APPENDIX B

Wetland Value Assessment
Project Information Sheets

Wetland Value Assessment Project Information Sheet

June 23, 2014

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 Marsh Creation Site

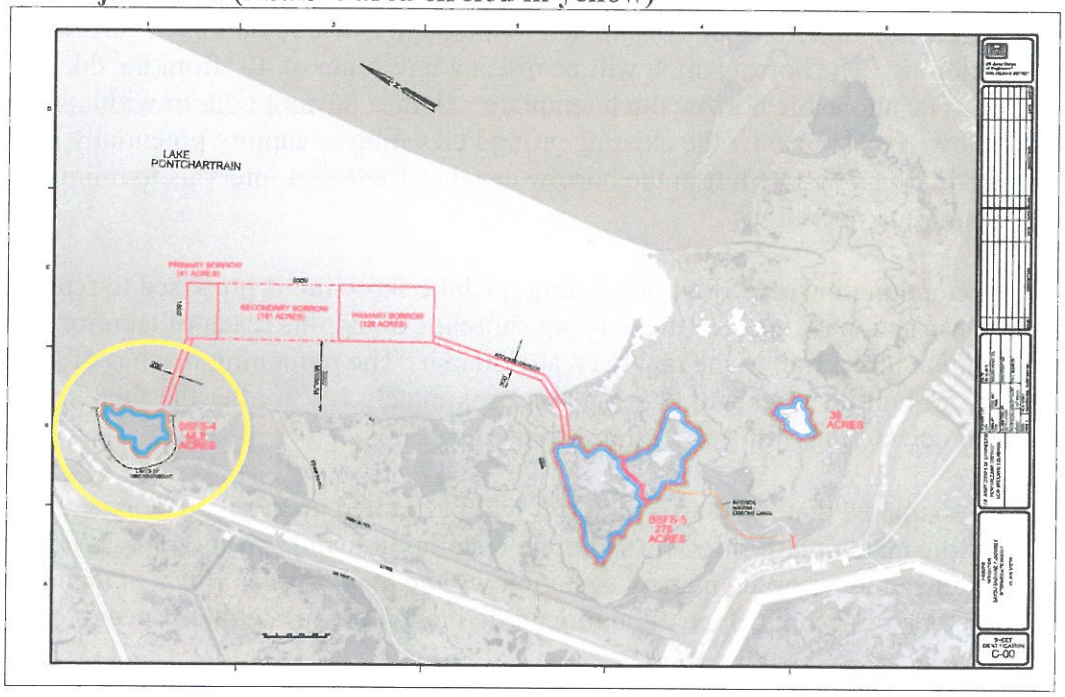
Revised from
<BSauv_PIS_MitWVA_FS_BrackishMarshCreate_PostFinal_Aug21_2012_editedACT20121017_mp.docx>

***Mitigation Potential:** 0.40

Project Type(s): Marsh Creation

Project Area: The Bayou Sauvage Marsh Creation site, BSFS-4, 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-4 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:

The most northern currently proposed marsh footprint (BSFS-4) is 49 acres in size and is located immediately east of Hwy 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, 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.

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 through restoration of a minimum of 325 (49 + 276) acres of flood side brackish marsh. Initial target elevation for dredge fill would be to approximate elevation +2.5 NAVD88, to ultimately hit a target marsh elevation ranging from +1.5 to +1.0 NAVD88. Total perimeter retention will be required. The retention dikes will be constructed to elevation +4.5 NAVD88, with a 5' crown. Due to poor soil conditions, 20 foot stability berms are required both interior and exterior of the dike alignment, resulting in an approximately 90 foot base width for the dike structure. For initial quantity estimates, the dikes are assumed to have 1 vertical on 4 horizontal side slopes. Retention dikes will be constructed to maintain a minimum of 1' of freeboard during dredging operations. The borrow ditch will be offset a minimum of 40' from the dike to assure dike stability. The allowable borrow ditch template will be a 80-foot bottom width, with excavation allowed to 15' below the existing ground elevation to capture potentially better deeper material. Plugs will be left in the borrow canal at 1000-foot intervals to minimize water flow during pumping operations.

The eastern retention dike of BSFS4 paralleling the lake shoreline is proposed to remain in place post marsh construction to enhance the existing shoreline along this reach of lakefront and provide additional protection to the newly created marsh. The remaining reaches of standard retention dike for both features will be gapped approximately 1 year after the final lift, upon settlement and dewatering of the created marsh platform.

Finally, it is anticipated that the marsh footprint will be planted upon satisfactory settlement and dewatering of the marsh platform. The shoreline restoration feature along Irish Bayou will also be planted. Plugs of appropriate marsh vegetation will be planted over 100% of the marsh restoration acreage on 7-foot centers. Planting guidelines and required plant species can be provided.

Marsh Creation in BSFS-4 would require 500,000 cubic yards of material obtained from Lake Pontchartrain, requiring a buffer of 2,000 feet between the existing shoreline and the borrow area

limit.

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 V_1 – 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

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

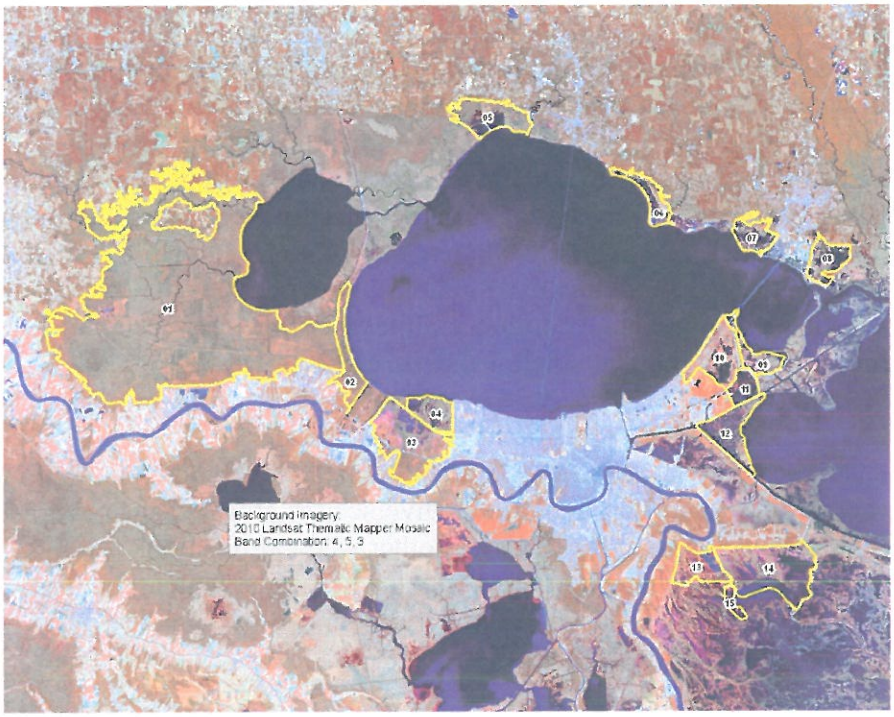
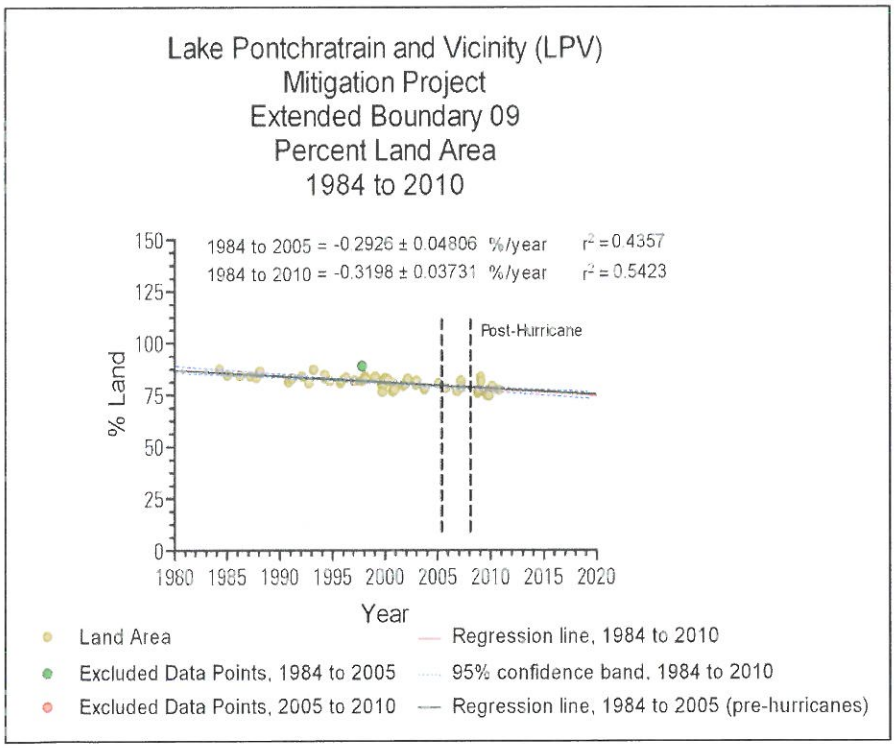


