Appendix B

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Table B-1: WBV Habitat Impacts as Documented During Completion of the IERs (Final Resolution of IER/DR/CAR Discrepancies)

	Protected Side										Flood Side												
IER*	Fresh/ Intermediate Marsh		Brackish Marsh		Swamp		BLH wet		BLH dry		Fresh/ Intermediate Marsh		Brackish Marsh		Swamp		BLH wet		BLH dry		Open Water	TOTAL	
	Acres	AAHUs	Acres	AAHUs	Acres	AAHUs	Acres	AAHUs	Acres	AAHUs	Acres	AAHUs	Acres	AAHUs	Acres	AAHUs	Acres	AAHUs	Acres	AAHUs	Acres	Acres	AAHUs
12	0	0	0	0	0	0	0	0	224.20	155.85	0	0	0	0	74.70	38.40	2.40	2.00	0	0	0	301.30	196.25
IER12-13	0	0	0	0	0	0	0	0	0.34	0.12	0	0	0	0	0	0	0	0	0	0	0	0.34	0.12
13	0	0	0	0	0	0	0	0	13.00	7.80	0	0	0	0	39.00	28.27	19.00	10.59	0	0	0	71.00	46.66
14	0	0	0	0	0	0	45.00	30.00	0	0	0	0	0	0	71.75	41.02	45.50	37.17	0	0	1.38	162.25	108.19
15	0	0	0	0	0	0	23.50	6.12	8.29	0.82	15.00	3.03	0	0	0	0	3.60	1.35	0	0	19.60	50.39	11.32
16	0	0	0	0	0	0	0	0	0	0	148.20	74.50	0	0	0	0	157.70	73.46	0	0	28.50	305.90	147.96
17	0	0	0	0	0	0	5.50	2.69	0	0	0	0	0	0	19.00	17.09	0	0	0	0	9.00	24.50	19.78
33	0	0	0	0	0	0	0	0	80.00	48.93	0	0	0	0	0	0	82.00	50.13	0	0	2.00	162.00	99.06
EA 437	0	0	0	0	0	0	0	0	162.10	58.95	0	0	0	0	0	0	0	0	0	0	0	162.10	58.95
EA 439	0	0	0	0	0	0	0	0	0	0	0	0	0	0	88.50	50.71	21.50	15.10	0	0	0	110.00	65.81
18 (Churchhill Farms)	0	0	0	0	0	0	0	0	29.90	10.62	0	0	0	0	0	0	0	0	0	0	0	29.90	10.62
TOTAL	*0*	*0*	*0*	*0*	*0*	*0*	*74.00*	*38.81*	*517.83*	*283.09*	*163.20*	*77.53*	*0*	*0*	*292.95*	*175.49*	*331.70*	*189.80*	*0*	*0*	*60.48*	*1379.68*	*764.72*

Table B-2: Risk & Reliability Data Matrix

Risk & Reliability - WBV	**Uncertainty Relative to Achieving Ecological Success**	**Uncertainty Relative to Implementability Concerns**	**Adaptability**	**Long-term Sustainability**
	Qualitative [Note: For FS projects, assume no impound & pump designs]	Qualitative	Qualitative	Forested: HSI at TY50; Marsh: % Emergent at TY50
Non-Park/404c BLH-Dry/BLH-Wet PS				
Bayou Segnette (Enhance)	Potential need for future surface hydrology adaptation. Uncertainty relative to achieving hydrologic restoration for BLH-W component. -	Real Estate: Public & Private owners; Coordination with/approval from State Park required. Design coordination with/approval from electrical transmission line owner for drainage features through easement required. - -	Options for adapting hydrology. Additional acreage can be added. 0	Wet = 0.96 Dry = 0.68 to 0.70
Dufrene Ponds (Restore)	Uncertainty associated with fill (quality/quantity/settlement/ location). Unproven methodology associated with BLH creation from open water. -	Real Estate: Private owners; Coordination with LADOTD re: I-49 required - -	If all project components are implemented there is minimal room to add acreage. Manipulating elevation after planting is not practical. Could be adapted with shoreline protection to address erosion. -	0.65 to 0.67
Lake Boeuf (Restore)	Potential need for future surface hydrology adaptation. 0	Real Estate: Private owners; Coordination with railroad and parish drainage authority required. - -	Additional acreage can be added. Manipulating elevation after planting is not practical, but there are options for manipulating surface hydrology. 0	Wet = 0.85 Dry = 0.66
Mitigation Bank (mitigate BLH-Dry impacts with BLH-Wet credits)	Minimal uncertainty, no adaptive mgmt need. +	Minimal uncertainty +	After credits are purchased no adaptation is necessary. +	unknown
Plaquemines Alt 2 (Restore)	Uncertainty associated with fill (quality/settlement/location). Unproven methodology associated with BLH creation from open water. -	Real Estate: Private owners -	Only 2 of the 3 project components can be implemented due to insufficient area. Manipulating elevation after planting is not practical. - -	0.93

