

APPENDIX B

Wetland Value Assessment
Project Information Sheets

marsh was lost (Coast 2050 Report- Appendix C 1999). The project area is impacted by natural subsidence and wave erosion of the shoreline marshes.

Project Goal:

This Bayou Sauvage FS Mitigation project (BSFS-4 and BSFS-5) is being implemented to mitigate 96.13 AAHUs of general impacts and 9.21 AAHUs of refuge impacts totaling 105.34 AAHUs. The most northern currently proposed marsh total footprint (BSFS-4) is 59 acres and is located immediately east of Louisiana Highway 11, fronting the community of Irish Bayou in Orleans Parish, Louisiana. Completion of this project will result in marsh creation that will provide some protection to the U.S. Highway 90, U.S. Interstate 10, and the Irish Bayou Community. Survey data obtained indicates fairly uniform bottom elevations ranging from approximately -2.0 to -2.5’ NAVD88. Two site specific soil borings reveal an approximate 4 foot organic peat layer underlain by very soft clays. Significant settlement of the dredge filled platform is anticipated.

Project Description: See Appendix A.

- 59 acres – Total project area
- 53 acres – Within retention dike
- 13 acres – Internal borrow channels*
- 58 acres – Benefit area after dikes degraded, of this
 - 52.2 acres – Emergent Marsh (2 acres of dike along shoreline remains in place)
 - 5.8 acres – Open Water (borrow canals)
 - 1.0 acres – Open Water associated with dike construction

*5.8 acres – Remaining open water from interior borrow channels – per communication with Keith O’Cain , Corps Eng, 50-60% would be backfilled to target elevations (55% of 13 ac= 7.2 ac, 13 - 7.2 = 5.8 ac)

Table 1: WVA Target Years for Construction and O&M activities

TY	Start	Finish	Notes
0		Aug-16	FWOP conditions end when construction begins
Construction (0)	Aug- 16	Nov- 2017	assume benefits begin once 2 nd demob starts, restoration platform is in place at the target elevations estimated for at that year.
1	Nov-17	Nov-18	(2017)
2	Nov-18		
	Jan-19	Feb-19	degrade/gap dikes, remove plugs
	Mar- 19	Jun- 19	Marsh plantings
		Nov-19	

Habitat Assessment Method

The WVA operates under the assumption that optimal conditions for general fish and wildlife

habitat within a given coastal wetland type can be characterized, and that existing or predicted conditions can be compared to that optimum to provide an index of habitat quality. Habitat quality is estimated or expressed through the use of a mathematical model developed specifically for each wetland type. Each model consists of 1) a list of variables that are considered important in characterizing fish and wildlife habitat, 2) a Suitability Index graph for each variable, which defines the assumed relationship between habitat quality (Suitability Index) and different variable values, and 3) a mathematical formula that combines Suitability Index for each variable into a single value for wetland habitat quality; that single value is referred to as the Habitat Suitability Index, or HSI.

The WVA model for marsh habitat attempts to assess the suitability of each habitat type for providing resting, foraging, breeding, and nursery habitat to a diverse assemblage of fish and wildlife species. While the model does not specifically assess other wetland functions and values such as storm-surge protection, floodwater storage, water quality improvement, nutrient import/export, and aesthetics, it can be generally assumed that these functions and values are positively correlated with fish and wildlife habitat quality.

The procedure for evaluating project benefits on fish and wildlife habitats, the WVA model, uses a series of variables that are intended to capture the most important conditions and functional values of a particular habitat. Values for these variables are derived for existing conditions and are estimated for conditions projected into the future if no restoration efforts are applied (i.e., future-without-project), and for conditions projected into the future if the proposed restoration project is implemented (i.e., future-with-project), providing an index of quality or habitat suitability of the habitat for the given time period. The habitat suitability index (HSI) is combined with the acres of habitat to get a number that is referred to as “habitat units”. Expected project benefits are estimated as the difference in habitat units between the future-with-project (FWP) and future-without project (FWOP). To allow comparison of WVA benefits to costs for overall project evaluation, total benefits are averaged over a 50-year period, with the result reported as Average Annual Habitat Units (AAHUs).

Variable V₁ – Percent of wetland area covered by emergent vegetation

Existing – The project area is open water. Surrounding marsh has been classified as brackish marsh consistently from 1949 to 2007 (O’Neil 1949, Chabreck and Linscombe 1997, Sasser et al. 2007).

The two major soil types in the project area are classified by Trahan (1987) as Lafitte muck and Clovelly muck. Both soil types are very poorly drained, very fluid organic soils typical of brackish marsh. They are generally flooded and ponded most of the time and have a high subsidence potential.

Land Loss Data

To calculate loss rates USGS evaluated a 5,079 acre extended boundary (Figure 3) to obtain land/water data through the 1985-2010 timeframe. The Service calculated land loss rate using the same USGS Land/Water data (1985-2010), using a linear regression (Land Acres: Time). The FWS percent loss rate was determined as a percent of the 1985 land area and also included

all data points provided by USGS. That rate was used to calculate land/water values over the life of the project.

Figure 2. USGS Extended Boundary for Bayou Sauvage (09)

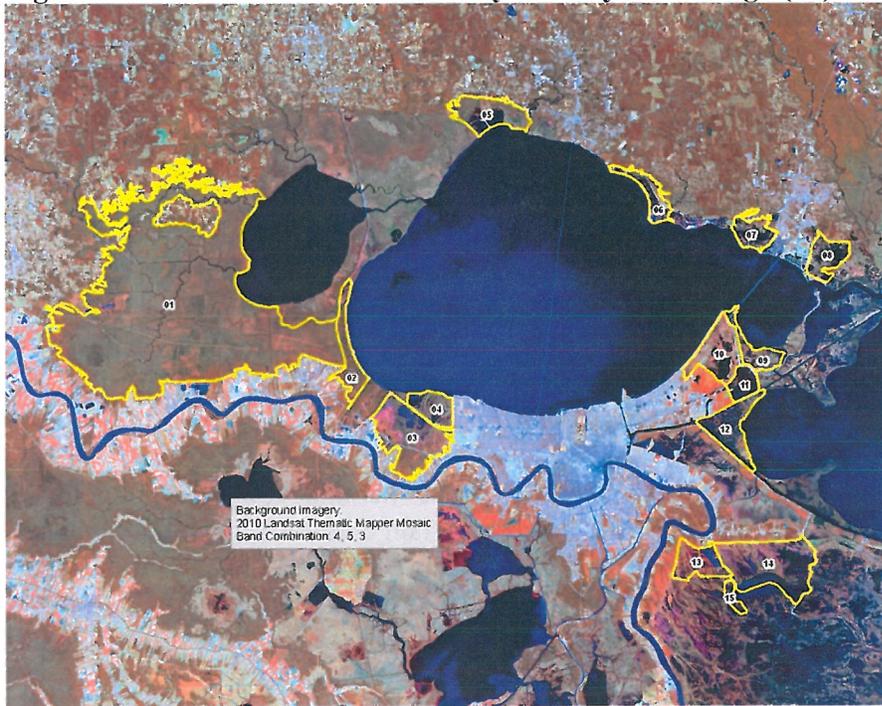
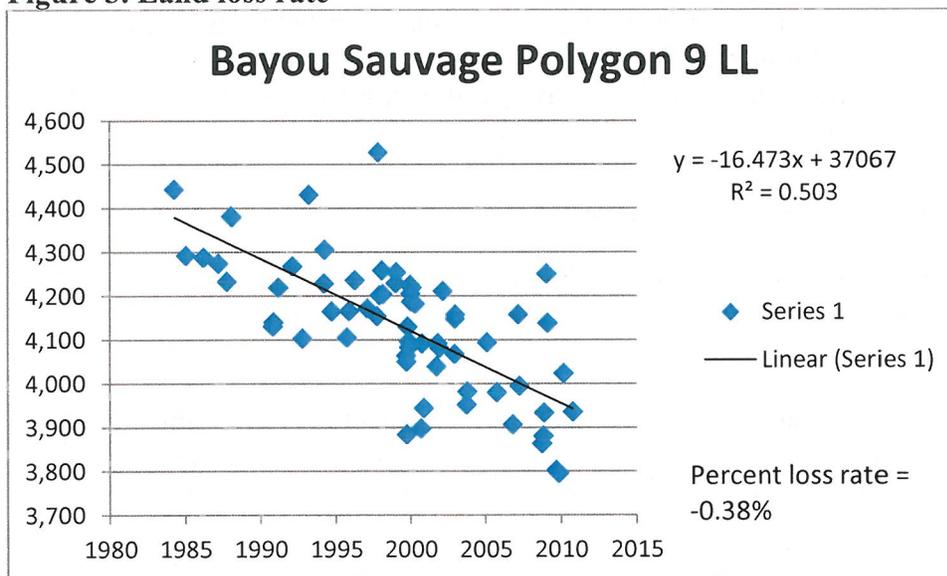


Figure 3. Land loss rate



FWOP

TY0-50

Marsh: 0 acres (0%)

Water: 59 acres (100%)

FWP

For use in the WVA models, projected Relative Sea Level Rise (RSLR) estimates were developed according to EC 1165-2-211, using a nearby reference gage (Rigolets gauge) in the Lake Pontchartrain and Vicinity mitigation watershed. The reference gage was used to develop low, intermediate and high RSLR estimates. Based on MVD planning guidance, the Intermediate RSLR scenario was used for the purpose of WVA modeling for alternative comparison and for design. Analysis of USGS landloss data indicates that land change is still occurring under the low SLR scenario. Therefore, the FWS applied the intermediate RSLR scenario starting from the last year of USGS landloss data, 2010.

Created marsh platform has limited marsh function until settlement, breaching of retention dikes, and vegetation occurs. Land loss is applied at the time of marsh creation. A settlement period of 5 years was also applied based on the Corps settlement analysis that indicates 66% of settlement occurs in the first 5 years, and marsh elevations has settled to an elevation that is flooded 1% of the time. Once functional elevations are achieved, the loss rate of the created marsh is assumed to be 50% of the background loss rate until 10 inches of sediment is assumed to have accreted on the marsh. At that time background loss rate is resumed. This assumption will delay when the loss rate changes back to 100% (YR, Settlement curves). Percent loss rate is of the entire project area acreage.

Research by Nyman et al. (1993) suggests that coastal marshes may undergo rapid degradation and conversion to open water beyond a critical rate of submergence/inundation. Louisiana Coastal Protection and Restoration Authority (CPRA) personnel working to model marsh loss for the 2012 Louisiana Coastal Master Plan have used statewide Coastal Reference Monitoring System data to develop plant productivity vs inundation (i.e., accretion deficit) relationships. From those relationships, they identified inundation ranges at the primary production low-end points to predicting onset of abrupt marsh collapse (Coastal Protection and Restoration Authority of Louisiana 2012). In this study, the median value for intermediate marsh (34.4 cm) was considered to predict onset of abrupt marsh collapse; however, marsh collapse does not occur under the intermediate RSLR scenario.

FWP (reduced by 50%) BSFS-4 Project Area Marsh Creation Acre per year lost rate = - 0.10 acres /year. (Rate reverts back to FWOP rate when water level rise equals 10 inches (-0.20 ac/year).

Reduced Functional Marsh Credit Assumption applied:

TY1 - 0% credit

TY2 - 10% dikes degraded, 55% of borrow areas filled

TY3 - 25%

TY4 - 62.5% (Note: this is a linear assumption, therefore TY4 is not needed in the spreadsheet)

TY5 - 100% credit of remaining marsh platform

Containment dikes are degraded at TY2, and therefore, associated marsh benefits are not

assumed until TY2. However, we are already applying a reduced credit assumption, and that captures the delay in dike acre benefit.

Containment dikes will be constructed to an elevation of 4.5 to 5.0 ft. The Corps proposed to allow the eastern CD to remain in place as an enhanced shoreline for additional protection. To account for the enhanced shoreline being above emergent marsh elevations, that acreage is removed from the benefits until TY 6 (assuming that the reduced functional marsh credit already accounts for those acres). According to CRMS 3784 water level data (2008-2014), the elevation at which the marsh would be flooded at least 1% of the time is 2.24 feet NAVD88 (FWS (NOLB WVA) 2014).

Table 2. FWP Marsh Acres

FWP		marsh			
		marsh (ac)	%	OW (ac)	OW (%)
2016	TY0	0.0	0%	59.0	100%
2017	TY1	0.0	0%	6.9	12%
2018	TY2	5.2	9%	7.0	12%
2019	TY3	13.0	22%	7.1	12%
2021	TY5	*49.7	*84%	7.3	12%
2022	TY6	51.5	87%	7.5	13%
2050	TY34	46.5	79%	12.5	21%
2066	TY50	41.0	70%	18.0	30%

* represents acres of benefits minus the 2 acres of enhanced shoreline

Variable V₂ - Percent of open water covered by aquatic vegetation

Existing Conditions –The project area is primarily shallow open water with SAV abundant in all sites. Optical area estimation and transect visual sampling for presence or absence was conducted on April 6, 2011 by USFWS, NOAA, and Corps personnel. It was estimated that 83% of the open water area had SAV cover dominated by *Myriophyllum spicatum* (Eurasian watermilfoil).

FWOP – While collecting water depths during an April 6, 2011, field trip, presence and absence of SAVs were determined at each water depth location along each transect. The entire site was then averaged to determine the total percent coverage of SAVs. It was determined that the project area contained approximately 83% SAV.

Existing conditions are expected to continue, with a decline in abundance as RSLR causes water depths to increase thus attenuating light penetration through the water column and reducing growth. Also, as the surrounding marsh decreases, the project area will eventually open to Lake Pontchartrain. Even without those breaches, the size of the open water area will increase, which will increase the fetch and wave energy. Increased wave energy may lead to increased turbidity and will also affect the amount of light available for optimal SAV growth.

TY 0	83%
TY 34	62% (75% of baseline; losses due to factors described above)
TY 50	12% (15% of baseline; assume 85% loss from baseline – standard assumptions)

FWP – When the marsh land platform is constructed, all existing SAV will be buried. Until the created marsh platform settles to marsh elevation and the retention dikes are breached.

TY 0	83%
TY 1-3	0%
TY 5	83% (100% of baseline)
TY 6	91% (increase baseline by 10%)
TY34	91% (increase baseline by 10%)
TY 50	21% (25% of baseline; 75% loss from baseline – standard assumptions)

Variable V₃ – Marsh edge and interspersion

Existing Conditions –The project area is open water; therefore the project area is assigned a Class 5 value for TY 50.

FWOP –
 TY 0 – 50: 100% Class 5

FWP –
 TY 0 100 % Class 5
 TY 1 100% Class 5
 TY 2-3 100% Class 3 (“carpet marsh”)
 TY 5 50% Class 3/ 50% Class 1
 TY 6 100% Class 1
 TY34 100% Class 2 (79% marsh)
 TY 50 100% Class 2 (70% marsh)

Variable V₄ – Percent of open water area <=1.5 feet deep in relation to marsh surface

Existing -

Water depths were measured with a survey rod in the project area on 6 April 2011. The average water depth for the area was calculated using the nearby CRMS3626 gage data and data from the Rigolets at Lake Pontchartrain gage. Using the gage data, the collected data was corrected for the effect of the tides and wind on the day the measurements were recorded. The Corps’ RSLR estimates predict a sea-level rise of approximately 1.0 feet for the year 2063 under the Intermediate RSLR scenario (Appendix). It was assumed that RSLR will reduce the existing shallow open water for FWOP and FWP at TY50 by 1/3 and 1/6 respectively.