Figure 3. Land loss rate determined by USGS



The Service calculated land loss rate using the same USGS Land/Water data (1985-2010), but with a different 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. That rate was used to calculate land/water values over the life of the project.

FWOP

Extended Boundary Percent Loss Rate = -0.38%

TY0-50
Marsh: 0 acres (0%)
Water: 49 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 TY32 when at least 10 inches of water is assumed to cover the marsh and, therefore, 10 inches of post-construction accretion is assumed to occur. At that time background loss rate is resumed. A settlement period of 3 years was also applied based on settlement curves of previous CWPPRA restoration projects. 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.

Target years 1- 5 and credit applied are based on assumptions used for the Milton 95% design settlement curves.

FWP (reduced by 50%) BSFS-4 Project Area Acre per year lost rate = - 0.09 acres /year. (Rate reverts back to FWOP rate when water level rise equals 10 inches (-0.18 ac/year).

TY0	
Marsh:	0 acres (0%)
Water:	49 acres (100%)
TY1	
Marsh:	0 acres (0% credit factor applied) Milton WVA assumptions
Water:	0.11 acres (0.22%)
TY2	
Marsh:	4.88 acres/10% (10% credit factor applied)
Water:	0.20 acres (0.42%)
TY3	
Marsh:	12.18 acres/24.8% (25% credit factor applied)
Water:	0.30 acres (0.61%)
TY5	
Marsh:	48.51 acres (99 %)
Water:	0.49 acres (1%)
TY6	
Marsh:	48.39 acres (98.7%)
Water:	0.61 acres (1.25%)
TY32:	
Marsh:	44.16 acres (90.1%)
Water	4.84 acres (9.87 %)
TY50:	
Marsh:	38.42 acres (78.4 %)
Water	10.58 acres (21.59 %)

Variable V_2 – 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 – 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 32 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%)
TY32	91% (increase baseline by 10%)
TY 50	21% (25% of baseline; 75% loss from baseline – standard assumptions)

Variable V_3 - 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
TY32	100% Class 1 (90% marsh)
TY 50	100% Class 2 (78% marsh)

Variable V_4 - Percent of open water area <=1.5 feet deep in relation to marsh surface

Existing - Double check once survey comes back
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 2.0 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

TY0	15%
TY1	15%
TY3	15%
TY5	15%
TY6	15%
TY32	15%
TY50	10%

FWP- the mitigation project land platform would be built to a subaerial elevation with dredged material. 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	15%
TY1	100%
TY3	100%
TY5	100%
TY6	100%
TY32	100%
TY50	83% (24.3 of 146.3 acres of shallow water becomes deep)

Variable V_5 - Salinity

Existing conditions - Currently estimates for salinity in the area are available from the CRMS3626 station which is near the vicinity of the project area. The mean salinity recorded by that station for the 2010 growing season was 3.65 ppt.

FWOP & FWP
TY0 – TY50 3.65 ppt

Variable V_6 – Aquatic organism access

Existing conditions – The project area is not impounded nor hydrologically controlled by structures.

FWOP Existing conditions are expected to persist.
TY0 – TY50 = 1.0

FWP During 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
TY3	0.0001
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.

Wetland Value Assessment Project Information Sheet

July 1, 2014

Prepared for:
U.S. Army Corps of Engineers

Prepared by
U.S. Fish and Wildlife Service

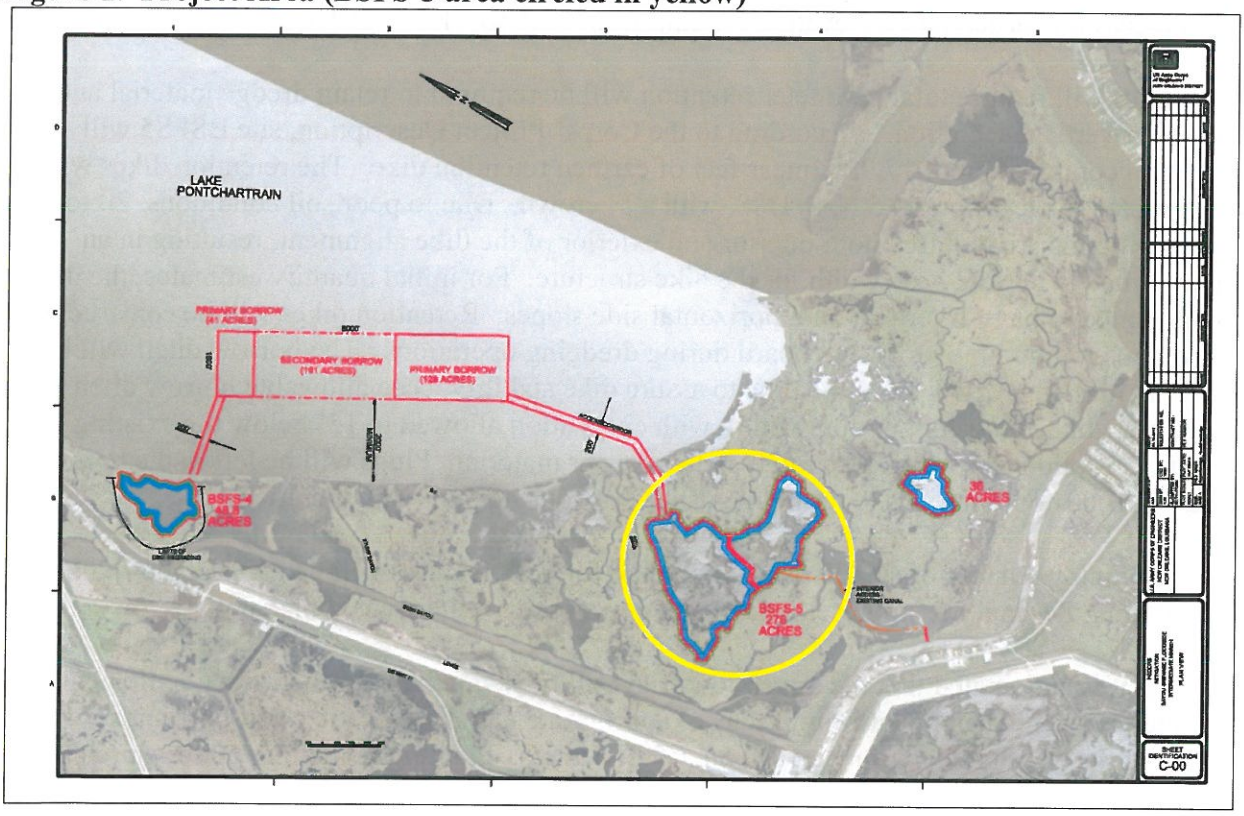
Project Name: LPV HSDRRS Mitigation- Bayou Sauvage Flood Side (BSFS-5) Marsh Creation Site

***Mitigation Potential:** *0.42 (AAHUs/acre) old,*
2014 Marsh Creation MP = 0.37AAHUs/ac & new Marsh Nourishment MP = 0.05 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 through restoration of a minimum of 325 (49 + 276) acres of flood side brackish marsh. *(FWS analysis of BSFS5 was based on 277.8 acres)

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.