	Self-Sustainability			Risk of Exposure to Stressors/ Reliability of Design			Financial Assurances
Risk & Reliability - WBV	Active engineering features?	Anticipated OMRR&R events	relative difficulty OMRR&R	relative probability of exposure to stressors	project performance relative to stressors	resiliency after exposure to stressors	relative differences
	Yes/No	Anticipated OMRR&R Activities	Qualitative	Qualitative	Qualitative		Qualitative
Non-Park BLH-Dry/BLH-Wet PS							
Bayou Segnette (Enhance)	No +	Increased due to adjacent invasive species seed stock and dike & weir maintenance. Inv species control, additional planting (if needed) and general monitoring. -	Standard 0	Susceptible to drought impacts 0	Functions well as long as no extended drought period 0		YES +
Dufrene Ponds (Restore)	No +	Inv species control, additional planting (if needed) and general monitoring. 0	Standard 0	Susceptible to storm surge, sea level rise, wave action, and salinity impacts - -	Salinity could stress/kill trees, sea level rise could convert BLH to different habitat. - -		YES +
Lake Boeuf (Restore)	No +	Inv species control, additional planting (if needed), road & culvert maintenance, and general monitoring. -	Standard 0	Susceptible to storm surge and sea level rise impacts 0	Sea level rise could convert BLH to different habitat. -		YES +
Mitigation Bank (mitigate BLH-Dry impacts with BLH-Wet credits)	n/a (because the bank is responsible) 0	n/a (because the bank is responsible) +	n/a (because the bank is responsible) +	unknown 0	Unknown 0		YES +
Plaquemines Alt. 2 (Restore)	No +	Inv species control, additional planting (if needed) and general monitoring. 0	Standard 0	Susceptible to storm surge, sea level rise, and salinity impacts -	Salinity could stress/kill trees, sea level rise could convert BLH to different habitat. - -		YES +

Risk & Reliability - WBV	Uncertainty Relative to Achieving Ecological Success	Uncertainty Relative to Implementability Concerns	Adaptability	Long-term Sustainability
WBV ALTERNATIVES	Qualitative [Note: For FS projects, assume no impound & pump designs]	Qualitative	Qualitative	Forested: HSI at TY50; Marsh: % Emergent at TY50
Non-Park BLH-Wet FS				
Dufrene Ponds (Restore)	Uncertainty associated with fill (quality/quantity/settlement/location). Unproven methodology associated with BLH creation from open water. - -	Real Estate: Private owners; Coordination with LADOTD re: I-49 required - -	If all project components are implemented there is minimal room to add acreage. Manipulating elevation after planting is not practical. Could be adapted with shoreline protection to address erosion. -	0.67
Lake Boeuf (Restore)	Potential need for future surface hydrology adaptation. -	Real Estate: Public & Private owners; Coordination with railroad and parish drainage authority required - -	Additional acreage can be added. Manipulating elevation after planting is not practical, but there are options for manipulating surface hydrology. 0	0.82 to 0.87
Plaquemines Alt. 2 (Restore)	Uncertainty associated with fill (quality/settlement/location). Unproven methodology associated with BLH creation from open water. - -	Real Estate: Private owners; If proposed mitigation bank is implemented before construction the project is not viable, unless protected side BLH-Wet mitigation is not implemented and design is changed - -	Only 2 of the 3 project components can be implemented due to insufficient area. Manipulating elevation after planting is not practical. - -	0.93
Non-Park Swamp FS				
Dufrene Ponds (Restore)	Uncertainty relative to achieving appropriate design elevation and hydrologic conditions. Disagreement about most effective design/operation. Unproven methodology. - -	Real Estate: Private owner; Coordination with LADOTD re: I-49 required - -	If all project components are implemented there is minimal room to add acreage. Manipulating elevation after planting is not practical. Could be adapted with shoreline protection to address erosion. -	0.60

Risk & Reliability - WBV	**Uncertainty Relative to Achieving Ecological Success**	**Uncertainty Relative to Implementability Concerns**	**Adaptability**	**Long-term Sustainability**
WBV ALTERNATIVES	Qualitative [Note: For FS projects, assume no impound & pump designs]	Qualitative	Qualitative	Forested: HSI at TY50; Marsh: % Emergent at TY50
Lake Boeuf (Restore)	Minimal uncertainty 0	Real Estate: Public & Private owners. -	If other project components are implemented there is minimal room to add swamp. Opportunities for minor hydrologic modifications. 0	0.68
Plaquemines Alt. 1 (Restore)	Uncertainty relative to achieving appropriate design elevation and hydrologic conditions. Disagreement about most effective design/operation. Unproven methodology. - -	Real Estate: Private owners. -	Opportunity to add acreage. Manipulating elevation after planting is not practical. -	0.73
Plaquemines Alt. 2 (Restore)	Uncertainty relative to achieving appropriate design elevation and hydrologic conditions. Disagreement about most effective design/operation. Unproven methodology. - -	Real Estate: Private owners: If proposed mitigation bank is implemented before construction the project is not viable, unless protected side BLH-Wet mitigation is not implemented and design is changed - -	Only 2 of the 3 project components can be implemented due to insufficient area. Manipulating elevation after planting is not practical. - -	0.68
Salvador Timken (Restore)	Uncertainty relative to achieving appropriate design elevation and hydrologic conditions. Disagreement about most effective design/operation. Unproven methodology. - -	Real Estate: Public owner; Project is not supported by La Dept. of Wildlife and Fisheries, Design must consider Davis Pond Diversion flow distribution - -	Limited room to add acreage due to existing Texaco/WBV mitigation project. Manipulating elevation after planting is not practical. -	0.60
Simoneaux Ponds (Restore)	Uncertainty relative to achieving appropriate design elevation and hydrologic conditions. Disagreement about most effective design/operation. Unproven methodology. - -	Real Estate: Private owner. -	Opportunity to add acreage. Manipulating elevation after planting is not practical. -	0.60