FWOP

TY2 – TY50

1.0

Literature Cited

- Fish and Wildlife Service. 2014. Draft - New Orleans Landbridge Shoreline Stabilization and Marsh Creation Wetland Value Assessment. PPL 24. Coastal Wetlands Planning, Protection and Restoration Act Program. September 2014.
- Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority. 1999. Coast 2050: Toward a Sustainable Coastal Louisiana, The Appendices. Appendix C – Region 1 Supplemental Information. Louisiana Department of Natural Resources. Baton Rouge, La.
- Trahan, Larry. 1987. Soil Conservation Service Soil Survey of Orleans Parish, Louisiana. United States Department of Agriculture, Soil Survey Service. January 1987.

2. Project Description, Pages 4-6, *edited for BSFS-4*

The Bayou Sauvage Brackish Marsh restoration project is located in the far south-eastern lobe of Lake Pontchartrain, east of Interstate 10. The project plan consists of two (2) areas of open water/broken marsh, which would be filled and/or restored to provide a healthy marsh platform. The two (2) areas are BSFS-4 which is approximately 53 acres as measured within the proposed retention dike centerline, and BSFS-5 which is 266 acres as measured within the proposed retention dike centerline. BSFS-4 and BSFS-5 are on the unprotected side of the HSDRRS. 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 BSFS-4 area is the northernmost proposed marsh footprint 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' NAVD88 (2006.81).

Settlement and consolidation analysis was performed for a two (2) lift construction scenario. Based on settlement analysis, a six (6) month settlement period will be required between the two lifts. The required fill elevation of dredge fill for BSFS-4 is to elevation +3.5' NAVD88 (2006.81) for both fill operations, ultimately to hit a target marsh elevation to +1.0' NAVD88 (2006.81).

It should be noted that the ultimate target elevation shown on the settlement curves does not achieve the proposed +1.0 target. However, the settlement curve does not take into account settlement occurring during the construction fill period. This period, though estimated at less than one (1) month duration will certainly result in foundation settlement, based on the character of the insitu material and the steep slope of anticipated settlement curve. It is estimated that during this construction period and unaccounted for 0.25 feet of fill material will be placed within the project footprint. Normally, this anticipated fill quantity would be adjusted for by adjusting the construction fill target height by that amount (i.e. adjusting the initial fill height to +3.25), and maintaining a quantity calculation for the +3.5 target. In this case however, the fill height will be held at +3.5 and the additional fill will theoretically overbuild the marsh platform. It is not anticipated that any settlement during construction concerns will be realized during the very short second construction period that needs to be accounted for in this settlement estimation. As a result, it is anticipated that the ultimate marsh platform elevation will reside between an approximate elevation range of +1.25' to +0.85 feet NAVD88.

Due to poor soil conditions, 20 foot stability berms are required both BSFS-4 and BSFS-5 retention dikes. All slopes of the dikes will have 1-foot vertical on 4-foot horizontal side slopes. Retention dikes would be constructed, using marsh buggies for access and using borrow material obtained from within the marsh creation areas. It is envisioned that any material required to maintain the dikes could come from the berm section once filling of the cell is underway. At that time the constructed dikes would have gained some strength and loading from the fill material will assist in dike stability.

The eastern retention dike of BSFS4 paralleling the lake shoreline, is proposed to remain in place post marsh construction if desired by the environmental community, 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 totally degraded a year after the final lift, upon settlement and dewatering of the created marsh platform. The degraded material would be used to partially backfill remaining borrow ditched on the interior of the dike alignment. The marsh footprint would be planted as necessary upon satisfactory settlement and dewatering of the marsh platform to assure adequate variety and coverage of vegetative material. Plugs of appropriate marsh vegetation would be planted over 100 percent of the marsh restoration acreage on seven (7) foot centers.

FINAL
Wetland Value Assessment Project Information Sheet

June 24, 2015

Prepared for:
U.S. Army Corps of Engineers

Prepared by
U.S. Fish and Wildlife Service

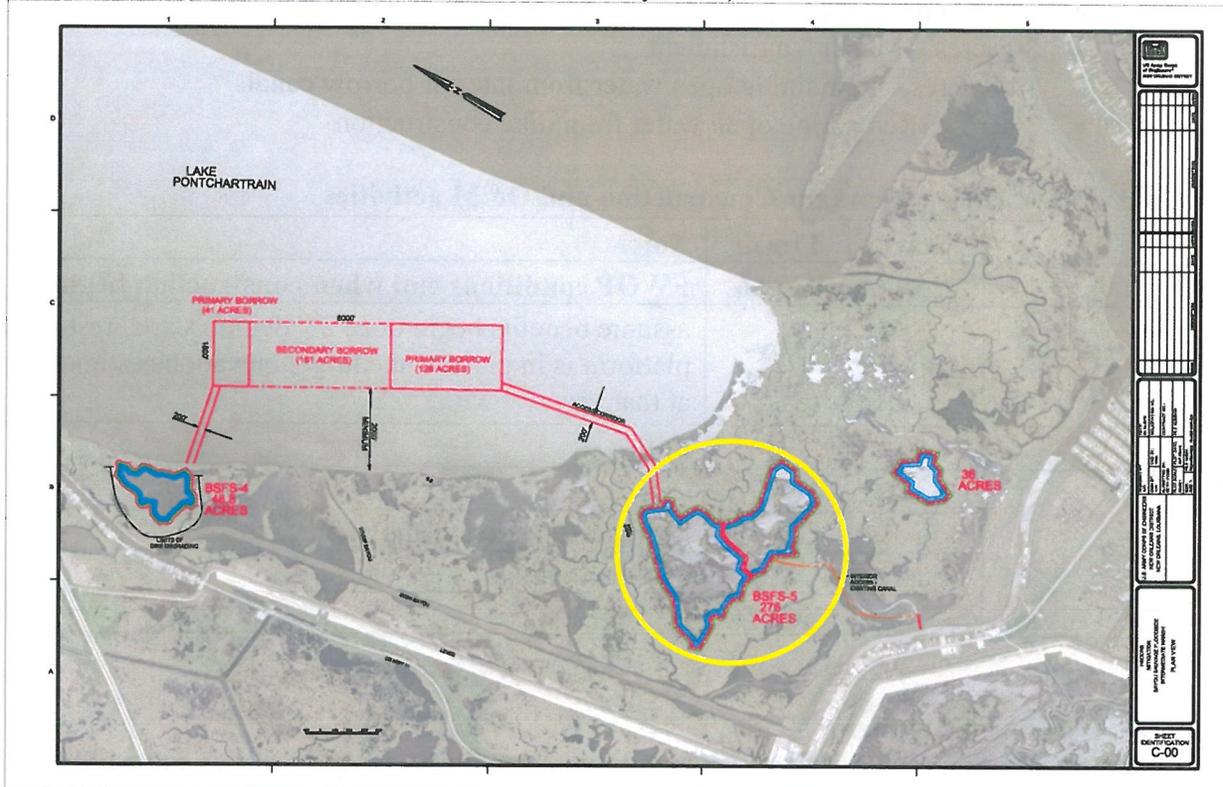
Project Name: LPV HSDRRS Mitigation- Bayou Sauvage Flood Side (BSFS-5) Marsh Creation Site

***Mitigation Potential:** 0.30 aahus/ac

Project Type(s): Marsh Creation & Nourishment

Project Area: The Bayou Sauvage Marsh Creation site, BSFS-5, is located within the Bayou Sauvage National Wildlife Refuge (BSNWR) at the extreme east but within the city limits of New Orleans, in Orleans Parish, Louisiana (Figure 1). The site is south of I-10 along the shoreline of Lake Pontchartrain

Figure 1. Project Area (BSFS-5 area circled in yellow)



Problem: According to the Coast 2050 Report, from 1932 to 1990, Lake Pontchartrain Basin lost approximately 74,800 acres of marsh out of a total of 322,000. Overall, 23% of the 1932 marsh was lost (Coast 2050 Report- Appendix C 1999). The project area is impacted by natural subsidence and wave erosion of the shoreline marshes.

Project Goal:

This Bayou Sauvage FS Mitigation project (BSFS-4 and BSFS-5) is being implemented to mitigate 96.13 AAHUs of general impacts and 9.21 AAHUs of refuge impacts totaling 105.34 AAHUs. The southern proposed marsh footprint (BSFS5) is a combination of open water and broken marsh; however evaluation of historic photography reveals continued degradation of the broken marsh component. Based on surveys conducted by the Corps the truly open water area elevations are similar to the northern site, ranging from -1.5 to -2.5’ NAVD88; getting slightly deeper in the northwestern corner where elevations increase to approximately -3.0’ NAVD88. Three (3) site specific soil borings reveal an approximate 6 foot organic peat layer underlain by very soft clays and silty sand layers. Again, significant settlement of the dredge filled platform is anticipated.

Project Description: See Appendix A.

Project Acres:

283 acres – Total Footprint

- 181.2 acres – Marsh Creation
- 84 acres – Marsh Nourishment
- 14.8 acres – Remaining open water from interior borrow canals
- 3 acres – Remaining open water from dike construction

Table 1: WVA Target Years for Construction and O&M activities

TY	Start	Finish	Notes
0		Aug-16	FWOP conditions end when construction begins
Construction (0)	Aug- 16	Nov-2017	assume benefits begin once 2 nd demob starts, restoration platform is in place at the target elevations estimated for at that year.
1	Nov-17	Nov-18	(2017)
2	Nov-18		
	Jan-19	Feb-19	degrade/gap dikes, remove plugs
	Mar- 19	Jun- 19	Marsh plantings
		Nov-19	

Habitat Assessment Method

The WVA operates under the assumption that optimal conditions for general fish and wildlife habitat within a given coastal wetland type can be characterized, and that existing or predicted

conditions can be compared to that optimum to provide an index of habitat quality. Habitat quality is estimated or expressed through the use of a mathematical model developed specifically for each wetland type. Each model consists of 1) a list of variables that are considered important in characterizing fish and wildlife habitat, 2) a Suitability Index graph for each variable, which defines the assumed relationship between habitat quality (Suitability Index) and different variable values, and 3) a mathematical formula that combines Suitability Index for each variable into a single value for wetland habitat quality; that single value is referred to as the Habitat Suitability Index, or HSI.

The WVA model for marsh habitat attempts to assess the suitability of each habitat type for providing resting, foraging, breeding, and nursery habitat to a diverse assemblage of fish and wildlife species. While the model does not specifically assess other wetland functions and values such as storm-surge protection, floodwater storage, water quality improvement, nutrient import/export, and aesthetics, it can be generally assumed that these functions and values are positively correlated with fish and wildlife habitat quality.

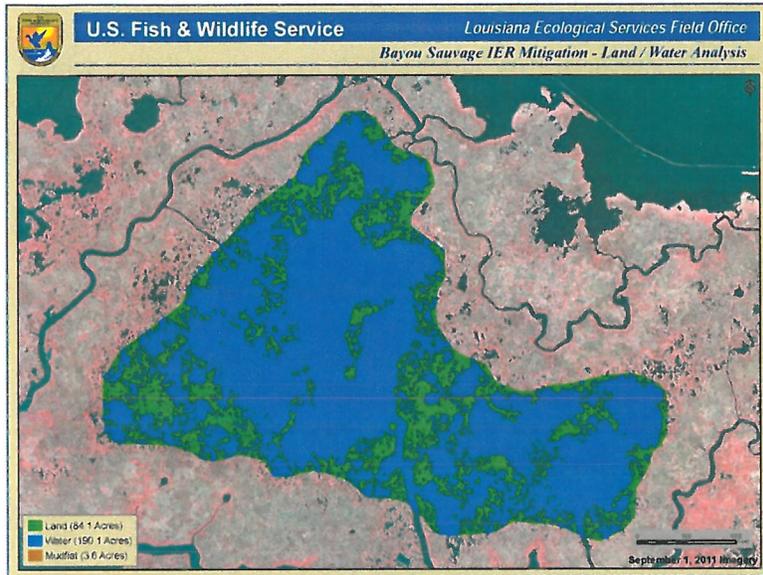
The procedure for evaluating project benefits on fish and wildlife habitats, the WVA model, uses a series of variables that are intended to capture the most important conditions and functional values of a particular habitat. Values for these variables are derived for existing conditions and are estimated for conditions projected into the future if no restoration efforts are applied (i.e., future-without-project), and for conditions projected into the future if the proposed restoration project is implemented (i.e., future-with-project), providing an index of quality or habitat suitability of the habitat for the given time period. The habitat suitability index (HSI) is combined with the acres of habitat to get a number that is referred to as “habitat units”. Expected project benefits are estimated as the difference in habitat units between the future-with-project (FWP) and future-without project (FWOP). To allow comparison of WVA benefits to costs for overall project evaluation, total benefits are averaged over a 50-year period, with the result reported as Average Annual Habitat Units (AAHUs).

Variable V₁ – Percent of wetland area covered by emergent vegetation

Existing – The 283 acre project area has been classified by the Service as 30% marsh (“**BSFS5-MN**”) and 70% water (“**BSFS5-MC**”) based on 2011 aerial imagery (Figure 2). The 3.6 acres classified as mudflat is considered in the open water (or marsh creation) classification. The project area and surrounding marsh has been classified as brackish marsh consistently from 1949 to 2007 (O’Neil 1949, Chabreck and Linscombe 1997, Sasser et al. 2007).

The two major soil types in the project area are classified by Trahan (1987) as Lafitte muck and Clovelly muck. Both soil types are very poorly drained, very fluid organic soils typical of brackish marsh. They are generally flooded and ponded most of the time and have a high subsidence potential.

Figure 2. Land Water Classification



Land Loss Data

To calculate loss rates USGS evaluated a 5,079 acre extended boundary (Figure 3) to obtain land/water data through the 1985-2010 timeframe. The Service calculated land loss rate using the same USGS Land/Water data (1985-2010), using a linear regression (Land Acres: Time). The FWS percent loss rate was determined as a percent of the 1985 land area and also included all data points provided by USGS. That rate was used to calculate land/water values over the life of the project.