Initial target elevation for dredge fill would be to approximate elevation +2.5 NAVD88, to ultimately hit a target marsh elevation ranging from +1.5 to +1.0 NAVD88.

Both sites will require total perimeter retention will be required to retain dredge material and allow for vertical accretion. According to the Corps' Project Description, site BSFS5 will require a combination of 17,925 linear feet of earthen retention dike. The retention dikes will be constructed to elevation +4.5 NAVD88, with a 5' crown. Due to poor soil conditions, 20 foot stability berms are required both interior and exterior of the dike alignment, resulting in an approximately 90 foot base width for the dike structure. For initial quantity estimates, the dikes are assumed to have 1 vertical on 4 horizontal side slopes. Retention dikes will be constructed to maintain a minimum of 1' of freeboard during dredging operations. The borrow ditch will be offset a minimum of 40' from the dike to assure dike stability. The allowable borrow ditch template will be a 80-foot bottom width, with excavation allowed to 15' below the existing ground elevation to capture potentially better deeper material. Plugs will be left in the borrow canal at 1000-foot intervals to minimize water flow during pumping operations.

The remaining reaches of standard retention dike for both features will be gapped approximately 1 year after the final lift, upon settlement and dewatering of the created marsh platform.

Finally, it is anticipated that the marsh footprint will be planted upon satisfactory settlement and dewatering of the marsh platform. Plugs of appropriate marsh vegetation will be planted over 100% of the marsh restoration acreage on 7-foot centers. Planting guidelines and required plant species can be provided.

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.

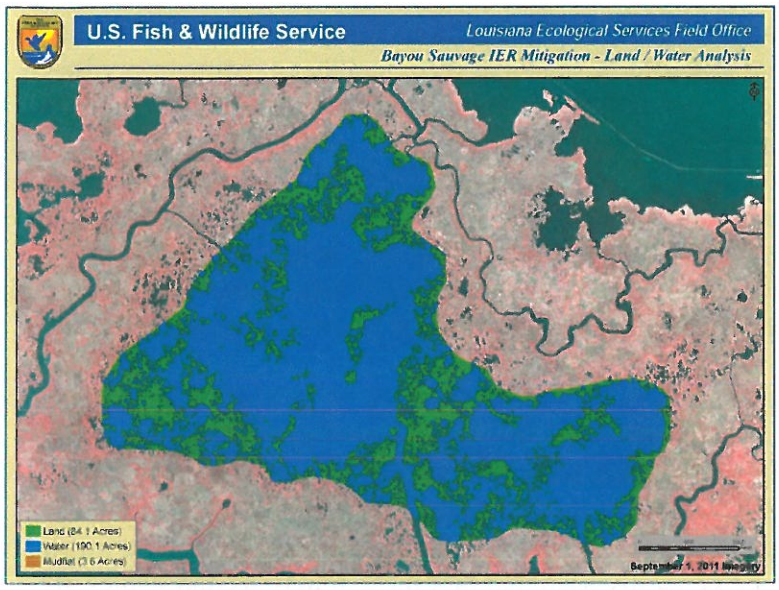
The procedure for evaluating project benefits on fish and wildlife habitats, the WVA model, uses a series of variables that are intended to capture the most important conditions and functional values of a particular habitat. Values for these variables are derived for existing conditions and are estimated 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 V_1 – Percent of wetland area covered by emergent vegetation

Existing – The 277.8 acre project area has been classified by the Service as 30% marsh ("**BSFS5-MN**", 84.1 acres) and 70% water ("**BSFS5-MC**", 193.7 acres) based on 2011 aerial imagery (Figure 2). The 3.6 acres classified as mudflat is considered in the open water 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

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

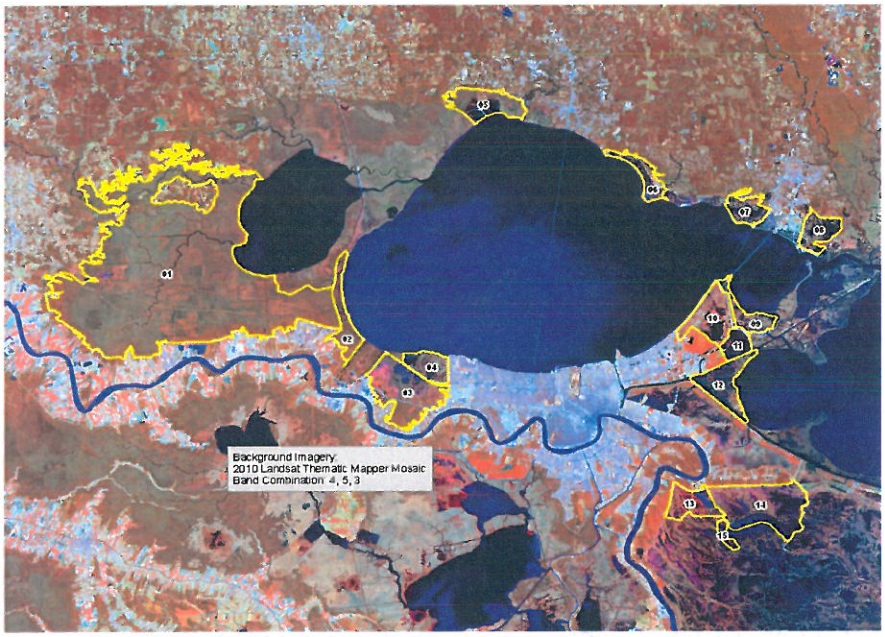
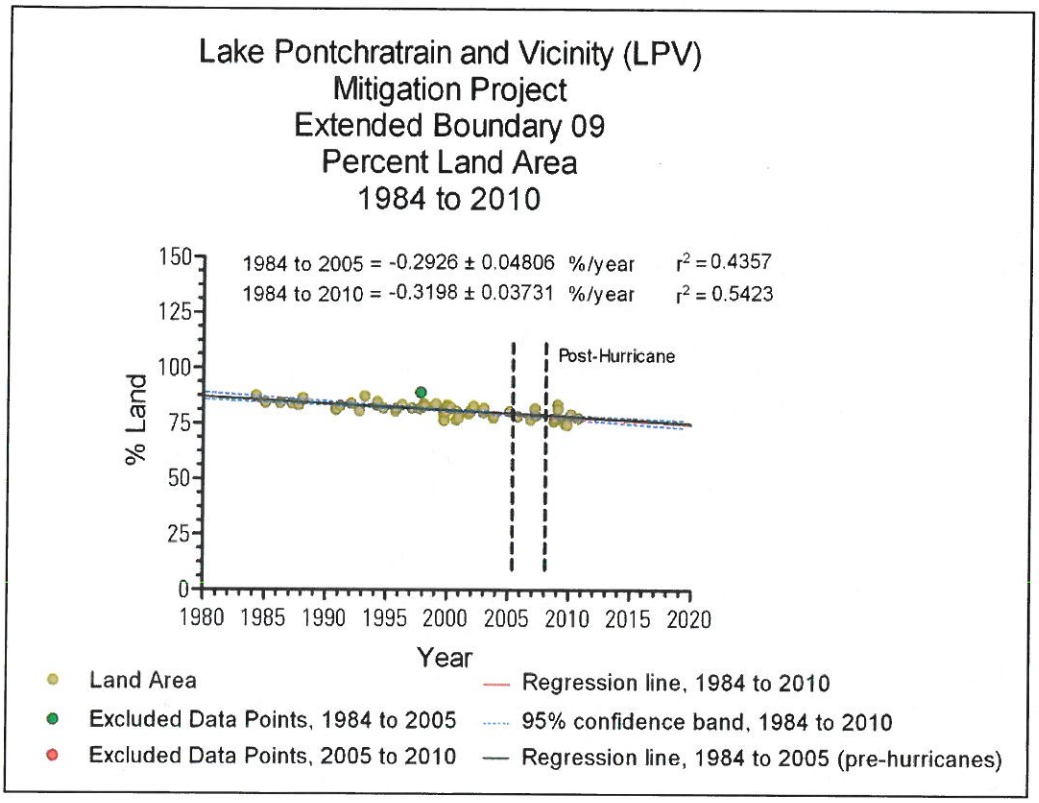