	Self-Sustainability			Risk of Exposure to Stressors/ Reliability of Design			Financial Assurances
Risk & Reliability - WBV	Active engineering features?	Anticipated OMRR&R events	relative difficulty OMRR&R	relative probability of exposure to stressors	project performance relative to stressors	resiliency after exposure to stressors	relative differences
	Yes/No	Anticipated OMRR&R Activities	Qualitative	Qualitative	Qualitative		Qualitative
Non-Park/404c BLH-Wet FS							
Dufrene Ponds Restore	No +	Inv species control, additional planting (if needed) and general monitoring. 0	Standard 0	Susceptible to storm surge, sea level rise, wave action, and salinity impacts - -	Salinity could stress/kill trees, sea level rise could convert BLH to different habitat. - -		YES +
Lake Boeuf Restore	No +	Inv species control, additional planting (if needed), road & culvert maintenance, and general monitoring. -	Standard 0	Susceptible to storm surge and sea level rise impacts 0	Sea level rise could convert BLH to different habitat. -		YES +
Plaquemines At. 2 (Restore)	No +	Inv species control, additional planting (if needed) and general monitoring. 0	Standard 0	Susceptible to storm surge, sea level rise, and salinity impacts -	Salinity could stress/kill trees, sea level rise could convert BLH to different habitat. - -		YES +
Non-Park/404c Swamp FS							
Dufrene Ponds (Restore)	No +	Inv species control, additional planting (if needed), dike maintenance, and general monitoring. -	Standard 0	Susceptible to storm surge, sea level rise, wave action, and salinity impacts - -	Salinity could stress/kill trees, sea level rise could convert swamp to different habitat. - -		YES +

	Self-Sustainability			Risk of Exposure to Stressors/ Reliability of Design			Financial Assurances
Risk & Reliability - WBV	Active engineering features?	Anticipated OMRR&R events	relative difficulty OMRR&R	relative probability of exposure to stressors	project performance relative to stressors	resiliency after exposure to stressors	relative differences
	Yes/No	Anticipated OMRR&R Activities	Qualitative	Qualitative	Qualitative		Qualitative
Lake Boeuf (Restore)	No +	Inv species control, additional planting (if needed), road & culvert maintenance, and general monitoring. - -	Standard 0	Susceptible to storm surge and sea level rise impacts 0	Sea level rise could convert swamp to different habitat. -		YES +
Plaquemines Alt. 1 (Restore)	No +	Inv species control, additional planting (if needed), dike maintenance, and general monitoring. -	Standard 0	Susceptible to storm surge, sea level rise, and salinity impacts -	Salinity could stress/kill trees, sea level rise could convert swamp to different habitat. - -		YES +
Plaquemines Alt. 2 (Restore)	No +	Inv species control, additional planting (if needed), dike maintenance, and general monitoring. -	Standard 0	Susceptible to storm surge, sea level rise, and salinity impacts -	Salinity could stress/kill trees, sea level rise could convert swamp to different habitat. - -		YES +
Salvador Timken (Restore)	No +	Inv species control, additional planting (if needed), dike maintenance, and general monitoring. -	Standard 0	Susceptible to storm surge, and sea level rise impacts 0	Sea level rise could convert swamp to different habitat. -		YES +
Simoneaux Ponds Restore	No +	Inv species control, additional planting (if needed), dike maintenance, and general monitoring. -	Standard 0	Susceptible to storm surge, sea level rise, and salinity impacts -	Salinity could stress/kill trees, sea level rise could convert swamp to different habitat. - -		YES +

Risk & Reliability - WBV	**Uncertainty Relative to Achieving Ecological Success**	**Uncertainty Relative to Implementability Concerns**	**Adaptability**	**Long-term Sustainability**
WBV ALTERNATIVES	Qualitative [Note: For FS projects, assume no impound & pump designs]	Qualitative	Qualitative	Forested: HSI at TY50; Marsh: % Emergent at TY50
Non-Park Fresh Marsh FS				
Dufrene Ponds (Restore)	Minimal uncertainty 0	Real Estate: Private owners; Coordination with LADOTD re: I-49 required - -	If all project components are implemented there is minimal room to add acreage. Could be adapted with marsh nourishment, supplemental plantings, or shoreline protection. 0	91% - 95%
Jean Lafitte Marshes (Restore)	Minimal uncertainty 0	Real Estate: Public owner; Coordination with NPS required 0	Opportunity to add acreage. Could be adapted with marsh nourishment, supplemental plantings, or shoreline protection/maintenance. +	JL1B2=96%; JL4B=0% (but 30% of protected existing marsh)
Plaquemines Alt. 1 (Restore)	Minimal uncertainty 0	Real Estate: Private owners -	Opportunity to add acreage. Could be adapted with marsh nourishment, supplemental plantings, or shoreline protection. +	96%
Salvador Timken (Restore)	Minimal uncertainty 0	Real Estate: Public owner; Project is not supported by La Dept. of Wildlife and Fisheries, design must consider Davis Pond Diversion flow distribution - -	Opportunity to add acreage. Could be adapted with marsh nourishment, supplemental plantings, or shoreline protection. +	95%
Simoneaux Ponds (Restore)	Minimal uncertainty 0	Real Estate: Private owner. -	Opportunity to add acreage. Could be adapted with marsh nourishment, supplemental plantings, or shoreline protection. +	95%