Figure: 3. USGS Extended Boundary for Bayou Sauvage (09)

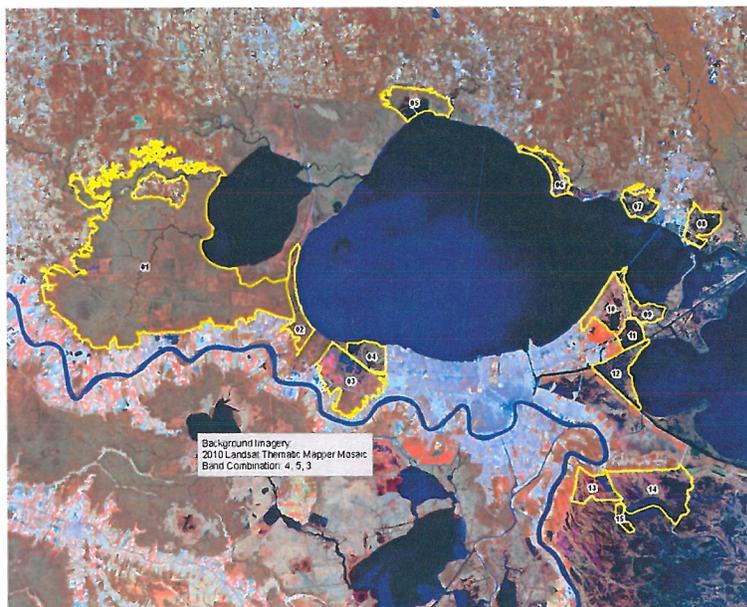
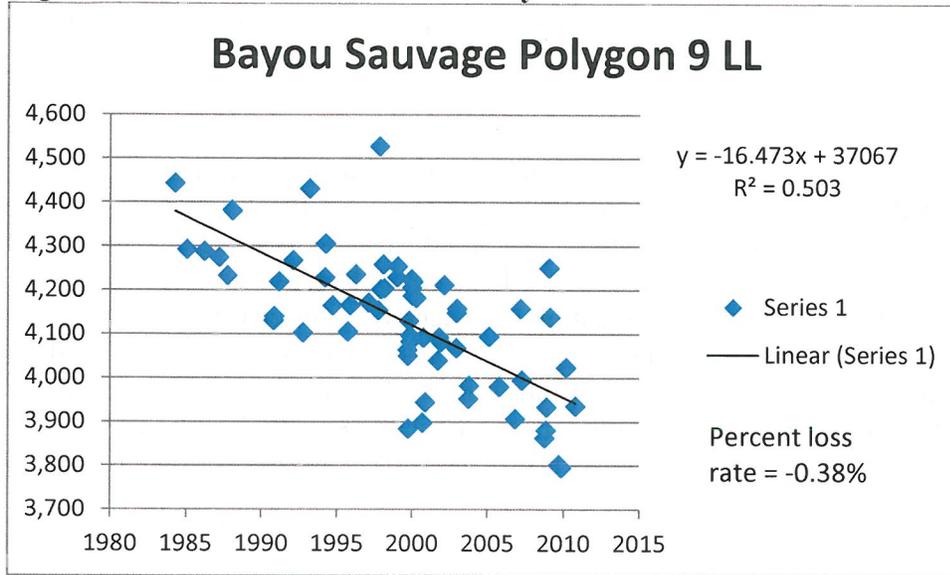


Figure 4. Land loss rate determined by FWS



For use in the WVA models, projected Relative Sea Level Rise (RSLR) estimates were developed according to EC 1165-2-211, using a nearby reference gage (Rigolets gauge) in the Lake Pontchartrain and Vicinity mitigation watershed. The reference gage was used to develop low, intermediate and high RSLR estimates. Based on MVD planning guidance, the Intermediate RSLR scenario was used for the purpose of WVA modeling for alternative comparison and for design. Analysis of USGS landloss data indicates that land change is still occurring under the low SLR scenario. Therefore, the FWS applied the intermediate RSLR scenario starting from the last year of USGS landloss data, 2010.

FWOP

FWS FWOP Project Area Loss Rate = -0.32 ac/yr based on the marsh acres available at TY0.

Table 1: FWOP BSFS5

(0)2016	82.3	29.1%	201	70.90%
(1)2017	82.00	29.0%	201	71.02%
(34)2050	67.48	23.8%	216	76.15%
(50)2066	58.30	20.6%	225	79.40%

FWP

Created marsh platform has limited marsh function until settlement, breaching of retention dikes, and vegetation occurs. Land loss is applied at the time of marsh creation. A settlement period of 5 years was also applied based on the Corps settlement analysis that indicates 66% of settlement occurs in the first 5 years, and marsh elevations has settled to an elevation that is flooded 1% of the time. Once functional elevations are achieved, the loss rate of the created marsh is assumed

to be 50% of the background loss rate until 10 inches of sediment is assumed to have accreted on the marsh. At that time background loss rate is resumed. This assumption will delay when the loss rate changes back to 100% (YR, Settlement curves). Percent loss rate is of the entire project area acreage.

Research by Nyman et al. (1993) suggests that coastal marshes may undergo rapid degradation and conversion to open water beyond a critical rate of submergence/inundation. Louisiana Coastal Protection and Restoration Authority (CPRA) personnel working to model marsh loss for the 2012 Louisiana Coastal Master Plan have used statewide Coastal Reference Monitoring System data to develop plant productivity vs inundation (i.e., accretion deficit) relationships. From those relationships, they identified inundation ranges at the primary production low-end points to predicting onset of abrupt marsh collapse (Coastal Protection and Restoration Authority of Louisiana 2012). In this study, the median value for intermediate marsh (34.4 cm) was considered to predict onset of abrupt marsh collapse; however, marsh collapse does not occur under the intermediate RSLR scenario.

Reduced functional marsh credit assumption applied to created marsh:

TY1 – 0% credit

TY2 – 10% dikes degraded, 55% of borrow areas filled

TY3 – 25%

TY4 – 62.5% (Note: this is a linear assumption, therefore TY4 is not needed in the spreadsheet)

TY5 – 100% credit of remaining marsh platform

Reduced Functional Marsh Credit Assumption applied to nourished marsh:

TY1 – 0%,

TY2 – 25%

TY3 – 50%

TY4 – 75% (Note: this is a linear assumption, therefore TY4 is not needed in the spreadsheet)

TY5 – 100%

Table 2: FWP Marsh Acres

FWP		marsh			
		marsh (ac)	%	OW (ac)	OW (%)
2016	TY0	82.3	29%	200.7	71%
2017	TY1	0.0	0%	20.0	7%
2018	TY2	38.5	14%	20.6	7%
2019	TY3	85.9	30%	21.1	7%
2021	TY5	260.7	92%	22.3	8%
2022	TY6	260.1	92%	22.9	8%
2050	TY34	234.3	83%	48.7	17%
2066	TY50	208.6	74%	74.4	26%

Further details can be found within the LLR-SLR Spreadsheet:
 “BSFS_5_Brackish_Marsh_LLRLR_SLR_20150601_95prcnt.xlsx”

The classification with the higher SI for FWOP was used to be conservative.

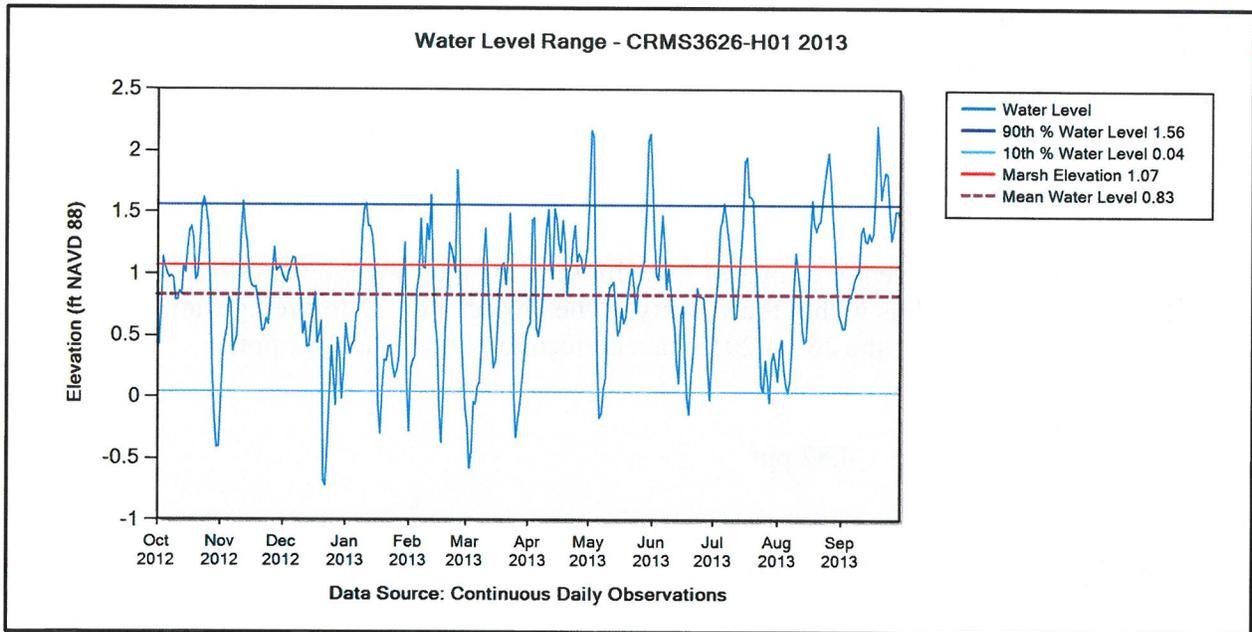
FWOP– The total area will continue to deteriorate converting to a Class 5 by TY50.

- TY0-1: 70% Class 5, 30% Class 2
 - TY34: 100% Class 4 (~25% marsh)
 - TY50: 100% Class 5 (~20% marsh in the entire project area)
- *note: MP is not sensitive to changes in the Interspersion value

FWP – Both BSFS5 MC and MN would be filled to target marsh elevations.

- TY 0: 70% Class 5, 30% Class 2
- TY 1 100% Class 5
- TY 2-3 100% Class 3 (“carpet marsh”)
- TY 5 50% Class 3, 50% Class 1
- TY 6 100% Class 1
- TY 34 100% Class 1 (marsh is ~83%)
- TY 50 100% Class 2 (marsh is ~74%)

Variable V₄– Percent of open water area <=1.5 feet deep in relation to marsh surface



Existing

Bottom elevations (water bottoms and marsh elevations) were collected by the Corps throughout the project area. That data can be provided upon request. Of the 840 data points, only 12 points measured above +1.0 ft NAVD (marsh elevation). Bottom elevations were subtracted from the average water elevation measured at CRMS3626 (+0.83 ft NAVD). Shallow open water (SOW)

will be determined using all points. If just open water areas were used SOW within and near the marsh would not be accounted for and the variable would favor the deeper areas. Based on all data points, 25% of the average water depth is ≥ 1.5 feet.

FWOP

The Corps' RSLR estimates predict a sea-level rise of approximately 2.0 feet for the year 2063 under the Intermediate RSLR scenario. It was assumed that RSLR will reduce the existing shallow open water for FWOP and FWP at TY50 by 1/3 and 1/6 respectively.

TY0	25%
TY1	25%
TY34	25%
TY50	17%

FWP- The project area will be filled to target marsh elevations. Marsh that is lost is assumed to become open water ≤ 1.5 feet deep until TY50. At that point, it is assumed that 1/6 of the shallow open water would become deeper than 1.5 feet.

TY0	25%
TY1	100%
TY3	100%
TY5	100%
TY6	100%
TY34	100%
TY50	83%

Variable V₅ - Salinity

Existing conditions - Currently estimates for salinity in the area are available from the CRMS3626 station which is within the vicinity of the project area. The average annual salinity recorded by that station for the 2011- 2013 data collection period was 4.82 ppt.

FWOP & FWP

TY0 – TY50	4.82 ppt
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Variable V₆ – Aquatic organism access

Existing conditions – The project area is not impounded or hydrologically controlled by any structures. There is a foreshore rock dike between the project area and Lake Pontchartrain, but there is a hydrologic connection of the project area marsh through bayous and a canal to the open waters of the lake and the surrounding marsh. Access to all parts of project area is assumed to be equal.

FWOP Existing conditions are expected to continue.

$$TY0 - TY50 = 1.0$$

FWP After construction, retention dikes will block all aquatic organism access. After the dikes are breached in TY3, it is assumed that aquatic organisms will have total and equal access to sites that make up the project area.

TY0	1.0
TY1	0.0001
TY2	1.0
TY5 - TY50	1.0

Literature Cited

- Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority. 1999. Coast 2050: Toward a Sustainable Coastal Louisiana, The Appendices. Appendix C – Region 1 Supplemental Information. Louisiana Department of Natural Resources. Baton Rouge, La.
- Trahan, Larry. 1987. Soil Conservation Service Soil Survey of Orleans Parish, Louisiana. United States Department of Agriculture, Soil Survey Service. January 1987.

2. Project Description, Pages 4-6, *edited for BSFS-5*

The Bayou Sauvage Brackish Marsh restoration project is located in the far south-eastern lobe of Lake Pontchartrain, east of Interstate 10. The project plan consists of two (2) areas of open water/broken marsh, which would be filled and/or restored to provide a healthy marsh platform. The two (2) areas are BSFS-4 which is approximately 53 acres as measured within the proposed retention dike centerline, and BSFS-5 which is 266 acres as measured within the proposed retention dike centerline. BSFS-5 is further subdivided into an east and west lobe to facilitate maximum fill placement in the open water areas. BSFS-4 and BSFS-5 are on the unprotected side of the HSDRRS. 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 BSFS-5 area is the southern proposed marsh footprint and is located approximate 2.5 miles south, south-east of BSFS-4. The southern feature is approximately 0.5 miles north of Chef Mentour Highway (Hwy 90). 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 -1.0 to -2.5 ft (NAVD88 2006.81).

The proposed initial fill elevation of dredge fill for BSFS-5 is to elevation +3.0' NAVD88 (2006.81), with a secondary lift to elevation +3.5' NAVD, ultimately to hit a target marsh elevation to +1.0' NAVD88 (2006.81). The lowering of the initial fill elevation not only projects to the correct final target elevation, but allows for more second lift fill capacity. Both features would require total perimeter retention to hold dredge material and allow for vertical accretion. Feature BSFS-5 will require approximately 17,982 linear feet of earthen retention dike and 2,000 linear feet for a cross dike. The BSFS-5 retention dike will be constructed to elevation of +4.5' to +5.0', with a five (5) foot wide crown, to provide one (1) foot of freeboard above the required second lift fill elevation of +3.5 feet. Due to poor soil conditions, 20 foot stability berms are required both BSFS-4 and BSFS-5 retention dikes. All slopes of the dikes will have 1-foot vertical on 4-foot horizontal side slopes. Retention dikes would be constructed, using marsh buggies for access and using borrow material obtained from within the marsh creation areas. It is envisioned that any material required to maintain the dikes could come from the berm section once filling of the cell is underway. At that time the constructed dikes would have gained some strength and loading from the fill material will assist in dike stability.

BSFS-5 will require two bulkheads at the locations where interior channels are too deep for normal dike construction. The bulkheads will be constructed of vinyl sheet piles and timber piles. These bulk heads will be removed in a separate contract when dike degrading and planting takes place. The remaining reaches of standard retention dike for both features would be totally degraded a year after the final lift, upon settlement and dewatering of the created marsh platform.

The degraded material would be used to partially backfill remaining borrow ditched on the interior of the dike alignment. The marsh footprint would be planted as necessary upon satisfactory settlement and dewatering of the marsh platform to assure adequate variety and

coverage of vegetative material. Plugs of appropriate marsh vegetation would be planted over 100 percent of the marsh restoration acreage on seven (7) foot centers.

FINAL
Wetland Value Assessment Project Information Sheet

May 29, 2015

Prepared for:
U.S. Army Corps of Engineers

Prepared by
U.S. Fish and Wildlife Service
Angela Trahan
Angela_Trahan@fws.gov

Project Name: LPV HSDRRS Mitigation- New Zydeco BLH-wet Restoration

Mitigation Potential: 0.60 AAHUs, without Open Water analysis; 159 acres, 95.05 Total AAHUs

Project Type: Create BLH-wet habitat in open water habitat

Project Area: The project area (Appendix A) is located approximately 3 miles southeast of Slidell, St. Tammany Parish, Louisiana, near the north shore of Lake Pontchartrain. The area is bounded by Salt Bayou to the south and east, U.S. Highway 90 further to the east, and open water to the north and west. Further west is Louisiana Highway 433.

Project Description: See Appendix B

Acres:

Dike center line = 152 acres

Elevation to +5.5 fill line at TY1 = 149 acres

Post-dike degradation at TY2 = 159 acres

Borrow footprint = 20 acres

Habitat Assessment Method

The WVA operates under the assumption that optimal conditions for general fish and wildlife habitat within a given coastal wetland type can be characterized, and that existing or predicted conditions can be compared to that optimum to provide an index of habitat quality. Habitat quality is estimated or expressed through the use of a mathematical model developed specifically for each wetland type. Each model consists of 1) a list of variables that are considered important in characterizing fish and wildlife habitat, 2) a Suitability Index graph for each variable, which defines the assumed relationship between habitat quality (Suitability Index) and different variable values, and 3) a mathematical formula that combines Suitability Index for each variable into a single value for wetland habitat quality; that single value is referred to as the Habitat Suitability Index, or HSI.

The WVA model for BLH habitat attempts to assess the suitability of each habitat type for providing resting, foraging, breeding, and nursery habitat to a diverse assemblage of fish and wildlife species. While the model does not specifically assess other wetland functions and values such as storm-surge protection, floodwater storage, water quality improvement, nutrient import/export, and aesthetics, it can be generally assumed that these functions and values are positively correlated with fish and wildlife habitat quality.

The procedure for evaluating project benefits on fish and wildlife habitats, the WVA model, uses a series of variables that are intended to capture the most important conditions and functional values of a particular habitat. Values for these variables are derived for existing conditions and are estimated for conditions projected into the future if no restoration efforts are applied (i.e., future-without-project), and for conditions projected into the future if the proposed restoration project is implemented (i.e., future-with-project), providing an index of quality or habitat suitability of the habitat for the given time period. The habitat suitability index (HSI) is combined with the acres of habitat to get a number that is referred to as “habitat units”. Expected project benefits are estimated as the difference in habitat units between the future-with-project (FWP) and future-without project (FWOP). To allow comparison of WVA benefits to costs for overall project evaluation, total benefits are averaged over a 50-year period, with the result reported as Average Annual Habitat Units (AAHUs).

The St. Tammany Soil Survey (<http://websoilsurvey.nrcs.usda.gov>) characterizes the project area soils as equally Clovelly muck and Lafitte muck typical of organic, brackish marshes over fluid clayey alluvium. Suitability of this site to be converted to BLH habitat is considered to be a slight risk considering the soils and future salinity impacts associated with RSLR.

Table 1: WVA Target Years for Construction and O&M activities

TY	Start	Finish	Notes
0		Oct-15	FWOP conditions end when construction begins
Construction	Oct-15	Jul-16	assume benefits begin once demob starts, restoration platform is in place at the target elevations estimated for at that year.
1	Jul-16	Jul-17	(2016)
2	Jul-17		
	Nov-17	Dec-17	degrade/gap dikes
	Dec-17	Jan-18	BLH plantings (age of seedling will be reflected in WVA)
	Mar-18	May-18	Marsh plantings
		Jul-18	

Variable V₁ - Stand Structure

Existing – There is no forest, only open water. The project area contains small marsh fragments.

FWOP – The project area is expected to persist as open water. Remaining marsh will convert to open water.

FWP –

Land shaping/grading would be required to restore surface grades to elevations that would support forested habitat and to allow for natural hydrologic patterns to occur.

Service BLH mitigation guidelines suggest that the entire acreage be planted with mast-producing species suited to the soil(s) and site conditions. Mid-story species (i.e., shrub species) could include mayhaw, hawthorn, and persimmon. Planting of mast-producing species would be on by 9-foot x 9-foot centers (538/acre) and mid-story species on 20-foot x 20-foot centers (109/acre) in order to quickly establish a dense canopy and to minimize the re-establishment and growth of Chinese tallow-trees. Hard to soft mast tree species ratio should range between 60 and 70 hardmast species to 30-40 softmast species.

- TY0: Class 1
- TY1: Class 1
- TY2: Class 5 as planted but not full function value; not mature canopy
- TY20: Class 5, mature canopy
- TY50: Class 5, salinity impacts and increased hydrology are a concern. However, for this analysis the highest target elevation of 3 feet is assumed. By TY50 the site could experience an elevation of 1.7 feet, best case scenario.

Potential salinity issues

Salinities range from 2 ppt to 4 ppt during the growing season. Planted vegetation should be chosen that has tolerance for low salinity water. As RSLR increases salinity intrusion will likely be more prevalent.

Variable V₂ - Stand Maturity

Existing Conditions –open water

FWOP – open water/no forest habitat potential.

FWP –

TY 2: age = 2

TY 50: age = 50

Variable V₃ - Understory / Midstory

Existing Conditions – open water

FWOP – open water/no forest habitat potential.

FWP – It is suggested that some shrub/scrub species (e.g., mayhaw, hawthorn, and persimmon) be planted on 20-foot x 20-foot centers (109/acre) in order to quickly establish a dense canopy and to minimize the re-establishment and growth of Chinese tallow-trees to ensure diversity within the forest.

TY 0 – 0/0 (U/M)

TY 1 & 2– 100/0

TY 20 – 25/60

TY 50 – 30/30

Variable V₄ – Hydrology

Existing

Relative Sea Level Rise (RSLR) projections provided by the Corps were incorporated into the assessment (note: for marsh analysis the Service incorporated USGS land change analysis and reevaluated the RSLR starting in 2011). For the Fritchie project area the Rigolets gage in Lake Pontchartrain was used. The low RSLR rate is an extrapolation of historic Relative Sea Level Rise (RSLR) rate experienced at the gage site. The intermediate rate is based on an estimate of local subsidence from the gage record and NRC curve I eustatic, and high rate is based on an estimate of local subsidence from the gage record and NRC curve III eustatic SLR. For the alternatives analysis the intermediate SLR was used for the WVA. The project area is considered to be influenced by a baseline RSLR rate of 4.70 mm/yr.

Under existing conditions the open water site experiences moderate tidal exchange through Salt Bayou and is permanently flooded; however it does not exist as a forested habitat. Therefore, the lowest SI value was assumed.

FWOP – existing conditions persist, no functional forest hydrology

FWP- It has been suggested restore surface grades to elevations that would support forested habitat (e.g., 3+ feet elevation for BLH-dry, 2-3 feet elevation for BLH-wet, 1.5-2 feet elevation for swamp); however, overbuilding may be considered in light of sea-level rise to ensure mitigation goals are achieved throughout the life of the project.

The Rigolets gage indicates that a 1.1 foot rise in sea level will occur by 2066 (TY50), which is the lowest rate of the five gages including WBV. If a target elevation of +3.15 feet is achieved the following FWP conditions are assumed:

TY: platform elevation, MHW elevation

(2016) TY1: +4.5 ft elevation, containment dikes in place

(2017) TY2: +4.4 ft elevation, containment dikes gapped/degraded

TY10: +3.2 ft elevation, MHW = 1.3 ft

TY25: +3.2 ft elevation, MHW = 1.5 ft

TY50: +3.2 ft elevation, MHW = 2.1 ft

Table 2: Projected FWP and FWOP Hydrologic Conditions

		Flooding Duration	Flow/Exchange	SI
FWOP	TY0-TY1	Permanent	None	0.10* entered lowest value since conditions do not represent a BLH
	TY50	Permanent	None	0.10*
FWP	TY1	Permanent	None	0.10
	TY2	Temporary	None	0.50
	TY25	Temporary	Low	0.70
	TY50	Seasonal	moderate	0.75

Variable V₅ - Size of Contiguous Forested Area

The project area is not forested and, therefore, only the FWP has a value greater than 0 for this variable.

FWOP – open water/no forest habitat potential.

FWP

TY 10-2 = Class 1

Ty 20-50 – Class 4 – 159 acres BLH

Variable V₆ – Suitability and Traversability of Surrounding Land Uses

FWOP

Marsh = 20%

Water (“Pasture/Hayfields) = 80%

FWP - FWP includes marsh mitigation

Marsh = 35%

Water = 65%

A development rate was not applied to this area. Impact assessments were evaluated with the assumption that no development rate increase would be realized through the life of the project.

Variable V₇ – Disturbance

FWP & FWOP – SI = 1

The project area is positioned parallel to U.S. Highway 90.

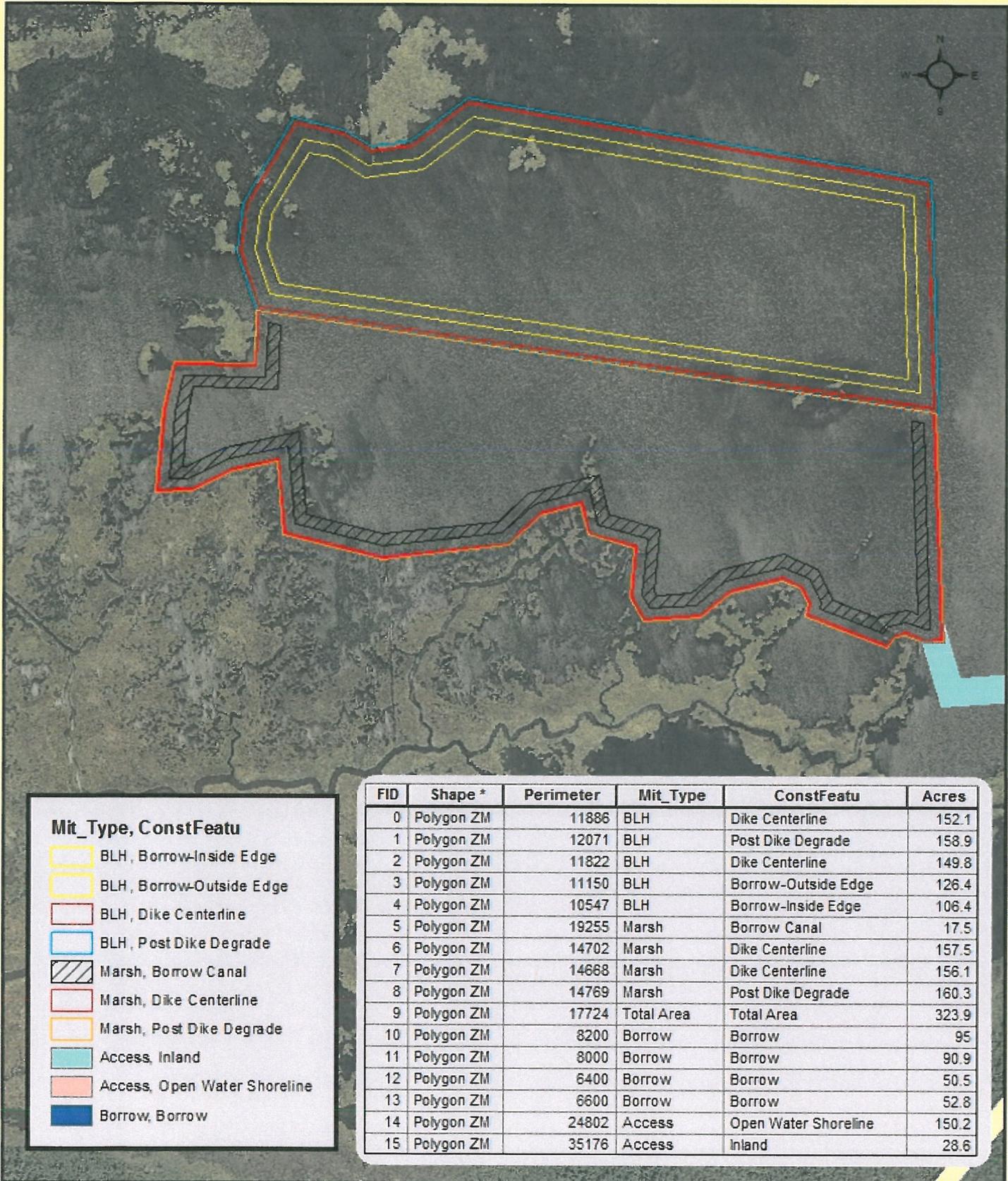
Major Highway (T Class 1) < 1,500 feet: D Class 3 = 1

Appendix A - Project Area



U.S. Fish and Wildlife Service

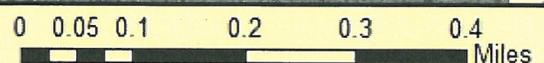
New Zydeco 95% Design Project Area



Mit_Type, ConstFeatu

- BLH, Borrow-Inside Edge
- BLH, Borrow-Outside Edge
- BLH, Dike Centerline
- BLH, Post Dike Degrade
- Marsh, Borrow Canal
- Marsh, Dike Centerline
- Marsh, Post Dike Degrade
- Access, Inland
- Access, Open Water Shoreline
- Borrow, Borrow

FID	Shape *	Perimeter	Mit_Type	ConstFeatu	Acres
0	Polygon ZM	11886	BLH	Dike Centerline	152.1
1	Polygon ZM	12071	BLH	Post Dike Degrade	158.9
2	Polygon ZM	11822	BLH	Dike Centerline	149.8
3	Polygon ZM	11150	BLH	Borrow-Outside Edge	126.4
4	Polygon ZM	10547	BLH	Borrow-Inside Edge	106.4
5	Polygon ZM	19255	Marsh	Borrow Canal	17.5
6	Polygon ZM	14702	Marsh	Dike Centerline	157.5
7	Polygon ZM	14668	Marsh	Dike Centerline	156.1
8	Polygon ZM	14769	Marsh	Post Dike Degrade	160.3
9	Polygon ZM	17724	Total Area	Total Area	323.9
10	Polygon ZM	8200	Borrow	Borrow	95
11	Polygon ZM	8000	Borrow	Borrow	90.9
12	Polygon ZM	6400	Borrow	Borrow	50.5
13	Polygon ZM	6600	Borrow	Borrow	52.8
14	Polygon ZM	24802	Access	Open Water Shoreline	150.2
15	Polygon ZM	35176	Access	Inland	28.6



2. Project Description, Pages 3-4, edited

This BLH-Wet and Brackish Marsh restoration project is located on the north shore of Lake Pontchartrain in the northeast quadrant of the lake, immediately adjacent to U.S. Highway 90, and approximately five (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 filling with dredge borrow material approximately 159 acres of BLH-Wet (incorporating degraded dikes) and 146 acres of brackish marsh (incorporating degraded dikes); all within a designated shallow open water area immediately northwest of Salt Bayou within the Fritchie Marsh area.

For the BLH-Wet construction scenario, initial target elevation for dredge fill would be to approximate elevation +5.5 feet NAVD88, to ultimately hit a target elevation (post settlement and consolidation) ranging from +2.5 feet to +3.25 feet NAVD88. The retention dike around the BLH-Wet creation area will be constructed to elevation +7.0 feet NAVD88 to contain the dredge slurry. A baseline retention dike at the southern boundary of the BLH-Wet creation area will also be constructed to elevation +7.0 feet NAVD88 which also composes the northern retention dike of the marsh creation areas. This baseline dike will ultimately be degraded to BLH-W elevation; the footprint being encapsulated into the BLH-W acreage but transitioning into the marsh creation platform. Overflow weirs will be constructed along this dike to allow effluent flow into the marsh creation area. Overflow weirs and/or spill boxes would also be allowed along the western leg of the project footprint. During placement of material into the marsh creation site, monitoring of Salt Bayou, as well as temporary canal closures (earthen deflection weirs, hay bales, silt curtains, etc. would be required of the Contractor in the immediate proximity of effluent overflow to assure no significant transporting of earthen fill in to Salt Bayou occurs. For the marsh construction scenario, initial target elevation for dredge fill would be to approximate elevation +3.0 feet NAVD88, to ultimately hit a target elevation (post settlement and consolidation) ranging from +0.8 feet NAVD88 to +1.2 feet NAVD88. A retention dike around the marsh creation area will be constructed to a lower elevation +4.0 feet NAVD88 and will tie into the baseline dike at the southeast and southwest limits of BLH-W work. Dredge effluent waters will be allowed to flow south and west into the adjacent open waters for nourishment of the adjacent marsh.

Fill Material for the creation of the BLH-Wet and marsh creation areas will come from a borrow site located in Lake Pontchartrain approximately 3,000 feet offshore from Treasure Island, LA. Dredging of the borrow will be conducted via hydraulic dredging and piped to the BLH-Wet and marsh creation areas. A floating/submerged pipeline will be placed from the borrow site to the beach along Old Spanish Trail Road. The Contractor will be required to maintain navigation access for recreational boaters. From the beach head, the pipeline will be laid on the ground to Old Spanish Trail Road. A 36" steel culvert will be jacked under Old Spanish Trail Road for the pipeline to pass under the road. From the new culvert to the marsh creation area, the pipeline will be placed on the ground along Old Spanish Trail Road and Chef Menteur Hwy between the edge of the road shoulders and the vegetation line along the existing marsh until it reaches Salt Bayou. Immediately north of Salt Bayou, a timber board road will be constructed along the proposed access corridor to the open water within of the refuge. Sand fill shall be placed in low

areas prior to placement of the board road. The timber board road shall be removed at completion of the project. If sand fill, as required for board road installation, is trucked onto the site via Chef Menteur Highway, the Contractor is responsible for keeping the highway free of dirt and debris as a result of this activity. At the location where the timber board road ends at open water, the pipeline will continue along the access corridor to the marsh and BLH-Wet creation areas. See Figure 1 in Appendix A for the overview of the project.

FINAL
Wetland Value Assessment Project Information Sheet

July 28, 2015

Prepared for:
U.S. Army Corps of Engineers

Prepared by
U.S. Fish and Wildlife Service
Angela Trahan
Angela_Trahan@fws.gov

Project Name: LPV HSDRRS Mitigation- New Zydeco Open Water Impacts

Referenced <FritchieFS_BandIMarsh_PIS_20120827.docx> for these assumptions.

Impacts: -21.15 AAHUs, 159 acres

Project Type: Intermediate Open Water Impacts

Project Area: The project area is the proposed New Zydeco BLH-Wet Mitigation site and is located approximately 3 miles southeast of Slidell, St. Tammany Parish, Louisiana, near the north shore of Lake Pontchartrain. The area is bounded by Salt Bayou to the south and east, U.S. Highway 90 further to the east, and open water to the north and west. Further west is Louisiana Highway 433. See figure in Appendix A.

Goals:

The project will consist of restoring approximately 159 acres of BLH-Wet habitat for mitigating on-refuge and non-refuge impacts associated with HSDRRS construction. For the BLH-Wet construction scenario, initial target elevation for dredge fill will be to approximate elevation +6.0 NAVD88, to ultimately hit a target marsh elevation ranging from +2.5 to +3.0 NAVD88.

Timeline: BLH construction start date – 12/2015

V1 - Emergent Vegetation

THE FOLLOWING INFORMATION WAS PROVIDED FOR THE FRITCHIE MARSH RESTORATION PROJECT AND IS GOOD BACKGROUND INFO. HOWEVER, THIS ANALYSIS IS EVALUATING REPLACING FWOP OPEN WATER HABITAT WITH UPLAND HABITAT. ALL EMERGENT MARSH/WATER HABITAT VALUE WILL BE REMOVED, AND FWP CONDITONS WILL HAVE AN HSI VALUE OF 0.0.

Excerpt from (PPL 19) Fritchie Marsh Terracing and Marsh Creation Project WVA Information Sheet (2009):

Historical and Present Vegetative Communities

...Project area wetlands within the terrace field transitioned from predominantly fresh marsh in 1956 and 1978 to brackish marsh in 1988. The 2000 data shows an almost even split within the terrace field between intermediate and brackish marsh. In the 2007 Operations, Maintenance, and Monitoring Report for the Fritchie Marsh Restoration Project (PO-06), salinity data was collected throughout the project area pre-construction, from 1997-2000, and from 2001-2005. The summary statistics showed that during the monitoring period, salinity averaged about 3 ppt post construction. This average was considerably higher pre-construction at about 6 ppt. Measurements taken during the WVA trip in June 2009 showed measurements around 3 ppt as well. The 2007 report discussion on vegetative composition indicated that portions of the vegetative communities were trending brackish, with the predominant vegetation being *Spartina patens* and *Schoenoplectus americanus*; however, there are several areas that are trending intermediate. Information provided during the July 29 WVA meeting from Larry Rouse, NRCS, and the OCPR indicates that Lake Pontchartrain salinities have been decreasing, which combined with the closure of the MRGO may further contribute to the Fritchie watershed becoming more fresh. For these reasons, the WVA group agreed to evaluate the project under the intermediate marsh model.

Land Loss Data – To calculate loss rates USGS evaluated a 6,072 acre extended boundary (polygon 08, Figure 2). USGS determined the 1985-2010 land change rate from a linear regression that is demonstrated in the graph below (Figure 3). The loss rate (-0.77%/yr) was calculated from percent land values (acres) from that 1985-2010 timeframe. USGS excluded some data points from the regression analysis due to low and high water events.

USGS's percent is percent of the total area (marsh + water). The FWS percent loss rate was determined as a percent of the 1985 land area and also included all data points provided. Typically, in WVAs and other such evaluations, we have used the FWS method as there might in some cases be non-wetlands within the polygon and then use of the total polygon area would result in errors. Therefore, the FWS method has been the standard method used in the past. Based on the data provided by USGS, the FWS determined a loss rate of -0.89% per year.

FWOP -revise

TY0

Marsh: 1.5 acres (1 %)
Water: 157.5 acres (99 %)

TY1

Marsh: 1.5 acres (1 %)
Water: 157.5 acres (99 %)

TY50

Marsh: 0.4 acres (0.3%)
Water: 158.6 acres (99 %)

FWP: initial maximum target elevation for dredge fill will be to approximate elevation +6.0 NAVD88

Marsh: 0 acres

Water: 0 acres

V2 – Submerged Aquatic Vegetation

Observations made during a 2009 CWPPRA field trip determined open water areas in the project area had 20 % SAV cover (NMFS 2009). During an April 14, 2011, field trip SAV was observed at 13 of 32 (41%) sample points. It is assumed that 41% of the site is SOW. These assumptions were averaged for existing conditions.

FWOP

TY0-20 31%

Intermediate

TY50 9% (reduce to 30% of baseline)

Brackish

TY50 5% (reduce to 15% of baseline)

FWP - initial maximum target elevation for dredge fill will be to approximate elevation +6.0 NAVD88

TY0 - 50 0%

V3 – Interspersion

At TY0 the marsh creation cell has 1.5 acres (1%) existing marsh; therefore, the site will be classified as Class 5 for FWOP.

FWOP & FWP

TY0 Class 5

TY1 Class 5

TY50 Class 5

V4 – Shallow Open Water Habitat

The draft 35 % design report indicates that based on aerial photography, it appears the target marsh site is very shallow open water and anticipates that the existing bottom elevations within the open water project area is approximately -1.0 NAVD88. Field reconnaissance and the 2007 OM&M report all indicate that the majority of both project areas are less than 1.5 ft deep (NMFS

2009). Additional data was collected during the April 14, 2011, field trip for the HSDDRS mitigation project. An average water elevation was obtained from two CRMS locations (4407 & 4406). Water depths collected on that day were adjusted to the average of the two water elevations (0.44 ft NAVD88). Of those sample locations 66% were less than or equal to 1.5 feet. Water depth data can be provided upon request.

FWOP

TY0 66%
TY1 66%
TY50 44% (1/3 SOW becomes deep = 33.33%)

FWP- initial target elevation for dredge fill will be to approximate elevation +4.0 NAVD88

TY1-50 0%

V5 – Salinity

CRMS 4406 along Salt Bayou references a 2010 mean growing season salinity of 3.63 ppt, while CRMS 4407, located north of Salt Bayou references 1.79 ppt for 2010 (2.71=average). A salinity of 2.4 ppt was measured during the April 14, 2011, field trip.

The Fritchie Marsh Terracing and Marsh Creation Project WVA Information Sheet (PPL21, 2011) based salinity values on CRMS data from 2007 to 2011, which resulted in a 3.2 ppt average.

FWOP

TY0-50 = 3.2 ppt

FWP

TY1-50 = 7, to apply lowest SI due to conversion to BLH

V6 – Fish Access

The mitigation project area lies within the “north area” of the CWPPRA PPL 19 Fritchie Marsh Terracing and Marsh Creation Project. After further consideration, it was determined that 70% of the area was influenced by the Louisiana Highway 433 Bridge (structure rating = 1.0) and 30% from the HWY 90 open culverts (structure rating = 0.5) (NMFS 2009).

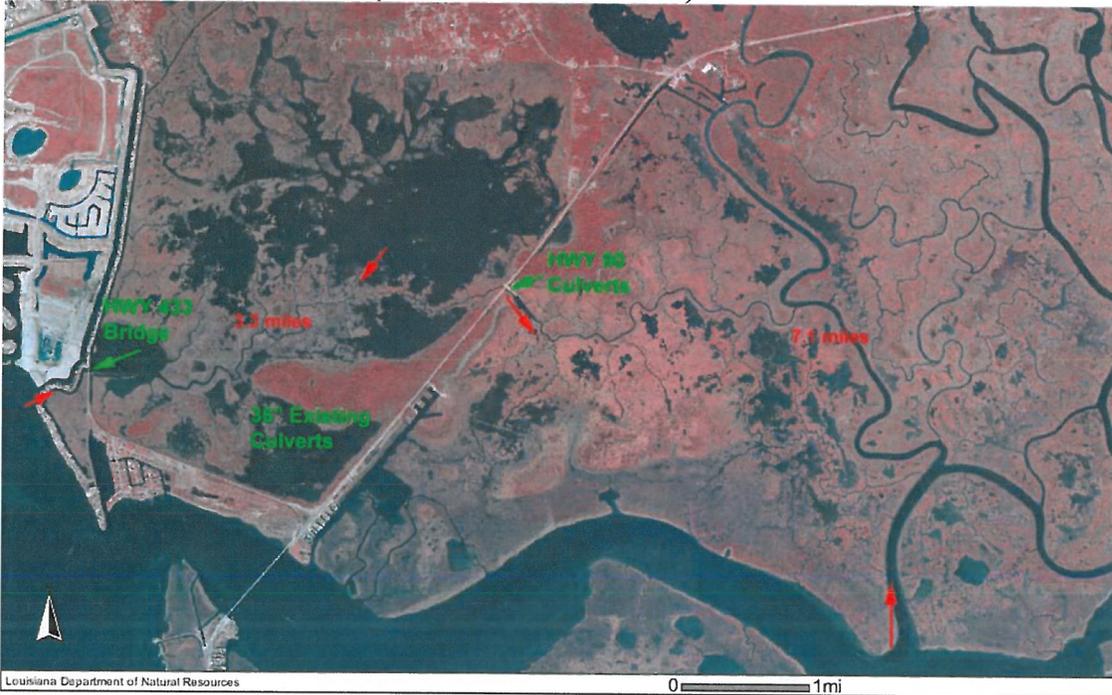
$$(0.70*1.0) + (0.30*0.5) = 0.70+0.15= 0.85$$

FWOP = 0.85

FWP - initial target elevation for dredge fill will be to approximate elevation +4.0 NAVD88

TY1-50 = 0.0001

Figure 4. Fisheries Access (Reference NMFS 2009)



Literature Cited

- Chabreck, R. H. and G. Linscombe. 1997. Vegetation type map of the Louisiana coastal marshes. Baton Rouge, LA. Louisiana Department of Wildlife and Fisheries.
- Chabreck, R. H., G. Linscombe, S. Hartley, J. B. Johnston, and A. Martucci. 2001. Coastal Louisiana Marsh-Vegetation Types. CD Version. USGS National Wetlands Research Center. Lafayette, LA
- NMFS. 2009. PPL 19 Fritchie Marsh Terracing and Marsh Creation Project: Project Information Sheet for Wetland Value Assessment. Revised October 16, 2009. CWPPRA Environmental Workgroup.
- Sasser, C.E., J.M. Visser, E. Mouton, J. Linscombe, and S.B. Hartley. 2008. Vegetation types in coastal Louisiana in 2007: U.S. Geological Survey Open-File Report 2008-1224, 1 sheet, scale 1:550,000.

FINAL
Wetland Value Assessment Project Information Sheet

July 28, 2015

Prepared for:
 U.S. Army Corps of Engineers

Prepared by
 U.S. Fish and Wildlife Service
 Angela Trahan
 Angela_Trahan@fws.gov

Project Name: LPV HSDRRS Mitigation- New Zydeco Marsh Mitigation (for OW impacts and for shortfall at BSFS)

Mitigation Potential: 0.32 AAHUs/acre Intermediate Marsh; 46.79 Total AAHUs (146 acres)

Project Type: Intermediate Marsh Creation

Project Area: The project area is located approximately 3 miles southeast of Slidell, St. Tammany Parish, Louisiana, near the north shore of Lake Pontchartrain. The marsh is bounded by U.S. Highway 90 to the south and east, Louisiana Highway 433 to the west, and U.S. Highway 190, just to the west of the Pearl River.

Project Features: The project will consist of restoring approximately 146 acres of marsh through dedicated dredging of material to be borrowed from Lake Pontchartrain. This marsh mitigation project is proposed to mitigate impacts to submerged aquatic habitat associated with bottomland hardwood mitigation as well as brackish marsh impacts that could not be addressed at the Bayou Sauvage mitigation area (BSFS4 & BSFS5). Details of marsh mitigation design can be found in Appendix A.

Table 1: WVA Target Years for Construction and O&M activities

TY	Start	Finish	Notes
0		Oct-15	FWOP conditions end when construction begins
Construction (0)	Oct-15	Jul-16	assume benefits begin once demob starts, restoration platform is in place at the target elevations estimated for at that year.
1	Jul-16	Jul-17	(2016)
2	Jul-17		
	Nov-17	Dec-17	degrade/gap dikes
	Dec-17	Jan-18	BLH plantings (age of seedling will be reflected in WVA)

	Mar-18	May-18	Marsh plantings
		Jul-18	

V1 - Emergent Vegetation

Excerpt from (PPL 19) Fritchie Marsh Terracing and Marsh Creation Project WVA Information Sheet (2009):

Historical and Present Vegetative Communities

...Project area wetlands within the terrace field transitioned from predominantly fresh marsh in 1956 and 1978 to brackish marsh in 1988. The 2000 data shows an almost even split within the terrace field between intermediate and brackish marsh. In the 2007 Operations, Maintenance, and Monitoring Report for the Fritchie Marsh Restoration Project (PO-06), salinity data was collected throughout the project area pre-construction, from 1997-2000, and from 2001-2005. The summary statistics showed that during the monitoring period, salinity averaged about 3 ppt post construction. This average was considerably higher pre-construction at about 6 ppt. Measurements taken during the WVA trip in June 2009 showed measurements around 3 ppt as well. The 2007 report discussion on vegetative composition indicated that portions of the vegetative communities were trending brackish, with the predominant vegetation being *Spartina patens* and *Schoenoplectus americanus*; however, there are several areas that are trending intermediate. Information provided during the July 29 WVA meeting from Larry Rouse, NRCS, and the OCPR indicates that Lake Pontchartrain salinities have been decreasing, which combined with the closure of the MRGO may further contribute to the Fritchie watershed becoming more fresh. For these reasons, the WVA group agreed to evaluate the project under the intermediate marsh model.

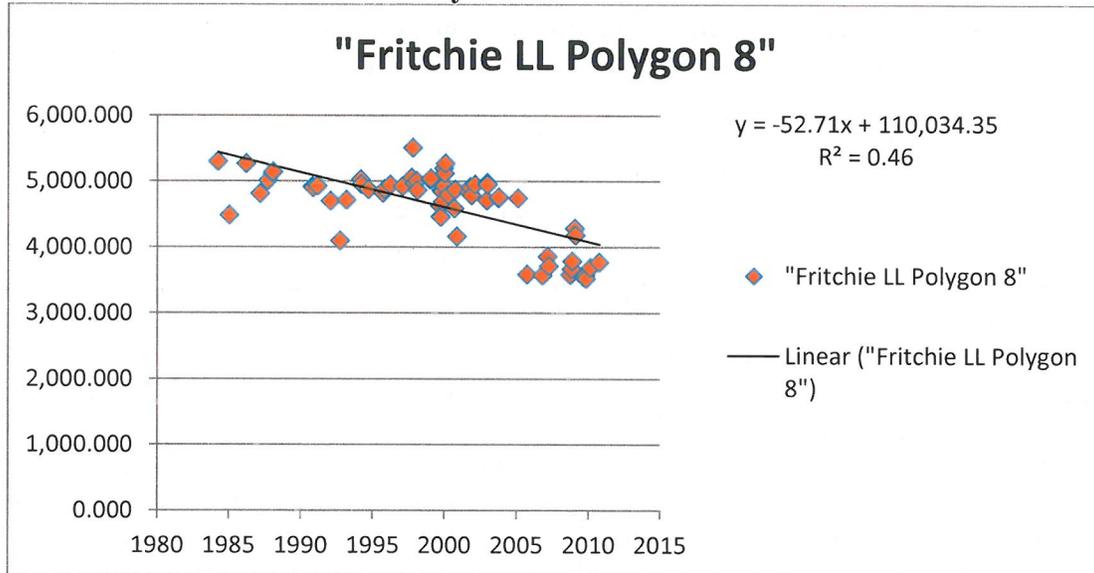
Land Loss Data

To calculate loss rates USGS evaluated a 6,072 acre extended boundary (polygon 08, Figure 2) to get land/water data for a 1984-2010 timeframe. The FWS percent loss rate was determined as a percent of the 1984 land area and also included all data points provided. Typically, in WVAs and other such evaluations, we have used the FWS method as there might in some cases be non-wetlands within the polygon and then use of the total polygon area would result in errors. Therefore, the FWS method has been the standard method used in the past. Based on the data provided by USGS, the FWS determined a loss rate of -0.88% per year. For FWP it is assumed that the loss rate would be reduced by 50% until a point when post-construction accretion exceeds 10 inches above the created marsh platform; and therefore, a loss rate of -0.77 acres per year was applied under the FWP scenario.

Figure: 2. USGS Extended Boundary for Fritchie Marsh (polygon 08)



Figure 3. Land loss rate determined by USGS



FWOP

Using 2013 aerial photography, it was determined that approximately 2 acres of marsh occurred within the project area. Loss rates were applied to determine the FWOP conditions through the project life.

Loss Rate: Extended Boundary Loss Rate -0.98% /year (FWS LLR,-0.0195 ac/yr)

TY0 –	Marsh	1.9 acres (1%)
	Water	146 acres (99%)
TY1 (2016) –	Marsh	1.9 acres (1%)
	Water	146 (99%)

TY50 –	Marsh	0.7 acres (0%)
	Water	147 acres (100%)

FWP

For use in the WVA models, projected Relative Sea Level Rise (RSLR) estimates were developed according to EC 1165-2-211, using a nearby reference gage (Rigolets gauge) in the Lake Pontchartrain and Vicinity mitigation watershed. The reference gage was used to develop low, intermediate and high RSLR estimates. Based on MVD planning guidance, the Intermediate RSLR scenario was used for the purpose of WVA modeling for alternative comparison and for design. Analysis of USGS landloss data indicates that land change is still occurring under the low SLR scenario. Therefore, the FWS applied the intermediate RSLR scenario starting from the last year of USGS landloss data, 2010.

Created marsh platform has limited marsh function until settlement, breaching of retention dikes, and vegetation occurs. Land loss is applied at the time of marsh creation. The rate is 50% of the background loss rate until at least 10 inches of water is assumed to cover the marsh and, therefore, 10 inches of post-construction accretion is assumed to occur. The year after 10 inches of water covers the marsh the background loss rate is resumed (2054, TY39).

Corps settlement analysis that indicates 66% of settlement occurs in the first 5 years (Appendix B). This assumption will delay when the loss rate changes back to 100% (YR, Settlement curves). Percent loss rate is of the entire project area acreage.

Research by Nyman et al. (1993) suggests that coastal marshes may undergo rapid degradation and conversion to open water beyond a critical rate of submergence/inundation. Louisiana Coastal Protection and Restoration Authority (CPRA) personnel working to model marsh loss for the 2012 Louisiana Coastal Master Plan have used statewide Coastal Reference Monitoring System data to develop plant productivity vs inundation (i.e., accretion deficit) relationships. From those relationships, they identified inundation ranges at the primary production low-end points to predicting onset of abrupt marsh collapse (Coastal Protection and Restoration Authority of Louisiana 2012). In this study, the median value for intermediate marsh (34.4 cm) was considered to predict onset of abrupt marsh collapse; however, marsh collapse does not occur under the intermediate RSLR scenario.

Project Area Loss rate = -0.71 ac/yr for 146 acres (reduced by 50%), reverts to -1.42 acres/yr in TY39.

TY1	Marsh:	1.9 ac (1%, assume 0% credit of the created marsh platform)
	Water:	0.9 acres (1%)
TY2	Marsh	16.3 acres (11%) (assume 10% credit of the remaining marsh platform for gapping/planting)
	Water	1.6 acres (1%, marsh loss; borrow area is expected to fill 100% to marsh elevations)
TY3	Marsh	37.8 acres (26% - assume 25% credit of remaining marsh platform)
	Water	2.3 acres (2%)
TY5	Marsh	144.2 acres (97% - assume full credit of remaining marsh platform)

	Water	3.8 acres (3%)
TY6	Marsh	143.4 acres (97%)
	Water	4.6 acres (3%)
TY39	Marsh	111.15 acres (75%)
	Water	36.85 acres (25%)
TY50	Marsh	90.7 acres (61%)
	Water	57.34 acres (39%)

V2 – Submerged Aquatic Vegetation

Observations made during a 2009 CWPPRA field trip determined open water areas in the project area had 20 % SAV cover (NMFS 2009). During an April 14, 2011, field trip SAV was observed at 13 of 32 (41%) sample points. It is assumed that 41% of the site is SOW. These assumptions were averaged for existing conditions.

FWOP

TY0-1	31%
Intermediate/Brackish – based on CWPPRA assumptions carried out to TY50.	
TY50	20%

FWP

For the HSDRRS Mitigation alternatives analysis the interagency team developed the following assumptions for a 50 year project life:

Intermediate

TY0	31%
TY1-3	(0%)
TY5	31% (100% of baseline)
TY6	36% (increase baseline X 15%)
TY39	36% (increase baseline X 15%)
TY50	16% (decrease baseline X 50%)* should be 50% of baseline/same 3/6/2012

V3 – Interspersion

At TY0 the marsh creation cell has approximately 1% existing marsh; therefore, the site will be classified as Class 5 for FWOP.

FWP, marsh creation will initiate a Class 5 area. This will transition to Class 3 (“carpet marsh”) by TY3 and Class 1 thereafter.

FWOP

TY0	Class 5
-----	---------

TY1 Class 5
 TY50 Class 5

FWP

TY1 Class 5 (Supra-tidal elevations persist, correlates with assumptions table and settlement data)
 TY2-3 Class 3 (“carpet marsh”)
 TY5 50% Class 3; 50% Class 1
 TY6 100% Class 1 Marsh: 97%
 TY39 100% Class 2 Marsh: 75%
 TY50 100% Class 3 Marsh: 61%

V4 – Shallow Open Water Habitat

The Fritchie draft 35 % design report indicates that based on aerial photography, it appears the target marsh site is very shallow open water and anticipates that the existing bottom elevations within the open water project area is approximately -1.0 NAVD88. Field reconnaissance and the 2007 OM&M report all indicate that the majority of both project areas are less than 1.5 ft deep (NMFS 2009). Additional data was collected during the April 14, 2011, field trip for the HSDDRS mitigation project. An average water elevation was obtained from two CRMS locations (4407 & 4406). Water depths collected on that day were adjusted to the average of the two water elevations (0.44 ft NAVD88). Of those sample locations 66% were less than or equal to 1.5 feet.

FWOP

TY0 66%
 TY1 66%
 TY50 44% (1/3 SOW becomes deep = 33.33%)

FWP

TY1 100% (no open water)
 TY2-6 100%
 TY39 100% Marsh loss is greater in this area; however, subsidence as documented at the Rigolets gage is comparably lower.*
 TY50 83% (of the 36 % water) =1/6 of shallow open water (marsh loss) becomes deep based RSLR

*PPL 19 CWPPRA project assumed that 100% of the marsh creation site will remain shallow and within the intertidal range after 20 years of subsidence.

V5 – Salinity

CRMS 4406 along Salt Bayou references a 2010 mean growing season salinity of 3.63 ppt, while CRMS 4407, located north of Salt Bayou references 1.79 ppt for 2010 (2.71=average). A salinity of 2.4 ppt was measured during the April 14, 2011, field trip.

Excerpt from (PPL 19) Fritchie Marsh Terracing and Marsh Creation Project WVA Information Sheet (2009):

In the 2007 Operations, Maintenance, and Monitoring Report for the Fritchie Marsh Restoration Project (PO-06), salinity data was collected throughout the project area pre-construction, from 1997-2000, and from 2001-2005. The summary statistics showed that during the monitoring period, salinity averaged about 3 ppt post construction. This average was considerably higher pre-construction at about 6 ppt. Field measurements taken during a 2009 WVA trip showed measurements around 3 ppt as well. The 2007 report discussion on vegetative composition indicated that the vegetative communities were trending brackish, and that the predominant vegetation is Spartina patens, and Schoenoplectus americanus. Given the influence of the Rigolettes on the Fritchie watershed, and the increasing salinities seen in Lake Pontchartrain, it is assumed that salinities will continue to increase. This is expected to be abated, however, by increasing freshwater entering through Salt Bayou after the planned NRCS bayou maintenance.

FWOP & FWP

CRMS 4406 along Salt Bayou references a 2010 mean growing season salinity of 3.63 ppt, while CRMS 4407, located north of Salt Bayou references 1.79 ppt for 2010 (2.71=average). A salinity of 2.4 ppt was measured during the April 14, 2011, field trip.

The Fritchie Marsh Terracing and Marsh Creation Project WVA Information Sheet (PPL21, 2011) based salinity values on CRMS data from 2007 to 2011, which resulted in a 3.2 ppt average.

TY0-50 = 3.2 ppt

V6 – Fish Access

The mitigation project area lies within the “north area” of the CWPPRA PPL 19 Fritchie Marsh Terracing and Marsh Creation Project. After further consideration, it was determined that 70% of the area was influenced by the Louisiana Highway 433 Bridge (structure rating = 1.0) and 30% from the HWY 90 open culverts (structure rating = 0.5) (NMFS 2009).

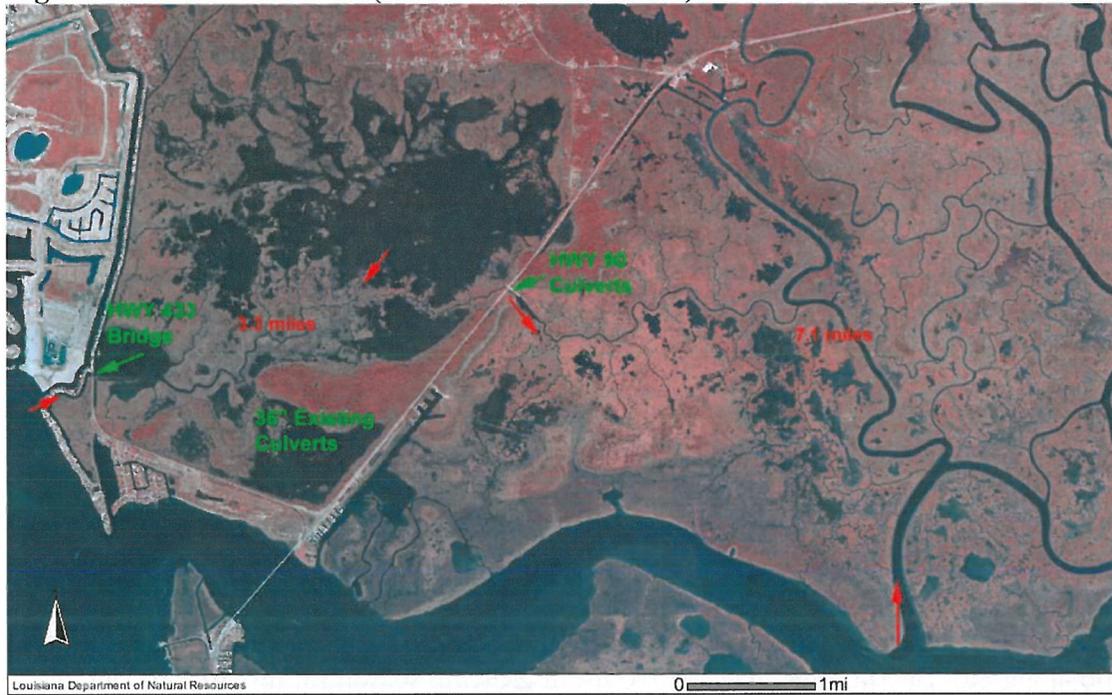
$$(0.70*1.0) + (0.30*0.5) = 0.70+0.15= 0.85$$

FWOP = 0.85

FWP

TY1	0.0001
TY3	0.0001

Figure 4. Fisheries Access (Reference NMFS 2009)



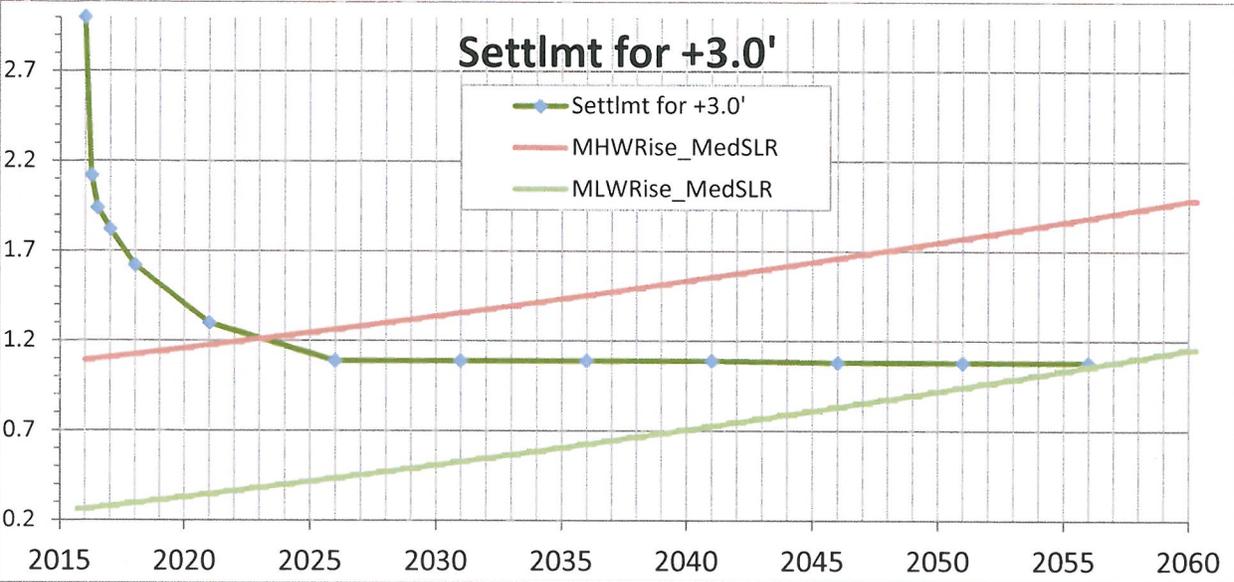
Literature Cited

Chabreck, R. H. and G. Linscombe. 1997. Vegetation type map of the Louisiana coastal marshes. Baton Rouge, LA. Louisiana Department of Wildlife and Fisheries.

Chabreck, R. H., G. Linscombe, S. Hartley, J. B. Johnston, and A. Martucci. 2001. Coastal Louisiana Marsh-Vegetation Types. CD Version. USGS National Wetlands Research Center. Lafayette, LA

NMFS. 2009. PPL 19 Fritchie Marsh Terracing and Marsh Creation Project: Project Information Sheet for Wetland Value Assessment. Revised October 16, 2009. CWPPRA Environmental Workgroup.

Sasser, C.E., J.M. Visser, E. Mouton, J. Linscombe, and S.B. Hartley. 2008. Vegetation types in coastal Louisiana in 2007: U.S. Geological Survey Open-File Report 2008-1224, 1 sheet, scale 1:550,000.



Fill +3.0				
Year	Foundation consolidation from Settle 3D, ft	Fill shrinkage above the water line, ft	Fill consolidation, ft	Elevation
0	0	0	0	3
0.25	0.87	0.01	0.01	2.12
0.5	1.02	0.02	0.01	1.94
1	1.11	0.05	0.03	1.82
2	1.14	0.15	0.09	1.62
5	1.17	0.32	0.20	1.30
10	1.19	0.44	0.27	1.09
30	1.19	0.45	0.28	1.08
50	1.19	0.45	0.28	1.08

Fill +3.0 - Dredged Fill Time Rate Shrinkage and Consolidation

15% Fill shrinkage - above the water line

Rate	10%	33%	72%	98%	100%	100%
Time	year 1	year 2	year 5	year 10	year 30	year 50
Amount	$0.15*3*0.1$	$0.15*3*0.33$	$0.15*3*0.72$	$0.15*3*0.98$	$0.15*3$	$0.15*3$
(in feet)	0.05	0.15	0.32	0.44	0.45	0.45

7% Fill consolidation

Rate	10%	33%	72%	98%	100%	100%
Time	year 1	year 2	year 5	year 10	year 30	year 50
Amount	$0.07*4*0.1$	$0.07*4*0.33$	$0.07*4*0.72$	$0.07*4*0.98$	$0.07*4$	$0.07*4$
(in feet)	0.03	0.09	0.20	0.27	0.28	0.28

2. Project Description, Pages 3-4, edited

This BLH-Wet and Brackish Marsh restoration project is located on the north shore of Lake Pontchartrain in the northeast quadrant of the lake, immediately adjacent to U.S. Highway 90, and approximately five (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 filling with dredge borrow material approximately 159 acres of BLH-Wet (incorporating degraded dikes) and 146 acres of brackish marsh (incorporating degraded dikes); all within a designated shallow open water area immediately northwest of Salt Bayou within the Fritchie Marsh area.

For the BLH-Wet construction scenario, initial target elevation for dredge fill would be to approximate elevation +5.5 feet NAVD88, to ultimately hit a target elevation (post settlement and consolidation) ranging from +2.5 feet to +3.25 feet NAVD88. The retention dike around the BLH-Wet creation area will be constructed to elevation +7.0 feet NAVD88 to contain the dredge slurry. A baseline retention dike at the southern boundary of the BLH-Wet creation area will also be constructed to elevation +7.0 feet NAVD88 which also composes the northern retention dike of the marsh creation areas. This baseline dike will ultimately be degraded to BLH-W elevation; the footprint being encapsulated into the BLH-W acreage but transitioning into the marsh creation platform. Overflow weirs will be constructed along this dike to allow effluent flow into the marsh creation area. Overflow weirs and/or spill boxes would also be allowed along the western leg of the project footprint. During placement of material into the marsh creation site, monitoring of Salt Bayou, as well as temporary canal closures (earthen deflection weirs, hay bales, silt curtains, etc. would be required of the Contractor in the immediate proximity of effluent overflow to assure no significant transporting of earthen fill in to Salt Bayou occurs. For the marsh construction scenario, initial target elevation for dredge fill would be to approximate elevation +3.0 feet NAVD88, to ultimately hit a target elevation (post settlement and consolidation) ranging from +0.8 feet NAVD88 to +1.2 feet NAVD88. A retention dike around the marsh creation area will be constructed to a lower elevation +4.0 feet NAVD88 and will tie into the baseline dike at the southeast and southwest limits of BLH-W work. Dredge effluent waters will be allowed to flow south and west into the adjacent open waters for nourishment of the adjacent marsh.

Fill Material for the creation of the BLH-Wet and marsh creation areas will come from a borrow site located in Lake Pontchartrain approximately 3,000 feet offshore from Treasure Island, LA. Dredging of the borrow will be conducted via hydraulic dredging and piped to the BLH-Wet and marsh creation areas. A floating/submerged pipeline will be placed from the borrow site to the beach along Old Spanish Trail Road. The Contractor will be required to maintain navigation access for recreational boaters. From the beach head, the pipeline will be laid on the ground to Old Spanish Trail Road. A 36" steel culvert will be jacked under Old Spanish Trail Road for the pipeline to pass under the road. From the new culvert to the marsh creation area, the pipeline will be placed on the ground along Old Spanish Trail Road and Chef Menteur Hwy between the edge of the road shoulders and the vegetation line along the existing marsh until it reaches Salt Bayou. Immediately north of Salt Bayou, a timber board road will be constructed along the proposed access corridor to the open water within of the refuge. Sand fill shall be placed in low

areas prior to placement of the board road. The timber board road shall be removed at completion of the project. If sand fill, as required for board road installation, is trucked onto the site via Chef Menteur Highway, the Contractor is responsible for keeping the highway free of dirt and debris as a result of this activity. At the location where the timber board road ends at open water, the pipeline will continue along the access corridor to the marsh and BLH-Wet creation areas. See Figure 1 in Appendix A for the overview of the project.

FINAL Wetland Value Assessment Project Information Sheet

July 28, 2015

Prepared for:
U.S. Army Corps of Engineers

Prepared by
U.S. Fish and Wildlife Service

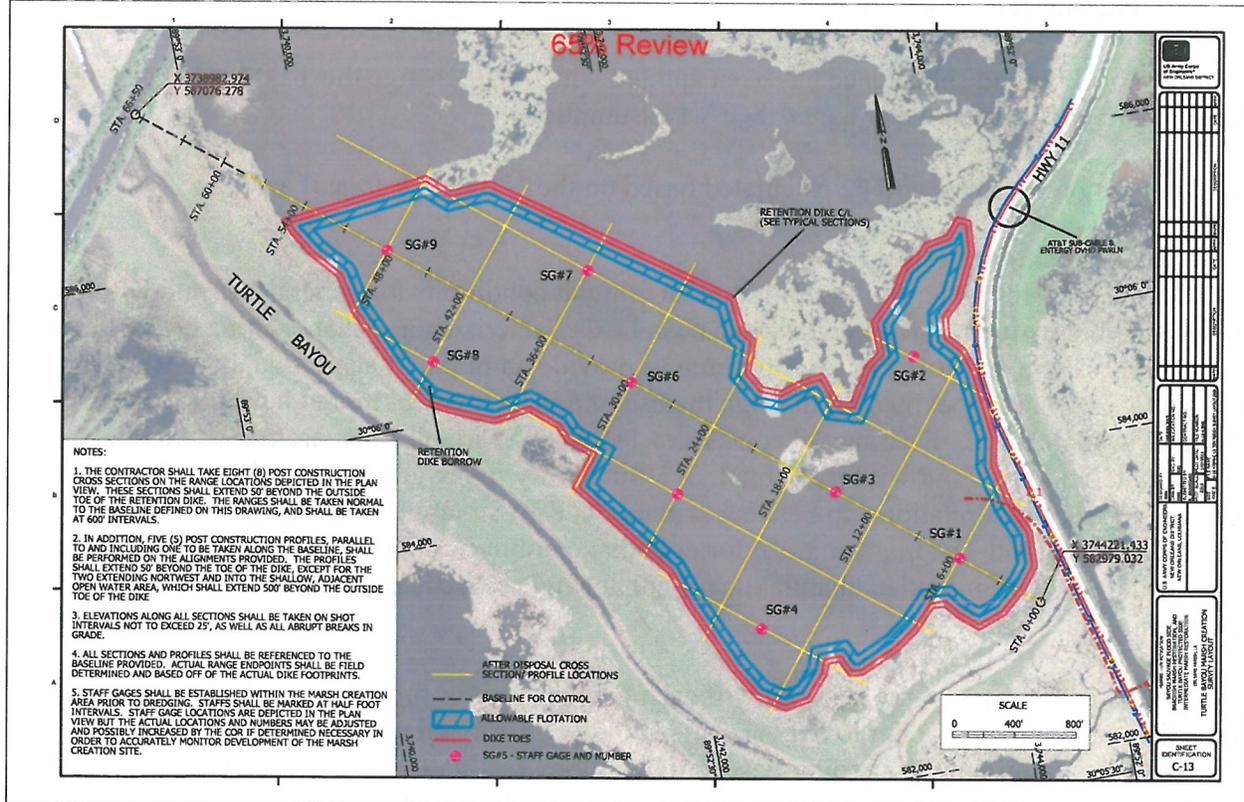
Project Name: LPV HSDRRS Mitigation- Turtle Bayou Protected Side Fresh/Intermediate Marsh Mitigation

Mitigation Potential: 0.39 AAHUs/acre; 45.24 Total AAHUs for 118 acres

Project Type(s): Protected Side, Fresh/Intermediate marsh restoration project

Project Area: The Turtle Bayou marsh mitigation project is located in the Bayou Sauvage National Wildlife Refuge 16 mi (25.8 km) east of New Orleans in Orleans Parish.

Figure 1. Project Area



Project Goal: Restore a sufficient amount of intermediate marsh habitat within the project area to mitigate for the 42.9 AAHUs of protected side, on-refuge, fresh and intermediate marsh habitat impacted by the LPV HSDRRS.

Project Description: See Appendix A.

Project Construction Schedule: construction start date – 12/2015, TY1 = 2017

TY0 – pre construction, FWOP conditions

Construction - November 2016 -June 2017: Physical Construction: Dredge, Dike work, etc.

TY1 – 2017 (May 2017 - May 2018: Settlement (1-yr))

TY2 – 2019 Jan-Feb 2019: Degrading dikes

TY2 – 2019 Mar-June 2019: Plantings

Project Acres (estimated before resizing to 117.5):

Total Area = 180.6 acres (marsh platform + containment dikes) as determined by ArcGIS files.

FWOP Existing Marsh @ 2010* = 4.4 acres

Marsh Creation Platform* = 164.7 acres

Containment Dike (CD) = 11.5 acres, degraded to marsh elevations @ TY 2

CD Borrow Area = 17.1 acres within marsh platform area, Corps Eng. assumption that 90% would be filled to marsh elevations = 15.4 ac marsh + 1.7 ac open water

Total Marsh = 164.7 +11.5 -1.7 + 4.4 = 178.9 acres marsh platform @ TY 2 (not including background subsidence/loss rate)

*Note: a background subsidence has been applied which will change the TY0 (2016) marsh creation acres and open water acres. See V1 assumptions.

The mitigation potential will be calculated based on the 180.6 acre area of analysis.

Habitat Assessment Method

The WVA operates under the assumption that optimal conditions for general fish and wildlife habitat within a given coastal wetland type can be characterized, and that existing or predicted conditions can be compared to that optimum to provide an index of habitat quality. Habitat quality is estimated or expressed through the use of a mathematical model developed specifically for each wetland type. Each model consists of 1) a list of variables that are considered important in characterizing fish and wildlife habitat, 2) a Suitability Index graph for each variable, which defines the assumed relationship between habitat quality (Suitability Index) and different variable values, and 3) a mathematical formula that combines Suitability Index for each variable into a single value for wetland habitat quality; that single value is referred to as the Habitat Suitability Index, or HSI.

The WVA models assess the suitability of each habitat type for providing resting, foraging, breeding, and nursery habitat to a diverse assemblage of fish and wildlife species. This standardized, multi-species, habitat-based methodology facilitates the assessment of project-induced impacts on fish and wildlife resources. The coastal marsh WVA model consists of six variables: 1) percent of wetland area covered by emergent vegetation; 2) percent of open water

area covered by aquatic vegetation; 3) marsh edge and interspersions; 4) percent of open water area \leq 1.5 feet deep in relation to marsh surface; 5) salinity; and 6) aquatic organism access.

Values for those variables are derived for existing conditions and are estimated for conditions projected into the future if no restoration efforts are applied (i.e., future-without-project), and for conditions projected into the future if the proposed restoration project is implemented (i.e., future-with-project), providing an index of quality or habitat suitability of the habitat for the given time period. The habitat suitability index (HSI) is combined with the acres of habitat to get a number that is referred to as "habitat units". Expected project benefits are estimated as the difference in habitat units between the future-with-project (FWP) and future-without-project (FWOP). To allow comparison of WVA benefits to costs for overall project evaluation, total benefits are averaged over a 50-year period, with the result reported as Average Annual Habitat Units (AAHUs).

V1 - Emergent Vegetation

Existing – The project area is classified as predominantly open water as determined by FWS analysis of 2013 aerial photography. Approximately 4.4 acres of marsh, in the form of small islands and marsh edge, exists within the proposed marsh creation area. Sasser et al. classified the area as intermediate marsh in 2007 and 2013.

According to USFWS (1994, per 2003 CWPPRA PO-18 Monitoring Report), the project area was over 90% non-fresh marsh (intermediate or brackish marsh) in 1956, 60% non-fresh marsh in 1978, and 14% non-fresh marsh in 1990. This was a 76% loss of non-fresh marsh. However, this non-fresh marsh loss was somewhat offset by an increase from 0% fresh marsh in 1956 to 30% fresh marsh in 1988. Probably the most dramatic indication of the project area deterioration due to impoundment was the increase in open-water area from 6.0 % in 1956 to 30% in 1988. The open-water ponds were about a third covered with submersed aquatics in 1978, but all of the submersed aquatic vegetation had disappeared by 1990. The loss of the non-fresh marsh and submersed aquatic vegetation has resulted in large open-water ponds, some over 1 mi (1.6 km) wide and approximately 1 ft (0.3 m) deep.

The soils are mainly Lafitte, Clovelly and Gentilly mucks characterized by very fluid organic soils underlain by clay. The higher areas are Aquent soils, which are highly variable and slightly saline. The remnants of the Pine Island Beach Ridge, which cross the area, were more highly drained sands and silts, but were mined for material for Interstate 10.

Land Loss Data

To calculate loss rates USGS evaluated 10,506 acre extended boundary (Figure 2, polygon10). USGS determined the 1985-2010 rate from a linear regression that is depicted in Figure 3. The rate (0.19%/yr), which shows slight land gain, was calculated from percent land values (acres) from that 1984-2010 timeframe. In some cases, USGS excludes some data points from the regression analysis due to low and high water events.

USGS's percent is of the total area (marsh + water). The FWS percent change rate was

determined as a percent of the 1985 land area and also included all data points provided. Typically, in WVAs and other such evaluations, we have used the FWS method as there might in some cases be non-wetlands within the polygon and then use of the total polygon area would result in obvious errors. Therefore, the FWS method has been the standard method used in the past. Based on the data provided by USGS, the FWS determined a change rate of 0.029% per year.

Typically, for FWP it is assumed that the loss rate would be reduced by 50% until a point when post-construction accretion exceeds 10 inches above the created marsh platform; however, since this area is showing land gain, no loss or reduction in loss is applied.

**Subsidence – Subsidence (Rigolets Gauge = 3.0 mm/yr) was factored into the land change analysis.

Figure: 2. USGS Extended Boundary for Turtle Bayou Marsh - polygon 10

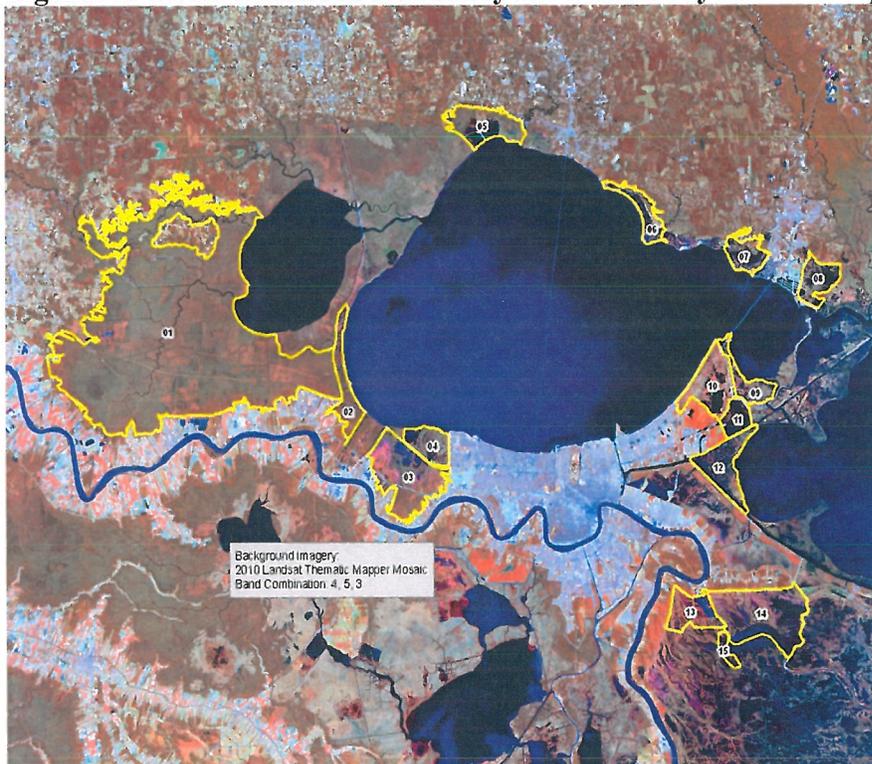
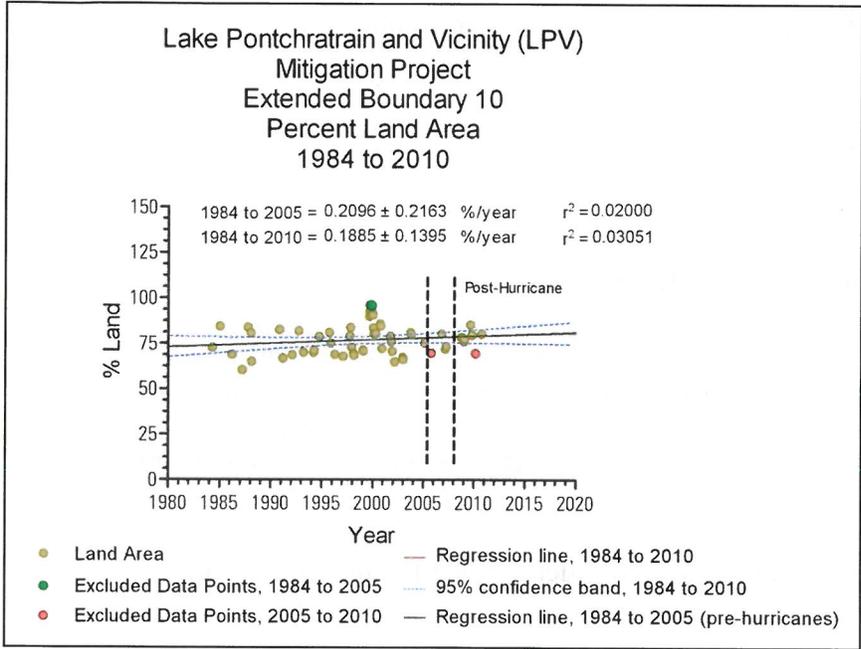


Figure3. Land loss rate determined by USGS (Ext Boundary 10)



FWOP

Land Change Rate: incorporated the background subsidence rate provided by the Corps to be conservative, no marsh loss rate was applied.

V1		marsh (ac)	marsh %	OW (ac)	OW (%)
FWOP					
2016	TY0	4.3	4%	113.2	96%
2017	TY1	4.3	4%	113.2	96%
2018	TY2	4.3	4%	113.2	96%
2019	TY3	4.3	4%	113.2	96%
2020	TY4	4.3	4%	113.2	96%
2021	TY5	4.3	4%	113.2	96%
2026	TY10	4.2	4%	113.3	96%
2036	TY20	4.0	4%	113.5	97%
2046	TY30	3.9	3%	113.6	97%
2053	TY37	3.8	3%	113.7	97%
2066	TY50	3.6	3%	113.9	97%

FWP

Projected Eustatic Sea Level Rise (SLR) estimates were not considered because this project is located within the flood protection system. Land change (gain) rates were also not applied to be conservative. Additionally, background subsidence rates were applied for this analysis to account for the uncertainty of construction methods and future conditions (long-term operation of pumps). Created marsh platform has limited marsh function until settlement, breaching of

retention dikes, and vegetation occurs. Those assumptions are applied through TY 5.
Credit assumption applied:

- TY1 - 0% credit
- TY2 - 10%
- TY3 - 25%
- TY4 - 62.5%
- TY5 - 100% credit of remaining marsh platform

See Appendix B for estimated settlement rates for the constructed marsh platform. Based on the operation plan, the constructed marsh elevations could be within the range of manipulated flooding regimes at TY 1, however, containment dikes may be in place through TY2. It is assumed that two years of settlement occurs before accretion is initiated, which factors into the loss rate reduction assumption.

Land Change Rate: 0 acres/year (FWS LLR), subsidence rate of 3 mm/yr applied.

FWP		marsh (ac)	marsh %	OW (ac)	OW (%)
2016	TY0	4.3	4%	113.2	96%
2017	TY1	4.3	4%	0.5	0%
2018	TY2	15.6	13%	0.5	0%
2019	TY3	32.5	28%	0.5	0%
2020	TY4	74.7	64%	0.5	0%
2021	TY5	117.0	100%	0.5	0%
2026	TY10	115.0	98%	2.5	2%
2036	TY20	111.2	95%	6.3	5%
2046	TY30	107.3	91%	10.2	9%
2053	TY37	104.6	89%	12.9	11%
2066	TY50	99.5	85%	18.0	15%

V2 – Submerged Aquatic Vegetation (SAV)

The 2003 CWPPRA monitoring report gives indication that the area has not supported SAVs over the recent years. During a May 20, 2014, HSDRRS WVA field trip SAV was not observed.

FWOP

TY0-50 0%

FWP

Although it is anticipated that SAV will reestablish with the creation of marsh in the area, to be

conservative FWOP conditions are assumed.

TY0-50 0%

V3 – Interspersion

The marsh creation cell is predominantly open water. For the HSDRRS Mitigation alternatives analysis it is assumed that marsh creation would occur within the entire cell and, therefore, no marsh nourishment would be credited. Therefore, the site will be classified as Class 5 for FWOP.

FWOP

TY0-50 100% Class 5

FWP

The created marsh will be considered a “carpet marsh” at TY3 (i.e., 100% Class 3) transitioning to a Class 1 by TY5.

TY0	100% Class 5
TY1	100% Class 5
TY2	100% Class 3 (“carpet marsh”)
TY3	100% Class 3 (“carpet marsh”)
TY4	50% Class 3 (“carpet marsh”), 50% Class 1
TY5	100% Class 1 (projected elevations are at TMEs)
TY37	100% Class 1 *(89% marsh)
TY50	100% Class 1 (85% marsh)

* USGS Interspersion tool assumes marsh areas >82% marsh = Class 1

V4 – Shallow Open Water Habitat

Water depths were taken throughout the project site during a May 20, 2014, field investigation with an average depth of 1.7 (not correct using an average water elevation). Based upon data obtained by the Corps during a January 22, 2014, the average water depth within the restoration area was approximately 1.7'. The gage at the boat launch, located off of LA Hwy 11 and north of the restoration site, read -0.6', placing the average elevation of water bottoms within the restoration area at approximately -2.3'. This area is influenced predominately by rainfall and water control pumps associated with the Bayou Sauvage NWR Hydrologic Restoration project authorized under Coastal Wetlands Protection, Planning, and Restoration Act (CWPPRA PO-18). That project goal is to promote reestablishment of emergent marsh by lowering water levels to -0.5 feet to 0.0 feet of marsh sediment elevation in the spring and summer and to within 0.5 feet of marsh sediment elevations throughout the rest of the year. After Katrina those pumps were not operated due to impacts associated with the storm and improvements to the levee system. The Corps replaced the pumps in 2011.

It is assumed that under FWP and FWOP water levels are 1.5 feet or less throughout the area due to management goals.

FWOP & FWP

TY0-50 - 100%

V5 – Salinity

Existing conditions - The water within the area has variable salinities. Also, if the proposed borrow areas in Lake Pontchartrain and Lake Borgne are utilized, brackish water and sediment may be introduced into the project area. The rate of evaporation and rainfall control the water salinity. Currently estimates for salinity in the area are only available south of Louisiana Highway 11 (CRMS4107). The mean salinity recorded by that station for the 2013 growing season was 2.7 ppt.

FWOP & FWP

TY0 – TY50 2.7 ppt

V6 – Fish Access

The project area is located within the HSDDRS levee system. Aquatic organisms within protection system have access to the area through gaps in canal banks. Access within this unit is also impeded by LA Hwy 11 and Interstate 10. Fish Access will not be improved under with project conditions.

FWOP - Existing conditions are expected to persist.

TY0-TY50: 0.0001

FWP - Existing conditions are expected to persist.

TY0 – TY50: 0.0001

Literature Cited

Chabreck, R. H. and G. Linscombe. 1997. Vegetation type map of the Louisiana coastal marshes. Baton Rouge, LA. Louisiana Department of Wildlife and Fisheries.

Nyman, J.A., R.D. Delaune, H.H. Roberts, and W.H. Patrick Jr. 1993. Relationship between vegetation and soil formation in a rapidly submerging coastal marsh. Marine Ecology Progress Series 96:269-279.

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Sasser, C.E., J.M. Visser, E. Mouton, J. Linscombe, and S.B. Hartley. 2008. Vegetation types in coastal Louisiana in 2007: U.S. Geological Survey Open-File Report 2008–1224, 1 sheet, scale 1:550,000.

WVA Appendix A.

Turtle Bayou PS IM Draft 65% DDR, February 2015

Section 2 Project Description, Pages 1-2 - The Turtle Bayou Protected Side Intermediate Marsh project is located on the Bayou Sauvage National Wildlife Refuge NWR and in eastern New Orleans adjacent to Turtle Bayou, and east of I-10. As proposed, the project would consist of creating approximately 172 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 HSDRRS LPV Mitigation – Bayou Sauvage Floodside brackish marsh (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 three (3) existing 36 inch CMP 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 Hwy11, would be used. This corridor is existing marsh and will be filled prior to construction with approximately 1 foot of earthen fill material and mats in order to prevent permanent damage to the wetlands. The actual footprint of required fill and mats will be determined by the Contractor. Excavation within all designated access corridors/ routes will not be allowed.

Disposal within the restoration feature will 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 +0.5-feet NAVD88 (2009.55) (excluding effluent waters). A vertical working tolerance of +/- 0.25 feet will be permitted. 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 retention features for this project would be earthen and constructed from adjacent borrow to be obtained from within the marsh restoration feature, except for borrow for the two (2) earthen closure locations where borrow may be taken from outside of the restoration area.

Approximately 13,000 feet of earthen retention dikes and approximately 2,700 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 and slopes no steeper than 1V on 3H. The dikes and closures shall be constructed to approximate elevation +3.5-foot NAVD88 (2009.55). 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.

Section 5.5.2 Marsh Creation, Page 14 - At a 65% level of design, an elevation of +0.15' NAVD88 (2009.55) was determined to be the maximum acceptable long term target marsh elevation. An elevation of +0.15' NAVD88 (2009.55) would, for the most part, provide a slightly higher marsh elevation than the existing healthy marsh elevations captured within the project surveys which ranged for the most part from +0.2' to -0.4' NAVD88 (2009.55).

Section 2 Project Description, Page 2 - TBN IM 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 160 acres of protected side intermediate marsh within the proposed 172-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.

Fill +0.5				
Year	Foundation consolidation from Settle 3D, ft	Fill shrinkage above the water line, ft	Fill consolidation, ft	Elevation
0	0	0	0	0.5
0.25	0.118	0.003125	0.00625	0.372625
0.5	0.12	0.00625	0.0125	0.36125
1	0.12	0.0125	0.025	0.3425
2	0.12	0.04125	0.0825	0.25625
5	0.12	0.09	0.18	0.11
10	0.12	0.1225	0.245	0.0125
30	0.12	0.125	0.25	0.005
50	0.12	0.125	0.25	0.005

Fill +0.5 - Dredged Fill Time Rate Shrinkage and Consolidation

25% Fill shrinkage - above the water line

Rate	10%	33%	72%	98%	100%	100%
Time	year 1	year 2	year 5	year 10	year 30	year 50
Amount (in feet)	$0.25*0.5*0.1$	$0.25*0.5*0.33$	$0.25*0.5*0.72$	$0.25*0.5*0.98$	$0.25*0.5$	$0.25*0.5$
	0.0125	0.04125	0.09	0.1225	0.125	0.125

10% Fill consolidation

Rate	10%	33%	72%	98%	100%	100%
Time	year 1	year 2	year 5	year 10	year 30	year 50
Amount (in feet)	$0.1*2.5*0.1$	$0.1*2.5*0.33$	$0.1*2.5*0.72$	$0.1*2.5*0.98$	$0.1*2.5$	$0.1*2.5$
	0.025	0.0825	0.18	0.245	0.25	0.25

APPENDIX C

General Mitigation Guidelines:

Plantings, Success Criteria, Monitoring and Other General Guidance

SIER36

Bayou Sauvage, Turtle Bayou & New Zydeco Ridge Restoration Projects

(as provided in the Draft SIER36)