Figure 4. Land loss rate determined by USGS



The Service calculated land loss rate using the same USGS Land/Water data (1985-2010), but with a different 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. That rate was used to calculate land/water values over the life of the project.

FWOP

Extended Boundary Percent Loss Rate = -0. 38%

BSFS5- MC = 0 ac/year
BSFS5- MN = -0.35 ac/year

(Of the 84.1 acres 1.82 acres coverts to open water prior to start of construction. As a conservative estimate this acreage is not considered in the calculations of marsh creation)

Table 1: FWOP BSFS5-MN Acres

BSFS5-MN (84.10 ac)			
TY	**Class**	**Acres**	**Percent**
0	Marsh	82.28	97.8%
	Water	1.82	2.16%
1	Marsh	81.90	97.3%

	Water	2.2	2.61%
32	Marsh	67.36	80.1%
	Water	17.0	19.9%
50	Marsh	56.48	67.2%
	Water	24.92	29.6%

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 TY32 when at least 10 inches of water is assumed to cover the marsh and, therefore, 10 inches of post-construction accretion is assumed to occur. At that time background loss rate is resumed. A settlement period of 3 years was also applied based on settlement curves of previous CWPPRA restoration projects. 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.

Target years 1- 5 percent credit to vegetated marsh platform are based on assumptions used for the Milton 95% design settlement curves. TY1 = 0%, TY2 = 10%, TY3 = 25%, TY4 = 62.5%, TY5 = 100% for marsh creation. TY1 = 0%, TY2 = 25%, TY3 = 50%, TY5 = 100% for nourished marsh.

FWP (reduced by 50%) BSFS-4 Project Area Acre per year lost rate = - 0.09 acres /year. (Rate reverts back to FWOP rate when water level rise equals 10 inches (-0.18 ac/year).

Table 2: FWP Marsh Acres

		BSFS5-MC			BSFS5 - MN			
TY	Class	Acres	%	% Credit	Acres	%	% Credit	*FWOP % L/W Comparison*
0	Marsh	0	0		82.28	97.8%		*97.8%*
	Water	193.7	100%		1.82	2.2%		
1	Marsh	0	0	0	0(82.28)	0 (97.6%)	0	*97.3%*
	Water	0.43	0.22%		2.02	2.4%		
2	Marsh	19.29	10%	10	20.47	24%	25	
	Water	0.81	0.42%		2.24	2.7%		
3	Marsh	48.13	24.8%	25	40.82	49%	50	
	Water	1.18	0.61%		2.45	2.92%		
5	Marsh	191.76	99%	100	81.2	96.5%	100	*95.5%*
	Water	1.94	1.00%		2.9	3.45%		
6	Marsh	191.28	98.7%		80.97	96.3%		
	Water	2.42	1.25%		3.13	3.7%		
32	Marsh	174.58	90.1%		72.96	86.8%		
	Water	19.12	9.87%		11.14	13.2%		
50	Marsh	151.88	78.4%		65.23	77.6%		*67.2%*
	Water	41.82	21.59%		18.87	22.4%		

Variable V_2 - Percent of open water covered by aquatic vegetation

Existing Conditions –The extended project area is a brackish marsh with interior open water ponds that are expanding in size as marsh loss continues. The immediate project area is approximately 70% water and 30% marsh. SAV is abundant. Based on observations during a May 20, 2014, field trip, it was estimated that 100% of the open water area had SAV cover (Eurasian watermilfoil and widgeon grass, or *Ruppia,* was observed).

FWOP – Existing conditions are expected to continue. This area is not expected to breach into the lake within the project life based on loss rates. 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. The existing foreshore rock dikes will provide diminishing wave energy protection for SAV as they subside below the water level.

BSFSN5- MC & MN

TY 0-1	100%
TY 32	75% (75% of baseline; losses due to factors described above)
TY 50	60% (60% of baseline, assuming the area is still classified as an interior pond)

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, it is assumed that very little open water, or SAV volunteers exists to support SAV growth.

BSFSN5- MC & MN

TY 0	100%
TY 1-3	0%
TY 5	100% (100% of baseline)
TY 6	100%
TY 32	100%
TY 50	75%

Variable V_3 - Marsh edge and interspersion

Existing Conditions – The 277 acre project area is 30% marsh and 70% open water, which can be considered 100% Class 4 (0.2 SI), or 30% Class 2 and 70% Class 5 (O.25 SI).
If this variable is divided into two WVAs, BSFS5-MC (70%) would be a Class 5 and BSFS5-MN (30%) would be a Class 2.

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.

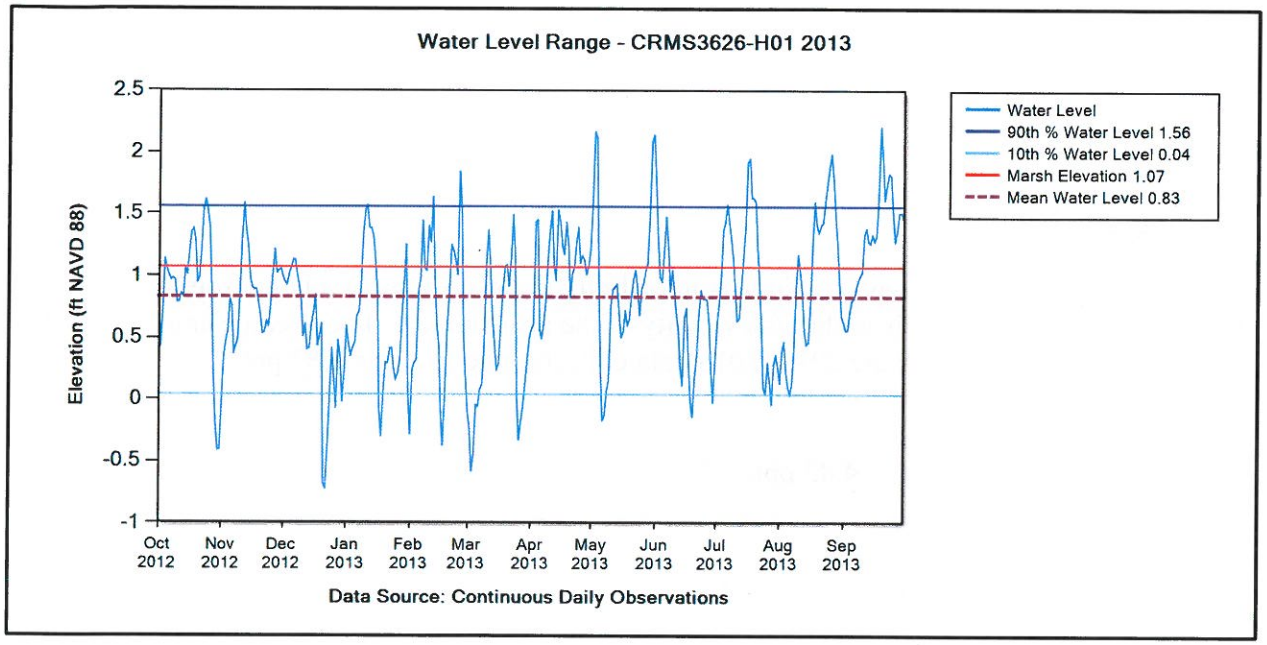
TY0-1:	70% Class 5, 30% Class 2
TY32:	100% Class 4 (~25% marsh)
TY50:	100% Class 5 (~20% marsh in the entire project area)