Risk & Reliability - WBV	Uncertainty Relative to Achieving Ecological Success	Uncertainty Relative to Implementability Concerns	Adaptability	Long-term Sustainability
WBV ALTERNATIVES	Qualitative [Note: For FS projects, assume no impound & pump designs]	Qualitative	Qualitative	Forested: HSI at TY50; Marsh: % Emergent at TY50
Park/404c BLH Wet				
JLNHPP BLH Alt. 1 (Restore)	Minimal uncertainty +	Real Estate: Public owners; West Jefferson Levee District may not approve land transfer. Need specific approval/authorization from EPA. Coordination with NPS required. -	Opportunity to add acreage. Manipulating elevation after planting is not practical. 0	0.93 to 0.95
JLNHPP BLH Alt. 2 (Restore)	Unproven methodology associated with BLH creation from open water -	Real Estate: Public owner; Need specific approval/authorization from EPA. Coordination with NPS required. NPS may not support conversion of geo-crib to BLH-W. -	Limited opportunity to add acreage. Manipulating elevation after planting is not practical. -	0.89 (JL15) to 0.94 (JL17 & JL18)
Park Fresh Marsh				
JLNHPP Marsh (Restore)	Minimal uncertainty	Real Estate: Public owner; Coordination with NPS required	Opportunity to add acreage. Could be adapted with marsh nourishment or supplemental plantings.	99%
Park/404c Swamp				
JLNHPP Swamp (Restore)	Minimal uncertainty	Real Estate: Public owner; Need specific approval/authorization from EPA. Coordination with NPS required.	Opportunity to add acreage. Manipulating elevation after planting is not practical.	0.60 to 0.68 (most 0.67 or 0.68)

	Self-Sustainability			Risk of Exposure to Stressors/ Reliability of Design			Financial Assurances
Risk & Reliability - WBV	Active engineering features?	Anticipated OMRR&R events	relative difficulty OMRR&R	relative probability of exposure to stressors	project performance relative to stressors	resiliency after exposure to stressors	relative differences
	Yes/No	Anticipated OMRR&R Activities	Qualitative	Qualitative	Qualitative		Qualitative
Non-Park Fresh Marsh FS							
Dufrene Ponds (Restore)	No +	Inv species control, general monitoring 0	Standard 0	Susceptible to wave action and sea level rise -	Sea level rise could convert marsh to different habitat (open water) 0		YES +
Jean Lafitte Marshes (Restore)	No +	Inv species control, general monitoring. 0	Standard 0	Susceptible to wave action and sea level rise; may be susceptible to salinity increases. - -	Sea level rise could convert marsh to different habitat (open water) 0		YES +
Plaquemines Alt. 1 (Restore)	No +	Inv species control, general monitoring. 0	Standard 0	Susceptible to sea level rise 0	Sea level rise could convert marsh to different habitat (open water) 0		YES +
Salvador Timken (Restore)	No +	Inv species control, general monitoring. 0	Standard 0	Susceptible to sea level rise 0	Sea level rise could convert marsh to different habitat (open water) 0		YES +
Simoneaux Ponds (Restore)	No +	Inv species control, general monitoring. 0	Standard 0	Susceptible to sea level rise 0	Sea level rise could convert marsh to different habitat (open water) 0		YES +

	Self-Sustainability			Risk of Exposure to Stressors/ Reliability of Design			Financial Assurances
Risk & Reliability - WBV	Active engineering features?	Anticipated OMRR&R events	relative difficulty OMRR&R	relative probability of exposure to stressors	project performance relative to stressors	resiliency after exposure to stressors	relative differences
	Yes/No	Anticipated OMRR&R Activities	Qualitative	Qualitative	Qualitative		Qualitative
Park/404c BLH Wet							
JLNHPP BLH Alt. 1 (Restore)	No +	Inv species control, additional planting (if needed) and general monitoring. 0	Standard 0	Susceptible to storm surge, sea level rise, and storm-induced salinity impacts 0	Sea level rise could convert BLH to different habitat; Storm-induced salinity could stress/kill trees 0		YES +
JLNHPP BLH Alt. 2 (Restore)	No +	Inv species control, additional planting (if needed) and general monitoring 0	Standard 0	Increased susceptibility to storm surge due to location, sea level rise, and storm-induced salinity impacts -	Sea level rise could convert BLH to different habitat; Storm-induced salinity could stress/kill trees 0		YES +
Park Fresh Marsh							
JLNHPP Marsh (Restore)	No	Inv species control, general monitoring.	Standard	Sea level rise	Sea level rise could convert marsh to different habitat (open water)		YES
Park/404c Swamp							
JLNHPP Swamp (Restore)	No	Inv species control, additional planting (if needed) and general monitoring.	Standard	Susceptible to storm surge, sea level rise, and storm-induced salinity impacts	Sea level rise could convert swamp to different habitat; Storm-induced salinity could stress/kill trees		YES

