basis. Documentation of the level of remediation is to be provided to the Service.

7. Funding mechanism for operation and maintenance of the mitigation lands and mitigation features (e.g., water control structures, timber stand improvements, etc.).

8. Documentation must be provided to the Service describing the mitigation goals and objectives in addition to a description of necessary operation and maintenance activities needed to accomplish the stated goals and objectives.

9. Mineral rights should be purchased. If it is not possible to purchase, then protection of surface rights via the following language:

"The vendors reserve for themselves, their successors and assigns, the right to explore, for, operate, produce, remove and transport, oil and gas from the lands herein described. The vendors reserve unto themselves, their successors and assigns, the right of ingress and egress over the said lands in pursuance of the reservations set forth above.

The land is now subject to oil and gas lease in favor of ______________________________, as per lease of record in the records of ______________, ________________, pages __________ of Book ____________, and the conveyance is subject to the rights of the lessee in said lease.

The oil and gas reservations made by the vendors herein in favor of themselves, their successors and assigns, shall be subject to the following stipulations, and any lease made by the vendors, their successors or assigns, subsequent to the date of this deed, shall contain the following stipulations for the protection of the vendee.

The vendors, their successors and assigns, agree that prior to entry upon the land for purposes of exploration, development or production of, oil and/or gas, they shall obtain a Special Use Permit from the U.S. Fish and Wildlife Service, which permit is for the purpose of providing for access and protecting the natural resources of the area for which the land was acquired, and whose terms and conditions will not unreasonably restrain the activities of the vendors, and their successors and assigns.

It is mutually understood between the parties that the intention of the Government in acquiring this area is to create a refuge for, and the protection of, wildlife in the area herein acquired, and the vendors will conform to, and be governed by, and the vendors herein bind themselves, their successors and assigns, agents and employees, to conform to, and be governed by, the rules and regulations pertaining to the protection of wildlife and refuge administration prescribed from time to time by the Secretary of the Interior or his/her authorized agent, the Director of Fish and Wildlife Service, except that such regulations shall not unreasonably restrain the exercise and use by the vendors, their successors and assigns, of the reservation set out in this agreement."

10. The Service would need a title commitment and policy in favor of United States of America that is in the American Land Title Association (ALTA) U.S. Policy 9/28/91 format as provided in Title Standards 2001.

If the title remains with the local-sharer or the Corps a General Plan as provided for under Section 3 of the Fish and Wildlife Coordination Act (48 Stat. 401; 16 U.S.C. 661 et seq.) must be written. However, the Service may chose to not manage lands for which it does not have title.

APPENDIX B

IER 11 Marsh Creation/Nourishment Areas
Date: 6/11/08

Subject: Guidance for Avoiding and Minimizing Impacts to Existing Marsh and Adequately Offsetting Conversion of Water Bottoms with Successful Marsh Creation:

1. The initial target fill elevation should take into consideration settlement, compaction, and oxidation to maximize the creation of elevations conducive to the establishment of intertidal marsh that would last as long as possible. The final target fill elevation should be obtained by averaging measurements from healthy stands of nearby marsh and approval by natural resource agencies.

2. No more than six inches of sediment should be placed on areas with existing vegetation. Depending on the initial target fill elevation for open water and the elevation of the existing marsh, there is a potential that up to one foot of fill on existing marsh may be allowed, if approved by the natural resource agencies, without requiring mitigation for those fill impacts.

3. Incorporation of an acceptable amount of tidal creeks into the design to be accomplished by either pre or post dredging may be necessary.

4. An onsite inspector should be present at all times during construction.

5. Containment dikes, if used, should be degraded to restore tidal exchange to the disposal area as deemed necessary by the natural resource agencies. Strategic degrading or gapping may be necessary prior to demobilization or one complete growing season after construction.

6. To ensure target elevations are achieved, survey stakes marked with the target elevation and a maximum vertical tolerance (i.e., max slurry elevation) should be installed on no more than 200-foot centers. Installation should be accomplished by means to avoid or minimize tracking on vegetation.

7. Pre-construction, as-built, and one year post-construction surveys should be required and supplied to the natural resource agencies. No later than one year after fill placement, data from each survey should be provided to the resource agencies plotted both in plan view overlaid on aerial imagery and cross sections. These plots should identify the aerial extent (in acres) and elevation data (in NAVD 88) of the disposal area and all access corridors, as well as how much marsh existing pre-project falls within the disposal area after construction and the elevation of those areas.

8. An interagency site inspection should be scheduled prior to demobilization of the dredging contractor.

9. No more then 15% of the final fill area shall exceed the agreed upon final fill elevation.

10. Remediation measures, including sediment removal and replanting (of the necessary plant species), should be required if more than 15% of the site is filled higher than the final target elevation or vegetation damage occurs from pipeline discharge routes or construction equipment access.

The Corps does not necessarily intend to use the subject marsh creation and nourishment areas as compensatory mitigation for wetland impacts for activities described in this IER. Compensatory mitigation for wetland impacts from this project will be described in a separate IER (IER #___). The Corps will, in coordination with the resource agencies, assess the marsh creation areas one year after placement of fill to determine whether there is the potential to use some portion of these areas as compensatory mitigation. If so, a complete compensatory mitigation plan will be developed and implemented for those areas which will be used as compensatory mitigation. This plan will be described in a separate IER. Given the difficulty in accurately quantifying the potential beneficial effects of marsh nourishment in this case, only the marsh creation areas would be considered as potential compensatory mitigation.

Potential for Mitigation Credit

After construction, mitigation credit for demonstrated marsh creation in open water may be possible. If the Corps, New Orleans District proposes to receive mitigation credit for this disposal, the following performance and success criteria should be met:

A. Initial Success Criteria (one year post construction)

After at least one year post construction, portions of the disposal area that are within a "functional marsh" elevation range (determined through elevation surveys) that previously were open water may be considered for mitigation credit if other criteria also are met.

B. Year Three Success Criteria

1. Three years post construction, at least 80% of the marsh elevations created in open water should be vegetated.
2. At least 80% of the vegetative cover are predominately facultative species or wetter, as verified by monitoring report and verified by an interagency team, if necessary.
3. Containment dikes should be degraded or breached and tidal creeks constructed and functioning as required by the natural resource agencies.

C. Year Five Success Criteria

Five years after construction, at least 75% of the marsh created in open water remains within the "functional marsh "target elevation range determined by the natural resource agencies. (Note: this would require a 5-year post-construction survey.)

Additionally, monitoring and reporting provisions would be a necessary requisite if approved as mitigation, and maintenance lifts may be necessary.

BOBBY JINDAL
GOVERNOR

HAROLD LEGGETT, PH.D.
SECRETARY

State of Louisiana

DEPARTMENT OF ENVIRONMENTAL QUALITY
ENVIRONMENTAL SERVICES

July 11, 2008

U.S. Army Corps of Engineers- New Orlenas District
P.O. Box 60267
New Orleans, LA 70160-0267

Attention: Laura Lee Wilkinson

RE: Water Quality Certification (WQC 080616-01/AI 158513/CER 20080001)
Corps of Engineers Individual Environmental Report (IER #11)
Orleans & St. Bernard Parishes

Dear Ms. Wilkinson:

The Department has reviewed your application for the IHNC/Lake Borgne Storm Surge Protection Structures project in Orleans & St. Bernard Parishes.

The requirements for Water Quality Certification have been met in accordance with LAC 33:IX.1507.A-E. Based on the information provided in your application, we have determined that the placement of the fill material will not violate the water quality standards of Louisiana provided for under LAC 33:IX.Chapter 11. Therefore, the Department has issued a Water Quality Certification.

Sincerely,

Bijan Sharafkhani, P.E.
Waste Permits Administrator

BS/jjp

Post Office Box 4313 • Baton Rouge, Louisiana 70821-4313 • Phone 225-219-3181 • Fax 225-219-3309
www.deq.louisiana.gov

Wilkinson, Laura L MVN

From: Cascio, Keith [kcascio@wlf.louisiana.gov]
Sent: Tuesday, July 22, 2008 8:05 AM
To: Wilkinson, Laura L MVN
Cc: Balkum, Kyle
Subject: RE: Scenic River and Stream Bayou Bienvenue and IER 11 Tier 2 Borgne

Laura,

We have reviewed the information you provided and agree with your conclusion that no significant change in the "Scenic" portion of Bayou Bienvenue's hydrology is anticipated. Since we are basing this determination on modeling, we must require that we be notified immediately of any significant changes to the proposal itself and/or any new or updated information that may affect the reliability of the model output so that we can make a new determination. Thank you so much for all of your help and patience with our process and please let me know if there is anything I can do to be of further assistance.

Keith Cascio
Scenic Rivers Coordinator

From: Wilkinson, Laura L MVN [mailto:Laura.L.Wilkinson@usace.army.mil]
Sent: Thursday, July 17, 2008 1:02 PM
To: Balkum, Kyle; Cascio, Keith
Subject: Scenic River and Stream Bayou Bienvenue and IER 11 Tier 2 Borgne

Attached is an evaluation of 56 data points for hydroperiod, 3 of which were in Bayou Bienvenue itself. Also attached is figure 33 of the report showing the points of detailed analysis.

<<Hydroperiod Analysis_52stations.doc>> <<Figure 33 from Hydroperiod Report.ppt>>
Please let me know if you have any questions. The link information for all the modeling reports: salinity, dissolved oxygen, velocity and hydroperiod, as well as the presentaitons is posted on

CHLguest FTP site:

ftp://134.164.34.99/HPO/NEPAmodeling/ <ftp://134.164.34.99/HPO/NEPAmodeling/>
Username: chlguest
Password: 3bit5map

Thanks,
Laura Lee Wilkinson
Environmental Coordinator
U.S. Army Corps of Engineers
New Orleans District
504-862-1212

BOBBY JINDAL
GOVERNOR

SCOTT A. ANGELLE
SECRETARY

State of Louisiana

DEPARTMENT OF NATURAL RESOURCES

OFFICE OF COASTAL RESTORATION AND MANAGEMENT

August 1, 2008

Elizabeth Wiggins
Chief, Environmental Planning and Compliance Branch
U. S. Army Corps of Engineers, New Orleans District
P. O. Box 60267
New Orleans, Louisiana 70160-0267

RE: **C20080280,** Coastal Zone Consistency
U. S. Army Corps of Engineers, New Orleans District
Direct Federal Action
Individual Environmental Report # 11, Improved Protection on the Inner Harbor Navigation Canal, Tier Two Borgne, Orleans, and St. Bernard Parishes, Louisiana

Dear Ms. Wiggins:

The above referenced project has been reviewed for consistency with the approved Louisiana Coastal Resource Program (LCRP) as required by Section 307 of the Coastal Zone Management Act of 1972, as amended. The project, as proposed in the application, is consistent with the LCRP.

This determination supercedes the Conditional Consistency issued by this office on June 23, 2008. If you have any questions concerning this determination please contact Brian Marcks of the Consistency Section at (225) 342-7939.

Sincerely yours,

Jim Rives
Administrator

JR/JH/bgm

cc: Harold Daigle, LDOTD
Tim Killeen, CMD FC
Wynecta Fisher, Orleans Parish
William McCartney, St. Bernard Parish
John Ettinger, USEPA
Richard Hartman, NMFS
Angela Trahan, USFWS
Chris Davis, LDWF

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701-5505
(727) 824-5317, FAX 824-5309
http://sero.nmfs.noaa.gov

F/SER31:DK

AUG 12 2008

Ms. Elizabeth Wiggins
Chief, Environmental and Compliance Branch
New Orleans District Corps of Engineers
P.O. Box 60267
New Orleans, Louisiana 70160-0267

Re: Tier 2 Borgne- IER #11

Dear Ms. Wiggins:

This responds to your letter dated June 12, 2008, requesting section 7 consultation pursuant to the Endangered Species Act (ESA) for the Army Corps of Engineers' (COE) Individual Evaluation Report (IER) #11, Tier 2 Borgne. The report evaluates the COE's proposal to construct storm surge protection structures between the Inner Harbor Navigation Canal (IHNC) and Lake Borgne for added flood protection for the IHNC, Orleans and St. Bernard Parishes, Louisiana. You requested concurrence from the National Marine Fisheries Service (NMFS) with your determination the project is not likely to adversely affect ESA-listed sea turtle species, Gulf sturgeon, or designated Gulf sturgeon critical habitat. Additional information, including a link to an FTP site providing all of the modeling results and related documents on dissolved oxygen, fish passage impacts, hydroperiod changes, as well as salinity and water velocity impacts in the IHNC, were provided in a July 1, 2008, e-mail from Laura Wilkinson of the COE.

The center of the project area is at approximately 30.0064°N, 89.9146°W (WGS84); the entire area spans both Orleans and St. Bernard Parishes, Louisiana. The proposed project consists of the construction of a flood control sector gate and bypass gate at the Gulf Intracoastal Waterway (GIWW) (approximately 1,150 ft east of the Michoud Canal), a new navigable flood control sector gate at Bayou Bienvenue (56 ft x 12 ft), a braced concrete wall across the Mississippi River Gulf Outlet (MRGO) (approximately 2,700 ft southeast of the existing Bayou Bienvenue flood control structure), and a concrete floodwall across the marsh between these waterways.

Construction activities for the proposed structures are slated to begin in late 2008, last approximately three years, and be completed in two phases. The advance measures, designed to provide a degree of protection in preparation for the 2009 hurricane season while the rest of the project is completed, are expected to be in place by June 2009. The final configuration is expected to be completed by 2011. A detailed explanation of both the advance measures and the final configuration of the project were provided in the consultation documents provided by the COE. A brief summary of pertinent aspects of the project is provided below.

Dredging activities for this project will be accomplished with a cutterhead dredge during the advanced measures phase. The project will include the dredging of a 17-ft-deep channel, approximately 350 feet wide, from the MRGO to the GIWW for construction access and materials delivery for the construction of a concrete floodwall. The dredging will excavate approximately 1,400,000 cubic yards of material which will be used for enhancement of the marsh area on the flood side of the floodwall within the 705-acre Bayou Bienvenue – Proposed Disposal Area. This includes 205 acres of open-water disposal area in open-water pockets within the salt marsh. The temporary access channel created by the dredging activity will be plugged to prevent navigation and water flow after construction is completed.

Other aspects of the advanced measures phase include the construction of the GIWW bypass swing gate structure, a sector gate structure at Bayou Bienvenue, and a braced concrete floodwall at the MRGO Crossing. The final configuration will include the addition of a sector gate across the GIWW, installation of a sector gate at Bayou Bienvenue, modifications to the concrete floodwall, and other additional features to increase the protection and structural resilience of the components constructed during the advanced measures phase to the 100-year level of protection.

ESA-listed species under NMFS jurisdiction that may occur in the action area include Gulf sturgeon and Kemp's ridley, green, and loggerhead sea turtles. The proposed project is not located within designated Gulf sturgeon critical habitat Unit 8, but is in the vicinity and has the possibility of impacting that critical habitat.

NMFS has reviewed the project details and has determined that the potential effects could result from the following routes: dredging; transit and anchoring of construction equipment and vessels at the site; water quality impacts associated with construction (i.e., turbidity and noise); and impacts to habitat.

Details of the activities were analyzed to determine if the potential routes of effects are likely to adversely affect Gulf sturgeon or sea turtles. The proposed dredging will occur in what is currently salt marsh, in order to create a temporary access channel as described previously. It is unlikely that sturgeon or sea turtles will be in the dredging area (salt marsh is not typical foraging or refuge habitat for these species) and also the noise and activity of the dredging will likely keep these animals from approaching the dredge as the channel is dug. Additionally, NMFS has previously determined that non-hopper-type dredging activities, such as the cutterhead dredge proposed for this project, are unlikely to adversely affect sea turtles or sturgeon. Further, due to their mobility, the likelihood of sea turtles and Gulf sturgeon being struck by the transit and anchoring of equipment and vessels at the project site is discountable. While sea turtles and Gulf sturgeon potentially present in the project area are likely to avoid the area during construction due to noise, the effects to these species as a result of avoiding refuge and foraging habitat at the site will be insignificant, as their exclusion from the area will be temporary. The installation and operation of gates in the GIWW and Bayou Bienvenue could potentially hinder passage by turtles and sturgeon, but these gates are expected to be open at all times except as needed to prevent flooding during major storms and for maintenance. Therefore, the likelihood of an adverse impact by barring passage is discountable. Given that other routes could be taken, if passage was temporarily barred, including sturgeon migration through Bayou Bienvenue, the impact would be insignificant to the animal. Injury from the closing and opening of the gates is not expected because the gates operate very slowly, thus the likelihood of injury is discountable. Water quality impacts related to construction, dredging and stockpiling of dredged material will be temporary and minimized by the use of silt curtains; therefore, impacts are expected to be insignificant. The habitat areas to be directly impacted by the project include waters in the GIWW, MRGO, and IHNC as a result of the construction of flood control structures, as well as salt marsh areas of Bayou Bienvenue, and associated open-water pockets within the salt marsh, as a result of dredging and dredge fill placement. However, these areas are either within heavily controlled artificial waterways of limited habitat value or in salt marsh areas not utilized by the species mentioned above, and thus any impacts are expected to be insignificant.

Although not located within designated Gulf sturgeon critical habitat, the project area does have nearby areas of critical habitat (part of Unit 8) that are hydrologically connected to the project area (Lake

Pontchartrain and Lake Borgne). The primary constituent elements (PCEs) essential for the conservation of Gulf sturgeon present in Unit 8 include abundant prey items, water quality, sediment quality, and safe and unobstructed migratory pathways. Of these PCEs, NMFS believes prey abundance, water quality, and sediment quality may be affected. However, based upon the analyses and modeling reports provided by the COE, no significant changes to hydroperiod, salinity, ability for benthic communities to establish and be maintained, water velocity, dissolved oxygen, siltation, or accessibility will occur as a result of the various structures to be constructed. Therefore this project is not expected to affect designated Gulf sturgeon critical habitat.

This concludes your consultation responsibilities under the ESA for species under NMFS' purview. Consultation must be reinitiated if a take occurs or new information reveals effects of the action not previously considered, or the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat in a manner or to an extent not previously considered, or if a new species is listed or critical habitat designated that may be affected by the identified action. We have enclosed additional information on other statutory requirements that may apply to this action, and on NMFS' Public Consultation Tracking System (PCTS) to allow you to track the status of ESA consultations.

Thank you for your continued cooperation in the conservation of threatened and endangered species under NMFS' purview. If you have any questions on this consultation or PCTS, please contact Dennis Klemm at (727) 824-5312, or by e-mail at dennis.klemm@noaa.gov.

Sincerely,

James E. Weaver

for Roy E. Crabtree, Ph.D.
Regional Administrator

Enclosures

File: 1514-22 F.I. LA
Ref: I/SER/2008/03778

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, FL 33701

SEA TURTLE AND SMALLTOOTH SAWFISH CONSTRUCTION CONDITIONS

The permittee shall comply with the following protected species construction conditions:

a. The permittee shall instruct all personnel associated with the project of the potential presence of these species and the need to avoid collisions with sea turtles and smalltooth sawfish. All construction personnel are responsible for observing water-related activities for the presence of these species.

b. The permittee shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing sea turtles or smalltooth sawfish, which are protected under the Endangered Species Act of 1973.

c. Siltation barriers shall be made of material in which a sea turtle or smalltooth sawfish cannot become entangled, be properly secured, and be regularly monitored to avoid protected species entrapment. Barriers may not block sea turtle or smalltooth sawfish entry to or exit from designated critical habitat without prior agreement from the National Marine Fisheries Service's Protected Resources Division, St. Petersburg, Florida.

d. All vessels associated with the construction project shall operate at "no wake/idle" speeds at all times while in the construction area and while in water depths where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will preferentially follow deep-water routes (e.g., marked channels) whenever possible.

e. If a sea turtle or smalltooth sawfish is seen within 100 yards of the active daily construction/dredging operation or vessel movement, all appropriate precautions shall be implemented to ensure its protection. These precautions shall include cessation of operation of any moving equipment closer than 50 feet of a sea turtle or smalltooth sawfish. Operation of any mechanical construction equipment shall cease immediately if a sea turtle or smalltooth sawfish is seen within a 50-ft radius of the equipment. Activities may not resume until the protected species has departed the project area of its own volition.

f. Any collision with and/or injury to a sea turtle or smalltooth sawfish shall be reported immediately to the National Marine Fisheries Service's Protected Resources Division (727-824-5312) and the local authorized sea turtle stranding/rescue organization.

g. Any special construction conditions, required of your specific project, outside these general conditions, if applicable, will be addressed in the primary consultation.

Revised: March 23, 2006
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