*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 32	100% Class 1 (marsh is ~90%)
TY 50	100% Class 2 (marsh is ~78%)

Variable V_4 - 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). For the BSFS 5 WVA 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%
TY32	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%
TY32	100%
TY50	83%

Variable V_5 - 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

Variable V_6 – 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
TY3	0.0001
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.

Wetland Value Assessment Project Information Sheet

July 9, 2014

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: 0.61 AAHUs, without Open Water analysis**

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

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 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.

Figure 1. Project Area (Insert)

Goals: (New Zydeco BLHW Project Description.docx, 4/9/2014) It was determined that this project alternative would consist 180 acres of floodside BLH-Wet restoration. For the BLH-Wet construction scenario, initial target elevation for dredge fill will be to approximate elevation +4.0 NAVD88, to ultimately hit a target marsh elevation ranging from +2.5 to +3.0 NAVD88. Though this results in a 5.5 foot lift of fill material (+4.0 to -1.5); a fairly firm bottom, and anticipated partially sandy borrow source minimizes concerns for any significant settlement of the proposed platform. Prior to geotechnical data collection and evaluation, we are assuming approximately a half foot settlement rate.

Approximately 16,700 linear feet of retention dike would be required. In general, the entire northern boundary, western boundary, and eastern boundary dikes are built in open water. As the eastern dike provides protection to the landowners property (from impacts due to construction), this dike is proposed to remain in place upon completion of all construction efforts. Approximately 5,000 linear feet of the northern and western dike reaches will be degraded in year 1, upon settlement and dewatering of the created platform. The degraded material can be disposed of in the original borrow canal if settlement allows, or cast into the open water immediately outside of the project footprint. The southern retention dike will be gapped in year 1, upon settlement and dewatering of the created marsh platform. The gaps will be spaced at approximately 500-foot intervals, with care being taken to locate gaps at all existing natural

bayous or openings. Approximately 9 gaps are anticipated. The gaps will require a 25-foot bottom at approximately elevation +2.0 NAVD88 (lower limit of existing BLHW platform) to assist in water interchange with the existing marsh.

Timeline: Construction start date – 12/2015

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.

Variable V_1 – 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. The Corps has indicated that marsh habitat will be avoided.

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 5 as planted but not full function value; not mature canopy
- TY2: Class 5 as planted but not full function value; not mature canopy
- TY20: Class 5mature 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 V_2 – Stand Maturity

Existing Conditions –open water

FWOP – open water/no forest habitat potential.

FWP –
TY 2: age = 2
TY 50: age = 50

Variable V_3 – 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 V_4 - 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 8.41 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- Target elevations have not been determined. 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 foot rise in sea level will occur by 2052 (TY39) and a 1.31 foot rise will occur by 2063 (TY50), which is the lowest rate of the five gages including WBV. If a target elevation of 2-3 feet is achieved the following FWP conditions are assumed:

TY1 2-3 feet, containment dikes in place
TY2 2-3 feet, containment dikes gapped
TY20 2-3 feet minus 0.56' in RSLR = 1.4 to 2.4'
TY25 2-3 feet minus 0.67' in RSLR = 1.3 to 2.3'
TY50 2-3 feet minus 1.31' in RSLR = 0.7 to 1.7'

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	Low	0.70
(2.4 feet)	**TY20**	Temporary	Low	0.70
(1.7 feet)	**TY50**	Seasonal	moderate	0.75

Variable V_5 - 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 - 180 acres BLH

Variable V_6 – Suitability and Traversability of Surrounding Land Uses

FWOP –
BLH/Marsh = 59%
NonHabitat = 1%
Water ("Pasture/Hayfields) = 40%

FWP Does not factor in the associated marsh creation project at this time.

BLH/Marsh = 59%
NonHabitat = 1%
Water = 40%

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 V_7 – 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

UPDATES:

July 09, 2014 – Project Area was reduced to 155 acres.

Wetland Value Assessment Project Information Sheet

May 29, 2014

Prepared for:
U.S. Army Corps of Engineers

Prepared by
U.S. Fish and Wildlife Service
Angela Trahan
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Project Name: LPV HSDRRS Mitigation- New Zydeco Open Water Impacts

Referenced <FritchieFS_BandIMarsh_PIS_20120827.docx> for these assumptions.

Impacts: -20.51 AAHUs (-0.13/ac)

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.

Figure 1. Project Area

Goals:
The project will consist of restoring approximately 180 acres of BLH-Wet habitat for mitigating on-refuge impacts associated with HSDRRS construction. For the BLH-Wet construction scenario, initial target elevation for dredge fill will be to approximate elevation +4.0 NAVD88, to ultimately hit a target marsh elevation ranging from +2.5 to +3.0 NAVD88. Though this results in a 5.5 foot lift of fill material (+4.0 to -1.5); a fairly firm bottom, and anticipated partially sandy borrow source minimizes concerns for any significant settlement of the proposed platform. Prior to geotechnical data collection and evaluation, we are assuming approximately a half foot settlement rate.

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 – NO LAND LOSS WAS APPLIED FOR THIS ANALYSIS

FWOP

TY0-50
Marsh: 0 acres (0 %)
Water: 847 acres (100 %)

FWP: initial target elevation for dredge fill will be to approximate elevation +4.0 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 target elevation for dredge fill will be to approximate elevation +4.0 NAVD88
TY0 - 50 0%

V3 – Interspersion

At TY0 the marsh creation cell has approximately 0% 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

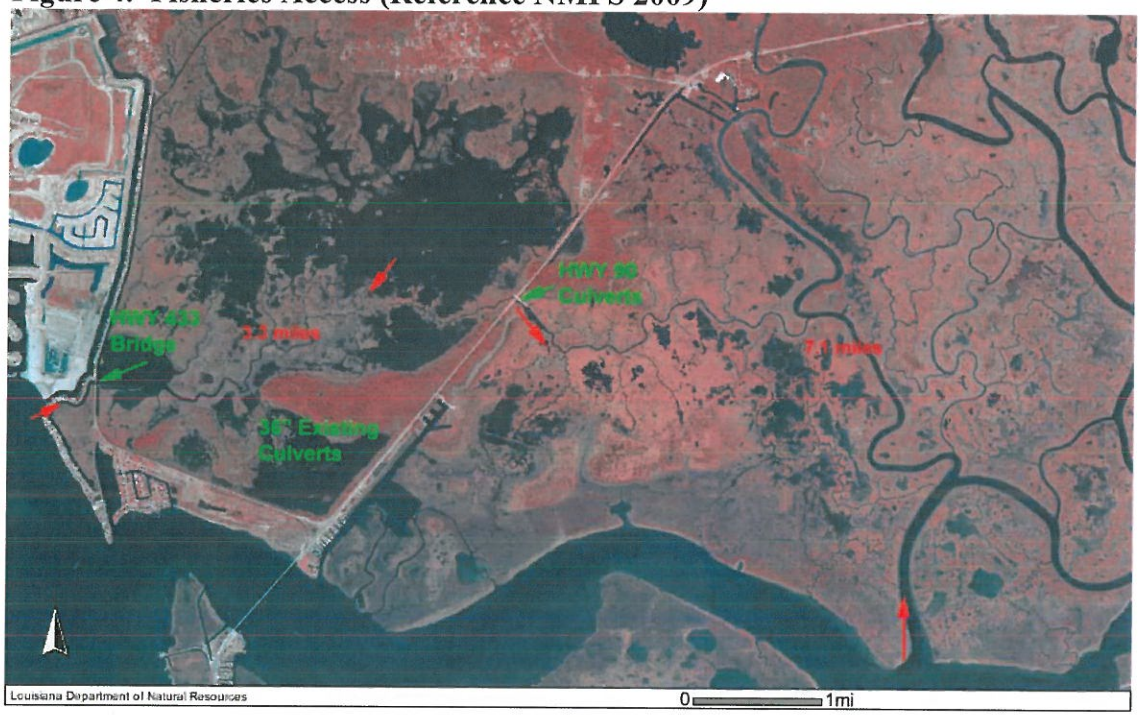
The mitigation project area lies within the "north area" of the CWPPRA PPL 19 Fritchie Marsh Terracing and Marsh Creation Project. After further consideration, it was determined that 70% of the area was influenced by the Louisiana Highway 433 Bridge (structure rating = 1.0) and 30% from the HWY 90 open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

Wetland Value Assessment Project Information Sheet

June 2014

Prepared for:
U.S. Army Corps of Engineers

Prepared by
U.S. Fish and Wildlife Service
Angela Trahan
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Project Name: LPV HSDRRS Mitigation- New Zydeco Marsh Mitigation

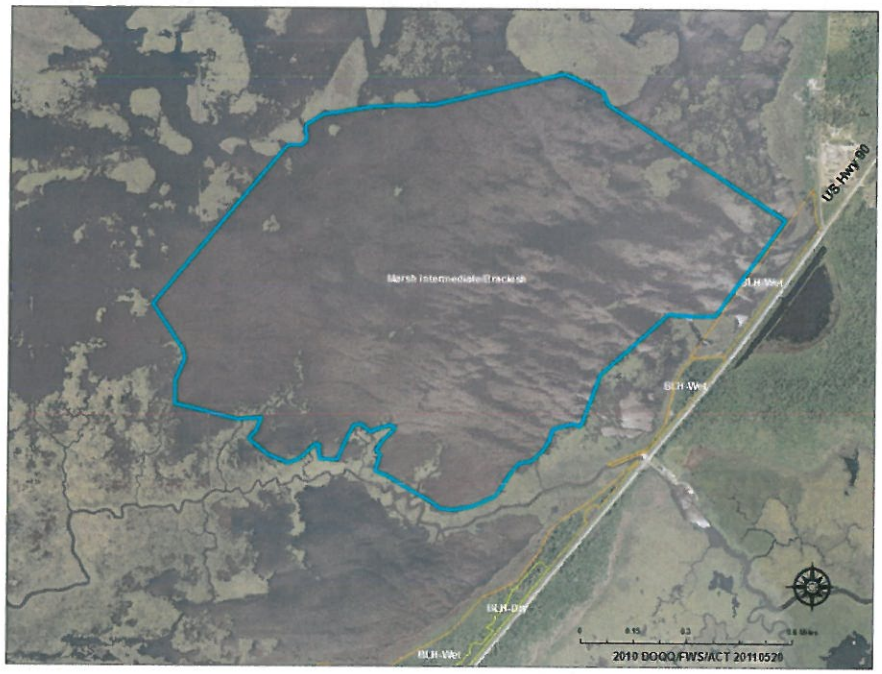
Edited from <FritchieFS_BandIMarsh_PIS_20110810_minoreditgagelable.docx>

***Mitigation Potential:** **0.33 AAHUs/acre Intermediate Marsh**

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.

Figure 1. Project Area



Goals:
The project will consist of restoring approximately 70.4 acres of marsh within an 845-acre area 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. Details of marsh mitigation design have not been developed. Assumptions are based on previous marsh mitigation designs proposed in the area by the Corps.

Timeline: BLH construction start date – 12/2015, TY1 = 2017

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). 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 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 loss rate of -0.89% 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 -0.31 acres per year [(-0.89%/2*70.4)/100] was applied under the FWP scenario.

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

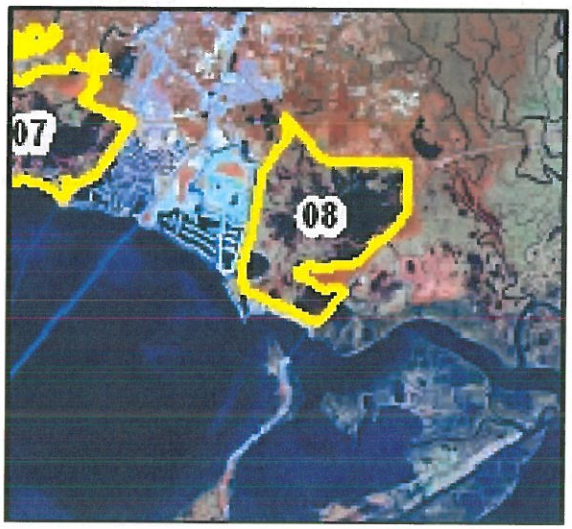
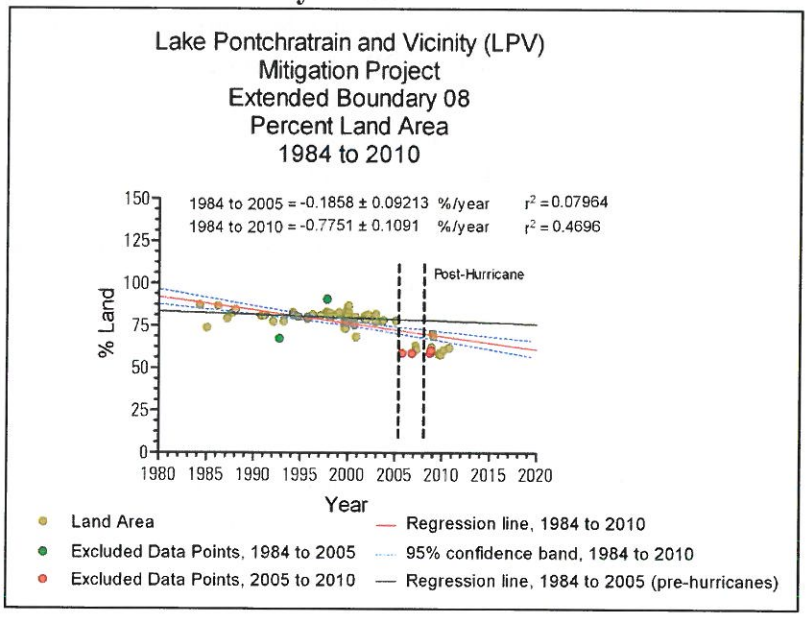


Figure 3. Land loss rate determined by USGS



FWOP

Loss Rate: -0.89% /year (FWS LLR, 0 acres/yr due to no land being in the PA polygon)

TY0-50	Marsh	0 acres (0%)	TY0 = 2016
	Water	70.4 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 TY38 when at least 10 inches of water is assumed to cover the marsh and, therefore, 10 inches of post-construction accretion is assumed to occur. At that time background loss rate is resumed. A settlement period of 3 years was also applied based on settlement curves of previous CWPPRA restoration projects. 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.

Loss Rate: -0.31 acres/year (FWS LLR) based on the 70.4 acre project area.

*Assumptions are similar to what was applied to Milton (and based on settlement curves). If we decide to revise these assumptions, changes will need to be made to the formulas in the landloss spreadsheet.

TY1	Marsh:	0 ac (0 assume 0% credit of the remaining 70.4-ac marsh platform) Water: 0 acres (0%)
TY2	Marsh	6.97 acres (9.9%) (assume 10% credit of the remaining marsh platform for gapping/planting)

	Water	0.65 acres (1%, marsh loss; will need to assess borrow area for containment)
TY3	Marsh	17.36 acres (25%) (assume 25% credit of remaining marsh platform)
	Water	0.97 acres (1%)
TY5	Marsh	68.8 acres (98% - assume full credit of remaining marsh platform)
	Water	1.6 acres (3%)
TY6	Marsh	68.5 acres (98%)
	Water	1.95 acres (2%)
TY38	Marsh	54.8 acres (78%)
	Water	15.61 acres (22%)
TY50	Marsh	44.81 acres (64%)
	Water	25.6 acres (36%)

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/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%)
TY38	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 0% 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 (not sure the justification behind this..?)	
TY2-3	Class 3 ("carpet marsh")	
TY5	50% Class 3; 50% Class 1	
TY6	100% Class 1 (97.7% marsh)	
TY38	100% Class 2	Marsh: 78%
TY50	100% Class 3	Marsh: 64%

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%
TY38	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 references1.79 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).

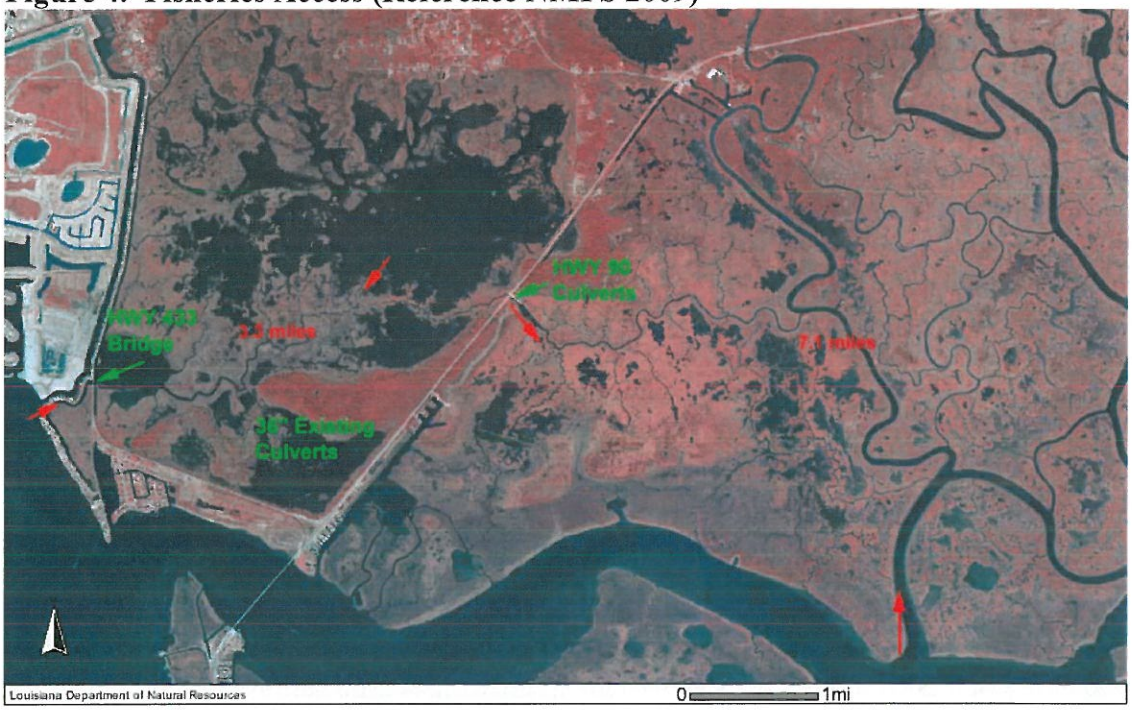
(0.70*1.0) + (0.30*0.5) = 0.70+0.15= 0.85

FWOP = 0.85

FWP

TY1	0.0001
TY3	0.0001
TY5-50	0.85

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.

Wetland Value Assessment Project Information Sheet

June 17, 2014

Prepared for:
U.S. Army Corps of Engineers

Prepared by
U.S. Fish and Wildlife Service

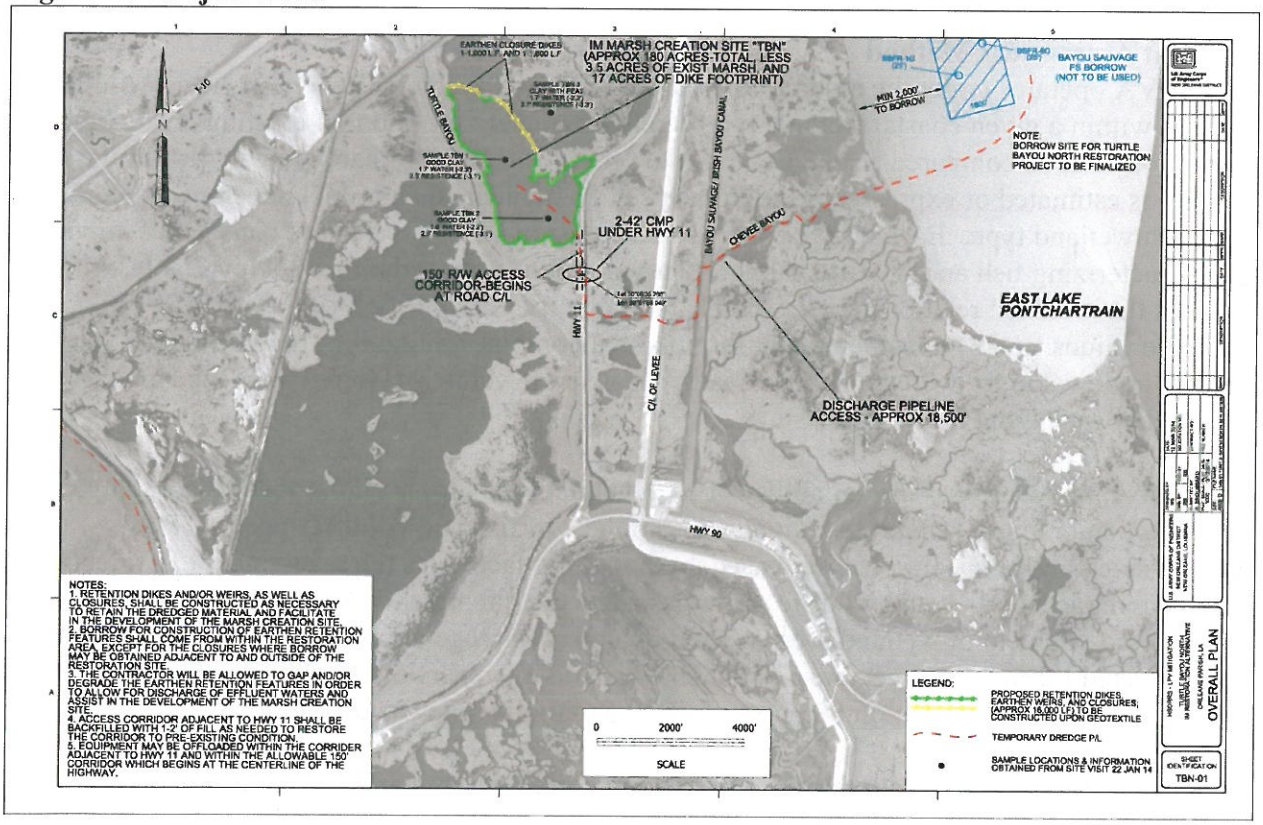
Project Name: LPV HSDRRS Mitigation- Turtle Bayou Protected Side Fresh/Intermediate Marsh Mitigation

Mitigation Potential: 0.39

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

Project Area: The North 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.

As currently proposed, the project will consist of creating approximately 159.5 acres* (180 acres less 3.5 acres of existing marsh and 17 acres of dike footprint, per TBH-01 drawing provided by the Corps) of fresh/intermediate marsh within a designated open water area immediately north of Turtle Bayou. Restoration would be accomplished through dedicated dredging of material to be borrowed from Lake Pontchartrain/Lake Borgne via hydraulic cutterhead dredge. This work would be coupled with the restoration work proposed under the Bayou Sauvage National Wildlife Refuge (BSNWR) Floodside Side (FS) brackish marsh restoration project, located just east of LA Hwy 11 and Irish Bayou. The dredge material will be placed confined to a maximum slurry elevation of +4' NAVD88. Target marsh elevations have not been determined. 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 site.

Access to the site will require a 150 foot wide corridor which would be backfilled with approximately 1'-2' of dredged material upon completion of work in order to restore the existing wetlands to pre-existing conditions.

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

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 interspersion; 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 3 acres of marsh, in the form of small islands, 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, plygon10). 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 was 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

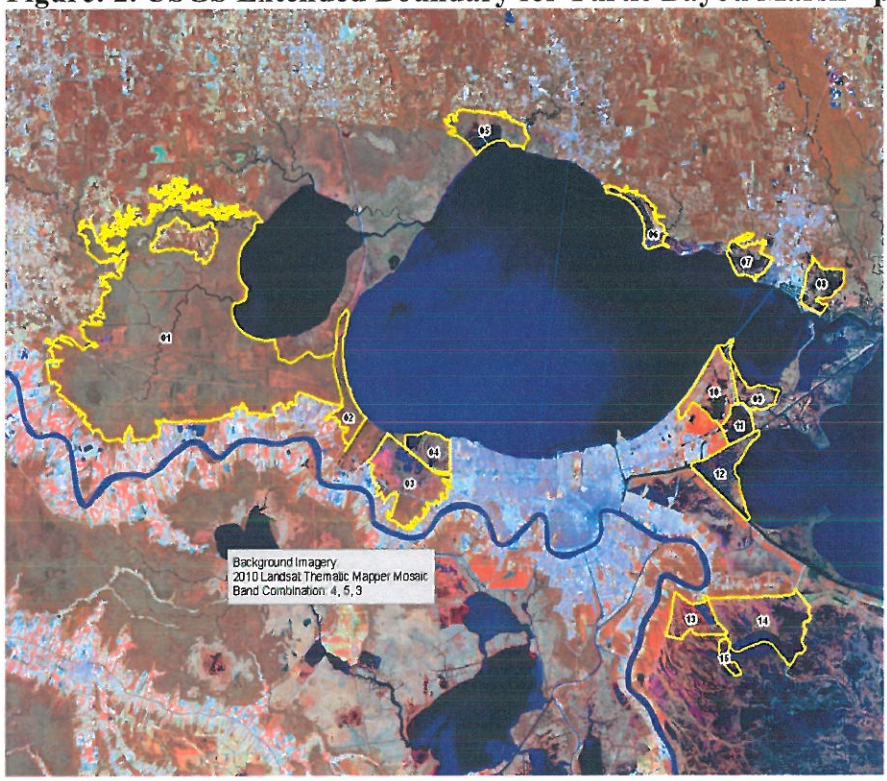
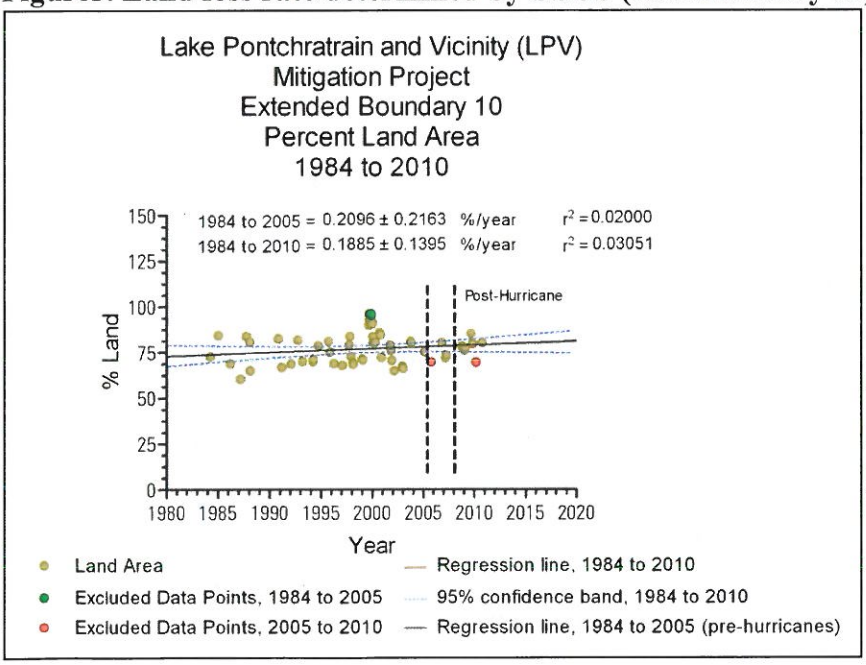


Figure3. Land loss rate determined by USGS (Ext Boundary 10)



FWOP

Land Change Rate: 0% /year (FWS LLR, 0 acres/yr due to no land being in the PA polygon)

TY0-50	Marsh	0 acres (0%)	TY0 = 2016
	Water	159.5 acres (100%)	

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. Additional 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.

Land Change Rate: 0 acres/year (FWS LLR)

TY0	Marsh	0 acres (0%)
	Water	0 acres (100%)
TY1	Marsh	0 acres (assume 0% credit of the 159.5-ac marsh platform)
	Water	0 acres (0%)
TY2	Marsh	15.9 acres (assume 10% credit of the remaining marsh platform for gapping/planting)
	Water	0.53 acres (0%)
TY3	Marsh	39.74 acres (assume 25% credit of remaining marsh platform)
	Water	0.53 acres (0%)
TY5	Marsh	158.97 acres (100% - assume full credit of remaining marsh platform)
	Water	0.53 acres (0%)
TY6	Marsh	158.45 acres (99%)
	Water	1.05 acres (1%)
TY38	Marsh	141.61 acres (89%)
	Water	17.89 acres (11%)
TY50	Marsh	135.29 acres (85%)
	Water	24.21 acres (15.18%)

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 100% 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 TY6.

TY0	100% Class 5	
TY1	100% Class 5	
TY2	100% Class 3 ("carpet marsh")	
TY3	100% Class 3 ("carpet marsh")	
TY5	100% Class 3 ("carpet marsh")	
TY6	100% Class 1	
TY38	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.

O'Neil, T. 1949. The muskrat in Louisiana coastal marshes: New Orleans, Louisiana Wildlife and Fisheries Commission, 28 p.

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.