Table B-3: Watershed & Ecological Site Considerations Data Matrix

Watershed & Ecological - WBV	Watershed Considerations/ Significance in Watershed					Ecological Site Considerations (swamp and marsh only)	
WBV ALTERNATIVES	Contiguous with or within resource managed area	Located in Parish with Impacts	Critical Geomorphic Feature	LaCPR Critical Landscape Feature	Habitat Linkage	fragmentation within site boundary	Habitat connectivity to larger project area given future land use trends
Non-Park /404c BLH-Dry/BLH-Wet PS							
Bayou Segnette (Enhance)	Partially within the Bayou Segnette State Park, adjacent to approved WBV BLH mitigation project ++	Yes (Jefferson) +	No 0	No 0	No -	n/a 0	n/a 0
Dufrene Ponds (Restore)	Completely within the BA-01 Davis Pond Freshwater Diversion Area, In close proximity to Paradis Mitigation Bank +	No (Lafourche) 0	No 0	Yes, Critical Feature #4 Highway 90 +	No -	n/a 0	n/a 0
Lake Boeuf (Restore)	Project area contiguous with Lake Boeuf Wildlife Management Area + +	No (Lafourche) 0	No 0	No 0	Partial (created if both FS and PS are implemented) +	n/a 0	n/a 0
Mitigation Bank (mitigate BLH-Dry impacts with BLH-Wet credits)	A mitigation bank is a resource managed area. +	Unknown 0	No 0	Yes, Critical Feature #4 Highway 90 +	No -	n/a 0	n/a 0
Plaquemines Alt. 2 (Restore)	Completely within the BA-01 Davis Pond Freshwater Diversion Area +	Yes (Plaquemines) +	No 0	Yes, Critical Feature #5 Wetlands South of GIWW +	No -	n/a 0	n/a 0

Consistency				
Watershed & Ecological - WBV	With State Master Plan	With Coast 2050 Plan	With LCA	With LACPR
WBV ALTERNATIVES	Yes / No (objective)	Yes / No (objective)	Yes / No	Yes / No
Non-Park/404c BLH-Dry/BLH-Wet PS				
Bayou Segnette (Enhance)	Yes. Objective 3 +	Yes - Strategic Goals (Create wetlands) +	This project is inside the WBV levee system, therefore there is no interaction between this alternative and authorized LCA projects. 0	Not coincident with a coastal measure. Project is located on the protected side of the existing WBV levee and also on the protected side of proposed planning unit 2, alternative 1 - authorized 100-year levees and alternative 2 GIWW barrier-weir which adds no additional benefit to existing and proposed levees. 0
Dufrene Ponds (Restore)	Yes. Objective 1 - Addition of BLH outside of levee protection, Objective 3 and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. However plan prefers dredge material from rivers and offshore. Conversion of open water to BLH +	Yes - Strategic Goals (Create wetlands, dedicated dredging) +	Yes, This project may experience some freshening and increased nutrient load as a result of the LCA Myrtle Grove diversion project as it lies within the area of potential freshwater influence. +	Completely within coastal measure 2-3 Davis Pond Freshwater Diversion reauthorization - run full discharge one year out of 5 years; Project is located on the floodside of existing WBV levees and proposed planning unit 2, alternative 1, authorized 100-year levees (including ring levees) . However, project is located on the protected side of the proposed planning unit 2, alternative 2 GIWW barrier weir which adds no benefit to proposed levees. ++

Consistency				
Watershed & Ecological - WBV	With State Master Plan	With Coast 2050 Plan	With LCA	With LACPR
WBV ALTERNATIVES	Yes / No (objective)	Yes / No (objective)	Yes / No	Yes / No
Lake Boeuf (Restore)	Yes. Objective 1 - Addition of BLH outside of levee protection, Objective 2 and Objective 3 - *The Governor's office commissioned an Advisory Panel to define stakeholder issues and make associated policy recommendations for sustainable management of coastal forests in Louisiana based upon the Coastal Wetland Forest Conservation and Use Science Working Group, 2005 report. One of the major recommendations was to develop state programs for restoration of existing coastal wetland forests or creation of new coastal wetland forests on agricultural or other suitable open lands, and ensure these programs work in concert with relevant federal programs.* Conversion of Ag Land to BLH +	Yes - Strategic Goals (Create wetlands) +	Because of its location in the basin, there is no interaction between this alternative and authorized LCA projects. 0	Not coincident with a coastal measure. Project is located on the floodside of existing WBV levees and proposed planning unit 2, alternative 1, authorized 100-year levees (including ring levees). However, project is located on the protected side of the proposed planning unit 2, alternative 2 GIWW barrier weir which adds no additional benefit to existing and proposed levees. +
Mitigation Bank (mitigate BLH-Dry impacts with BLH-Wet credits)	No change to the ecosystem since the habitat is already in place 0	No change to the ecosystem since the bank is already in place 0	No change to the ecosystem since the bank is already in place 0	No Change to the ecosystem since the habitat is already in place 0

Consistency				
Watershed & Ecological - WBV	With State Master Plan	With Coast 2050 Plan	With LCA	With LACPR
WBV ALTERNATIVES	Yes / No (objective)	Yes / No (objective)	Yes / No	Yes / No
Plaquemines Alt. 2 (Restore)	Yes. Objective 1 - Addition of BLH outside of levee protection, Objective 3 and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. However plan prefers dredge material from rivers and offshore. Conversion of open water to BLH +	Yes - Strategic Goals (Create wetlands, dedicated dredging) +	Yes, This project may experience some freshening and increased nutrient load as a result of the LCA Myrtle Grove diversion project as it lies within the area of potential freshwater influence. +	Completely within coastal measure 2-4 Naomi Diversion – sized to sustain receiving area; Project is located adjacent to and on the floodside of Oakville to La Reussite Non-Federal Levee and on the floodside of proposed planning unit 2, alternative 1 authorized 100-year levees (including ring levees) and alternative 2 GIWW levee (including ring levees) which benefits existing and proposed levees by providing additional wooded acreage to be converted from open water ++

Watershed & Ecological - WBV	Watershed Considerations/ Significance in Watershed					Ecological Site Considerations (swamp and marsh only)	
WBV ALTERNATIVES	Contiguous with or within resource managed area	Located in Parish with Impacts	Critical Geomorphic Feature	LaCPR Critical Landscape Feature	Habitat Linkage	fragmentation within site boundary	Habitat connectivity to larger project area given future land use trends
Non-Park/404c BLH-Wet FS							
Dufrene Ponds (Restore)	Completely within the BA-01 Davis Pond Freshwater Diversion Area, In close proximity to Paradis Mitigation Bank +	No (Lafourche) 0	No 0	Yes, Critical Feature #4 Highway 90 +	No -	n/a 0	n/a 0
Lake Boeuf (Restore)	Project area contiguous with Lake Boeuf Wildlife Management Area + +	No (Lafourche) 0	No 0	No 0	Partial (created if both FS and PS are implemented) +	n/a 0	n/a 0
Plaquemines Alt. 2 (Restore)	Completely within the BA-01 Davis Pond Freshwater Diversion Area +	Yes (Plaquemines) +	No 0	Yes, Critical Feature #5 Wetlands South of GIWW +	No -	n/a 0	n/a 0

Consistency				
Watershed & Ecological - WBV	With State Master Plan	With Coast 2050 Plan	With LCA	With LACPR
WBV ALTERNATIVES	Yes / No (objective)	Yes / No (objective)	Yes / No	Yes / No
Non-Park BLH-Wet FS				
Dufrene Ponds (Restore)	Yes. Objective 1 - Addition of BLH outside of levee protection, Objective 2, Objective 3 and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. However plan prefers dredge material from rivers and offshore. Conversion of open water to BLH +	Yes - Strategic Goals (Create wetlands, dedicated dredging) +	Yes, This project may experience some freshening and increased nutrient load as a result of the LCA Myrtle Grove diversion project as it lies within the area of potential freshwater influence. +	Completely within coastal measure 2-3 Davis Pond Freshwater Diversion reauthorization - run full discharge one year out of 5 years. Project is located on the floodside of existing WBV levee and proposed planning unit 2, alternative 1, authorized 100-year levees (including ring levees) . However, project is located on the protected side of the proposed alternative 2 GIWW barrier weir which adds no benefit to proposed levees. ++
Lake Boeuf (Restore)	Yes. Objective 1 - Addition of BLH outside of levee protection, Objective 2 and Objective 3 - *The Governor's office commissioned an Advisory Panel to define stakeholder issues and make associated policy recommendations for sustainable management of coastal forests in Louisiana based upon the Coastal Wetland Forest Conservation and Use Science Working Group, 2005 report. One of the major recommendations was to develop state programs for restoration of existing coastal wetland forests or creation of new coastal wetland forests on agricultural or other suitable open lands, and enusre these programs work in concert with relevant federal programs.* Conversion of Ag Land to BLH +	Yes - Strategic Goals (Create wetlands) +	Because of its location in the basin, there is no interaction between this alternative and authorized LCA projects. 0	Not coincident with a coastal measure; Project is located on the floodside of existing WBV levee and proposed planning unit 2, alternative 1 , authorized 100-year levees (including ring levees). However, project is located on the protected side of the proposed planning unit 2, alternative 2 GIWW barrier weir which adds no benefit to proposed levees . +

Consistency				
Watershed & Ecological - WBV	With State Master Plan	With Coast 2050 Plan	With LCA	With LACPR
WBV ALTERNATIVES	Yes / No (objective)	Yes / No (objective)	Yes / No	Yes / No
Plaquemines Alt. 2 (Restore)	Yes. Objective 1 - Addition of BLH Wet outside of levee protection, Objective 2, Objective 3 and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. However plan prefers dredge material from rivers and offshore. Conversion of open water to BLH +	Yes - Strategic Goals (Create wetlands, dedicated dredging) +	Yes, This project may experience some freshening and increased nutrient load as a result of the LCA Myrtle Grove diversion project as it lies within the area of potential freshwater influence . +	Completely within coastal measure 2-4 Naomi Diversion – sized to sustain receiving area; Project is located adjacent to and on the floodside of Oakville to La Reussite Non-Federal Levee and on the floodside of proposed planning unit 2, alternative 1 authorized 100-year levees (including ring levees) and alternative 2 GIWW levee (including ring levees) which benefits existing and proposed levees by providing additional wooded acreage to be converted from open water ++

Watershed & Ecological - WBV	Watershed Considerations/ Significance in Watershed					Ecological Site Considerations (swamp and marsh only)	
WBV ALTERNATIVES	Contiguous with or within resource managed area	Located in Parish with Impacts	Critical Geomorphic Feature	LaCPR Critical Landscape Feature	Habitat Linkage	fragmentation within site boundary	Habitat connectivity to larger project area given future land use trends
Non-Park/404c Swamp FS							
Dufrene Ponds Restore	Completely within the BA-01 Davis Pond Freshwater Diversion Area, In close proximity to Paradis Mitigation Bank +	No (Lafourche) 0	No 0	No 0	No -	No +	No -
Lake Boeuf Restore	Project area contiguous with Lake Boeuf Wildlife Management Area + +	No (Lafourche) 0	No 0	No 0	Partial +	Yes --	No -
Plaquemines Alt. 1 (Restore)	Completely within the BA-01 Davis Pond Freshwater Diversion Area +	Yes (Plaquemines) +	No 0	Yes, Critical Feature #5 Wetlands South of GIWW +	No -	No +	No -
Plaquemines Alt. 2 (Restore)	Completely within the BA-01 Davis Pond Freshwater Diversion Area +	Yes (Plaquemines) +	No 0	Yes, Critical Feature #5 Wetlands South of GIWW +	No -	No +	No -
Salvador Timken (Restore)	Completely within Salvador Wildlife Management Area, Completely within the BA-01 Davis Pond Freshwater Diversion Area, Adjacent to 1991 Texaco/WBV mitigation area +	No (St Charles) 0	Yes (lake rim) +	No 0	Partial +	No +	No -
Simoneaux Ponds (Restore)	Completely within the BA-01 Davis Pond Freshwater Diversion Area +	No (St Charles) 0	No 0	No 0	No -	No +	No -

Consistency				
Watershed & Ecological - WBV	With State Master Plan	With Coast 2050 Plan	With LCA	With LACPR
WBV ALTERNATIVES	Yes / No (objective)	Yes / No (objective)	Yes / No	Yes / No
Non-Park/404c Swamp FS				
Dufrene Ponds Restore	Yes. Objective 1 - Addition of Swamp outside of levee protection, Objective 2, Objective 3 and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. However plan prefers dredge material from rivers and offshore. Conversion of open water to Swamp +	Yes - Regional Ecosystem Strategies (Restore swamps), Strategic Goals (Create wetlands, dedicated dredging) +	Yes, This project may experience some freshening and increased nutrient load as a result of the LCA Myrtle Grove diversion project as it lies within the area of potential freshwater influence. +	Completely within coastal measure 2-3 Davis Pond Freshwater Diversion reauthorization - run full discharge one year out of 5 years; Project is located on the floodside of WBV levees and proposed planning unit 2, alternative 1, authorized 100-year levees (including ring levees). However, project is located on the protected side of the proposed alternative 2 GIWW barrier weir which adds no additional benefit to proposed levees. ++
Lake Boeuf (Restore)	Yes. Objective 1 - Addition of Swamp outside of levee protection, Objective 2 and Objective 3 - *The Governor's office commissioned an Advisory Panel to define stakeholder issues and make associated policy recommendations for sustainable management of coastal forests in Louisiana based upon the Coastal Wetland Forest Conservation and Use Science Working Group, 2005 report. One of the major recommendations was to develop state programs for restoration of existing coastal wetland forests or creation of new coastal wetland forests on agricultural or other suitable open lands, and ensure these programs work in concert with relevant federal programs.* Conversion of Ag land to Swamp +	Yes - Regional Ecosystem Strategies (Restore swamps), Strategic Goals (Create wetlands) +	Because of its location in the basin, there is no interaction between this alternative and authorized LCA projects. 0	Not coincident with a coastal measure; Project is located on the floodside of WBV levee and proposed planning unit 2, alternative 1 , authorized 100-year levees (including ring levees). However, project is located on the protected side of the proposed planning unit 2, alternative 2 GIWW barrier weir which adds no additional benefit to proposed levees. +

Consistency				
Watershed & Ecological - WBV	With State Master Plan	With Coast 2050 Plan	With LCA	With LACPR
WBV ALTERNATIVES	Yes / No (objective)	Yes / No (objective)	Yes / No	Yes / No
Plaquemines Alt. 1 (Restore)	Yes. Objective 1 - Addition of Swamp outside of levee protection, Objective 2, Objective 3 and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. However plan prefers dredge material from rivers and offshore. Conversion of open water to swamp +	Yes - Regional Ecosystem Strategies (Restore swamps), Strategic Goals (Create wetlands, dedicated dredging) +	Yes, This project may experience some freshening and increased nutrient load as a result of the LCA Myrtle Grove diversion project as it lies within the area of potential freshwater influence. +	Completely within coastal measure 2-4 Naomi Diversion – sized to sustain receiving area; Project is located adjacent to and on the floodside of Oakville to La Reussite Non-Federal Levee and on the floodside of proposed planning unit 2, alternative 1 authorized 100-year levees (including ring levees) and alternative 2 GIWW levee (including ring levees) which benefits existing and proposed levees by providing additional swamp acreage to be converted from open water ++
Plaquemines Alt. 2 (Restore)	Yes. Objective 1 - Addition of Swamp outside of levee protection, Objective 2, Objective 3 and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. However plan prefers dredge material from rivers and offshore. Conversion of open water to swamp +	Yes - Regional Ecosystem Strategies (Restore swamps), Strategic Goals (Create wetlands, dedicated dredging) +	This project may experience some freshening and increased nutrient load as a result of the LCA Myrtle Grove diversion project as it lies within the area of potential freshwater influence. +	Completely within coastal measure 2-4 Naomi Diversion – sized to sustain receiving area; Project is located adjacent to and on the floodside of Oakville to La Reussite Non-Federal Levee and on the floodside of proposed planning unit 2, alternative 1 authorized 100-year levees (including ring levees) and alternative 2 GIWW levee (including ring levees) which benefits existing and proposed levees by providing additional swamp acreage to be converted from open water ++

Consistency				
Watershed & Ecological - WBV	With State Master Plan	With Coast 2050 Plan	With LCA	With LACPR
WBV ALTERNATIVES	Yes / No (objective)	Yes / No (objective)	Yes / No	Yes / No
Salvador Timken (Restore)	Yes. Objective 1 - Addition of Swamp outside of levee protection, Objective 2, Objective 3 and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. However plan prefers dredge material from rivers and offshore. Conversion of open water to swamp +	Yes - Regional Ecosystem Strategies (Restore swamps, maintain critical landforms), Strategic Goals (Create wetlands, dedicated dredging) +	Yes/No, This project would benefit from increased freshwater and nutrient input, and may experience some sediment deposition as a result of the LCA Modification to Davis Pond diversion project. The proposed swamp mitigation could increase sediment trapping within the project footprint; however, the mitigation project likely duplicates some benefits for marsh creation assigned to the LCA Modification to Davis Pond project. The mitigation project should be designed to facilitate flow-through from the David Pond Diversion consistent with the assumptions of the LCA Modification to Davis Pond feasibility study. This alternative may experience some freshening and increased nutrient load as a result of the LCA Myrtle Grove diversion project as it lies within the area of potential freshwater influence. 0	Completely within coastal measure 2-3 Davis Pond Freshwater Diversion reauthorization - run full discharge one year out of 5 years; Project is located on the floodside of WBV levees and proposed planning unit 2, alternative 1, authorized 100-year levees (including ring levees). However, project is located on the protected side of the proposed alternative 2 GIWW barrier weir which adds no benefit to proposed levees. ++

Consistency				
Watershed & Ecological - WBV	With State Master Plan	With Coast 2050 Plan	With LCA	With LACPR
WBV ALTERNATIVES	Yes / No (objective)	Yes / No (objective)	Yes / No	Yes / No
Simoneaux Ponds Restore	Yes. Objective 1 - Addition of Swamp outside of levee protection, Objective 2, Objective 3 and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. However plan prefers dredge material from rivers and offshore. Conversion of open water to swamp +	Yes - Regional Ecosystem Strategies (Restore swamps), Strategic Goals (Create wetlands, dedicated dredging) +	Yes, This project may experience some freshening and increased nutrient load as a result of the LCA Myrtle Grove diversion project as it lies within the area of potential freshwater influence. +	Completely within coastal measure 2-3 Davis Pond Freshwater Diversion reauthorization - run full discharge one year out of 5 years; Project is located on the floodside of WBV levee and proposed planning unit 2, alternative 1, authorized 100-year levees (including ring levees). However, project is located on the protected side of the proposed alternative 2 GIWW barrier weir which adds no benefit to proposed levees. ++

Watershed & Ecological - WBV	Watershed Considerations/ Significance in Watershed					Ecological Site Considerations (swamp and marsh only)	
WBV ALTERNATIVES	Contiguous with or within resource managed area	Located in Parish with Impacts	Critical Geomorphic Feature	LaCPR Critical Landscape Feature	Habitat Linkage	fragmentation within site boundary	Habitat connectivity to larger project area given future land use trends
Non-Park Fresh Marsh FS							
Dufrene Ponds (Restore)	Completely within the BA-01 Davis Pond Freshwater Diversion Area, In close proximity to Paradis Mitigation Bank +	No (Lafourche) 0	No 0	No 0	No -	Yes --	No -
Jean Lafitte (Restore)	Completely within Jean Lafitte National Historical Park and Preserve, Completely within the BA-01 Davis Pond Freshwater Diversion Area +	Yes (Jefferson) +	Yes (lake rim) +	No 0	Partial +	Yes --	No -
Plaquemines Alt. 1 (Restore)	Completely within the BA-01 Davis Pond Freshwater Diversion Area +	No (Plaquemines) 0	No 0	Yes, Critical Feature #5 Wetlands South of GIWW +	No -	No +	No -
Salvador Timken (Restore)	Completely within Salvador Wildlife Management Area, Completely within the BA-01 Davis Pond Freshwater Diversion Area, Adjacent to 1991 Texaco/WBV mitigation area, