

**DRAFT  
INDIVIDUAL ENVIRONMENTAL REPORT**

**PREPARED TO SUPPLEMENT:  
PROGRAMMATIC INDIVIDUAL ENVIRONMENTAL REPORT 36**

**BAYOU SAUVAGE, TURTLE BAYOU & NEW ZYDECO RIDGE RESTORATION  
PROJECTS  
SAINT TAMMANY & ORLEANS PARISHES, LOUISIANA**

**PIER 36, SUPPLEMENT 1**



**US Army Corps  
of Engineers®**

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## TABLE OF CONTENTS

TITLE	PAGE
1. INTRODUCTION .....	1
1.1 PURPOSE AND NEED FOR THE PROPOSED ACTION .....	4
1.2 AUTHORITY FOR THE PROPOSED ACTION.....	4
1.3 PRIOR REPORTS .....	8
1.4. PUBLIC CONCERNS .....	8
1.5. DATA GAPS AND UNCERTAINTIES .....	8
2. ALTERNATIVES .....	8
2.1. ALTERNATIVE DEVELOPMENT AND PRELIMINARY SCREENING CRITERIA.....	8
2.2. DESCRIPTION OF THE ALTERNATIVES .....	9
2.3. PROPOSED ACTION .....	9
2.3.1 Bayou Sauvage Floodside Brackish .....	9
2.3.2 Turtle Bayou Protected-Side Intermediate Marsh .....	10
2.3.3 New Zydeco Ridge .....	12
2.3.4 Borrow Sites .....	16
2.3.5 Mitigation Banks and the State's In Lieu Fee Program.....	17
2.4. ALTERNATIVES TO THE PROPOSED ACTION.....	18
2.5. ALTERNATIVES ELIMINATED FROM FURTHER CONSIDERATION.....	19
3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES .....	19
3.1. ENVIRONMENTAL SETTING .....	19
3.2. SIGNIFICANT RESOURCES.....	19
3.2.1. Wildlife .....	21
3.2. 2. Threatened and Endangered Species .....	23
3.2. 3. Fisheries, Aquatic Resources, and Water Quality.....	28
3.2. 4. Essential Fish Habitat.....	30
3.2. 5. Cultural Resources .....	33
3.2. 6. Recreational Resources .....	35
3.3. WETLANDS.....	38
3.4. HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE (HTRW).....	39
3.5 CUMULATIVE IMPACTS.....	39
4. COORDINATION AND CONSULTATION.....	40
4.1. PUBLIC INVOLVEMENT .....	40
4.2. AGENCY COORDINATION.....	40
4.3. COMPLIANCE WITH ENVIRONMENTAL LAWS, REGULATIONS, AND GUIDANCE .....	42
5. CONCLUSION.....	44
6. PREPARERS .....	44
7. LITERATURE CITED .....	44

**LIST OF TABLES**

<b>TITLE</b>	<b>PAGE</b>
<b>Table 1 - Significant Resources In and Near the Project Areas .....</b>	<b>20</b>
<b>Table 2 - T&amp;E Species in St. Tammany &amp; Orleans Parishes.....</b>	<b>23</b>
<b>Table 3 - EFH for the Managed Species Expected in Project Area .....</b>	<b>31</b>

**LIST OF FIGURES**

<b>TITLE</b>	<b>PAGE</b>
<b>Figure 1 - Bayou Sauvage, Turtle Bayou &amp; New Zydeco Ridge Projects – All Features.....</b>	<b>5</b>
<b>Figure 2 – Bayou Sauvage and Turtle Bayou Projects.....</b>	<b>6</b>
<b>Figure 3 – New Zydeco Ridge Projects .....</b>	<b>7</b>

**LIST OF APPENDICES**

- Appendix A: Public Comments and Responses (Reserved for Final Supplement)**
- Appendix B: Interagency Correspondence**
- Appendix C: General Mitigation and Monitoring Guidelines**
- Appendix D: Adaptive Management Plan**

## 1. INTRODUCTION AND BACKGROUND

The U.S. Army Corps of Engineers (USACE), Mississippi Valley Division, New Orleans District (CEMVN), has prepared this supplemental Individual Environmental Report (SIER) to present changes to the recommended mitigation plan described in the Programmatic Individual Environmental Report (PIER) 36 titled "Lake Pontchartrain and Vicinity (LPV) Hurricane and Storm Damage Risk Reduction System (HSDRRS) Mitigation, Orleans, Plaquemines, St. Bernard, St. Charles, St. John the Baptist and St. Tammany Parishes, Louisiana" and its Decision Record approved by the CEMVN Commander on November 22, 2013. This supplemental IER evaluates the potential impacts associated with implementation of the proposed mitigation projects that would mitigate LPV HSDRRS construction impacts to National Wildlife Refuge (NWR) lands and portions of the general impacts that occurred off of NWR lands. These projects include measures to restore brackish marsh, fresh/intermediate marsh and bottom land hardwood wetlands (BLH-Wet) at the Bayou Sauvage, Turtle Bayou and New Zydeco Ridge features, respectively. Unlike PIER 36, which presented a mitigation plan consisting of both programmatic and constructible features, all features presented in this supplement to PIER 36 would be constructible. Both PIER 36 and its decision record are hereby incorporated by reference

This document was prepared following the National Environmental Policy Act (NEPA) of 1969 and the Council on Environmental Quality's Regulations (40 CFR §1500-1508), and USACE Engineering Regulation (ER) 200-2-2, Procedures for Implementing NEPA. These regulations allow Federal agencies, in consultation with the Council on Environmental Quality (CEQ), to implement Alternative Arrangements to comply with NEPA in lieu of a traditional Environmental Assessment (EA) or Environmental Impact Statement (EIS) in certain emergency circumstances (40 CFR 1506.11). The CEMVN published the CEQ-approved Emergency Alternative Arrangements on March 13, 2007, in the Federal Register. This process was implemented to expeditiously complete the environmental analyses for the HSDRRS. The Alternative Arrangements are found at [www.nolaenvironmental.gov](http://www.nolaenvironmental.gov), and are incorporated by reference.

The approved LPV HSDRRS mitigation plan in PIER 36 provides compensatory mitigation for the following habitat types:

<b>Habitat Type</b>	<b>Average Annual Habitat Units (AAHU)</b>
Non-Refuge Bottomland Hardwood (BLH) - Wet/Dry	93.85 AAHU
Non-Refuge Swamp	108.01 AAHU
Non-Refuge Fresh/Intermediate Marsh	45.70 AAHU
Non-Refuge Brackish Marsh	118.06 AAHU
Refuge Brackish Marsh	8.79 AAHU
Refuge Protected Side BLH-Wet	83.92 AAHU
Refuge Intermediate Marsh	41.29 AAHU
Refuge Flood Side BLH-Wet	8.91 AAHU

The approved LPV HSDRRS mitigation plan set forth in PIER 36 contained the following features:

<b>Constructible Features</b>	Mitigation Bank (BLH-Wet/Dry)
	Mitigation Bank (Swamp)
<b>Programmatic Features*</b>	Milton Island Marsh Restoration (Non-Refuge Intermediate Marsh)
	Bayou Sauvage Marsh Restoration (Non-Refuge/Refuge Brackish Marsh)
	Bayou Sauvage Protected Side Refuge BLH-Wet/Intermediate Marsh Restoration
	Fritchie Flood Side Refuge BLH-Wet Enhancement

Subsequent investigations since the release of PIER 36 revealed that a number of these previously identified programmatic mitigation features for general and refuge impacts are not feasible due to high construction costs and real estate issues. Specifically, the following programmatic features are no longer considered feasible:

- Bayou Sauvage Protected Side Refuge BLH-Wet/Intermediate Marsh Restoration. Engineering and design analysis produced significantly higher construction cost estimates than anticipated in earlier planning.
- Bayou Sauvage Refuge Floodside Marsh Restoration. Portions of the site as originally planned had poor soils and deep water conditions that resulted in significantly higher estimated construction costs.
- Fritchie Floodside Bottomland Hardwood-Wet. This mitigation feature was intended to compensate for floodside BLH-wet impacts that occurred within the Bayou Sauvage National Wildlife Refuge. The project would be located on private property and would require condemnation for use as a mitigation site. The U.S. Fish and Wildlife Service, which operates the Bayou Sauvage National Wildlife Refuge, has expressed an unwillingness to accept property into the Refuge that has been acquired by condemnation. As this mitigation feature would be incorporated into the Refuge, the Service’s position renders this option non-viable.

When the above programmatic features were deemed infeasible, the USACE re-worked one of the earlier features and developed seven additional options to consider as alternatives to provide the required mitigation. Alternative formulation was constrained by United States Fish and Wildlife Service (USFWS) policy requiring that Refuge habitat impacts be mitigated on Refuge property or within the authorized Refuge acquisition boundary and by the LPV HSDRRS mitigation screening criterion, that mitigation occur within the LPV Basin. The LPV HSDRRS Mitigation Basin boundaries coincide with the watershed boundaries as limited by the coastal zone to the north and excluding the barrier islands to the south.

Alternatives were developed separately for each impacted habitat type. New alternatives to meet mitigation requirements for on-refuge impacts are presented in this document. The mitigation alternatives evaluated in this document were developed in coordination with the U.S. Fish and Wildlife Service (USFWS) ecological office and Refuge staff to ensure

satisfaction of their mitigation requirements. The non-federal sponsor (NFS) was also consulted. The alternatives were evaluated using existing site information and data collected in field inspections. The table below depicts the seven additional features developed and selection criteria.

		Refuge Priority	Soils	Essential Fish Habitat	Endangered Species	Relative Cost
Bottomland Hardwood	New Zydeco Ridge	Medium	Best	Potential	Potential	Favorable
	Salt Bayou <u>Private</u>	High	Best	Potential	Potential	Favorable
Fresh/Intermediate Marsh	Blind Lagoon – PS	High	Poor	None	Potential	Unfavorable
	Turtle Bayou North - PS	High	Best	None	Potential	Favorable
	Thomas Bayou – PS	High	Poor	None	Potential	Unfavorable
	Salt Bayou	Medium	Best	Potential	Potential	Favorable
	Salmen	Low	Moderate	Potential	Potential	Favorable
Brackish Marsh	Bayou Sauvage Brackish Marsh	High	Moderate	None	Potential	Favorable

Alternatives that have been tentatively selected are:

- New Zydeco Ridge BLH-Wet and Brackish Marsh - a 152 acre flood-side bottomland hardwood and 118 acre brackish marsh restoration project in the Fritchie Marsh area of the Big Branch National Wildlife Refuge (BBNWR);
- Turtle Bayou Protected Side Intermediate Marsh - a 160 acre protected-side intermediate marsh restoration project at Turtle Bayou, north of the Bayou Sauvage National Wildlife Refuge (BSNWR); and
- Bayou Sauvage Brackish Marsh – site selection was reformulated to utilize areas without poor soil and deep water conditions resulting in a 325 acre brackish marsh restoration and nourishment project at BSNWR.

The tentatively-selected features were chosen over the other potential alternatives as they are significantly more cost-effective.

The proposed Bayou Sauvage Floodside Brackish Marsh (BSFBM), Turtle Bayou Protected Side Intermediate Marsh (TBPIM), and New Zydeco Ridge (NZR) BLH-Wet and Brackish Marsh (BM) projects are located on National Wildlife Refuge lands at three separate locations. BSFBM and TBPIM are located on the Bayou Sauvage NWR and NZR is located on Big Branch Marsh NWR. Figure 1 shows the locations of the mitigation projects including the designated borrow sources in Lake Pontchartrain. Figures 2 and 3 show a closer view of the proposed mitigation areas.

### **1.1 PURPOSE AND NEED FOR THE PROPOSED ACTION**

The purpose of the proposed action is to compensate for impacts to both general and refuge brackish marsh habitats and for impacts to refuge intermediate marsh and BLH-wet habitats incurred during construction of the LPV component (on the east bank of the Mississippi River) of the HSDRRS. The proposed mitigation would replace the lost functions and services of the impacted habitats through restoration activities designed to create, increase, and improve the habitat functions or services at the specific mitigation feature.

### **1.2 AUTHORITY FOR THE PROPOSED ACTION**

The Flood Control Act of 1965 (P.L. [Public Law] 89-298, Title II, Sec. 204) authorized the LPV project stating “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 authorization for the LPV Project was amended by the Water Resources Development Acts (WRDA) of 1974 (P.L. 93-251, Title I, Sec. 92), 1986 (P.L. 99-662, Title VIII, Sec. 805), 1990 (P.L. 101-640, Sec. 116); 1992 (P.L. 102-580, Sec. 102), 1996 (P.L. 104-303, Sec. 325), 1999 (P.L. 106-53, Sec. 324), and 2000 (P.L. 106-541, Sec. 432); and 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 authority for the HSDRRS is provided as part of a number of hurricane and storm damage risk reduction supplemental appropriations. These laws provide funds to modify and improve several existing USACE projects in southeastern Louisiana. These include the LPV project east of the Mississippi River in St. Charles, Jefferson, Orleans, and St. Bernard Parishes.

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, and Flood Control and Coastal Emergencies) authorized accelerated completion of the LPV 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) authorizes construction of a 100-year level of protection; replacement or reinforcement of floodwalls; and construction of levee armoring at critical locations.

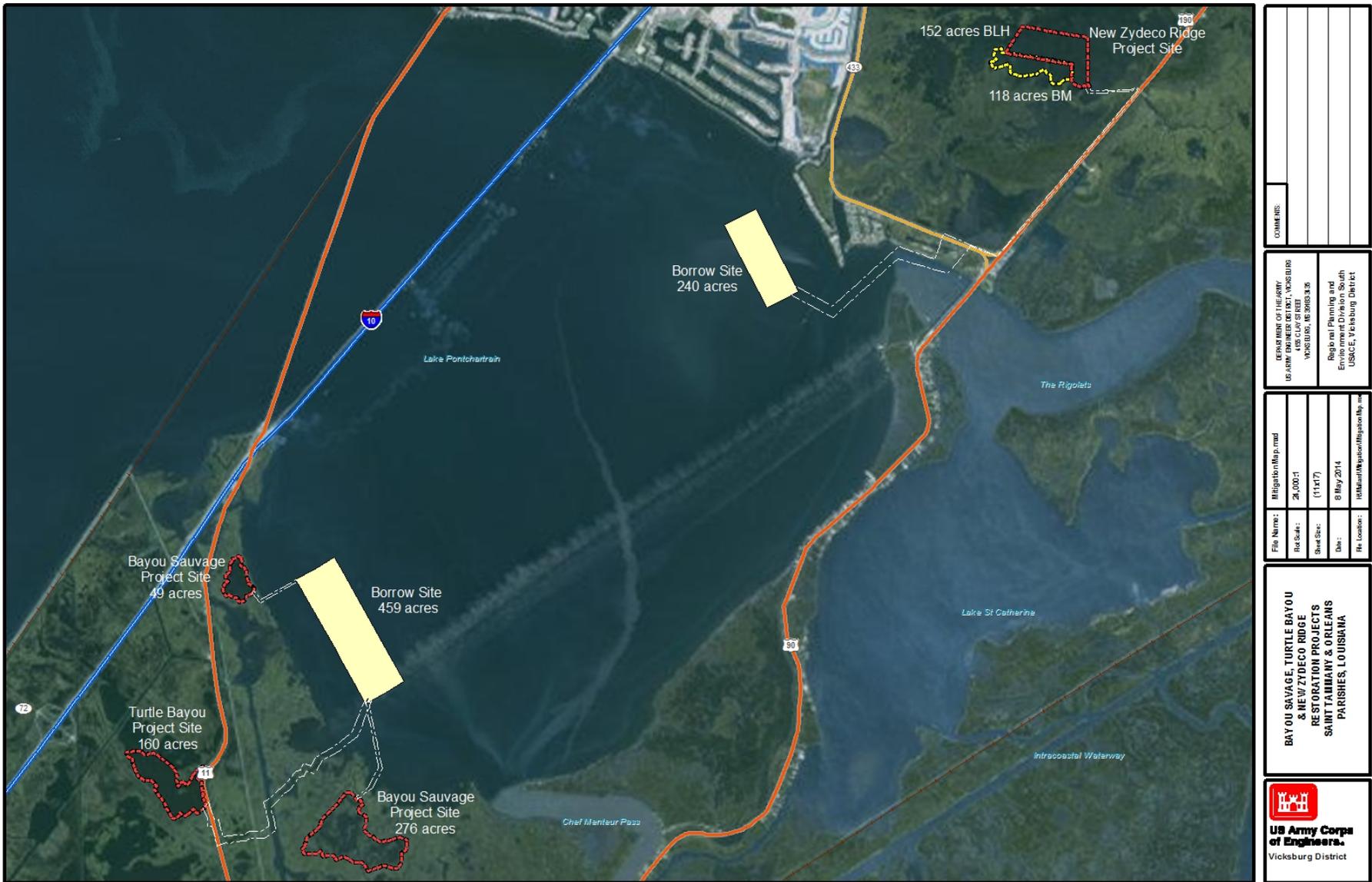


Figure 1 – Bayou Sauvage, Turtle Bayou, and New Zydeco Ridge Projects – All Features





Figure 3 – New Zydeco Ridge Projects

The 6th Supplemental, PL 110-252, Title III, Chapter 3, authorized additional amounts for “Construction,” for necessary expenses related to the consequences of Hurricane Katrina and other hurricanes of the 2005 season, to modify authorized projects in southeast Louisiana to provide hurricane, storm and flood damage reduction in the greater New Orleans and surrounding areas to the levels of protection necessary for participation in the National Flood Insurance Program under the base flood elevations current at the time of enactment of this Act, including funding for the Lake Pontchartrain and Vicinity project.

### **1.3 PRIOR REPORTS**

A number of studies and reports on water resources development in the proposed project areas have been prepared by the USACE, other Federal, state, and local agencies, universities, research institutes, and individuals. The most relevant report to the proposed action is PIER 36. It references all pertinent previous reports and studies and is hereby incorporated by reference.

### **1.4 PUBLIC CONCERNS**

The foremost public concern is reducing risk of hurricane and storm damage for businesses and residences, and enhancing public safety during major storm events in the New Orleans metropolitan area. In the Lake Pontchartrain basin, the public has expressed a desire for sufficient funding to be allocated for the HSDRRS mitigation efforts and that the mitigation be completed in a timely manner.

### **1.5 DATA GAPS AND UNCERTAINTIES**

At the time of submission of this report coordination is still ongoing with Federally-recognized Indian tribes and local, state, and Federal agencies regarding the proposed action. Prior to a decision on the proposed action evaluated in this document, all relevant coordination would be completed. At that point, no known data gaps should exist. However, all restoration projects contain certain inherent uncertainties. Those uncertainties and accompanying contingencies will be further discussed in the project specific monitoring and adaptive management plans, which will be completed prior to finalization of this document. The drafts of these plans are included as appendices to this report.

## **2. ALTERNATIVES**

### **2.1 ALTERNATIVES DEVELOPMENT AND SCREENING CRITERIA**

NEPA requires that in analyzing alternatives to a proposed action a Federal agency consider an alternative of “No Action.” That alternative is evaluated in this document. Multiple alternatives to meet the requirements of mitigation of Refuge and general brackish marsh impacts, Refuge intermediate marsh and BLH-WET impacts were evaluated in the PIER 36. However, none of the programmatic Refuge mitigation features that were identified in the PIER were deemed viable due to high costs and real estate issues. In response, the CEMVN and USFWS developed the BSFBM, TBPIM, and NZR features that would perform more favorably under the Risk and Reliability, Cost Effectiveness, Time, and Other Cost Considerations criteria that were applied to evaluations of each potential mitigation project.

## **2.2 DESCRIPTION OF THE ALTERNATIVES**

This supplemental IER discusses on-refuge mitigation projects not previously included in the PIER 36 recommended mitigation plan. Although these project locations were described generally and some of the new mitigation features may have been in close proximity to previously proposed mitigation features, the specific locations of these projects were not investigated in PIER 36.

In order to ensure that HSDRSS impacts were adequately mitigated, a functional assessment model titled the Wetland Value Assessment Model (WVA) was utilized to predict the Average Annual Habitat Units (AAHUs) lost from the project impact against the AAHUs generated by the proposed mitigation. Detailed descriptions of the BSFSM, TBPIIM and NZR BLH-Wet and NZR BM restoration features are found below. Results from preliminary WVA calculations are incorporated within the project descriptions in Section 2.3. WVA model calculations can be found at [www.nolaenvironmental.gov](http://www.nolaenvironmental.gov). The WVA results and estimated AAHU outputs referenced within this SIER were calculated using preliminary design plans and site data obtained during field visits. Subsequent WVA calculations will be conducted after the CEMVN has further refined construction plans and construction contracts are awarded. In the event that the anticipated AAHU output of the proposed mitigation features does not fully offset the LPV construction impacts, resizing of the proposed projects may occur, when possible, to ensure that sufficient AAHUs are generated. Likewise, if it is determined that anticipated AAHU output of a proposed mitigation feature will exceed the AAHU requirements of a certain habitat type, project boundaries may be reduced to most-efficiently meet project need.

## **2.3 PROPOSED ACTIONS**

### **2.3.1 Bayou Sauvage Floodside Brackish Marsh**

The BSFBM restoration project is located in the far south-eastern lobe of Lake Pontchartrain, east of Interstate 10. The project plan consists of two areas of open water/broken marsh, which would be filled and/or restored to provide a healthy marsh platform. Both areas are within the existing marsh environment, at an adequate distance from the lake shoreline so that shoreline hardening for marsh protection is not considered warranted.

The northernmost proposed marsh footprint is 49 acres (BSFS4) and is located immediately east of Hwy 11, fronting the community of Irish Bayou in Orleans Parish, Louisiana. Completion of this project would result in marsh creation that would provide some buffer to U.S. Highway 90, Interstate 10, and the Irish Bayou Community. Survey data indicates fairly uniform bottom elevations ranging from approximately -2.0 to -2.5-feet NAVD88. Two soil borings reveal an approximate 4-foot organic peat layer underlain by very soft clays. Significant settlement of the dredge-placed sediment is anticipated.

The southern proposed marsh footprint (BSFS5) is 276 acres and is located approximate 2.5 miles south, south-east of the northern polygon. The southern feature is approximately 0.5 miles north of Chef Mentour Highway (Hwy 90). The site is a combination of 194 acres of

open water and 82 acres broken marsh; however evaluation of historic photography reveals continued degradation of the broken marsh component. Survey data indicates a range of existing elevations within the site. The open water area bottom elevations are similar to the northern site, ranging from -1.5 to -2.5-foot NAVD88; getting slightly deeper in the northwestern corner where elevations increase to approximately -3.0-foot NAVD88. Three soil borings in the site reveal an approximate 6-foot organic peat layer underlain by very soft clays and silty sand layers. Significant settlement of the dredge filled platform is anticipated.

Initial target elevation for dredge fill would be to approximate elevation +2.5-foot NAVD88, ultimately to hit a target marsh elevation ranging from +1.5 to +1.0-foot NAVD88. Both features would require total perimeter retention to hold dredge material and allow for vertical accretion. Feature BSFS4 (49 acres) would require 7,040 linear feet of earthen retention dike. Feature BSFS5 (276 acres) would require a 17,925 linear feet of earthen retention dike. The retention dikes would be constructed to elevation +4.5-foot NAVD88, with a 5-foot crown. Due to poor soil conditions, 20 foot stability berms are required both interior and exterior of the dike alignment, resulting in an approximately 90 foot base width for the dike structure. For initial quantity estimates, the dikes are assumed to have 1-foot vertical on 4-foot horizontal side slopes. Retention dikes would be constructed, using marsh buggies for access and movement, to maintain a minimum of 1-foot of freeboard during dredging operations. The dike borrow ditch would be offset a minimum of 40-feet from the dike to assure dike stability. The allowable borrow ditch template would be an 80-foot bottom width, with excavation allowed to 15-feet below the existing ground elevation to capture potentially better deeper material. Earthen plugs would be left in the borrow canal at 1,000-foot intervals to minimize water flow during pumping operations.

The eastern retention dike of BSFS4 paralleling the lake shoreline, is proposed to remain in place post marsh construction to enhance the existing shoreline along this reach of lakefront and provide additional protection to the newly created marsh. The remaining reaches of standard retention dike for both features would be gapped approximately a year after the final lift, upon settlement and dewatering of the created marsh platform. The marsh footprint would be planted upon satisfactory settlement and dewatering of the marsh platform. The shoreline restoration feature along Irish Bayou would also be planted. Plugs of appropriate marsh vegetation would be planted over 100 percent of the marsh restoration acreage on 7-foot centers.

The proposed brackish marsh restoration project would provide the required 8.79 AAHU of on-Refuge brackish marsh restoration and approximately 86.58 AAHU of general brackish marsh restoration, through restoration of approximately 243 acres of brackish marsh and the nourishment of approximately 82 acres within a 325-acre project area. Cumulatively, the implementation of BSFS4 and BSFS5 would result in the creation of approximately 95.37 AAHU of brackish marsh within the BSNWR.

### 2.3.2 Turtle Bayou Protected-Side Intermediate Marsh

The TBPIM project is located on the Bayou Sauvage National Wildlife Refuge NWR and in eastern Orleans Parish, Louisiana. The site is immediately west of LA Hwy 11, north of and

adjacent to Turtle Bayou, and east of I-10. As proposed, the project would consist of creating approximately 160 acres of intermediate marsh within an open water area immediately north of Turtle Bayou.

Based upon data obtained during a site visit on January 22, 2014, the average water depth within the restoration area was approximately 1.7-foot. The gage at the boat launch, located off of LA Hwy 11 and north of the restoration feature, read -0.6-foot, placing the average elevation of water bottoms within the restoration area at approximately -2.3-foot NAVD88.

The proposed mitigation feature is within the northeast portion of the Mississippi River deltaic plain. Depositional environments in the area are related to the St. Bernard Delta, which was active in this area approximately 3,000 years ago. Dominant physiographic features in the area include Bayou Sauvage and its associated natural levee, Chef Menteur Pass, Lake Pontchartrain, and marsh. Natural elevations are highest on the levees of Bayou Sauvage and decrease away from these levees to the marshes near Lake Pontchartrain.

Boring and map data in the vicinity of the proposed mitigation feature shows that the surface and shallow subsurface contains approximately 3 to 10 feet of marsh deposits characterized by very soft organic clays and peat with high water content. Interdistributary deposits underlie marsh deposits and are composed of very soft to medium clays and silty clay approximately 20 feet thick. Pleistocene deposits composed of very stiff clays, silt, and sand underlie interdistributary deposits. There are buried beach deposits at approximately elevation -15 feet immediately north and south of Bayou Chevee. Beach deposits are composed mainly of fine sand and shell.

Restoration would be accomplished through dedicated dredging of material to be borrowed from Lake Pontchartrain via hydraulic cutterhead dredge. This work would be coupled with the restoration work proposed under the BSFBM project, located just east of LA Hwy 11 and Irish Bayou. The dredge material would be obtained from a borrow site in east Lake Pontchartrain with access from the lake to the restoration feature to follow the location depicted in figure 1. To minimize marsh impacts, the pipeline and equipment would follow open water and canals as much as possible. The pipeline would cross under LA Hwy 11 via one of two existing 42 inch culverts, which the Bayou Sauvage National Wildlife Refuge has indicated may be used for the dredge pipeline to access the site. For offloading pipeline and equipment to the restoration feature, a 150-foot access corridor, commencing west of the centerline of LA Hwy 11, would be used. This corridor is existing marsh and would be backfilled with 1-foot to 2-foot of dredged material upon completion of work to restore the wetlands to pre-existing conditions.

Disposal within the restoration feature would be confined, with dredge effluent waters allowed to be returned to the adjacent open waters for nourishment of adjacent marsh and for enhancement of submerged aquatic habitat. The dredge material would be placed confined to a maximum slurry elevation of +4-foot NAVD88. Spill box weirs may be constructed to control the pool level within the restoration area and the earthen dikes and closures may be gapped and/or degraded as necessary to facilitate development of the restoration feature.

It is anticipated that all features for this project would be earthen and constructed from adjacent borrow to be obtained from within the marsh restoration feature, other than borrow for the 2 earthen closure locations where borrow may be taken from outside of the restoration area. Approximately 13,600-feet of earthen retention dikes and approximately 2,800-feet of earthen closures shall be constructed prior to the placement of dredged material and maintained at all times during pumping operations. The earthen retention dikes and weirs shall be constructed to a minimum 5-foot crown width, slopes no steeper than 1V on 3H, with minimum 3-foot high and 10-foot wide stability berms on each side. The dikes and closures shall be constructed to approximate elevation +5.5-foot NAVD88. Upon completion of the project, the dikes and weirs may either be left in place to naturally degrade, or be degraded at a later date, after the dredged material has had time to settle out within the restoration feature. In the event the dikes and closures are to be degraded, the degraded material shall be put back into the borrow pits that were used to construct these retention features. Excess material would be placed on adjacent open water areas at an elevation conducive to marsh creation.

TBPIM has a mitigation potential of 0.39 AAHU per acre and provides the 41.29 AAHU required for refuge impacts to intermediate marsh through the creation of approximately 106 acres of protected side intermediate marsh within the proposed 160-acre project area. A subsequent WVA analysis utilizing more refined construction plans will be conducted prior to awarding the construction contract. Final project sizing will be determined by the inter-agency PDT upon the completion of this analysis, and will ensure the creation of 41.29 AAHU of Refuge protected-side intermediate marsh habitat.

### 2.3.3 New Zydeco Ridge

#### BLH-Wet Component

The NZR BLH-Wet restoration project is located on the north shore of Lake Pontchartrain in the north east quadrant of the lake, immediately adjacent to U.S. Highway 90, and approximately 5 miles east of Slidell, Louisiana. The project feature is bounded on the east by U.S Highway 90, on the North by U.S. Highway 190, on the west by Interstate 10, and on the south by Lake Pontchartrain. As currently proposed, the project would consist of creating approximately 152 acres of BLH-Wet within a designated shallow open water area immediately north of Salt Bayou.

Based on a site visit on April 9, 2014, the area is very shallow open water. Open water depths in the proposed project area ranged from 1.3-foot to 2.0-foot. Based on Lake Pontchartrain gage data that day in the project vicinity, the lake level during the site investigation was approximately 0.2-foot NAVD88, resulting in bottom elevations of approximately -1.2-foot to -1.8-foot NAVD88. An average value of -1.5-foot would be used to compute required fill quantities for this project. The water bottoms at the project site appeared to be fairly firm, after penetrating a foot or so of softer materials.

Available LIDAR data was used to evaluate existing marsh elevations in the proximity of the project site. In general, the data indicated a range of marsh elevations from approximately +0.5 to +1.5 NAVD88, with the majority of data at approximately +1.0-foot NAVD88. This

coincides with North shore CRMS data in the project vicinity which indicates existing marsh elevation of +0.9-foot. The lake shoreline fronting the potential project feature has been developed with roads, camps, residences, etc.; thus, minimizing the potential for shoreline erosion at this location.

The proposed mitigation feature is located southeast of Slidell, between the Pleistocene terraces and Lake Pontchartrain. Depositional environments in the area include marshes bordering terrace deposits and dominant physiographic features in the area include Prevost Island, the Pleistocene terraces, marsh, Lake Pontchartrain, and the Rigolets.

Natural elevations of approximately +5 feet are found on the terraces bordering the northeastern edge of the site based on LIDAR data. Elevations reach approximately +7 feet on Prevost Island.

Based on boring and map data in the vicinity, it is estimated that the surface and shallow subsurface of the proposed feature contains marsh deposits from 2-foot to 8-foot thick. Marsh deposits are characterized by very soft organic clays and clay with peat. Marsh deposits are thinner near the Pleistocene terraces and Prevost Island and thicken towards Lake Pontchartrain. Pleistocene deposits composed of stiff clays, silty clay, silt, and sands underlie marsh deposits.

For the BLH-Wet construction scenario, initial target elevation for dredge fill would be to approximate elevation +4.0 NAVD88, to ultimately hit a target elevation ranging from +2.5 to +3.0 NAVD88. Though this results in a 5.5-foot lift of fill material (+4.0-foot to -1.5-foot); a fairly firm bottom and anticipated partially sandy borrow source minimizes concerns for any significant settlement of the proposed platform. Prior to geotechnical data collection and evaluation, a 0.5 foot settlement rate is assumed.

It is assumed that total perimeter retention would be required to retain dredge material and allow for vertical accretion. Retention dikes would be construction to maintain a minimum of 1 foot of freeboard during dredging operations. The retention dikes would be constructed using marsh buggies for access and movement to elevation +5.0 foot NAVD88, with a 5 foot crown to assure dike integrity. Borrow for these retention dikes would come from within the BLH-Wet creation footprint. The borrow ditch would be offset a minimum of 40 foot from the dike to assure dike stability. The allowable borrow ditch template would be a 50 foot bottom width, with excavation not to exceed 10 feet below the existing ground elevation. For initial quantity estimates, the dikes are assumed to have 1 vertical on 4 horizontal side slopes. Plugs would be left in the borrow canal at 1,000 foot intervals to minimize water flow during pumping operations. Spill boxes or weirs would be constructed at pre-determined locations within the retention dike to allow for effluent water release from within the marsh creation area.

Approximately 13,900 linear feet of retention dike would be required. Dikes would be degraded in year 1 to target BLH-Wet elevation, upon settlement and dewatering of the created platform. The degraded material can be disposed of in the original borrow canal if settlement allows, or cast into the open water immediately outside of the project footprint.

With a mitigation potential of 0.61 AAHU per acre, the BLH-Wet restoration project provides the required 92.83 AAHU of Refuge BLH-Wet impacts through restoration of a minimum of 152 acres of floodside BLH-Wet within the proposed project area. The estimated 92.83 AAHU provided by this BLH-Wet restoration project would fulfill the 83.92 AAHU of protected side BLH-Wet refuge impacts as well as the 8.91 AAHU of floodside BLH-Wet refuge impacts that resulted from LPV construction activities. A subsequent WVA analysis utilizing more refined construction plans will be conducted prior to awarding the construction contract. Final project sizing will be determined by the inter-agency PDT upon the completion of this analysis, and will ensure the creation of 92.83 AAHU of Refuge bottomland hardwood wetland habitat.

### New Zydeco Ridge Floodside Brackish Marsh Component

Efforts to implement BLH-Wet mitigation in a location that would avoid impacts to essential fish habitat (EFH) were coordinated with FWS Refuge staff. However, due to policy requiring that refuge habitat impacts be mitigated on refuge property or within the authorized Refuge acquisition boundary and the Refuge's preference that lands used be acquired from landowners willing to sell their properties, options to locate BLH-Wet mitigation were extremely limited. After much deliberation, it was determined that the selected New Zydeco Ridge BLH-Wet mitigation feature would be the most appropriate location for BLH-Wet mitigation. Therefore, impacts to shallow open water habitats were unavoidable.

To mitigate for these permanent impacts to approximately 152 acres of EFH, a WVA was conducted to determine the habitat unit loss from conversion of open water to non-tidally influenced BLH-Wetland habitat. The WVA resulted in a loss of approximately 20.61 AAHU of EFH in the form of shallow open water. To offset these impacts to EFH, it is proposed that approximately 62.5 acres of shallow open water south of the proposed BLH-Wet restoration footprint be restored to brackish marsh habitat (mitigation potential of 0.33 AAHU/acre). The New Zydeco Ridge Brackish Marsh (NZR-BM) feature is expected to fully compensate for the unavoidable impacts to EFH by converting relatively low quality shallow open water to emergent brackish marsh habitat.

The proposed brackish marsh restoration activities at the BSFBM are anticipated to create approximately 95.37 AAHU of the required 126.85 AAHU of brackish marsh that are required to fully offset the on-Refuge and general LPV brackish marsh impacts. To address a portion of this shortfall, it is proposed that approximately 55.5 additional acres of emergent brackish marsh be created to the north of the NZR BLH-Wet location. With a mitigation potential of 0.33 AAHU/acre, it is anticipated that the additional creation of 55.5 acres of emergent brackish marsh will result in the creation of an additional 18.32 AAHU of floodside brackish marsh.

To achieve a platform suitable for brackish marsh restoration, disposal within the restoration feature would be confined, with dredge effluent waters allowed to be returned to the adjacent open waters for nourishment of adjacent marsh and for enhancement of submerged aquatic habitat. The dredge material would be placed confined to a maximum slurry elevation of +4-foot NAVD88. Spill box weirs may be constructed to control the pool

level within the restoration area and the earthen dikes and closures may be gapped and/or degraded as necessary to facilitate development of the restoration feature. Available LIDAR data was used to evaluate existing marsh elevations in the proximity of the project site. In general, the data indicated a range of marsh elevations from approximately +0.5 feet to +1.5 feet NAVD88, with the majority of data at approximately +1.0 foot NAVD88. This coincides with Northshore CRMS data in the project vicinity, which indicates existing marsh elevation of +0.9-foot. The lake shoreline fronting the potential project feature has been developed with roads, camps, residences, etc.; thus, minimizing the potential for shoreline erosion at this location.

The proposed construction of the NZR Marsh Creation project would result in approximately 118 acres of shallow open water being filled to elevations of approximately +2.0 feet NAVD88, to ultimately reach a target marsh elevation ranging from +1.5 feet to +1.0 feet NAVD88.

Disposal within the restoration feature would be confined, with dredge effluent waters allowed to be returned to the adjacent open waters for nourishment of adjacent marsh and for enhancement of submerged aquatic habitat. The dredge material would be placed confined to a maximum slurry elevation of +2.0 feet NAVD88. Spill box weirs may be constructed to control the pool level within the restoration area and the earthen dikes and closures may be gapped and/or degraded as necessary to facilitate development of the restoration feature.

Total perimeter retention would be constructed to retain dredge material and allow for vertical accretion. The retention dikes would be constructed to elevation +3.5 NAVD88, with a 5 foot crown to assure dike integrity and maintain a minimum of 1 foot of freeboard during dredging operations. Borrow for these retention dikes would come from within the NZR brackish marsh creation footprint. The borrow ditch would be offset a minimum of 40-foot from the dike to assure dike stability. The allowable borrow ditch template would be a 50 foot bottom width, with excavation not to exceed 8 feet below the existing ground elevation. For initial quantity estimates, the dikes are assumed to have 1 foot vertical on 4 foot horizontal side slopes. Plugs would be left in the borrow canal at 1,000 foot intervals to minimize water flow during pumping operations. Spill boxes or weirs would be constructed at pre-determined locations within the retention dike to allow for effluent water release from within the marsh creation area.

Approximately 8,500 linear feet of retention dike would be required, tying into the southern BLH-Wet retention dikes. The entire western and southern boundaries would be built on the rim of existing marsh. The northern and eastern boundary would use the adjacent BLH-Wet retention dike. The dike would be degraded in year 1, upon settlement and dewatering of the created platform. The degraded material can be disposed of in the original borrow canal if settlement allows, or cast into the open water immediately outside of the project footprint.

### **2.3.4 Borrow Sites**

#### Bayou Sauvage Floodside Brackish Marsh & Turtle Bayou Protected Side Intermediate Marsh Components

Due to the locations of these two projects, the borrow source would be combined to reduce mobilization impacts and increase efficiency. BSFBM creation would require borrow of approximately 2.6 million cubic yards of material and TBPIM creation would require borrow of approximately 1,250,000 cubic yards of material. The borrow plan is to obtain material from Lake Pontchartrain, requiring a buffer of 2,000 feet between the existing shoreline and the borrow area limit. Borrow would not be allowed greater than 10-foot below the existing lake bottom, except that a tolerance of 1-foot below this target elevation would be provided for the contractor to account for inaccuracies in the dredging process. Based on these criteria, the required borrow site would be approximately 229.5 acres. To assure adequate borrow; the proposed pit size would be approximately doubled, for a total of 459 acres to account for unsuitable materials, unknown utilities, unidentified anomalies, and/or unsighted cultural finds. Three access corridors (one to each site) would be allowed from the lake to the proposed marsh creation feature. These corridors would be restricted to 200-feet in width and can be used to establish a pipeline corridor, offload equipment as necessary, and transport personnel to and from the worksite. The pipeline would be a submerged line without anchoring to reduce impacts. The pipeline location would require buoy markers and lights to notify mariners of its location. No anticipated excavation would be required within the access corridors.

#### New Zydeco Ridge BLH-Wet and Brackish Marsh Component

A total of 2,500,000 cubic yards of borrow is required for all work. A primary borrow site encompassing approximately 144 acres has been sited to accommodate all NZR lake borrow scenarios. To assure adequate borrow, the proposed pit size would be increased by a factor of approximately 1.7 (total 240 acres) to account for unsuitable materials, unknown utilities, unidentified anomalies, and/or unsighted cultural finds. Borrow would not be allowed greater than 10 foot below the existing lake bottom, except that a tolerance of 1-foot below this target elevation would be provided the contractor to account for inaccuracies in the dredging process.

An access corridor would be allowed from the lake to the proposed BLH-Wet creation feature. The proposed corridor, 500 feet in width, remains in deeper water fronting the existing marina facilities along the lakefront, then hugs the shallow water shoreline towards US Highway 90. The pipeline would be a submerged line without anchoring to reduce impacts. The pipeline location would require buoy markers and lights to notify mariners of its location. To stay out of the US-90 corridor, the pipeline access corridor must cross the beach and Old Spanish Trail roadway well to the east of the highway. The allowable access corridor is widened through this section to allow the contractor to select the most preferable route from the lake across the road. The contractor would ultimately select a 200-foot wide corridor proposed for use. To transport dredged material from the borrow area to the mitigation features, the pipeline would be routed roadways to minimize local impacts. It should be noted that the pipeline access

route from Old Spanish Trail to US 90 hugs the northern road shoulder to minimize impacts to private lands. The access corridor then basically parallels the west side of US Highway 90 until it intersects the existing gravel parking lot at the BBNWR, which is proposed to be used as a project staging site. If this site were used as a staging area, alternate parking locations would be provided to minimize impact to the public and the parking area would be returned to before-project conditions upon completion of the construction work. The pipeline would then extend westward into the proposed BLH-Wet creation footprint. The corridor would be restricted to 200 feet in width in open water and across the beach, but would be restricted to the available ROW corridor alongside Hwy 90. The corridor can be used to establish a pipeline corridor, offload equipment as necessary, and transport personnel to and from the worksite. The contractor would be instructed to minimize usage and damage within the access corridor, by using Hwy 90 and the proposed staging area for daily transportation of supplies and personnel where possible.

### 2.3.5 Mitigation Banks and the State In Lieu Fee Program

The proposed BSFBM project would provide the required 8.79 AAHU of on-Refuge brackish marsh restoration and approximately 86.58 AAHU of general brackish marsh restoration. Further, the non-EFH portion of the NZR BM project would provide approximately 18.32 AAHU of floodside brackish marsh habitat. Cumulatively, it is anticipated that the BSFBM and the non-EFH portions of the NZR BM features would satisfy all of the 8.79 AAHU of on-Refuge floodside brackish marsh requirements and would satisfy 104.9 AAHU of general floodside brackish marsh requirements. However, it is anticipated that there could be a shortfall of approximately 13.16 AAHU of general floodside brackish marsh impacts with current project alignment.

The configuration of the BSFS4 and BSFS5 polygons and the conditions of adjacent habitats would not readily allow for project boundary expansion. Thus, one option for addressing this shortfall would be the expansion of the NZR-BM footprint to the north to allow for additional brackish marsh mitigation opportunities.

Following guidelines established in the Water Resources Development Act (WRDA) of 2007 Section 2036(c)(1) in carrying out a water resources project involving wetlands mitigation and impacts that occur within the service area of a mitigation bank, USACE, where appropriate, would first consider the use of the mitigation bank if the bank contains sufficient available credits to offset the impact and the bank is approved in accordance with the Federal guidance for the establishment, use, and operation of mitigation banks. However, due to USFWS policy requiring that Refuge habitat impacts be mitigated on refuge property or within the authorized Refuge acquisition boundary on lands that would be transferred to Refuge ownership, mitigation bank credits may not be used to compensate for Refuge impacts.

If a shortfall of general brackish marsh AAHU mitigation were anticipated, the CEMVN may also consider the purchase of released credits from approved mitigation banks within the LPV basin or from the State of Louisiana's In Lieu Fee (ILF) Program. The utilization of such credits is attractive in terms of risk and reliability, time, cost effectiveness, and

other considerations such as operation and maintenance. Mitigation banks and the ILF have minimal uncertainty relative to achieving ecological success and implementability because they are already established and do not require any real estate transactions. Mitigation banking instruments and the ILF Program Instrument are binding agreements in which the mitigation bank or ILF is obligated to monitor ecological success, adaptively manage the site to ensure ecological success, and provide financial assurances for such actions. Purchase of mitigation credits can proceed considerably faster than the design, contract award, and construction of USACE-designed alternatives.

According to Implementation Guidance for WRDA 2007, Section 2036(c), Wetlands Mitigation, the purchase of mitigation credits for a water resources project relieves the Corps from responsibility of monitoring the mitigation measure and demonstrating that the mitigation measure is successful. Such activities would be conducted by the owner or operator of the mitigation bank or ILF Program.

If it is determined upon review of the finalized construction plans that there is a shortfall in AAHU compensation for general brackish marsh impacts, the PDT would evaluate the cost effectiveness of expanding the NZR-BM footprint versus the purchase of mitigation credits. If based on an evaluation of available options to achieve the required mitigation and if mitigation credits could be procured at a cost that is advantageous to the Government, USACE may seek to purchase mitigation credits for the remainder of the general brackish marsh mitigation requirements.

## **2.4 ALTERNATIVES TO THE PROPOSED ACTION**

Alternative formulation and alternatives to the proposed action were considered in PIER 36. Additional alternatives eliminated from consideration are discussed in Section 1.0. This supplement addresses only the No Action alternative and the Proposed Action to mitigate for each habitat type. As discussed in Section 1.0, the mitigation features that were selected in PIER 36 for the proposed on-refuge mitigation projects have been deemed infeasible, therefore proposed replacement on-refuge mitigation features are discussed in this supplement to PIER 36.

NEPA requires that in analyzing alternatives to a proposed action, a Federal agency consider an alternative of "No Action." Typically the No Action alternative evaluates not implementing any of the alternatives and represents the future without-project condition against which alternatives considered in detail are compared. However, because compensatory mitigation for unavoidable impacts is required by law (e.g. Clean Water Act and the Water Resources Development Acts of 1986 and 2007), the No Action alternative is not considered a reasonable or legally viable alternative. Under the No Action Alternative, the Pontchartrain Basin would continue a trend of land loss caused by both natural factors such as subsidence, erosion, tropical storms and sea level rise, and human factors such as flood risk reduction projects, canal dredging, development, interruption of accretion processes, and oil and gas exploration. The No Action Alternative would not provide for the compensatory mitigation of unavoidable impacts from the construction of the HSDRRS.

## **2.5 ALTERNATIVES ELIMINATED FROM FURTHER CONSIDERATION**

As discussed in Section 1.0, the following alternatives were developed but were eliminated from further consideration due to their site conditions and relatively high costs to implement:

- Salt Bayou Private BLH
- Blind Lagoon Protected Side Fresh/Intermediate Marsh
- Thomas Bayou Protected Side Fresh/Intermediate Marsh
- Salt Bayou Fresh/Intermediate Marsh
- Salmen Fresh/Intermediate Marsh

## **3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES**

### **3.1. ENVIRONMENTAL SETTING**

The Lake Pontchartrain and Vicinity HSDRRS mitigation planning basin is bounded to the north by Interstate 12 from the Louisiana/Mississippi state line to the Mississippi River at Baton Rouge. From Baton Rouge, the boundary then proceeds south utilizing the centerline of the Mississippi River. The southern boundary is situated to exclude the barrier islands since the HSDRRS work did not impact the barrier islands.

The three restoration areas are located in the Lake Pontchartrain Basin. BSFBM and TBPIIM are located on the southern lobe and NZR is located on the north shore. The lake is slightly brackish, with a silty to sandy bottom, and up to about 15 feet deep. Historically, the shorelines of the lake were bordered by cypress/tupelo gum swamps, fresh to intermediate marshes, and bands of bottomland hardwood forests bordering natural drainages and the lake rim in some areas. Currently, much of the lake's southern and northeastern shoreline is composed of urban and suburban development. The lake shoreline near the project areas is a mixture of low-density residential development and undeveloped wetlands, including second-growth swamp and bottomland hardwood forest, scrub/shrub wetlands and intermediate to brackish marshes. The general project area supports a wide variety of fish and wildlife resources, many of which are important to recreational and commercial fishermen and hunters.

### **3.2. SIGNIFICANT RESOURCES**

This section contains a list of the significant resources located in and near the proposed action, and describes in detail those resources that would be impacted, directly or indirectly. Direct impacts are those that are caused by the action taken and occur at the same time and place (40 CFR §1508.8(a)). Indirect impacts are those that are caused by the action and are later in time or further removed in distance, but are still reasonably foreseeable (40 CFR §1508.8(b)). A cumulative impact is defined as the "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).

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. Table 1 shows those significant resources found in and near the project area, and notes whether they would be impacted by the proposed alternative.

All resources that would not be impacted, or only negligibly impacted are not discussed in this document. Aesthetics is not addressed since the project locations are only visible from a small number of residences, and because the undeveloped nature of the project area would be preserved. Air quality is not addressed since the only emissions would be from temporary construction equipment, and St. Tammany and Orleans Parishes are in attainment for all monitored air quality parameters. No construction emissions assessment to demonstrate conformity with any air quality program is required. Noise is not addressed due to the undeveloped nature of the project area and the distance between the project area and the closest receptors, which are the residences which are approximately 1,000 feet west of the BSFS4 project area.

The potential for impacts to socioeconomic resources including environmental justice were also considered. There are no anticipated impacts to population, housing, or minority or low-income populated areas since the project area and surrounding lands are uninhabited, remote, and Federally-owned. Environmental justice concerns are not present with respect to this project due to the undeveloped nature of the area. Additionally, the only residences in the vicinity are indicative of high value and are not primarily occupied by minorities or low income groups. There are no commercial/industrial properties, public facilities, or transportation infrastructure within the project boundaries or in adjacent areas, and therefore no impacts to employment, businesses, industry, public facilities and services, community and regional growth, community cohesion, or property values are anticipated to occur with construction of this project. The proposed project does not require any agricultural or forestry land to be impacted or converted, therefore the requirements of the Farmland Protection Policy Act, Section 1541(b), do not apply. Most construction equipment and personnel would access the project areas via aquatic access resulting in no impacts to land-based transportation; although there would be minimal impact from the pipeline crossing for movement of dredge material from Lake Pontchartrain to the proposed project locations.

**Table 1: Significant Resources In and Near the Project Area**

<b>Significant Resource</b>	<b>Impacted</b>	<b>Not Impacted</b>
Wildlife	X	
Threatened & Endangered Species	X	
Aquatic Resources	X	
Water Quality	X	
Essential Fish Habitat	X	
Recreation	X	

Cont.

Significant Resource	Impacted	Not Impacted
Cultural Resources <sup>1</sup>		X
Air Quality		X
Noise		X
Aesthetics		X
Environmental Justice		X
Socioeconomic Resources		X
HTRW <sup>2</sup>		X
Wetlands	X	

<sup>1</sup>Although not impacted, cultural resources are addressed to comply with the National Historic Preservation Act.

<sup>2</sup>Hazardous, Toxic, and Radioactive Waste. Although the area has been determined to have a low probability of containing HTRW, it is assessed in this document to comply with USACE policy.

### 3.2.1 Wildlife

Existing Conditions. The coastal wetlands in the Pontchartrain Basin provide important and essential fish and wildlife habitats, especially transitional habitat between estuarine and marine environments, which are used for shelter, nesting, feeding, roosting, cover, nursery, and other life requirements. Emergent intermediate and brackish wetlands are typically used by many different wildlife species, including: seabirds; wading birds; shorebirds; dabbling and diving ducks; raptors; rails; coots and gallinules; nutria; muskrat; mink; river otter; and raccoon; rabbit; white-tailed deer; and American alligator (LCWCRTF & WCRA 1999). All of these species are likely to be found in or near the projects areas.

Open water habitats such as Lake Pontchartrain provide wintering and multiple use functions for brown pelicans, various seabirds, and other open water residents such as laughing gulls and least terns, and migrants such as lesser scaup and double crested cormorants (LCWCRTF & WCRA, 1999). Open water in the project areas provide suitable habitat for many of these species, especially dabbling ducks, coots, and gallinules, which feed primarily on submerged aquatic vegetation.

Bottlenose dolphins are protected under the Marine Mammal Protection Act of 1972, and are found in temperate and tropical waters around the world including Lake Pontchartrain. The lake appears to have a semi-resident population of dolphins that generally are found in the eastern side of the lake which has the higher salinity level. They likely feed on various estuarine fish and shellfish. It is highly unlikely that dolphins venture into the area proposed for wetland mitigation due to existing very shallow water and submerged aquatic vegetation.

No Action: Without implementation of the proposed mitigation features the areas would continue to naturally subside and the emergent marsh habitat would continue to decrease, resulting in more open water habitat. Changes to adjacent plant communities and submerged aquatic vegetation would likely take place due to these factors, thus negatively

impacting wildlife diversity and utilization of the existing area. Land based animals would be the most directly affected, due to loss of the herbaceous and wooded wetlands around the project area. Because the habitat losses caused by the construction of the HSDRRS would not be compensated, wildlife species inhabiting BLH-wet, intermediate and brackish marsh habitats would sustain permanent habitat loss within the watershed.

Proposed Action: Direct impacts to wildlife would result from the conversion of approximately 673 acres of shallow open water to emergent marsh or BLH-Wet habitat and the nourishment of approximately 82 acres of existing emergent marsh. This conversion would reduce use and function for brown pelicans, seabirds, dabbling and diving ducks, coots, and gallinules and other species that feed in the shallow open water in this location, but it is anticipated they would utilize adjacent areas of open water habitat that are abundant in close proximity to the proposed features. It is anticipated that the project areas would experience improved overall wetland habitat functions once construction and establishment of the proposed marsh and BLH-Wet restoration areas are achieved. The proposed mitigation projects would result in the establishment of approximately 160 acres of intermediate marsh at the TBPIM feature, the establishment of approximately 243 acres of brackish marsh in the BSFBM feature, approximately 82 acres of marsh nourishment at the BSFBM feature, and the creation of approximately 118 acres of brackish marsh at the NZR feature. These actions would create or enhance approximately 603 acres of emergent marsh habitat for terrestrial and semi-aquatic species such as nutria, muskrat, mink, river otter, and raccoon. Reptiles including the American alligator, western cottonmouth, water snakes, speckled kingsnake, rat snake, and eastern mud turtle are likely to utilize and populate the proposed marsh areas as well. Amphibians expected to colonize the area include the bullfrog, southern leopard frog, and Gulf coast toad. The edges and small areas of open water that would form over time would also provide feeding habitat for common wading bird species including great blue heron, green heron, tricolored heron, great egret, snowy egret, yellow-crowned night-heron, black-crowned night-heron, and white ibis. The creation of about 152 acres of BLH-Wet habitat at the NZR feature would provide habitat utilized by species such as songbirds, white-tailed deer, raccoons, squirrels, and rabbits.

Incidentally created mudflats and shallow-water areas would provide habitat for numerous species of shorebirds and seabirds. Shorebirds expected to use such areas include American avocet, wouldet, black-necked stilt, dowitchers, and various species of sandpipers. White pelican, black skimmer, herring gull, laughing gull, and several species of terns would be expected to forage in and near the project area. Migratory and resident non-game birds, such as the boat-tailed grackle, red-winged blackbird, seaside sparrow, northern harrier, belted kingfisher, and marsh wrens, would also use the project areas. Game birds using the area would include the clapper rail, sora rail, Virginia rail, American coot, common moorhen, and common snipe in addition to resident and migratory waterfowl. The project areas are not of sufficient depth to be used by bottlenose dolphins nor would sufficient access be available to anticipate the use of it by this species. As such, construction of the project should not result in entrapment of this species within the marsh or BLH-Wet creation features.

Indirectly, species that utilize shallow open water habitats would be displaced by the habitat conversion. However, these species would have the opportunity to utilize adjacent shallow open water areas. Many species utilizing the current habitat type would thrive with the additional foraging, cover, and resting habitat the project would create. A rise in turbidity at the borrow site could immediately reduce water quality in the area; however those effects would be temporary and would be reduced by movement of the tides. Any bottlenose dolphins or their prey in the borrow area would be free to relocate during construction since the borrow area encompasses only a small section of a 403,200 acre estuarine/brackish lake. This project would help to offset an overall loss in the basin of intermediate and brackish marsh and BLH-Wet habitat necessary for many wildlife species. These projects, when added to other past, present, and reasonably foreseeable ecosystem restoration and mitigation projects in the basin, would prevent the net loss of intermediate, brackish and BLH wetland function and overall decline of wildlife species within the basin and would be beneficial in both preserving the species bio-diversity and combating the current trend of conversion of coastal marsh to open water, which would be accelerated due to sea level rise.

### 3.2.2 Threatened and Endangered Species

Existing Conditions: Within St. Tammany Parish and Orleans Parishes there are ten documented animal and one plant species under the jurisdiction of the USFWS and/or the National Marine Fisheries Service (NMFS), presently classified as endangered or threatened (table 2). Designated critical habitat for one of the animal species (Gulf sturgeon) is located within St. Tammany Parish. The USFWS and the NMFS share jurisdictional responsibility for sea turtles and Gulf sturgeon. Other species that were listed on the Endangered Species List, but have since then been de-listed because population levels have improved, are bald eagle and brown pelican. Currently, American alligators and shovelnose sturgeon are listed as threatened under the Similarity of Appearance clause in the Endangered Species Act (ESA) of 1973, as amended, but are not subject to ESA Section 7 consultation requirements.

**Table 2: Threatened and Endangered Species in St. Tammany Parish**

Species	Potentially in Project Areas	Status	Jurisdiction	
			USFWS	NFMS
West Indian Manatee ( <i>Trichechus manatus</i> )	X	E	X	
Red Cockaded Woodpecker ( <i>Picoides borealis</i> )		E	X	
Gopher Tortoise ( <i>Gopherus polyphemus</i> )		T	X	
Ringed Map Turtle ( <i>Graptemys oculifera</i> )		T	X	
Kemp's Ridley Sea Turtle ( <i>Lepidochelys kempii</i> )	X	E	X	X
Green Sea Turtle ( <i>Chelonia mydas</i> )	X	T	X	X

Species	Potentially in Project Areas	Status	Jurisdiction	
			USFWS	NFMS
Loggerhead Sea Turtle ( <i>Caretta caretta</i> )	X	T	X	X
Pallid Sturgeon ( <i>Scaphirhynchus albus</i> )		E	X	
Gulf Sturgeon ( <i>Acipenser oxyrinchus desotoi</i> )	X	T	X	X
Alabama Heelsplitter Mussel ( <i>Potamilus inflatus</i> )		T	X	
Louisiana Quillwort ( <i>Isoetes louisianensis</i> )		E	X	

Of the listed animal and plant species occurring in St. Tammany and Orleans Parishes, only the West Indian manatee; Gulf sturgeon; and Kemp’s ridley, loggerhead, and green sea turtles are expected to potentially be found in the proposed borrow areas in Lake Pontchartrain. It would be highly unlikely that any of the listed marine species would be found in the proposed marsh or BLH-Wet mitigation project areas due to very shallow water. All of these species are typically found in deeper water where they are able to maneuver and forage effectively.

**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). Critical habitat for the manatee has been designated in Florida, but not in Louisiana (USFWS 1977). The manatee is a large gray or brown aquatic mammal that may reach a length of 13 feet and a weight of over 2,200 pounds. It occurs in both freshwater and saltwater habitats within tropical and subtropical regions. The manatee is not a year-round resident in Louisiana, but it may migrate there during warmer months. 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, such as discarded fishing line or crab traps (USFWS 2007).

There have been 110 reported sightings of manatees in Louisiana since 1975 (LDWF 2005). Sightings in Louisiana, which have been uncommon and sporadic, have included occurrences in Lake Pontchartrain as well as the Amite, Blind, Tchefuncte, and Tickfaw Rivers. Between 1997 and 2000, there were approximately 16 sightings in the Lake Pontchartrain area and a general increase in the number of manatees per sighting (Abadie et al. 2000). Sightings of the manatee in the Lake Pontchartrain basin have increased in recent years, and in late July 2005, 20 to 30 manatees were observed in the lake from the air (Powell and Taylor 2005).

To minimize the potential for construction activities to cause adverse impacts to manatees, the following standard manatee protection measures, developed by the USFWS, Lafayette, Louisiana Field Office, would be implemented when activities are proposed that would impact habitat where manatees could occur: All contract personnel associated with the project would be informed of the potential presence of manatees and the need to avoid collisions with manatees. All construction personnel would be responsible for observing water-related activities for the presence of manatees. Temporary signs would be posted prior to and during all construction/dredging activities to remind personnel to be observant for manatees during active construction/dredging operations or within vessel movement zones (i.e., the work area), and at least one sign would be placed where it is visible to the vessel operator. If a manatee is sighted within 100 yards of the active work zone, special operating conditions would be implemented, including: moving equipment would not operate within 50 ft of a manatee; all vessels would operate at no wake/idle speeds within 100 yards of the work area; and siltation barriers, if used, would be re-secured and monitored. Once the manatee has left the 100-yard buffer zone around the work area of its own accord, special operating conditions would no longer be necessary, but careful observations would be resumed. Any manatee sighting would be immediately reported to the USFWS (337/291-3100) and the Louisiana Department of Wildlife and Fisheries (LDWF), Natural Heritage Program (225/765-2821).

### **Gulf Sturgeon**

The Gulf sturgeon was listed as threatened throughout its range on September 30, 1991. The Gulf sturgeon is an anadromous fish that migrates from salt water into coastal rivers to spawn and spend the warm summer months. Subadults and adults typically spend the three to four coolest months of the year in estuaries or Gulf of Mexico waters foraging before migrating into the rivers. This migration typically occurs from mid-February through April. Most adults arrive in the rivers when temperatures reach 70 degrees Fahrenheit and spend eight to nine months each year in the rivers before returning to estuaries or the Gulf of Mexico by the beginning of October.

Critical habitat identifies specific areas that have been designated as essential to the conservation of a listed species. Critical habitat units (areas) designated for the Gulf sturgeon in Louisiana include Lake Pontchartrain east of the Causeway, Lake Catherine, Lake Borgne, out into the Mississippi Sound (USACE 2006a). Studies by the LDWF have shown the presence of Gulf sturgeon in Lake Pontchartrain during the winter and during periods of migration between marine and riverine environments. Most records of Gulf sturgeon from Lake Pontchartrain have been located east of the Causeway, particularly on the eastern north shore. Gulf sturgeon has been documented west of the causeway, typically near the mouths of small rivers (USFWS and NMFS 2003).

### **Kemp's Ridley, Loggerhead, and Green Sea Turtles**

Sea turtles inhabit tropical and subtropical marine and estuarine waters around the world. Of the seven species in the world, six occur in U.S. waters, and all are listed as threatened or endangered. The three species potentially occurring in Lake Pontchartrain and Lake Borgne in the vicinity of the mitigation projects have a similar 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 sea turtle 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 sea turtle is the largest of these three species – adults average 300 to 350 pounds with a length of more than 3 feet and a brown coloration (its name comes from its greenish colored fat). The Kemp's Ridley has a carnivorous diet that includes fish, jellyfish, and mollusks. The loggerhead has an omnivorous diet that includes fish, jellyfish, mollusks, crustaceans, and aquatic plants. The green sea turtle has an herbivorous diet of aquatic plants, mainly sea grasses and algae, which is unique among sea turtles. All three species nest on sandy beaches, which are not present near Lake Pontchartrain. The life stages that may occur in Lake Pontchartrain range from older juveniles to adults.

No Action: Without implementation of the proposed mitigation features the areas would continue to naturally subside causing the emergent marsh habitat within the region to continue to decrease, resulting in more open water habitat. Even with the natural subsidence, no listed species would be expected to utilize the area due to the shallow water depths. The areas proposed for borrowing fill material (Lake Pontchartrain), would continue to be available to any of the listed species in the area. The proposed borrow features would not likely provide feeding habitat for manatees and green sea turtles due to the lack of submerged aquatic vegetation, but they may pass through the area. This area of the lake could provide feeding habitat for Gulf sturgeon although the mud/silt substrate is not to their preference, which is sandy bottom. Kemp's ridley and loggerhead sea turtles may forage in the lake at the borrow site, although available evidence indicates that they very rarely are found in the lake. Because the habitat losses caused by the construction of the HSDRRS would not be compensated, wildlife species inhabiting intermediate and brackish marsh habitats would sustain permanent loss of habitat in the watershed.

Proposed Action: No listed species are expected to be directly impacted within the proposed marsh and BLH-Wet mitigation areas since they would not be expected there due to shallow water depths (typically less than 2 feet). Still, precautions would be taken during construction to ensure no impacts to listed species. The construction contractor would be required to induce listed species to leave the immediate work area prior to any work regardless of water depth. A bucket (or similar equipment) would be dropped into the water and retrieved empty one time. After the bucket has been dropped and retrieved, a 1-minute no work period must be observed. During this no work period, personnel should carefully observe the work area in an effort to visually detect listed species. If species are sighted, no bucket dredging should be initiated until the listed species have left the work area. If the water turbidity makes such visual sighting impossible, work may proceed after the 1-minute no work period has elapsed. If more than 15 minutes elapses with no work, then the empty bucket drop/retrieval process shall be performed again prior to work commencing.

The borrow area could potentially be utilized by manatees and sea turtles. Direct impacts to these listed species in the proposed borrow area are unlikely as the site is located

outside of designated critical habitat and the construction activities would be of a nature that are not known to directly injure the species. The indirect impacts resulting from the temporary loss of the area as foraging habitat would be insignificant given the small size of the borrow area compared to the overall area of Lake Pontchartrain. The presence of construction-related activity, machinery, and noise would be expected to cause these species to temporarily avoid the project area during the construction period. Dredging for borrow material would occur via hydraulic cutterhead dredge. Entrainment of sea turtles is not expected since hydraulic dredges are slow moving and use of them is not known to impact these species. Manatee could potentially be affected by dredging operations, but the impacts would be mitigated by implementation of standard manatee protection measures developed by the USFWS as a method to minimize the likelihood that USACE dredging contracts in coastal Louisiana would adversely affect manatees. These conditions are included in the construction contract specifications for nearly all USACE dredging contracts in coastal Louisiana.

Expected impacts to sturgeon feeding habits would occur from borrow excavation in Lake Pontchartrain because the borrow locations are inside of designated critical habitat. Sturgeon primarily feed on sandy water bottoms. Preliminary borings show that the borrow locations have a high clay content especially at surface floor levels; the sandy substrates lie 10-11 feet below surface. Turbidity would increase at each location, but would remain localized and should be reduced by movement of the tides.

Although turbidity impacts would be localized and temporary, concern over borrow pit water quality impacts is justified. A wealth of evidence suggests that improperly planned dredge pits can result in hypoxic/anoxic conditions. The development of these conditions has been linked to the inability of the water to be properly mixed and flushed within the pits, resulting in stagnation and stratification. Water quality impacts from borrow pits varies greatly due to geographic location, pit design, and environmental parameters. Hypoxic and anoxic conditions have been linked to the tendency for a borrow pit to accumulate organic material. This accumulation can be reduced by: 1) limiting the depth of the pit; 2) increasing the pits surface area; and 3) decreasing side-slopes that transition from the pit to adjacent water bottoms. A shallow and broad "pan-shaped" borrow pit would facilitate circulation with adjacent waters, thereby decreasing the likelihood that organic material would become entrained, as well as allow for periodic flushing of the pit during storm events.

The proposed borrow plan has been developed with an emphasis of mimicking a natural depression in the lake bottom. A gradual side slope of 1V:3H has been designed for the borrow pits. This gradual slope would facilitate tidal flushing. Borrow pits also have been consolidated together to increase their surface area, which would facilitate tidal mixing of the water column. Borrow pit depth would be kept to 10-11 feet.

Though a change to the sediment composition of Lake Ponchartrain is not expected to occur, the removal of borrow material would result in the direct, indirect, temporary, and irretrievable impacts to the benthic communities within the lake, which may not fully recover within the excavated areas. This potential permanent loss of benthic resources is

not anticipated to adversely affect Gulf Sturgeon due to the relatively small size of the borrow sites (459 acres and 240 acres respectively) compared either to the total area of designated critical habitat within Lake Pontchartrain (201,600 acres) or compared to the available forage area within the remaining 402,501 acres of lake bottom. Due to the size of the anticipated impacts, these effects would be considered insignificant.

The USACE has assessed the potential of the proposed action to affect listed species and has determined that the proposed action may affect, but is not likely to adversely affect the Gulf Sturgeon, West Indian manatee, and the green, Kemp's Ridley, and loggerhead sea turtles and may affect, but is not likely to adversely affect Gulf Sturgeon Critical Habitat and is not likely to destroy or adversely modify it. A biological assessment is being developed and will be transmitted to USFWS and NMFS for comment and concurrence.

### **3.2.3 Fisheries, Aquatic Resources, and Water Quality**

Existing Conditions: The NMFS oversees and manages our Nation's domestic fisheries through development and implementation of fishery management plans and actions. The Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), first enacted in 1976, amended in 1996, and reauthorized in 2006, is the primary law governing marine fisheries management in United States Federal waters to end overfishing, promote market-based management approaches, improve science, serve a larger role in decision-making, and enhance international cooperation.

The NMFS has determined that Lake Pontchartrain and adjacent wetlands provide nursery and foraging habitats which support varieties of economically important marine fishery species, including striped mullet, Atlantic croaker, Gulf menhaden, spotted and sand sea trout, southern flounder, black drum, and blue crab. Some of these species also serve as prey for other fish species managed under the MSFCMA by the Gulf of Mexico Fishery Management Council (e.g., mackerel, snapper, and grouper) and highly migratory species managed by NMFS (e.g., billfish and shark).

The existing submerged aquatic vegetation and shallow open water within the project area, and adjacent wetlands, provide important estuarine fisheries habitat, including transitional habitat between estuarine and marine environments used by migratory and resident fish, as well as other aquatic organisms for nursery, foraging, spawning, and other life requirements. Historically and currently, the area provides valuable recreational and commercial fishing opportunities a wide variety of finfish and shellfish (Rounsefell, 1964; Penland et al., 2002).

The assemblage of species in the proposed project area is largely dictated by salinity levels and season. During low-salinity periods, species such as Gulf menhaden, blue crab, white shrimp, blue catfish, largemouth bass and striped mullet are present in the project area. During high-salinity periods, more salt-tolerant species such as sand seatrout, spotted seatrout, black drum, red drum, Atlantic croaker, sheepshead, southern flounder, Spanish mackerel, and brown shrimp may move into the project area, especially the borrow area in Lake Pontchartrain. Wetlands throughout the project area also support small resident fishes and shellfish such as least killifish, sheepshead minnow, sailfin molly,

grass shrimp, and others. Those species are typically found along marsh edges or among submerged aquatic vegetation, and provide forage for a variety of fish and wildlife.

The water quality of the hydrologic units which these projects are in does not fully support two of its designated uses: (1) Primary Contact Recreation. The suspected source of this impairment, fecal coliform, is from on-site treatment systems, such as septic systems and similar decentralized systems. (2) Fish and Wildlife Propagation. The suspected sources of this impairment, low dissolved oxygen, includes on-site treatment systems such as septic systems and similar decentralized systems, and permitted discharges in the area. Lake Pontchartrain, the project's borrow source, is considered to fully support its designated uses.

No Action: Without implementation of the proposed mitigation features, the areas would continue to naturally subside and the emergent marsh habitat would continue to decrease resulting in more open water habitat. Continued loss of submerged aquatic vegetation would lower habitat value for some resident species such as grass shrimp and killifishes that provide food for many species of birds. Increased salinity would allow more estuarine species to utilize the proposed marsh mitigation areas. The site containing the proposed borrow source would likely remain unchanged.

Proposed Action: Approximately 521 acres of open water and mud substrate would be replaced with intermediate and brackish marsh at TBPIM, BSFBM, and NZRBM features, increasing spawning, nursery, forage and cover habitat for fisheries resources over the long term. For approximately 5 years after project construction the area would be above daily tidal inundation and only partially vegetated, so maximum fisheries benefits would not be realized until after this 5-year period has elapsed. Turbidity during borrow excavation and fill placement would temporarily impair visual predators and impact filter feeders, but this impact is expected to cease and benthic species rebound once construction is complete. Temporary water quality impacts from turbidity are not anticipated to be substantial enough to cause impairment of the water body's designated uses as defined under the standards of Louisiana Administrative Code, Title 33, Part IX, Chapter 11. Water quality impacts in the fill area would temporarily add to the water quality impairment of this sub-segment, but these impacts would be minimized through best management practices and would diminish to background levels after construction.

Fish access to this area would be extremely limited until the material consolidated and settled to an elevation conducive to that of natural emergent marsh habitats. It is expected this "lag" time would be approximately 5 years. Once the success criteria have been achieved, this area would once again serve its traditional functional role in the local ecosystem.

It is probable that crab fishermen sometimes place crab traps within the proposed borrow area as the practice is common throughout Lake Pontchartrain. Shrimp fishermen may venture into the area either pulling trawls or pushing "skimmer" nets. The fishermen and their gear would be temporarily displaced during project construction, and the borrow area may be less productive for up to a year after project construction due to loss of benthic

animals from the dredging operation. The depth restriction on the borrow pit, preventing it from being more than 10 feet deeper than adjacent lake bottom, would minimize the chance that the area would suffer from low oxygen conditions. The borrow pit should revert to productive habitat within a few months of project construction. Overall, commercial fisheries in Lake Pontchartrain would not be disrupted by the proposed action.

At the NZR project area there would be a conversion of approximately 152 acres of shallow open water habitat to BLH-Wet habitat. It is anticipated that the effects of loss of approximately 152 acres of shallow open water in the project area would be minimized by the availability of other shallow open water areas adjacent to the project feature and the regional degradation of emergent marsh habitats due to sea-level rise and subsidence. However, this conversion of approximately 152 acres of EFH in the form of shallow open water would be offset by the creation of 62.5 acres of brackish marsh in shallow open water habitat adjacent to the BLH-Wet creation area. The resulting marsh would provide a cumulative benefit in the form of additional spawning, nursery, forage and cover habitat for important fish species in the basin. Combined with other HSDRRS mitigation efforts, the proposed actions would provide a great overall environmental lift with an incidental improvement to water quality within the basin. However, because this project would offset habitat losses caused by the HSDRRS construction, there would be no net gain for these habitats. Implementation of this project would prevent an overall loss in the basin of intermediate and brackish marsh habitat. This project, when added to other past, present, and reasonably foreseeable ecosystem restoration and mitigation projects in the basin would help retard the loss of wetlands and combat the current trend of conversion of marsh to open water. There would be an overall loss of open water habitat containing submerged aquatic vegetation in the basin, but no permanent adverse impacts are anticipated because this habitat is prevalent throughout the basin. Direct impacts from the aquatic vegetation loss were factored into the mitigation planning analysis and would be mitigated by the restoration of intermediate and brackish marsh in the proposed project areas.

### **3.2.4 Essential Fish Habitat**

Existing Conditions: The MSFCMA (50 CFR 600) states that EFH is “those waters and substrate necessary for fish for spawning, breeding or growth to maturity” (16 United States Code [USC] 1802(10); 50 CFR 600.10). The 2005 amendments to the MSFCMA set forth a mandate for the NMFS, regional Fishery Management Councils (FMC), and other Federal agencies to identify and protect EFH of economically important marine and estuarine fish. A provision of the MSFCMA requires that FMCs identify and protect EFH for every species managed by a Fishery Management Plan (FMP) 16 USC 1853. The public places a high value on seafood and recreational and commercial opportunities provided by EFH. Specific categories of EFH include all estuarine waters and substrates (mud, sand, shell, rock, and associated biological communities), subtidal vegetation (seagrasses and algae), and adjacent intertidal vegetation (marshes and mangroves). Table 3 shows the categories of EFH and the managed species that occur in the project area.

**Table 3- EFH for the Managed Species Expected in Project Areas**

<b>Life Stage</b>	<b>Brown Shrimp</b>	<b>White Shrimp</b>	<b>Red Drum</b>
Adults		R	R
Eggs			
Juveniles	C to HA	C to A	C
Larvae			
Spawners			
<b>Relative Abundance:</b> Blank - Not Present    A – Abundant    R – Rare    HA - Highly Abundant    C – Common (Variation in abundance due to seasonality) (NMFS, 1998)			
<b>Life Stage</b>	<b>Essential Fish Habitat</b>		
Brown Shrimp - Adults	Silt, sand, muddy sand		
Brown Shrimp - Juveniles	Marsh edge, submerged aquatic vegetation, tidal creeks, inner marsh		
White Shrimp - Adults	Silt, soft mud		
White Shrimp - Juveniles	Marsh edge, submerged aquatic vegetation, ponds, inner marsh, oyster reefs		
Red Drum – Adults	Estuarine mud substrate		
Red Drum - Juveniles	Submerged aquatic vegetation, estuarine mud substrate, marsh/water interface		

The project is located within an area identified as essential fish habitat for postlarval/juvenile brown shrimp; postlarval/juvenile white shrimp; and postlarval/juvenile and adult red drum. The 2005 generic amendment of the FMP for the Gulf of Mexico, prepared by the Gulf of Mexico FMC, identifies EFH in the project area to be estuarine emergent wetlands, submerged aquatic vegetation, estuarine water column, and mud substrates.

**No Action:** Without implementation of the proposed mitigation features the areas would continue to naturally subside and the emergent marsh habitat would continue to decrease resulting in more open water habitat. Loss of adjacent estuarine emergent wetlands and submerged aquatic vegetation would likely take place thus adversely impacting these essential fish habitats. These habitats would likely convert to shallow, mud bottom estuarine, which is another category of essential fish habitat. Mud bottom estuarine habitat is more common in the Lake Pontchartrain Basin and generally considered to be less valuable habitat for critical early life stages of these managed species. Because the habitat losses caused by the construction of the HSDRRS would not be compensated, species inhabiting intermediate and brackish marshes would sustain permanent loss of habitat in the watershed.

Proposed Action: The existing essential fish habitat at the marsh restoration features includes estuarine water bottom, estuarine water column, and submerged aquatic vegetation. These habitats would be largely converted to another type of essential fish habitat – estuarine intertidal herbaceous wetlands (marsh). Benthic resources within the borrow site would be lost until they can re-colonize the borrow area which should take no more than a year or so following project construction. The borrow area would not be excavated more than 10 feet below the adjacent lake bottom thereby minimizing the possibility of anoxic conditions forming. Fisheries access to the marsh mitigation area would be extremely limited during the initial 3-5 years of the project life while the pumped-in sediments are dewatering and subsiding. These areas were once a functional marsh system that provided nursery and feeding habitat to local fisheries. Over time, the proposed actions would result in an increase of functional marsh and associated shallow water habitat thereby accomplishing the required level of mitigation and offsetting adverse impacts to certain categories of EFH. The adverse impacts to essential fish habitat that would result from the proposed actions may affect, but should not adversely affect, managed species considering the small acreage involved relative to Lake Pontchartrain, plus the project would provide long-term benefit to the managed species by providing intertidal wetlands, a valuable type of essential fish habitat.

Indirect impacts to managed species include increased turbidity and disturbance of Lake Pontchartrain in the vicinity of the borrow area. These species may be temporarily displaced. Cumulative impacts to fresh and intermediate marsh EFH resulting from construction of the LPV HSDRRS were considered and found to be adequately offset by the resulting increase in habitat quality from the proposed action. Implementation of the proposed action would result in sufficient EFH habitat improvement to offset adverse impacts to brackish and intermediate marsh EFH and open water designated as essential fish habitat from the LPV HSDRRS construction projects as well as the construction of this proposed mitigation project. The other LPV HSDRRS mitigation projects recommended in PIER 36 were evaluated and found to have inconsequential cumulative impacts to EFH. No additional UCASE activities that would impact similar open water EFH were identified in the project vicinity.

At the NZR project feature, there would be a conversion of approximately 152 acres of shallow open water habitat to non-tidal BLH-Wet habitat. It is anticipated that the effects of loss of approximately 152 acres of shallow open water in the project area would be minimized by the availability of other shallow open water areas adjacent to the project site and the regional degradation of emergent marsh habitats to shallow open water due to sea-level rise and subsidence. However, this conversion of approximately 152 acres of EFH in the form of shallow open water would be offset by the creation of 62.5 acres of brackish marsh in a shallow open water area south of the BLH-Wet creation area. The resulting marsh would provide a cumulative benefit in the form of additional spawning, nursery, forage and cover habitat for important fish species in the basin. Combined with other HSDRRS mitigation efforts, the proposed actions would provide a great overall environmental lift with an incidental improvement to water quality within the basin. However, because this project would offset habitat losses caused by the HSDRRS construction, there would be no net gain for these habitats. Implementation of this project

would prevent an overall loss in the basin of intermediate and brackish marsh habitat. This project, when added to other past, present, and reasonably foreseeable ecosystem restoration and mitigation projects in the basin would help retard the loss of wetlands and combat the current trend of conversion of marsh to open water. There would be an overall loss of open water habitat containing submerged aquatic vegetation in the basin, but no permanent adverse impacts are anticipated because this habitat is prevalent throughout the basin. Direct impacts from the aquatic vegetation loss were factored into the mitigation planning analysis and would be mitigated by the restoration of intermediate and brackish marsh in the proposed project areas.

### 3.2.5. Cultural Resources

**BSFBM and TBPIM (project areas are in close proximity and share the same cultural and historic background):** Several surveys for cultural resources have been carried out in the vicinity of the proposed Bayou Sauvage marsh restoration project. In 1970, surveys were carried out in the vicinity of the proposed project area for levee enlargement as part of the LPV Project (Neuman 1970). No sites were identified in the vicinity of the proposed project area as a result of this survey. In 1975, the Louisiana Department of Transportation performed a review and on-site inspection of five proposed bridge replacement sites along Highway 11 (Rivet 1975). This on-site inspection identified the presence of one cultural resource site. The site is located within 1 mile of marsh restoration feature BSFS5 that is part of the currently proposed project, but the cultural resources site would not be impacted by activities associated with the project.

In the summer and early fall of 1982, New World Research, Inc. conducted a cultural resources investigation of specific areas within the proposed Lake Pontchartrain and Vicinity Hurricane Protection project (New World Research 1982). The surveys consisted of Phase I terrestrial surveys of the proposed levee enlargement and off-shore remote sensing survey of two proposed borrow sources in Lake Pontchartrain. During these surveys, no cultural resources were identified in the vicinity of the currently proposed marsh restoration project.

In 1985, the CEMVN conducted remote sensing surveys for seven flotation channels as part of the New Orleans East Lakefront Levee Enlargement and Foreshore Protection, a feature of the Lake Pontchartrain and Vicinity Hurricane Protection project (Stout 1985). No cultural resources were identified in the vicinity of the currently proposed project.

In 1994, Coastal Environments, Inc. conducted a Phase I cultural resources evaluation of the Bayou Sauvage National Wildlife Refuge for the USFWS. The survey identified several cultural resources sites on the Refuge, three of which are located within one mile of the currently proposed marsh restoration project. The survey also proposed criteria for determining the potential for cultural resources on the Refuge. Patterns of pre-historic and historic settlement were most likely associated “with certain deltaic landform features, specifically elevated landforms such as sand ridges, beach ridges, and, most importantly, natural levees which developed along active deltaic distributary streams” (Pearson et al 1994).

In 2008, R. Christopher Goodwin and Associates, Inc. conducted a “*Phase I Cultural Resources Survey and Archeological Inventory, Nautical Remote Sensing Survey, and Phase II National Register Testing and Evaluation of Locus 07-02-E-01, Target 36\_2, and Site 16OR453, Performed for Lake Pontchartrain and Vicinity Project, Individual Environmental Report Area 7 (IER #7), Orleans Parish, Louisiana*” (Heller et al. 2008). The Phase I surveys identified three new cultural resources sites, none of which were significant and no additional investigations were recommended. The remote sensing survey identified three targets that exhibited potential shipwreck characteristics. Additional evaluation of the three target locations determined that two of the targets were not significant and no additional work was recommended. The remaining target exhibited potential shipwreck characteristics and avoidance was recommended. None of the cultural resources identified during this survey effort are located within the currently proposed project area.

**New Zydeco Ridge:** A review of the Louisiana Division of Archaeology, Cultural Resources Map indicates that two surveys for cultural resources have been previously carried out in portions of the proposed project area. In 1983, Coastal Environments, Inc conducted a Level I survey of the Rigolets Estates Property for a proposed residential development (Gagliano 1982). During this survey no sites were identified in the survey area. A portion of the proposed projects access corridor would extend through the area surveyed by Coastal in 1983. In 1999, Historic Preservation Associates conducted a survey to identify cultural resources along a proposed fiber optic line extending from New Orleans, Louisiana to Pensacola, Florida. A portion of this survey was located along Highway 90 adjacent to the currently proposed project area, and a single cultural resource was identified. The site was identified as a very thin scatter of Rangia shell and three flakes of unknown prehistoric affiliation. The site record indicates that the site is not eligible for listing to the National Register of Historic Places.

The CEMVN elected to fulfill its obligations under Section 106 of the National Historic Preservation Act of 1966, as amended, through the execution and implementation of a Programmatic Agreement for the HSDRRS, Lake Pontchartrain and Vicinity and West Bank and Vicinity mitigation projects. The Programmatic Agreement was developed in consultation with the Advisory Council on Historic Preservation, the Louisiana State Historic Preservation Officer (SHPO), Federally recognized Indian Tribes, and other identified interested parties. The Programmatic Agreement was executed on June 18, 2013, and is available at the [nolaenvironmental.gov](http://nolaenvironmental.gov) website (click on Projects, Mitigation, PIER 36). Pursuant to that agreement, the CEMVN is assessing the Bayou Sauvage, Turtle Bayou, and New Zydeco Ridge restoration projects for potential impacts on historic properties and would coordinate the results of surveys and an effects determination with the Louisiana SHPO and Federally recognized Indian Tribes.

**No Action:** Without implementation of the proposed mitigation sites the areas would continue to naturally subside and the emergent marsh habitat would continue to decrease resulting in more open water habitat. Cultural resources that are present would continue to be impacted and eventually lost to erosion and conversion of existing land areas to open water.

Proposed Action: Existing and as yet undiscovered cultural resources could be adversely impacted by activities associated with the proposed projects such as retention dike construction, gapping along natural bayous, degrading of dikes, staging area location, access corridor use, and other activities. Implementation of the proposed action to restore vegetated marsh and BLH-WET could help to prevent or slow future erosion, which over time could contribute to the protection and preservation of cultural resources that may exist in the project area.

The draft report titled “*Phase I Cultural Resources Investigations and Remote Sensing Survey of Lake Pontchartrain and Vicinity Refuge Mitigation Projects – National Wildlife Refuge Habitat Mitigation Orleans and St. Tammany Parishes, Louisiana – Turtle Bayou, Bayou Sauvage Marsh, and New Zydeco Ridge*” was received on July 7, 2014. The report findings and potential effects to historic properties is currently under review, and consultation with the SHPO and Federally recognized Indian Tribes pursuant to Section 106 of the National Historic Preservation Act and in accordance with the Programmatic Agreement executed on June 18, 2013, is ongoing.

### **3.2.6 Recreational Resources**

Existing Conditions: Recreation areas in the Pontchartrain Basin include two NWR, four LA Wildlife Management Areas, four state parks, and one state historic site, as well as other significant areas. These areas alone represent approximately 214,000 acres that are visited annually nearly 450,000 times for recreational purposes. The recreation areas include 46 miles of trails for hiking and biking, 38 boat ramps, 2 fishing piers, 4 classroom spaces, 3 visitor centers or museums, 4 picnic shelters, and 2 historic sites. The recreation areas provide opportunities for hunting, hiking, biking, boating, bird watching, fishing and crabbing, crawfishing, shrimping, education, camping, picnicking, and playing.

There are 2 NWR in the project areas including Bayou Sauvage (BS) and Big Branch (BB). The BBNWR, located in St. Tammany Parish, encompasses about 18,000 acres offering diverse habitats supporting a wide variety of wildlife species, attracting concentrations of waterfowl, wading birds, shorebirds, and neotropical migrants. In addition to providing habitat for a natural diversity of wildlife, the refuge seeks to provide a variety of opportunities for public outdoor recreation and education. Most of these opportunities are located on refuge lands west of Highway 11 and include hiking trails, public fishing, picnicking, interpretive tours, biking, canoeing, and hunting.

Waterfowl hunting is the most popular activity at the New Zydeco Ridge location. According to the BBNWR Manager, the Salt Bayou parking lot is full during waterfowl season as hunters launch pirogues and paddle to the nearest site, New Zydeco Ridge. About 5-10 hunters use the site per day during the season, according to the NWR Manager.

The BSNWR offers environmental education, birding, youth waterfowl hunting, fishing, hiking, wildlife observation, photography and canoeing attracting 50,000 visitors annually. Boating, hunting and fishing occur on the floodside lands of the refuge in the vicinity of the

proposed restoration feature. The BSFBM feature is used for youth waterfowl hunting and the area is accessible by boat.

Turtle Bayou, located in BSNWR on the protected side just west of Highway 11 and south of I-10, is used less often recreationally than the floodside site. Little recreation occurs at this site as it is hard to access and the area does not offer much opportunity for recreational fishing or hunting.

The BSFS4 feature, currently owned by the Audubon Nature Institute, is not currently being used for recreational purposes. Previous plans to build trails and allow canoeing and hiking have not been implemented.

Recreational boating does take place in BSNWR, particularly in Irish Bayou and Bayou Chevee. There are six boat launches providing access around the NWR including a canoe and a boat launch in the refuge. There is minimal recreational boating in the area of the New Zydeco Ridge restoration feature while hunters use pirogues to access the site.

No Action: Recreational resources in the project area that would be most affected in the Future Without Action are affected by loss of wetlands/marshes and habitat diversity. Many recreation activities are based on aquatic resources and are directly related to the habitat and species in an area. Habitat changes affect fish and wildlife populations, thereby affecting many recreational resources. Changes in habitat types can be a result of increased salinities and other factors affecting estuarine dependent fish. Loss of marshland and an increase in open water is expected to have impacts on recreational fishing and hunting over the next 50 years. Fishery habitats would decline as spawning places in the marsh are destroyed. Larger open water areas are forming resulting in less shallow waters available as nursery habitat for spawning areas of fish. A decline in the game fish population would also affect hunting opportunities. Populations of migratory birds and other animals directly dependent on the marsh and swamp would decrease dramatically as would bird viewing, an impact that would be felt in much of North America, where some of these species spend part of their life cycle.

Another major impact of land loss is the possible loss of facilities and infrastructure that support or are supported by recreational activities. Land loss can literally result in the loss of boat launches, parking areas, access roads, as well as marinas and supply shops. The loss of access features, such as roads and boat launches, directly impacts the public's ability to recreate in particular areas. Marinas and other shops may lose business as access diminishes or may lose their facilities altogether. Alternatively, demand for goods and services may change. Habitat change and resulting changing recreation opportunities (i.e. fresh to marine) may for example severely impact a marina specializing in services to particularly types of recreation (i.e. loss of freshwater opportunities).

Under the no action plan, the land berm partially separating the proposed BSFS4 marsh mitigation area from Lake Pontchartrain would continue to erode exposing the interior area to increased wave energies and salinity changes. Changes to adjacent plant communities and submerged aquatic vegetation would likely take place reducing its utilization by

waterfowl and the likelihood that hunters would try to hunt them. Fish usage would likely decrease as well with a related decrease in recreational fishing success.

Proposed Action: Recreational opportunities within the project area may increase with increased formulation of emergent marsh and other fish and wildlife habitats. An increase in habitat value would likely result in increased wildlife usage of the project area.

BSFS4 would be acquired in fee by the local sponsor to preserve the benefits of the proposed mitigation in perpetuity. The local sponsor would be responsible for managing the area would determine how the land would be specifically used in the future. BSFBM, TBPIM, and NZR mitigation features are all located within NWRs and would continue to be used recreationally.

Direct impacts from the restoration that are common to all of the restoration features include restricted boating, fishing and hunting during construction and for a period afterwards. Recreational use once the habitats are established would be at the discretion of the Refuge or the local sponsor. Earthen retention dikes would remain in place for a period to allow for material to settle out within the restoration feature. Once the restoration is complete and the site matures, direct benefits should accrue to recreational users in the restoration features due to improved habitat quality attracting wildlife or fish. Indirect benefits would also take place in areas surrounding the restoration features as some of the material placed would naturally migrate once the dikes are plugged and/or degrade, nourishing marsh cells and benefiting waterfowl and birds.

The Turtle Bayou feature may not see much change in use from existing conditions since this area is difficult to access. After restoration, it is anticipated that recreational use should remain similar to use today which is mainly hunting.

The proposed restoration at the Bayou Sauvage Floodside feature may directly impact the youth waterfowl hunting program that takes place during waterfowl hunting season usually between November and January. Depending on when construction begins and the duration, hunting and all recreation use may be restricted during construction and for a period of time afterwards to allow for drainage, settling and consolidation of dredge material.

Positive long-term benefits would likely be realized from the deposition of dredged material into shallow open water areas and onto existing emergent marsh vegetation. The mitigation area would accept the dredge material in its highly turbid form and in time, become continuous, non-turbid, brackish, or saline marsh. Marsh plants consisting of emergent and/or submergent vegetation would become established, complementing the already existing fish and wildlife habitat and increasing future recreational activities in the area.

Hunting and all other recreational uses at the New Zydeco features would also be restricted during construction so as to enable the new material to settle and provide an adequate base for growth. Hunters likely would have to navigate around the site through private

land to hunt on NWR lands while the site is closed. Once the site is opened, better habitat from the BLH-W restoration should improve conditions and opportunities for big and small game hunting or bird viewing.

Temporary direct impacts from dredging Lake Pontchartrain include an increase in water turbidity, which would affect fishing in the area of the activity. Dredging activities would disrupt most recreational activity occurring within the area of work; however, these adverse impacts would be temporary and short-lived. There are, however, many other locations in the lake to fish. Once construction activities are completed, the newly dug pits at the lake bottom should offer new habitat and fishing opportunities should return to the area.

Indirect impacts to boaters would be minor and result from placement of the pipeline needed to deliver the dredge material to the restoration features. In general, waterways would remain accessible and would not be totally shutoff from navigation. Where the pipeline crosses a navigable waterway, it would be submerged. In areas where the pipeline crosses a body of waterway, it would run along the waterway near its edge. Boaters may have to travel longer distances to arrive at their destination in areas where the floating pipeline blocks navigation. Indirect impacts would also accrue to areas surrounding the proposed restoration features as wildlife and fish in the vicinity would benefit from improved habitat nearby.

Recreational opportunities should improve in Lake Pontchartrain Basin once all of the LPV mitigation features are restored. These areas would provide valuable habitat to both fisheries and wildlife using the Lake and surrounding marshes. Long-term cumulative impacts of proposed marsh and BLH creation in the Lake Pontchartrain Basin would have positive impacts on recreational fishing and hunting by increasing habitat nursery and feeding areas. Cumulative impacts of these types of actions normally are positive for recreational resources; however, the negative impacts that occur during construction activities may affect recreational use in the short-term. Since there are an abundant number of places to fish and hunt in the basin, these negative, temporary impacts are expected to only minimally, cumulatively impact recreational resources and are far outweighed by the long-term benefits.

### **3.3. WETLANDS**

Existing emergent wetlands and shallow open water within the project areas provide important habitat and EFH, including transitional habitat between estuarine and marine environments used by migratory and resident fish, as well as other aquatic organisms for nursery, foraging, spawning, and other life requirements. Emergent fresh, intermediate, and brackish wetlands are typically used by many different wildlife species, including: seabirds; wading birds; shorebirds; dabbling and diving ducks; raptors; rails; coots; and gallinules; nutria; muskrat; mink, river otter, and raccoon; rabbit; white-tailed deer; and American alligator. Emergent saline marshes are typically utilized by: seabirds; wading birds; shore birds; dabbling and diving ducks; rails, coots, and gallinules; other saline

marsh residents and migrants; nutria; muskrat; mink, river otter, and raccoon; rabbits; deer; and American alligator.

Open water habitats such as Lake Pontchartrain provide wintering and multiple use functions for brown pelicans, seabirds, and other open water residents and migrants. Open water habitats in the project area provide wintering and multiple use functions for brown pelicans, seabirds, dabbling and diving ducks, coots, and gallinules as well as other open water residents and migrants.

No Action: Without implementation of the proposed mitigation features the areas would continue to naturally subside and the emergent wetland habitat would continue to decrease throughout the project area, resulting in more open water habitat.

Proposed Action: A cumulative total of approximately 755 acres of existing emergent wetlands and shallow open water would be replaced with approximately 160 acres of intermediate marsh at the TBPIIM feature, approximately 243 acres brackish marsh creation and approximately 82 acres of brackish marsh nourishment at the BSFBM feature, and the creation of approximately 152 acres of BLH-Wet and the creation of approximately 118 acres of brackish marsh at the NZR feature. The locations selected for mitigation features were coordinated with USACE and FWS staff to select wetlands areas that provided relatively low habitat quality and improve the habitat through the creation and enhancement of higher quality wetland habitat such as emergent marsh and BLH-Wetland. Although the proposed projects would take place in existing shallow open water habitats, the overall habitat quality of the project area would be enhanced by the proposed creation of marsh and BLH habitat types that are currently being lost in coastal Louisiana.

### **3.4. HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE (HTRW)**

In accordance with Engineering Regulation 1165-2-132, the potential to encounter HTRW in the project area was investigated.

The proposed mitigation features were surveyed via aerial photographs, topographic maps, field investigation, and database searches. The proposed features have not been developed in recent historic times based on a time-series of aerial photography. No recognized environmental concerns were found or identified within or near the proposed mitigation areas. The database searches failed to identify any pipelines crossing the proposed mitigation area or borrow area. Likewise, no oil or gas well or waste pits have been identified. In conclusion, there would be a low probability of encountering HTRW in the proposed mitigation area and borrow area.

### **3.5. CUMULATIVE IMPACTS**

NEPA requires Federal agencies to consider not only the direct and indirect impacts of a proposed action, but also the cumulative impacts of the action. A cumulative impact is defined as the “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 of the proposed action relative to specific resources were discussed in the evaluation of effects to individual resources in Section 3. Those impacts were determined to be individually and cumulatively insignificant. The proposed action is one part of a larger mitigation plan addressed in PIER 36. PIER 36 and the Final Comprehensive Environmental Document, Phase I, Greater New Orleans Hurricane and Storm Damage Risk Reduction System (USACE 2013) both included detailed cumulative impact analysis and are incorporated herein by reference.

## **4. COORDINATION AND CONSULTATION**

### **4.1. PUBLIC INVOLVEMENT**

Public involvement has been sought in planning the mitigation for HSDRRS impacts beginning with a public notice of the NEPA Alternative Arrangements published in the Federal Register on March 13, 2007, (Federal Register Volume 72, No. 48) which included a commitment to analyze alternatives to determine appropriate mitigation. The notice is available at [www.nolaenvironmental.gov](http://www.nolaenvironmental.gov).

Mitigation-specific public involvement was sought in preparing PIER 36, which is supplemented by this document. The details of specific coordination are specified in PIER 36 (incorporated by reference).

This draft supplement will be distributed for a 30-day public review and comment period. A public meeting specific to the proposed action would be held if requested during the review period. Any comments received during this public meeting would be considered part of official record. After the 30-day comment period, and public meeting if requested, the CEMVN 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 CEMVN Commander will make a decision on the proposed action. This decision will be documented in a Supplemental Decision Record. If a comment(s) is determined to be substantive in nature, an addendum to the Supplement would be prepared and published for an additional 30-day public review and comment period. After the expiration of the public comment period the CEMVN Commander would make a decision on the proposed action. The decision would be documented in a Supplemental Decision Record.

### **4.2. AGENCY COORDINATION**

Preparation of this supplemental will be coordinated with appropriate Congressional, Federal, state, and local interests, as well as environmental groups and other interested parties. An interagency environmental team was established in which Federal and state agency staff played an integral part in the project planning and alternative analysis phases of the HSDRRS mitigation planning (members of this team are listed in appendix C). This interagency environmental team was integrated with the CEMVN project delivery team. A

subset of the interagency environmental team participated in the more detailed development and analysis of the refuge mitigation projects and during preparation of this document.

The following agencies and Tribes, as well as other interested parties, are receiving copies of this draft supplement:

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  
Louisiana Coastal Protection and Restoration Authority Board  
Louisiana 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  
Alabama Coushatta Tribe of Texas  
Caddo Nation of Oklahoma  
Chitimacha Tribe of Louisiana  
Choctaw Nation of Oklahoma  
Coushatta Tribe of Louisiana  
Jena Band of Choctaw Indians  
Mississippi Band of Choctaw Indians  
Seminole Nation of Oklahoma  
Seminole Tribe of Florida  
Tunica-Biloxi Tribe of Louisiana

CEMVN's biological assessment of a determination of may effect, but not likely to adversely affect listed species is currently being developed and will be submitted to the USFWS and NMFS for consideration.

The CEMVN found the proposed action to be consistent with the LCRP. This determination will be forwarded to LDNR for its consideration.

The Louisiana Department of Environmental Quality (LDEQ) is reviewing the proposed action. An application for Water Quality Certification has been submitted to LDEQ for its consideration.

Section 106 of the National Historic Preservation Act, as amended, requires consultation with the SHPO and Tribes. The CEMVN elected to fulfill its obligations under Section 106 through the execution and implementation of a Programmatic Agreement (PA) with the Advisory Council on Historic Preservation (ACHP), SHPO and Tribes. Implementation of the terms of the PA executed on June 18, 2013, evidences that the USACE has taken into

account the effects of the proposed action upon historic properties and has afforded the ACHP an opportunity to comment. Consultation with the SHPO and Tribes pursuant to Section 106 of the National Historic Preservation Act and in accordance with the Programmatic Agreement executed on June 18, 2013, is ongoing.

A final Fish and Wildlife Coordination Act Report (CAR) for PIER 36 was provided by the USFWS on October 28, 2013. The final CAR concluded that the USFWS supports the current constructible features and recognizes that additional supplemental or TIER IERs would further address individual mitigation features that were still in early design phases. The CAR states that the USFWS supports the USACE's plan to mitigate impacts to fish and wildlife resources associated with the HSDRRS and believes that the recommendations provided in their October 28, 2013, CAR addressing PIER 36 continue to remain valid and should be incorporated into future project planning and implementation. The draft CAR for this project has not yet been provided. Additional project-specific recommendations from the FWS are expected during the public review period of this SIER. The NMFS provided comments on PIER 36 by letter dated September 24, 2013. The NMFS provided a variety of comments related to potential impacts to essential fish habitats and the need to scale the final mitigation projects based on advanced engineering and design to ensure no net loss of wetlands and corresponding functions. The NMFS expressed concern that the WVA analysis may not be addressing all of the potential impacts to aquatic resources. The USFWS, NMFS, and the CEMVN environmental staffs worked together to assess the potential mitigation benefits of the refuge mitigation projects to assure that the proposed action is capable of fully and adequately compensating for the adverse impacts to brackish and intermediate marsh and BLH-WET as a result of constructing the Lake Pontchartrain and Vicinity component of the HSDRRS. Additional guidance from NMFS is anticipated during the review period of this SIER.

#### **4.3. COMPLIANCE WITH ENVIRONMENTAL LAWS, REGULATIONS, AND GUIDANCE**

Construction of the proposed action would not commence until the proposed action achieves environmental compliance with all applicable laws and regulations, as described below.

Environmental compliance for the proposed action would be achieved upon coordination of this Supplement with agencies, organizations, and individuals for their review and comments; USFWS and NMFS confirmation that the proposed action would not be likely to adversely affect any threatened or endangered species or their critical habitats; LDNR concurrence with the determination that the proposed action is consistent, to the maximum extent practicable, with the Louisiana Coastal Resources Program; SHPO concurrence with the determination that the proposed action would not adversely affect cultural resources; receipt and acceptance or resolution of all Fish and Wildlife Coordination Act recommendations; and receipt and acceptance or resolution of all LDEQ comments on the water quality (including Section 401 Certification). Correspondence documenting compliance will be included in the final SIER, Appendix B. Other specific environmental requirements were addressed in PIER 36 and require no further consideration is this

supplemental. A Section 404 (b)(1) evaluation is currently being developed. A public notice would be distributed to solicit public and agency input for that evaluation. A decision document would not be signed until completion of all required coordination and the Section 404 (b)(1) evaluation.

An effective monitoring program is required by the Water Resources Development Act of 2007, Section 2036, to determine if the project outcomes are consistent with the identified success criteria. A monitoring plan including general success criteria, monitoring requirements, and planting guidelines for the proposed mitigation projects has been developed and is included as Appendix C.

The purpose of adaptive management activities in the life-cycle of the project is to address ecological and other uncertainties that could prevent successful implementation of a project. Adaptive management also establishes a framework for decision making that utilizes monitoring results and other information, as it becomes available, to update project knowledge and adjust management/mitigation actions. Hence, early implementation of adaptive management and monitoring allows for a project that can succeed under a wide range of conditions and can be adjusted as necessary. Furthermore, careful monitoring of project outcomes both advances scientific understanding and helps adjust operations changes as part of an iterative learning process. An adaptive management plan has been developed and is included as Appendix D.

A "habitat-based methodology" in the form of the WVA model was used to assess impacts from construction of the HSDRRS work and future benefits to be obtained through the compensatory mitigation projects. The WVA model computes the difference in the habitat value over the period of analysis between the future with project and future without project (No Action) conditions. The difference is expressed as net AAHUs. The same version of the model was used to calculate both the impacts from construction the HSDRRS work and future benefits to be obtained through the implementation of the proposed mitigation. The WVA model analysis indicated a need for 8.79 AAHU to compensate for impacts to on-Refuge brackish marsh and 118.06 AAHU for impacts to general brackish marsh, 41.29 AAHU of intermediate marsh, and 92.83 AAHU of wet BLH-WET resulting from the construction of the Lake Pontchartrain and Vicinity portion component of the HSDRRS. Additionally, the implementation of the NZR BLH-Wet mitigation feature is anticipated to permanently impact approximately 152 acres of EFH. The NZR-BM feature would fully offset these impacts. The proposed action would result in the creation of the same number of AAHUs of EFH as are ultimately impacted. The results of the WVA analysis for each of the proposed alternative projects can be viewed at [www.nolaenvironmental.com](http://www.nolaenvironmental.com).

## **5. CONCLUSION**

The proposed action has been assessed for its potential impacts to wildlife, threatened and endangered species, fisheries, aquatic resources, water quality, essential fish habitat, cultural resources, and recreation, and for the potential of the project to encounter HTRW. The proposed action would provide 113.69 AAHU of mitigation required for brackish marsh, 41.29 AAHU of mitigation required for intermediate marsh and 92.83 AAHU of

mitigation required for BLH-Wet for impacts of the Lake Pontchartrain and Vicinity HSDRRS. These benefits would be realized through restoration and nourishment of 325 acres of brackish marsh at the BSFBM feature, restoration of 55.5 acres of brackish marsh at the NZR-BM feature, restoration of 160 acres of intermediate marsh at the TBPIM feature and the creation of 152 acres of BLH-Wet at the NZR-BLH feature. The conversion of approximately 152 acres of EFH from shallow open water to non-tidal BLH-Wet habitat would be offset by the construction of approximately 62.5 acres of brackish marsh at the NZR-BM feature. It is anticipated that there could be a shortfall of approximately 13.16 AAHU of general floodside brackish marsh impacts with current project alignments. To address these remaining AAHU requirements, the footprint of the NZR-BM restoration feature could be expanded, or the CEMVN could choose to purchase released mitigation credits from approved mitigation banks within the LPV basin or from the State of Louisiana's In Lieu Fee (ILF) Program. The CEMVN has determined that the proposed action would adequately mitigate for specific habitat impacts resulting from construction of the LPV HSDRRS.

## **6. PREPARERS**

This supplemental was prepared by Matthew Mallard, Plan Formulator and Daniel Sumerall, Biologist. Eric Williams, Archeologist, prepared the Cultural Resources sections. Andrew Perez prepared the Recreation sections. Support provided by Patrick Erwin, Project Manager, and Sean Mickal, Plan Formulator. The address of the preparers is: U.S. Army Corps of Engineers, Regional Planning and Environment Division, CEMVN-RPEDS; P.O. Box 60267; New Orleans, Louisiana 70160-0267.

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**APPENDIX A**

**Public Comment and Response**

**(Reserved for Final Supplemental)**

**APPENDIX B**

**INTERAGENCY CORRESPONDENCE**

## **APPENDIX C**

### **GENERAL MITIGATION GUIDELINES: PLANTINGS, SUCCESS CRITERIA, MONITORING AND OTHER GENERAL GUIDANCE**

#### **SUPPLEMENTAL INDIVIDUAL ENVIRONMENTAL REPORT 36 BAYOU SAVAGE, TURTLE BAYOU & NEW ZYDECO RIDGE RESTORATION PROJECTS**

### **INTRODUCTION**

This document follows the general mitigation guidelines developed for both the Lake Pontchartrain and Vicinity and the West Bank and Vicinity Hurricane Storm Damage and Risk Reduction System (HSDRRS) Mitigation Program. They were developed by the U.S. Army Corps of Engineers (USACE) in coordination with an Interagency Team and the non-Federal project sponsor (NFS). The original guidelines were included as Appendix J in PIER 36. This appendix makes project specific adjustments and outlines the project specific guidelines and success criteria.

The proposed mitigation actions include construction, with the NFS responsible for operation and maintenance of functional portions of work as they are completed. On a cost shared basis, USACE would monitor completed mitigation to determine whether additional construction, invasive species control and/or planting are necessary to achieve mitigation success. USACE would undertake additional actions necessary to achieve mitigation success in accordance with cost sharing applicable to the project and subject to the availability of funds. Once USACE determines that the mitigation has achieved initial success criteria, monitoring would be performed by the NFS as part of its OMRR&R obligations. If, after meeting initial success criteria, the mitigation fails to meet its intermediate and/or long-term ecological success criteria, USACE would consult with other agencies and the NFS to determine whether operational changes would be sufficient to achieve ecological success criteria. If, instead, structural changes are deemed necessary to achieve ecological success, USACE would implement appropriate adaptive management measures in accordance with the contingency plan and subject to cost sharing requirements, availability of funding, and current budgetary and other guidance.

The responsibilities for the construction, monitoring, and maintenance of this project are as follows:

1. Construction and planting (the “construction phase”) - performed by USACE per applicable cost-sharing;
2. After construction and planting, USACE issues Notice of Construction Complete (NCC) and provides the Operation, Maintenance, Repair, Replacement, and Rehabilitation manual to the NFS (the “O&M phase”);

3. Notwithstanding NCC, USACE would monitor the project on a cost-shared basis until it reaches its Initial Success Criteria;

4. If, after NCC, but before Initial Success Criteria are achieved, the project needs additional construction, invasive species control or planting, USACE would perform these items subject to applicable cost-sharing and availability of funds;

5. After Initial Success Criteria are achieved, NFS would monitor project;

6. If, after Initial Success Criteria are achieved, there is a problem that can be corrected through a change in operation, NFS would be responsible to change its operation of the project; and

7. If, after Initial Success Criteria are achieved, there is a problem that requires structural changes, USACE would implement adaptive management according to applicable cost-sharing and subject to availability of funds.

For the Bayou Sauvage, Turtle Bayou, and New Zydeco Ridge Restoration projects, "construction" is defined as:

1. Mobilization and de-mobilization of required construction equipment to the site.

2. Construction of temporary retention/perimeter dikes and associated spill boxes to contain dredged material.

3. Construction of the shoreline restoration feature along the eroded shoreline of Lake Pontchartrain, including planting of the feature with specified vegetation, dredging the access channel to the site, and filling the access channel once the feature has been constructed.

4. Dredging material from the bottom of Lake Pontchartrain and pumping the material via hydraulic pipeline along a defined access corridor to the designated fill site to establish a marsh platform at design elevation.

5. Surveying to determine fill height during and at the end of the dredging operation.

6. Degrading the perimeter dikes and gapping the dikes to allow water exchange.

7. Initial (during first year after establishment of marsh and BLH-WET platforms) invasive and nuisance plant species control.

8. Surveying 1 year after fill event and before planting to determine fill elevation.

9. One year after establishment of marsh and BLH-WET platform, planting native, herbaceous, wetland vegetation and BLH-WET species throughout the fill areas.

## **MITIGATION PLANTING GUIDELINES**

### **PLANTING GUIDELINES FOR BOTTOMLAND HARDWOOD (BLH) HABITATS**

Canopy species would be planted on 9-foot centers (average) to achieve a minimum initial stand density of 538 seedlings (trees) per acre. Midstory species would be planted on 18-foot centers (average) to achieve a minimum initial stand density of 134 seedlings per acre. Stock would be at least 1 year old, at least 2 feet in height, have a minimum root collar diameter of 3/8 inch, have a root length of at least 8 to 10 inches with at least 4 to 8 lateral roots, and must be obtained from a registered licensed regional nursery/grower and of a regional eco-type species properly stored and handled to ensure viability. The plants would typically be installed during the period from December through March 15 (planting season/dormant season); however unanticipated events such as spring flooding may delay plantings until late spring or early summer. The seedlings would be installed in a manner that avoids monotypic rows of canopy and midstory species (i.e. goal is to have spatial diversity and mixture of planted species). If herbivory may threaten seedling survival, then seedling protection devices such as wire-mesh fencing or plastic seedling protectors would be installed around each planted seedling.

#### **Species for Wet Bottomland Hardwood Habitats (BLH-Wet Habitats)**

The canopy species installed would be in general accordance with the species lists provided in tables 1A and 1B. Plantings would be conducted such that the total number of plants installed in a given area consists of approximately 60 percent hard mast-producing species (table 1A) and approximately 40percent soft mast-producing species (table 1B). The species composition of the plantings for each of the two groups of canopy species (e.g. hard mast species and soft mast species) should mimic the percent composition guidelines indicated in tables 1A and 1B. However, site conditions (factors such as hydrologic regime, soils, composition of existing native canopy species, etc.) and planting stock availability may necessitate deviations from the species lists and/or the percent composition guidelines indicated in these tables. In general, a minimum of three hard mast species and a minimum of three soft mast species should be utilized.

The midstory species installed would be selected from the species list provided in table 1C. Plantings would consist of at least three different species. The species used and the proportion of the total midstory plantings represented by each species (percent composition) would be dependent on various factors including site conditions (composition and frequency of existing native midstory species, hydrologic regime, soils, etc.) and planting stock availability.

**Table 1A: Preliminary Planting List for Wet Bottomland Hardwood Habitat, Hard Mast-Producing Canopy Species (60% of Total Canopy Species)**

Common Name	Scientific name	Percent Composition
Nuttall oak	Quercus nuttalli, Q. texana	30% - 40%
Wouldow oak	Quercus phellos	30% - 40%
Water oak	Quercus nigra	5%
Overcup oak	Quercus lyrata	10% - 20%
Swamp chestnut oak	Quercus michauxii	10% - 20%
Water hickory	Carya aquatica	10% - 20%

**Table 1B: Preliminary Planting List for Wet Bottomland Hardwood Habitat, Soft Mast-Producing Canopy Species (40% of Total Canopy Species)**

Common Name	Scientific name	Percent Composition
Drummond red maple	Acer rubrum var. drummondii	15% - 25%
Sugarberry	Celtis laevigata	15% - 25%
Green ash	Fraxinus pennsylvanica	15% - 25%
Sweetgum	Liquidambar styraciflua	10% - 20%
American elm	Ulmus americana	10% - 20%
Bald cypress	Taxodium distichum	5% - 15%

**Table 1C: Preliminary Planting List for Wet Bottomland Hardwood Habitat, Midstory Species**

Common Name	Scientific name	Percent Composition
Saltbush	Baccharis halimifolia	TBD
Buttonbush	Cephalanthus occidentalis	TBD
Roughleaf dogwood	Cornus drummondii	TBD
Mayhaw	Crataegus opaca	TBD
Green hawthorn	Crataegus viridis	TBD
Common persimmon	Diospyros virginiana	TBD
Honey locust	Gleditsia triacanthos	TBD
Possumhaw	Ilex decida	TBD
Dahoon holly	Ilex cassine	TBD
Red mulberry	Morus rubra	TBD
Wax myrtle	Myrica cerifera	TBD

TBD = To Be Determined

**Deviations from Typical Planting Guidelines**

Proposed mitigation features that involve restoration would commonly require planting the entire feature using the prescribed planting guidance addressed in the preceding sections. In contrast mitigation features that involve enhancement would often require adjustments to the typical plant spacing/density guidelines and may further require adjustments to the guidelines pertaining to species composition.

Where initial enhancement activities include the eradication of invasive and nuisance plant species, significant numbers of native canopy and/or midstory species may remain, but in a spatial distribution that leaves relatively large “gaps” in the canopy stratum and/or the midstory stratum. In such cases, areas measuring approximately 25 feet by 25 feet that are devoid of native canopy species should be planted and areas measuring approximately 45 feet by 45 feet that are devoid of native midstory species should be planted.

The initial enhancement actions involved within a particular mitigation site could include a variety of measures such as the eradication of invasive and nuisance plant species, topographic alterations (excavation, filling, grading, etc.), and hydrologic enhancement actions (alterations to drainage patterns/features, installation of water control structures, etc.). These actions may result in areas of variable size that require planting of both canopy and midstory species using the typical densities/spacing described previously. There may also be areas where several native canopy and/or midstory species remain, thus potentially altering the general guidelines described as regards the spacing of plantings, and/or the species to be planted, and/or the percent mitigation success criteria may involve cases where the general guidelines discussed above would not necessarily be applicable.

Given these uncertainties, initial planting plans specific to enhancement features would be required and must be specified in the Mitigation Work Plan for the mitigation site. The initial planting plans would be developed by the USACE in cooperation with the Interagency Team. Initial plantings would be the responsibility of the USACE. If re-planting of an area is necessary following initial plantings, a specific re-planting plan must also be prepared and must be approved by the USACE in cooperation with the Interagency Team prior to re-planting. With the exception of any re-planting actions necessary to attain the initial survivorship success criteria (i.e. survival required 1 year following completion of initial plantings), the NFS would be responsible for preparing re-planting plans and conducting re-planting activities, subject to the provisions mentioned in the Introduction section. Re-planting necessary to achieve the initial survivorship criteria would be the responsibility of the USACE. Re-planting necessary to achieve the initial survivorship criteria to the provisions mentioned in the Introduction section.

### **PLANTING GUIDELINES FOR INTERMEDIATE AND BRACKISH MARSH HABITATS**

Herbaceous species would be planted on 7-foot centers (average) to achieve a minimum density of 889 plants per acre. Stock would typically be either 4-inch container size or bare-root or liner stock, depending on the species involved. The required stock size for each plant species proposed for installation must be specified in the Mitigation Work Plan. Plants must be obtained from a registered licensed regional nursery/grower and of a regional eco-type species properly stored and handled to ensure viability. Plant installation should be conducted during the period from March 15 through June 15. Planting should not be undertaken later than approximately July 15, although planting during the early fall may be deemed acceptable on a case-by-case basis.

Species installed in proposed intermediate marsh habitats would be selected from the species list provided in table 4. Plantings would consist of at least two different species. The species used and the proportion of the total plantings represented by each species would be dependent on various factors including site conditions and plantings represented by planting stock availability.

**Table 4: Preliminary Planting List for Intermediate Marsh Habitats**

Common Name	Scientific Name
California bulrush	Schoenoplectus californicus
Black needle rush	Juncus roemerianus
Giant cutgrass	Zizaniopsis miliacea
Marsh-hay cordgrass	Spartina patens
Maidencane	Panicum hemitomon
Common threesquare	Schoenoplectus americanus
Big cordgrass	Spartina cynosuroides
Seashore paspalum	Paspalum vaginatum

Species installed in proposed brackish marsh habitats would be selected from the species list provided in table 5. Plantings would consist of at least two different species. The species used and the proportion of the total plantings represented by each species would be dependent on various factors including site conditions and planting stock availability.

**Table 5: Preliminary Planting List for Brackish Marsh Habitats**

Common Name	Scientific Name
Marsh-hay cordgrass	Spartina patens
Black needle rush	Juncus roemerianus
Smooth cordgrass	Spartina alterniflora
Common threesquare	Schoenoplectus americanus
Saltmarsh bulrush	Schoenoplectus robustus
Salt grass	Distichlis spicata

**Deviations from Typical Planting Guidelines**

Initial planting plans specific to an intermediate marsh or to a brackish marsh mitigation site would be required and must be specified in the Mitigation Work Plan for the site. The initial planting plans would be developed by the USACE in cooperation with the Interagency Team. Initial plantings would be the responsibility of the USACE, subject to the provisions set forth in the Introduction section. If re-planting of an area is necessary following initial plantings, a specific re-planting plan must also be prepared and must be approved by the USACE in cooperation with the Interagency Team prior to re-planting.

It may be determined that the initial planting of brackish marsh features would best be conducted in phases. Using this approach, a certain percentage of the total number of plants required would be installed in the year that final marsh construction activities are completed while the remainder would be installed in the following year. The determination of whether to use phased planting or to install all the necessary plants

upon completion of construction activities would be made during the final design phase of the mitigation project. The proposed planting scheme would be subject to review and approval by the Interagency Team.

As previously discussed, planting of fresh marsh features could be necessary if the initial vegetative cover goal is not achieved. Re-planting of intermediate marsh features and/or brackish marsh features could also be required if the initial plant survivorship goal is not attained or if initial vegetative cover goals are not achieved. In such cases, re-planting or supplemental planting of such mitigation features would be the responsibility of the USACE (subject to the provisions in the Introduction section). Once the initial success criteria are achieved, the NFS would be responsible for conducting any re-planting activities necessary to achieve success, subject to the provisions in the Introduction section. All re-planting plans would be subject to review and approval by the USACE and Interagency Team prior to plant installation. These plans may deviate from the general planting guidelines as regards the density of plantings, the species utilized, or the plant stock size in an effort to rapidly establish appropriate vegetative cover.

## **MITIGATION SUCCESS CRITERIA AND MITIGATION MONITORING**

### **BOTTOMLAND HARDWOOD MITIGATION FEATURES**

#### **1. General Construction**

- A. As applicable, complete all necessary initial earthwork and related construction activities in Mitigation TY1 (2014), and in accordance with the mitigation work plan as well as the final project plans and specifications. The necessary activities would vary with the mitigation site. Examples include, but are not limited to: clearing, grubbing, and grading activities; construction of new water management features (weirs, flap-gates, diversion ditches, etc.); modifications/alterations to existing water control structures and surface water management systems; construction of perimeter containment dikes and installation of fill (dredged sediments or other soil). These requirements classify as initial success criteria.
- B. For mitigation features established in existing open water areas, complete all final construction activities in Mitigation TY2 (2015), and in accordance with the mitigation work plan as well as the final project plans and specifications. The necessary activities would vary with the mitigation site. Examples include, but are not limited to: degrading or “gapping” of perimeter retention dikes; construction of water management structures (weirs, etc.). These requirements classify as initial success criteria.

## **2. Native Vegetation**

A. Complete initial planting of canopy and midstory species in accordance with the authorized initial planting plan. This requirement classifies as an initial success criterion.

B. 1 Year Following Completion of Initial Plantings (at end of first growing season following the year plants are first installed) –

- Achieve a minimum average survival of 50 percent of planted canopy species (i.e. achieve a minimum average canopy species density of 269 seedlings/ac.). The surviving plants must approximate the species composition and the species percentages specified in the initial plantings component of the Mitigation Work Plan. These criteria would apply to the initial plantings as well as any subsequent replantings necessary to achieve this initial success requirement.
- Achieve a minimum average survival of 85 percent of planted midstory species (i.e. achieve a minimum average midstory species density of 114 seedlings/ac.). The surviving plants must approximate the species composition percentages specified in the initial plantings component of the Mitigation Work Plan. These criteria would apply to the initial plantings as well as any subsequent replantings necessary to achieve this initial success requirement.
- The requirements above classify as initial success criteria.

C. 4 Years Following Completion of Initial Plantings –

- Achieve a minimum average density of 300 living native canopy species per acre (planted trees and/or naturally recruited native canopy species).
- Achieve a minimum average density of 120 living, native, hard mast-producing species in the canopy stratum but no more than approximately 150 living hard-mast producing species in the canopy stratum (planted trees and/or naturally recruited native canopy species). The remaining trees in the canopy stratum must be comprised of soft-mass producing native species. These criteria would thereafter remain in effect for the duration of the overall monitoring period. Modifications to these criteria could be necessary for reasons such as avoidance of tree thinning if thinning is not warranted and the long-term effects of sea level rise on tree survival. Proposed modifications must first be approved by the USACE in coordination with the Interagency Team.
- Achieve a minimum average density of 85 living native midstory species per acre (planted midstory and/or naturally recruited native midstory species).
- For BLH-Wet habitats only -- Demonstrate that vegetation satisfies USACE hydrophytic vegetation criteria. This criterion (requirement) would thereafter remain in effect for the duration of the overall monitoring period.
- The requirements above classify as intermediate success criteria; with the exception that the requirement to demonstrate vegetation satisfies USACE hydrophytic vegetation criteria throughout the duration of the overall monitoring period classifies as a long-term success criterion.

D. Within 10 Years Following Completion of Initial Plantings –

- Attain a minimum average cover of 80 percent by planted canopy species and/or naturally recruited native canopy species. This criterion would thereafter remain in effect for the duration of the overall monitoring period. This requirement to meet the specified minimum average cover within 10 years following completion of initial plantings classifies as an intermediate success criterion. The requirement to meet the specified minimum average cover for the duration of the overall monitoring period classifies as a long-term success criterion.

E. 15 Years Following Completion of Initial Plantings –

- Achieve a minimum average density of 75 living native plants per acre in the midstory stratum (planted midstory and/or naturally recruited native midstory species). This requirement classifies as an intermediate success criterion.

F. 25 Years Following Completion of Initial Plantings –

- Average cover by native species in the midstory stratum must be greater than 20 percent, but cannot exceed 50 percent. This criterion would thereafter remain in effect for the duration of the overall monitoring period.
- Average cover by native species in the understory stratum must be greater than 30 percent, but cannot exceed 60 percent. This criterion would thereafter remain in effect for the duration of the overall monitoring period.
- The requirements above classify as long-term success criteria.

Note: The requirement that the above criteria remain in effect for the duration of the overall monitoring period may need to be modified later due to factors such as the effect of sea level rise on vegetative cover, may need to be modified later due to factors such as the effect of sea level rise on vegetative cover. Proposed modifications must first be approved by the USACE in coordination with the Interagency Team.

### **3. Invasive and Nuisance Vegetation**

A. Complete the initial eradication of invasive and nuisance plant species. This requirement classifies as an initial success criterion.

B. Maintain all areas such that they are essentially free from invasive and nuisance plant species immediately following a given maintenance event and such that the total average vegetative cover accounted for by invasive and nuisance species each constitute less than 5 percent of the total average plant cover during periods between maintenance events. Note -These criteria must be satisfied throughout the duration of the overall monitoring period. Until such time that monitoring responsibilities are transferred from the USACE to the NFS, this requirement classifies as an initial success criterion. Following

the transfer of monitoring responsibilities, this requirement classifies as a long-term success criterion.

#### **4. Topography**

A. For mitigation features requiring earthwork to attain desired grades (excluding areas restored from existing open water features) – Following completion of initial construction activities (anticipated in TY1, 2014), demonstrate that at least 80 percent of the total graded area within each feature is within approximately 0.5 feet of the proposed target soil surface elevation (e.g. the desired soil surface elevation). This requirement classifies as an initial success criterion.

B. For mitigation features restored from existing open water areas – (a) In the year that final construction activities are completed (anticipated in TY2, 2015), demonstrate that at least 80 percent of the total graded area within each feature is within approximately 0.5 feet of the proposed target soil surface elevation (e.g. the desired soil surface elevation), and; (b) In the year after final construction activities are completed, demonstrate that at least 85 percent of the total graded area within each feature is within approximately 0.5 feet demonstrate that at least 85 percent of the total graded area within each feature is within approximately 0.5 foot of the proposed target soil surface elevation. These requirements classify as initial success criteria.

#### **5. Thinning of Native Vegetation (Timber Management)**

The USACE, in cooperation with the Interagency Team, may determine that thinning of the canopy and/or midstory strata is warranted to maintain or enhance the ecological value of the site. This determination would be made approximately 15 to 20 years following completion of initial plantings. If it is decided that timber management efforts are necessary, the NFS would develop a Timber Stand Improvement/Timber Management Plan, and associated long-term success criteria, in coordination with the USACE and Interagency Team. Following approval of the plan, the NFS would perform the necessary thinning operations and demonstrate that these operations have been successfully completed. Timber management activities would only be allowed for the operations that have been successfully completed.

#### **6. Hydrology**

A. In a year having essentially normal rainfall, demonstrate that the water table is less than or equal to 12 inches below the soil surface for a period of at least 14 consecutive days. This requirement classifies as an intermediate success criterion.

B. If the mitigation program includes actions intended to enhance site hydrology or hydroperiod, demonstrate that the affected site is irregularly inundated or soils are saturated to the soil surface for a period ranging from 7 percent to approximately 13 percent of the growing season during a year having essentially normal rainfall. The Mitigation Work Plan for a specific site may establish more specific hydrologic

enhancement goals. If this is the case, demonstrate attainment of the specific goals identified in the plan. These hydrology/hydroperiod requirements classify as long-term success criteria.

## **MITIGATION MONITORING GUIDELINES**

### **“Time Zero” Monitoring Report (Monitoring Report #1)**

Shortly after completion of all initial mitigation activities (e.g. initial eradication of invasive and nuisance plants, first/initial planting of native species, completion of initial earthwork, grading, surface water management system alterations/construction, etc.), the mitigation site would be monitored and a “time zero” or “baseline” monitoring report prepared. Information provided would typically include the following items:

- A detailed discussion of all mitigation activities completed.
- A description of the various features and habitats within the mitigation site.
- A plan view drawing of the mitigation site showing the approximate boundaries of different mitigation features (ex. planted areas, areas only involving eradication of invasive and nuisance plant species; surface water management features, etc.), monitoring transect locations, sampling plot locations, photo station locations, and, if applicable, piezometer, and staff gage locations.
- An as-built survey of finished grades for any relatively large areas subject to topographic alterations and an as-built survey of any surface water drainage features, drainage culverts, and/or water control structures constructed. Detailed surveys of topographic alterations simply involving the removal of existing linear features such as berms/spoil banks, or involving the filling of existing linear ditches or canals, would not be required. However, the as-built survey would include spot cross-sections of such features sufficient to represent typical conditions. The as-built survey must include a survey of areas where existing berms, spoil banks, or levees have been breached in sporadic locations. For mitigation areas involving habitat restoration in existing open water areas, the as-built survey must include a topographic survey of the entire restoration feature.
- A detailed inventory of all canopy and midstory species planted, including the number of each species planted and the stock size planted. In addition, provide a breakdown itemization indicating the number of each species planted in a particular portion of the mitigation site and correlate this itemization to the various areas depicted on the plan view drawing of the mitigation site.

### **Additional Monitoring Reports**

All monitoring reports generated after the initial “time zero” report would typically provide the following information unless otherwise noted:

- A plan view drawing of the mitigation site showing the approximate boundaries of different mitigation features (ex. planted areas, areas only involving eradication of invasive and nuisance plant species; surface water management features, etc.), monitoring transect locations, sampling plot locations, photo station locations, and, if applicable, piezometer, and staff gage locations.
- A brief description of maintenance and/or management and/or mitigation work performed since the previous monitoring report along with a discussion of any other significant occurrences.
- Photographs documenting conditions in the mitigation site at the time of monitoring. Photos would be taken at permanent photo stations within the mitigation site. At least two photos would be taken at each station with the view of each photo always oriented in the same general direction from one monitoring event to the next. The number of photo stations required, as well as the locations of these stations, would vary depending on the mitigation site. The USACE would make this determination in coordination with the Interagency Team and would specify the requirements in the Mitigation Monitoring Plan. For mitigation features involving habitat enhancement rather than restoration, the permanent photo stations would primarily be established in areas slated for planting of canopy and midstory species, but some may also be located in areas where plantings are not needed.
- Quantitative plant data collected from permanent monitoring plots measuring approximately 90 feet X 90 feet in size or from circular plots having a radius of approximately 53 feet. Data recorded in each plot would include: number of living planted canopy species present and the species composition; number of living planted midstory species present and the species composition; average density of all native species in the canopy stratum, the total number of each species present, and the wetland indicator status of each species; average cover by native species in the canopy stratum; average density of all native species in the midstory stratum, the total number of each species present, and the wetland indicator status of each species; average cover by native species in the midstory stratum; average percent cover accounted for by invasive plant species (all vegetative strata combined); average percent cover accounted for by nuisance plant species (all vegetative strata combined). The permanent monitoring plots would be located within mitigation areas where initial planting of canopy and midstory species is necessary. The number of plots required as well as the locations of these plots would vary depending on the mitigation site. The USACE would make this determination in coordination with the Interagency

Team and would specify the requirements in the Mitigation Monitoring Plan. Typically there would be at least one monitoring plot for every 20 acres planted.

- Quantitative plant data collected from either: (1) permanent transects sampled using the point-centered quarter method with a minimum of 20 sampling points established along the course of each transect, or; (2) permanent belt transects approximately 50 feet wide. The number of transects necessary as well as the location and length of each transect would vary depending on the mitigation site. The USACE would make this determination in coordination with the Interagency Team and would specify the requirements in the Mitigation Monitoring Plan. Data recorded from the sampling transects would include: average density of living planted canopy species present and the species composition; average density of living planted midstory species present and the species composition; average density of all native species in the canopy stratum along with the species composition and the wetland indicator status of each species; average percent cover by all native species in the canopy stratum; average height of native species in the canopy stratum; average density of native species in the midstory stratum, the total number of each species present, and the wetland indicator status of each species; average percent cover by native species in the midstory stratum; average height of native species in the midstory stratum; if present, average percent cover accounted for by invasive and nuisance species present in the canopy and midstory strata (combined).
- Quantitative data concerning plants in the understory (ground cover) stratum and concerning invasive and nuisance plant species would be gathered from sampling quadrats. These sampling quadrats would be established either along the axis of the belt transects discussed previously, or at sampling points established along point-centered quarter transects discussed previously, depending on which sampling method is used. Each sampling quadrat would be approximately 2 meters by 2 meters in size. The total number of sampling quadrats needed along each sampling transect would be determined by the USACE with the Interagency Team and would be specified in the Mitigation Monitoring Plan. Data recorded from the sampling quadrats would include: average percent cover by native subcanopy species; composition of native subcanopy species and the wetland indicator status of each species; average percent cover by invasive plant species; average percent cover by nuisance plant species.
- For BLH-Wet habitats only -- A summary of rainfall data collected during the year preceding the monitoring report based on rainfall data recorded at a station located on or in close proximity to the mitigation site. Once all hydrology success criteria have been achieved, collection and reporting of rainfall data would no longer be required.
- For BLH-Wet habitats only -- A summary of water table elevation data collected from piezometers coupled with staff gages installed within the mitigation

site. Data (water table elevations) would be collected at least bi-weekly. Once the monitoring indicates the water table may be rising to an elevation that would meet hydrologic success criteria, water table elevations would be collected on a daily basis until it is evident the success criteria has been satisfied. The schedule of water table elevation readings can shift back to a bi-weekly basis for the remainder of the monitoring period. The number of piezometers and staff gages required as well as the locations of these devices would vary depending on the mitigation site. The USACE would make this determination in coordination with the Interagency Team and would specify the requirements in the Mitigation Monitoring Plan. Once hydrology success criteria have been satisfied, water table monitoring would no longer be required. However, monitoring reports generated subsequent to the attainment of success criteria would include a general discussion of water levels and hydroperiod based on qualitative observations.

- Various qualitative observations would be made in the mitigation site to help assess the status and success of mitigation and maintenance activities. These observations would include: general estimates of the average percent cover by native plant species in the canopy, midstory, and understory strata; general estimate of the average percent cover by invasive and nuisance plant species; general estimates concerning the growth of planted canopy and midstory species; general observations concerning the colonization by volunteer native plant species. General observations made during the course of monitoring would also address potential problem zones, general condition of native vegetation, trends in the composition of the plant communities, wildlife utilization as observed during monitoring, and other pertinent factors.
- For mitigation features restored from existing open water areas, provide an as-built topographic survey of all such mitigation features in the year immediately following the “time zero” monitoring event. No additional topographic surveys would typically be required following this second survey. However, if the second survey indicates topographic success criteria have not been achieved and supplemental topographic alterations are necessary, then another topographic survey may be required following completion of the supplemental alterations. This determination would be made by USACE in coordination with the Interagency Team.
- A summary assessment of all data and observations along with recommendations as to actions necessary to help meet mitigation and management/maintenance goals and mitigation success criteria.
- A brief description of anticipated maintenance/management work to be conducted during the period from the current monitoring report to the next monitoring report.

### **Monitoring Reports Involving Timber Management Activities**

In cases where timber management activities (thinning of trees and/or shrubs in the canopy and/or midstory strata) have been approved by the USACE in coordination with the Interagency Team, monitoring would be required in the year immediately preceding and in the year following completion of the timber management activities (i.e. pre-timber management and post-timber management reports). These reports must include data and information that are in addition to the typical monitoring requirements. The NFS's proposed Timber Stand Improvement/Timber Management Plan must include the proposed monitoring data and information that would be included in the pre-timber management and post-timber management monitoring reports. The proposed monitoring plan must be approved by the USACE in coordination with the Interagency Team prior to the monitoring events and implementation of the timber management activities.

### **Monitoring Reports Following Re-Planting Activities**

Re-planting of certain areas within the mitigation site may be necessary to ensure attainment of applicable native vegetation success criteria. Any monitoring report submitted following completion of a re-planting event must include an inventory of the number of each species planted and the stock size used. It must also include a depiction of the areas re-planted, cross-referenced to a listing of the species and number of each include a depiction of the area species planted in each area.

### **MITIGATION MONITORING SCHEDULE AND RESPONSIBILITIES**

Monitoring would typically take place in late summer of the year of monitoring, but may be delayed until later in the growing season due to site conditions or other unforeseen circumstances. Monitoring reports would be submitted by December 31 of each year of monitoring. Monitoring reports would be provided to the USACE, the NFS, and the agencies comprising the Interagency Team. The various monitoring and reporting responsibilities addressed in this section are all subject to the provisions set forth in the Introduction section.

The USACE would be responsible for conducting the monitoring events and preparing the associated monitoring reports until such time that the following mitigation success criteria are achieved (criteria follow numbering system used in success criteria section):

1. General Construction – 1.A or 1.B, as applicable.
2. Native Vegetation – A and B.
3. Invasive & Nuisance Vegetation – A, plus B until such time as monitoring responsibilities are transferred to the NFS.
4. Topography – A, as applicable, or B, as applicable.

Monitoring events associated with the above would include the “time zero” (first or baseline) monitoring event plus annual monitoring events thereafter until the monitoring responsibilities are transferred to the NFS. The years applicable to these monitoring events would vary depending on the type of mitigation involved (restoration or enhancement) and site conditions present at the time mitigation activities are initiated. For example, the first monitoring event may occur in 2014 (TY2) for certain mitigation sites while this event may not occur until 2015 (TY3) for other mitigation sites.

The NFS would be responsible for conducting the required monitoring events and preparing the associated monitoring reports after the USACE has demonstrated the mitigation success criteria listed above have been achieved. The overall responsibility for management, maintenance, and monitoring of the mitigation would typically be transferred to the Sponsor during the first quarter of the year immediately following submittal of the monitoring report that demonstrates attainment of said criteria, subject to the provisions identified in the Introduction section.

Once monitoring responsibilities have been transferred to the NFS, the next monitoring event would typically take place during the year that attainment of success criterion 2.C (native vegetation criterion applicable 4 years after completion of initial plantings) must be demonstrated. Thereafter, monitoring would typically be conducted every 5 years throughout the 50-year period of analysis (based on 50-year period of analysis beginning in 2013 (TY0) and ending in 2063 (TY50)).

If the initial survival criteria for planted canopy and midstory species are not achieved (i.e. the 1-year survival criteria specified in native vegetation success criteria 2.B), a monitoring report would be required for each consecutive year until two annual sequential reports indicate that all survival criteria have been satisfied (i.e. that corrective actions were successful). The USACE would be responsible for conducting this additional monitoring and preparing the monitoring reports. The USACE would also be responsible for the purchase and installation of supplemental plants needed to attain this success criterion, subject to the provisions mentioned in the Introduction section.

If the native vegetation success criteria specified for 4 years following completion of initial plantings are not achieved (i.e. native vegetation success criteria 2.C), a monitoring report would be required for each consecutive year until two annual sequential reports indicate that these criteria have been satisfied. The NFS would be responsible for conducting this additional monitoring and preparing the monitoring reports. The NFS would also be responsible for the purchase and installation of supplemental plants needed to attain these success criteria.

If timber management activities conducted in the mitigation features by the NFS, the NFS would be responsible for conducting the additional monitoring and preparing the associated monitoring reports necessary for such activities (e.g. one monitoring event and report in the year immediately preceding timber management activities and one monitoring event and report in the year that timber management activities are completed).

The year in which mitigation features are first planted, a key milestone triggering the start of mitigation monitoring may vary depending on the type of mitigation involved and the mitigation construction activities involved. In certain cases, it is also possible that the BLH mitigation features may be established along with other mitigation features like swamp or marsh habitats at the same mitigation site. Such factors make it necessary to develop a reasonable and efficient monitoring schedule at the time final mitigation plans are generated. This schedule must be in general accordance with the guidance provided above and would be prepared by the USACE in coordination with the Interagency Team and the NFS.

Once monitoring responsibilities have transferred to the NFS, the NFS would retain the ability to modify the monitoring plan and the monitoring schedule should this become necessary due to unforeseen events or to improve the information provided through monitoring. Twenty years following completion of initial plantings, the number of monitoring plots and/or monitoring transects that must be sampled during monitoring events may be reduced substantially if it is clear that mitigation success is proceeding as anticipated. Any significant modifications to the monitoring plan or the monitoring schedule must first be approved by the USACE in coordination with the Interagency Team.

## **MARSH MITIGATION FEATURES (Intermediate and Brackish Marsh Habitats)**

### **1. General Construction**

A. Within approximately 8 months following the start of mitigation construction, complete all initial mitigation construction activities (e.g. construction of temporary retention/perimeter dikes, placement of fill (borrow material/dredged material) into mitigation site, construction of permanent dikes if applicable, etc.), in accordance with the mitigation work plan and in accordance with final project plans and specifications. These requirements classify as initial success criteria

B. Approximately 1 year following completion of all initial mitigation construction activities (when the restored marsh feature has attained the desired target soil surface elevation), complete all final mitigation construction activities, in accordance with the mitigation work plan and in accordance with final project plans and specifications. Such activities could include, but are not limited to: degrading temporary retention dikes such that the areas occupied by these dikes have a surface elevation equivalent to the desired target marsh elevation; completion of armoring, if required, of any permanent dikes; “gapping” or installation of “fish dips” in permanent dikes; and construction of trenasses or similar features within marsh features as a means of establishing shallow water interspersion areas within the marsh. Finishing the aforementioned construction components would be considered as the “completion of final mitigation construction activities.” As noted previously, this is anticipated to occur approximately 1 year after placement of fill material in the mitigation feature is completed. The requirements stated herein classify as initial success criteria.

## **2. Topography**

- A. Upon completion of final mitigation construction activities (approximate Target Year 2) –
- Demonstrate that at least 80 percent of each mitigation feature has a surface elevation that is within 0.5 feet of the desired target surface elevation. This requirement classifies as an initial success criterion.
- B. 1 Year following completion of final mitigation construction activities (approximate Target Year 3) –
- Demonstrate that at least 80 percent of the mitigation site has a surface elevation that is within 0.5 feet of the desired target surface elevation. This requirement classifies as an initial success criterion.
- C. 3 years following completion of final mitigation construction activities (approximate Target Year 5) –
- Demonstrate that at least 90 percent of the mitigation site has a surface elevation that is within the functional marsh elevation range. This requirement classifies as an intermediate success criterion.

Notes: The desired target elevation for each marsh feature would be determined during the final design phase. The “functional marsh elevation range”, i.e. the range of the marsh surface elevation that is considered adequate to achieve proper marsh functions and values, would also be determined during the final design phase. The target elevation and functional marsh elevation range would be determined by the USACE in conjunction with the Interagency Team. These determinations would apply to the topographic success criteria above and could potentially alter the marsh area percentages set forth in these criteria.

## **3. Native Vegetation**

- A. For intermediate marsh and brackish marsh restoration features only –
- Complete initial marsh planting in accordance with applicable initial marsh planting guidelines. This requirement classifies as an initial success criterion.
- B. For intermediate marsh and brackish marsh restoration features only; 1 year following completion of initial plantings–
- Attain at least 80 percent survival of planted species, or; Achieve a minimum average cover of 25 percent, comprised of native herbaceous species (includes planted species and volunteer species).
  - Demonstrate that vegetation satisfies USACE hydrophytic vegetation criteria. This criterion would thereafter remain in effect for the duration of the overall monitoring period.
  - The requirements above classify as initial success criteria; with the exception that the requirement to demonstrate vegetation satisfies USACE hydrophytic vegetation

criteria throughout the duration of the overall monitoring period classifies as a long-term success criterion.

C. For intermediate marsh and brackish marsh restoration features only; 3 years following completion of initial plantings –

- Achieve a minimum average cover of 75 percent, comprised of native herbaceous species (includes planted species and volunteer species). This requirement classifies as an intermediate success criterion.

D. For all marsh restoration features (intermediate and brackish) –

- For the period beginning 5 years following completion of final mitigation construction activities and continuing through 20 years following completion of final mitigation construction activities, maintain a minimum average cover of 80 percent, comprised of native herbaceous species. This requirement classifies minimum average cover of 80 percent, as a long-term success criterion.

#### **4. Invasive and Nuisance Vegetation**

A. Complete the initial eradication of invasive and nuisance plant species within 1 year of completion of final mitigation construction activities. This requirement classifies as an initial success criterion.

B. Maintain all areas such that they are essentially free from invasive and nuisance plant species immediately following a given maintenance event and such that the total average vegetative cover accounted for by invasive and nuisance species each constitute less than 5 percent of the total average plant cover during periods between maintenance events. These criteria must be satisfied throughout the duration of the overall monitoring period. Until such time that monitoring responsibilities are transferred from the USACE to the NFS, this requirement classifies as an initial success criterion. Following the transfer of monitoring responsibilities, this requirement classifies as a long-term success criterion.

#### **MITIGATION MONITORING GUIDELINES**

The guidelines for mitigation monitoring provided herein are applicable to all the types of marshes being restored (i.e. intermediate and brackish), unless otherwise indicated.

#### **“Time Zero” Monitoring Report (First Monitoring Report)**

The mitigation site would be monitored and a “time zero” or “baseline” monitoring report prepared . Information provided would typically include the following items:

- A detailed discussion of all mitigation activities completed.
- A plan view drawing of the mitigation site showing the approximate boundaries of the restored marsh features, significant interspersed features

established within the marsh features (as applicable), monitoring transect locations, sampling plot locations, photo station locations, and staff gage locations.

- An as-built survey of surface elevations (topographic survey) within each marsh feature, along with an as-built survey of any permanent dikes constructed as part of the marsh restoration features including any “gaps” or “fish dips” established in such dikes. If a particular marsh feature is immediately adjacent to existing marsh habitat, the topographic survey would include spot elevations collected within the existing marsh habitat near the restored marsh feature. In addition to the survey data, an analysis of the data would be provided addressing attainment of topographic success criteria.
- Photographs documenting conditions in each restored marsh feature at the time of monitoring. Photos would be taken at permanent photo stations within the marsh features. At least two photos would be taken at each station with the view of each photo always oriented in the same general direction from one monitoring event to the next. The number of photo stations required as well as the locations of these stations would vary depending on the mitigation site. The USACE would make this determination in coordination with the Interagency Team and would specify the requirements in the Mitigation Monitoring Plan. At a minimum, there would be at least 4 photo stations established within each marsh feature.
- For restored intermediate marsh and brackish marsh features only -- A detailed inventory of all species planted, including the number of each species planted and the stock size planted. For mitigation sites that include more than one restored marsh feature, provide a breakdown itemization indicating the number of each species planted in each marsh and correlate this itemization to the marsh features depicted on the plan view drawing of the mitigation site.
- Water level elevation readings collected at the time of monitoring from a single staff gage installed within one of the restored marsh features. The location of the staff gage would be determined by the USACE in coordination with the Interagency Team during the final design phase of the mitigation project and would be specified in the Mitigation Monitoring Plan. The monitoring report would provide the staff gage data along with mean high and mean low water elevation data as gathered from a tidal elevation recording station in the general vicinity of the mitigation site. The report would further address estimated mean high and mean low water elevations at the mitigation site based on field indicators.
- Various qualitative observations would be made in the mitigation site to help assess the status and success of mitigation and maintenance activities. These observations would include: general estimate of the average percent cover by native plant species; general estimates of the average percent cover by

invasive and nuisance plant species; general observations concerning colonization of the mitigation site by volunteer native plant species; general condition of native vegetation; trends in the composition of the plant community; wildlife utilization as observed during monitoring (including fish species and other aquatic organisms); the condition of interspersion features (tidal channels, trenasses, depressions, etc.) constructed within the marsh features, noting any excessive scouring and/or siltation occurring within such features; the natural formation of interspersion features within restored marshes; observations regarding general surface water flow characteristics within marsh interspersion features; the general condition of “gaps”, “fish dips”, or similar features constructed in permanent dikes; if present, the general condition of any armoring installed on permanent dikes. General observations made during the course of monitoring would also address potential problem zones and other factors deemed pertinent to the success of the mitigation program.

- A summary assessment of all data and observations along with recommendations as to actions necessary to help meet mitigation and management/maintenance goals and mitigation success criteria.
- A brief description of anticipated maintenance/management work to be conducted during the period from the current monitoring report to the next monitoring report.

### **Additional Monitoring Reports**

All monitoring reports generated after the initial “time zero” report would provide the following information unless otherwise noted:

- All items listed for the “time zero” (baseline) monitoring report with the exception of: (a) the topographic/as-built survey, although additional topographic/as-built surveys are required for specific monitoring reports (see below); (b) the inventory of planted species; although such an inventory must be provided in any monitoring report generated for a year in which a restored intermediate or brackish marsh feature is re-planted to meet applicable success criteria, and such an inventory must be provided in any monitoring report generated for a year in which a restored fresh marsh feature is planted to meet applicable success criteria.
- Quantitative data concerning plants in the ground cover stratum. Data would be collected from permanent sampling quadrats established at approximately equal intervals along permanent monitoring transects established within each marsh feature. Each sampling quadrat would be approximately 2 meters by 2 meters in size, although the dimensions of each quadrat may be increased if necessary to provide better data in planted marsh features. The number of monitoring transects and number of sampling quadrats per transect

would vary depending on the mitigation site. This would be determined the USACE in coordination with the Interagency Team during the final design phase of the mitigation project and the resulting requirements, including quadrat dimensions, would be specified in the final Mitigation Monitoring Plan for the project. Data recorded from the sampling quadrats would include: average percent cover by native plant species; average percent cover by invasive plant species; average percent cover by nuisance plant species; composition of plant species and the wetland indicator status of each species. The average percent survival of planted species (i.e. number of living planted species as a percentage of total number of plants installed) would also be recorded in intermediate and brackish marsh features. However, data for percent survival of planted species would only be recorded until it is demonstrated that success criteria for plant survivorship has been achieved.

- A brief description of maintenance and/or management work performed since the previous monitoring report along with a discussion of any other significant occurrences.
- In addition to the above items, the monitoring report prepared for 1 year following completion of mitigation construction activities (estimated TY3) and the monitoring report prepared for 3 years following completion of mitigation construction activities (estimated TY5) would include a topographic survey of each marsh restoration feature. These surveys would cover the same components as described for the topographic survey conducted for the “time zero” monitoring report. In addition to the surveys themselves, each of the two monitoring reports involving topographic surveys would include an analysis of the data as regards attainment of applicable topographic success criteria. If the second survey indicates topographic success criteria have not been achieved and supplemental topographic alterations are necessary, then another topographic survey may be required following completion of the supplemental alterations. This determination would be made by USACE in coordination with the Interagency Team.

### **Monitoring Reports Following Re-Planting Activities in Intermediate or Brackish Marsh Features**

Re-planting of certain areas within restored intermediate and/or brackish marsh habitats may be necessary to ensure attainment of applicable native vegetation success criteria.

Any monitoring report submitted following completion of a re-planting event (for intermediate and brackish marshes) must include an inventory of the number of each species planted and the stock size used. It must also include a depiction of the areas re-planted or those planted, as applicable, cross-referenced to a listing of the species and number of each species planted in each area.

## **MITIGATION MONITORING SCHEDULE AND RESPONSIBILITIES**

Monitoring would typically take place in mid to late summer of the year of monitoring, but may be delayed until later in the growing season due to site conditions or other unforeseen circumstances. Monitoring reports would be submitted by December 31 of each year of monitoring. Monitoring reports would be provided to the USACE, the NFS, and the agencies comprising the Interagency Team. The various monitoring and reporting responsibilities addressed in this section are all subject to the provisions set forth in the Introduction section.

The USACE would be responsible for conducting the monitoring events and preparing the associated monitoring reports until such time that the following mitigation success criteria are achieved (criteria follow numbering system used in success criteria section):

1. General Construction – A and B.
2. Topography – A and B.
3. Native Vegetation – For intermediate marsh and brackish marsh features, criteria 3.A and 3.C
4. Invasive & Nuisance Vegetation – A, plus B until monitoring responsibilities are transferred to the NFS.

Monitoring events associated with the above would include the “time zero” (first or baseline) monitoring event (estimated in TY2, 2015) and a second monitoring event 1 year after the time zero monitoring event (estimated in TY3, 2016). The USACE would be responsible for conducting these monitoring activities and preparing the associated monitoring reports.

The NFS would be responsible for conducting the required monitoring events and preparing the associated monitoring reports after the USACE has demonstrated the mitigation success criteria listed above have been achieved. The overall responsibility for management, maintenance, and monitoring of the mitigation would typically be transferred to the NFS during the first quarter of the year immediately following submittal of the monitoring report that demonstrates attainment of said criteria. Once monitoring responsibilities have been transferred to the NFS, the next monitoring event should take place in 2019 (TY5) in order to demonstrate attainment of success criteria 2.C and either 3.D (for fresh marsh) or 3.E (for intermediate and brackish marsh). Thereafter, monitoring would be conducted every 5 years throughout the remaining 50-year period of analysis (based on 50-year period of analysis beginning in 2013 (TY0) and ending in 2063 (TY50)).

In certain cases it is possible that the marsh mitigation features may be established along with other mitigation features, like swamp or bottomland hardwood habitats, at the same mitigation site. This scenario could require some adjustments to the typical

monitoring schedule described previously in order to develop a reasonable and efficient monitoring schedule that covers all the mitigation features. Such adjustments, if necessary, would be made at the time final mitigation plans are generated. This schedule must be in general accordance with the guidance provided above and would be prepared by the USACE in coordination with the Interagency Team and the NFS.

If certain success criteria are not achieved, failure to attain these criteria would trigger the need for additional monitoring events not addressed in the preceding paragraphs. The USACE would be responsible for conducting such additional monitoring and preparing the associated monitoring reports. The following lists instances requiring additional monitoring that would be the responsibility of the USACE:

(A) For intermediate and brackish marsh features –

- If the initial survival criterion for planted species or the initial vegetative cover criterion are not achieved (i.e. the criteria specified in success criteria 3.C), a monitoring report would be required for each consecutive year until two sequential annual reports indicate that the applicable survival criterion or vegetative cover criteria have been satisfied (i.e. that corrective actions were successful). The USACE would also be responsible for the purchase and installation of supplemental plants needed to attain the success criteria.

(B) For all types of marsh features (intermediate, brackish) –

- If topographic success criteria 2.A or 2.B are not achieved, a monitoring report would be required for each consecutive year until two sequential annual reports indicate the applicable criteria have been satisfied. Since failure to meet topographic success criteria would mandate corrective actions such as addition of fill, removal of fill, or other actions to change grades within the subject marsh feature, the USACE would also be responsible for performing the necessary corrective actions.

There could also be cases where failure to attain certain success criteria would trigger the need for additional monitoring events for which the NFS would be responsible:

(A) For intermediate and brackish marsh features –

- If the vegetative cover criterion specified for 3 years after the initial planting of marsh features is not achieved (i.e. success criterion 3.E), a monitoring report would be required for each consecutive year until two sequential annual reports indicate that the vegetative cover criterion has been satisfied. The Sponsor would also be responsible for the purchase and installation of supplemental plants needed to attain the success criterion.

(C) For all types of marsh features (intermediate, brackish) –

- If the topographic success criterion 2.C is not achieved, a monitoring report would be required for each consecutive year until two sequential annual reports indicate success criteria have been satisfied. Since failure to meet this topographic success criteria would mandate corrective actions such as addition

of fill, removal of fill, or other actions to change grades within the subject marsh feature, the Sponsor would also be responsible for performing the necessary corrective actions.

- Native vegetation success criterion 3.D is applicable to the period extending from 5 years through 20 years following completion of mitigation construction activities and is applicable to all marsh features. If this criterion is not satisfied at the time of monitoring, the NFS would be responsible for implementing corrective actions. Such actions could include installing additional plants in the subject marsh (probable course of action), adding sediment to the subject marsh in problem zones (marsh nourishment), or a combination of these activities. Under this scenario, a monitoring report would be required for each consecutive year following completion of the corrective actions until two sequential annual reports indicate that the vegetative cover criterion has been attained. The NFS would be responsible for conducting these additional monitoring events and preparing the associated monitoring reports.

Once monitoring responsibilities have been transferred to the NFS, the NFS would retain the ability to modify the monitoring plan and the monitoring schedule should this become necessary due to unforeseen events or to improve the information provided through monitoring. Twenty years following completion of mitigation construction activities, the number of monitoring transects and/or quadrats that must be sampled during monitoring events may be reduced substantially if it is clear that mitigation success is proceeding as anticipated. Any significant modifications to the monitoring plan or the monitoring schedule must first be approved by the USACE in coordination with the Interagency Team.

**MITIGATION MONITORING COSTS**

The total estimated cost of monitoring each proposed project is approximately \$399,870. The estimated costs are provided in table 3.

Table 3. Estimates Mitigation Monitoring Costs

Target Year	Calendar Year	Work Item	Work Item Description	Cost
1	2016	Initial Construction	Mob and Demob, Dredge, Dike & Weir Construction (May-Aug)	0.00
2	2017	Topographic Survey	Perform as-built topographic survey of restored marsh areas. Results documented in mitigation monitoring report.	40,000.00
		Monitoring	Perform field mitigation monitoring (Aug-Sept).	13,828.00
		Idle	Sep	0.00
		Monitoring Report	Submit report Oct-Dec.	20,742.00
		Idle	(Oct-Feb)	0.00
3	2018	Initial Plantings	(Mar-Apr) Initial (first) planting of restored marsh features. Install herbaceous species	0.00
		Idle	(May-Aug)	0.00
		Topographic Survey	Perform as-built topographic survey of restored marsh areas. Results documented in mitigation monitoring report.	40,000.00
		Monitoring	Perform field mitigation monitoring (Sep).	6,562.50
		Monitoring	Perform field mitigation monitoring (Oct).	6,562.50

		Monitoring Report	Submit report Nov-Dec.	13,125.00
		Analysis for Notice of Construction Complete	Review monitoring report from prior year and other data to make determination to turn over project to Non-Federal Sponsor. (Jan.)	2,800.00
		<b>Transfer to NFS</b>	Transfer (turn-over) project to Non-Federal Sponsor (Feb thru April). Note: transfer occurs early this year unless topographic corrections and/or marsh planting required in TY5.	0.00
		<b>Begin OMRR&amp;R</b>	(May)	
<b>5</b>	<b>2020</b>	Topographic Survey	Perform as-built topographic survey of restored marsh areas. Results documented in mitigation monitoring report.	50,000.00
		Monitoring	Perform field mitigation monitoring (Aug-Sept).	10,500.00
		Monitoring Report	Submit report Oct-Dec. Includes aerial photography.	15,750.00
<b>7</b>	<b>2022</b>	Monitoring	Perform field mitigation monitoring (Aug-Sept).	7,200.00
		Monitoring Report	Submit report Oct-Dec.	10,800.00
<b>10</b>	<b>2025</b>	Monitoring	Perform field mitigation monitoring (Aug-Sept).	7,200.00
		Monitoring Report	Submit report Oct-Dec.	10,800.00
<b>15</b>	<b>2030</b>	Monitoring	Perform field mitigation monitoring (Aug-Sept).	7,200.00
		Monitoring Report	Submit report Oct-Dec.	10,800.00
<b>20</b>	<b>2035</b>	Monitoring	Perform field mitigation monitoring (Aug-Sept).	7,200.00
		Monitoring Report	Submit report Oct-Dec.	10,800.00
<b>25</b>	<b>2040</b>	Monitoring	Perform field mitigation monitoring (Aug-Sept).	7,200.00
		Monitoring Report	Submit report Oct-Dec.	10,800.00
<b>30</b>	<b>2045</b>	Monitoring	Perform field mitigation monitoring (Aug-Sept).	7,200.00
		Monitoring Report	Submit report Oct-Dec.	10,800.00
<b>35</b>	<b>2050</b>	Monitoring	Perform field mitigation monitoring (Aug-Sept).	7,200.00
		Monitoring Report	Submit report Oct-Dec.	10,800.00
<b>40</b>	<b>2055</b>	Monitoring	Perform field mitigation monitoring (Aug-Sept).	7,200.00
		Monitoring Report	Submit report Oct-Dec.	10,800.00
<b>45</b>	<b>2060</b>	Monitoring	Perform field mitigation monitoring (Aug-Sept).	7,200.00
		Monitoring Report	Submit report Oct-Dec.	10,800.00
<b>50</b>	<b>2065</b>	Monitoring	Perform field mitigation monitoring (Aug-Sept).	7,200.00
		Monitoring Report	Submit report Oct-Dec.	10,800.00
		<b>End OMRR&amp;R</b>	(Dec)	
			<b>Total Project Cost</b>	<b>\$399,870.00</b>

## DEFINITION OF TERMS

### ***Growing Season***

As used herein, the growing season is considered to be the period from April through October of any given year, although some deviation from this typical range is allowed.

### ***Interagency Team***

The “Interagency Team” consists of representatives from the following resource agencies; US Fish and Wildlife Service, National Marine Fisheries Service, US Environmental Protection Agency, Louisiana Department of Wildlife and Fisheries, State of Louisiana Office of Coastal Protection and Restoration, Louisiana Department of Natural Resources.

### ***Interspersion Features***

This term refers to shallow open water features situated within marsh habitats. Examples include tidal channels, creeks, trenasses, and relatively small, isolated ponds. Emergent vegetation is typically absent in such features although they may contain submerged aquatic vegetation. They provide areas of foraging and nursery habitat for fish and shellfish along with associated predators, and provide loafing areas for waterfowl and other waterbirds. The marsh/open water interface forms an ecotone where post-larval and juvenile organisms can find cover and where prey species frequently concentrate.

### ***Invasive Plant Species***

All plant species identified as invasive or as non-indigenous (exotic) in the following two sources:

Louisiana Aquatic Invasive Species Task Force. 2005. State Management Plan for Aquatic Invasive Species in Louisiana, Appendix B. Invasive Species in Louisiana (plants). Center for Bioenvironmental Research, Tulane & Xavier Universities, New Orleans, LA. (Website - [http://is.cbr.tulane.edu/docs\\_IS/LAISMP7.pdf](http://is.cbr.tulane.edu/docs_IS/LAISMP7.pdf))

Barataria-Terrebonne National Estuary Program (BTNEP). 2012. Exotic Invasive Species of the Barataria-Terrebonne, Invasive Species in Louisiana. BTNEP, Thibodaux, LA. (Website - <http://invasive.btnep.org/invasivesvsnatives/invasivesinla2list.aspx>)

In addition, invasive plant species include; Japanese climbing fern (*Lygodium japonicum*), tall fescue (*Festuca arundinacea*), chinaberry (*Miscanthus sinensis*), Brazilian vervain (*Verbena litoralis* var. *brevibracteata*), coral ardisia (*Ardisia crenata*), Japanese ardisia (*Ardisia japonica*), cogon grass (*Imperata cylindrical*), golden bamboo (*Phyllostachys aurea*), and rescuegrass (*Bromus catharticus*).

### ***Native Plant Species***

This category includes all plant species that are not classified as invasive plant species and are not considered to be nuisance plant species.

### ***Non-Federal Sponsor (NFS)***

This term refers to the Non-Federal Sponsor for the mitigation projects. In this case, the NFS is the Louisiana Coastal Protection & Restoration Authority Board (CPRAB).

### ***Nuisance Plant Species***

Nuisance plant species would include native species deemed detrimental due to their potential adverse competition with desirable native species. Nuisance plant species identified for the mitigation project include; dog-fennel (*Eupatorium* spp.), ragweed (*Ambrosia* spp.), cattail (*Typha* spp.), grapevine (*Vitis* spp.), wild balsam apple (*Momordica charantia*), climbing hempvine (*Mikania scandens*, *M. micrantha*), pepper

vine (*Ampelopsis arborea*), common reed (*Phragmites australis*), catbrier (*Smilax* spp.), blackberry (*Rubus* spp.), black willow (*Salix nigra*), and box elder (*Acer negundo*). Following completion of the initial mitigation activities (e.g. placement of fill, initial plantings), the preceding list may be expanded to include other nuisance plant species. Any such addition to the list would be based on the results of the standard monitoring reports. The determination of whether a particular new plant species should be considered as a nuisance species and therefore eradicated or controlled would be determined by the USACE in coordination with the NFS and Interagency Team.

### ***Planting Season***

This is generally considered to be the period from approximately December 15 through March 15, although some deviation from this typical range is allowed.

### ***Target Year***

This document often refers to a “Target Year.” Target Years are the years in which construction or monitoring activities are expected to occur, based on Target Year 1 as the year in which the initial mitigation construction activities are anticipated to be completed, which is presently estimated to occur in calendar year 2016. Target Year 2 (2017) is the year in which the final construction contract is expected to be completed. Target years increase from this time forward in concert with the corresponding calendar year.

### ***USACE Hydrophytic Vegetation Criteria***

Reference to satisfaction of USACE hydrophytic vegetation criteria (i.e. plant community is dominated by hydrophytic vegetation) shall mean that sampling of the plant community demonstrates that one or more of the hydrophytic vegetation indicators set forth in the following reference is achieved:

USACE. 2010. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region (Version 2.0); ERDC/EL TR-10-20. USACE Engineer Research and Development Center, Vicksburg, MS.

### ***Wetland Indicator Status of Plant Species***

The wetland indicator status of plants is a means of classifying the estimated probability of a species occurring in wetlands versus non-wetlands. Indicator categories include; obligate wetland (OBL), facultative wetland (FACW), facultative (FAC), facultative upland (FACU), and obligate upland (UPL). The wetland indicator status of a particular plant species shall be as it is set forth in the following reference (the “2012 National Wetland Plant List”), using the Region 2 listing contained therein. If the USACE approves and adopts a new list in the future, the new list would apply.

Lichvar, Robert W. and J.T. Kartesz. 2009. North American Digital Flora: National Wetland Plant List, version 2.4.0 ([https://wetland\\_plants.usace.army.mil](https://wetland_plants.usace.army.mil)). USACE, Engineer Research and Development Center, Cold Regions Research and Engineering Laboratory, Hanover, NH and BONAP, Chapel Hill, NC.

## APPENDIX D

### ADAPTIVE MANAGEMENT PLAN

#### SUPPLEMENTAL INDIVIDUAL ENVIRONMENTAL REPORT 36 BAYOU SAUVAGE, TURTLE BAYOU & NEW ZYDECO RIDGE RESTORATION PROJECTS

##### 1.0. Introduction

This Adaptive Management (AM) Plan is for the Bayou Sauvage, Turtle Bayou and New Zydeco Ridge mitigation projects. The projects are designed to mitigate for impacts to refuge brackish and intermediate marsh and BLH-WET resulting from construction of the Lake Pontchartrain and Vicinity (LBV) component of the Hurricane and Storm Damage Risk Reduction System (HSDRRS). The Water Resources Development Act (WRDA) of 2007, Section 2036(a) and U.S Army Corps of Engineers (USACE) implementation guidance for Section 2036(a) (CECW-PC Memorandum dated August 31, 2009: *“Implementation Guidance for Section 2036 (a) of the Water Resources Development Act of 2007 (WRDA 2007) – Mitigation for Fish and Wildlife and Wetland Losses”*) requires adaptive management and monitoring plans be included in all mitigation plans for fish and wildlife habitat and wetland losses.

##### 2.0. Adaptive Management Planning

Initial adaptive management planning was conducted during the planning process for the Programmatic Individual Environmental Report (PIER) 36 and was reviewed and revised for the Bayou Sauvage (BSFBM), Turtle Bayou (TBPIM) and New Zydeco Ridge (NZR) Supplemental Individual Environmental Report (SIER). Adaptive management planning elements included: 1) development of a Conceptual Ecological Model (CEM), 2) identification of key project uncertainties and associated risks, 3) evaluation of the mitigation projects as a candidate for adaptive management and 4) the identification of potential adaptive management actions (contingency plan) to better ensure the mitigation project meets identified success criteria. The adaptive management Plan is a living document and would be refined as necessary.

The BSFBM, TBPIM, and NZR mitigation project are designed to compensate for unavoidable impacts resulting from construction of the LPV HSDRRS on brackish and intermediate marsh and bottomland hardwoods wet (BLH) habitat located on the flood side and protected side of the levees and floodwalls, on National Wildlife Refuge lands. Descriptions of the project areas and proposed mitigation plans can be found in the SIER.

## 2.1. Conceptual Ecological Model

A CEM was developed to identify the major stressors and drivers affecting the proposed mitigation projects (see table 1). The CEM does not attempt to explain all possible relationships of potential factors influencing the mitigation sites; rather, the CEM presents only those relationships and factors deemed most relevant to obtaining the required acres/average annual habitat units (AAHU). Furthermore, this CEM represents the current understanding of these factors and would be updated and modified, as necessary, as new information becomes available. Stressors and Drivers identified in the CEM were identified during the PIER Alternative Evaluation Process (AEP) process to evaluate relative risks associated with each alternative mitigation project.

**Table 1. Conceptual Ecological Model**

Alternative Project /Issues/Drivers	Flood Side Brackish Marsh	Protected Side Intermediate Marsh	BLH Wet
Subsidence	-	-	-
Sea Level Rise	-	-	-
Runoff	-	-	-
Storm Induced	+/-	+/-	+/-
Salinity Impacts	+/-	+/-	+/-
Wave Action	-	-	-
Storm Surge	-	-	-
Vegetative Invasive Species	-	-	-
Herbivory	-	-	-
Hydrology (water table; wet/dry days; soil inundation)	+/-	+/-	+/-
Topography (elevation)	+/-	+/-	+/-

Key to Cell Codes: - = Negative Impact/Decrease  
 + = Positive Impact/Increase  
 +/- = Duration Dependent

## 2.2. Sources of Uncertainty and Associated Risks

A fundamental tenet underlying adaptive management is decision making and achieving desired project outcomes in the face of uncertainties. There are many uncertainties associated with restoration of the coastal systems. The project delivery team (PDT) identified the following uncertainties during the planning process.

- Climate change, such as relative sea level rise, drought conditions, and variability of tropical storm frequency, intensity, and timing
- Subsidence and water level trends
- Uncertainty relative to achieving ecological success
- Long-term sustainability of project benefits

- Adaptability

### **2.3. Adaptive Management Evaluation**

As part of PIER 36, the project site was evaluated and planned through the AEP to develop a project with minimal risk and uncertainty. The items listed below were incorporated into the mitigation project implementation plan and Operation, Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R) plans to minimize project risks.

- Detailed planting guidelines for intermediate and brackish marsh and BLH
- General monitoring guidelines for project success
- Specified success criteria (i.e., mitigation targets)
- Invasive species control
- Supplementary plantings as necessary (contingency)
- Corrective actions to meet topographic success as required (contingency)

Subsequently, as part of the adaptive management planning effort, the project features were re-evaluated against the CEM and sources of uncertainty and risk were identified to determine if there was any need for additional adaptive management actions.

Based on the uncertainties and risks associated with the project implementation the following contingency/adaptive management actions have been identified to be implemented if needed to ensure the required AAHU are met:

Potential Action #1. Additional vegetative plantings as needed to meet identified success criteria.

Potential Action #2. Marsh renourishment by adding sediment to obtain elevations necessary for marsh establishment and maintenance.

Potential Action #3. Repair or modification of the shoreline restoration feature as necessary to reduce Lake Pontchartrain wave and salinity influences on the marsh restoration features.

Potential Action #4. Potential need to adjust the gapping in the permanent dikes in the future to maintain sufficient marsh hydrology and connectivity.

Actions 1-3 are not recommended as separate adaptive management actions since they are already built into the mitigation plan and success criteria identified in Appendix C. In the event that monitoring reveals the project does not meet the identified vegetation or topographic success criteria, additional plantings or construction activities would be conducted under the mitigation project. Specific measures to implement Action 2, if determined necessary to achieve project benefits, would be coordinated with the NFS and other agencies to determine the appropriate course of action. If it is determined that the project benefits are significantly compromised because of improper elevation, additional fill material may need to be pumped into the project areas. The USACE would be responsible for performing any necessary corrective actions, but the overall cost would be shared with the NFS according to the project cost-share agreement. Action 4 has not been addressed in the implementation or OMRR&R plan and should be considered as a separate potential adaptive management action in the future.

The USACE would be responsible for the proposed mitigation construction and monitoring until the initial success criteria are met. Initial construction and monitoring would be funded in accordance with all applicable cost-share agreements with the NFS. The USACE would monitor (on a cost-shared basis) the completed mitigation to determine whether additional construction, invasive/nuisance plant species control, and/or plantings are necessary to achieve initial mitigation success criteria. Once the USACE determines that the mitigation has met the initial success criteria, monitoring would be performed by the NFS as part of its OMRR&R obligations. If after meeting initial success criteria, the mitigation fails to meet its intermediate and/or long-term ecological success criteria, the USACE would consult with other agencies and the NFS to determine the appropriate management or remedial actions required to achieve ecological success. The USACE would retain the final decision on whether or not the project's required mitigation benefits are being achieved and whether or not remedial actions are required. If structural changes are deemed necessary to achieve ecological success, the USACE would implement appropriate adaptive management measures in accordance with the contingency plan and subject to cost-sharing requirements, availability of funding, and current budgetary and other guidance.

### **3.0. Monitoring for Project Success**

A monitoring plan consistent with WRDA 2007 Section 2036(a) specific to the mitigation project has been developed (see Appendix C). The monitoring plan identifies success criteria and targets, a schedule for the monitoring events, and the specific content for the monitoring reports that measure progress towards meeting the success criteria.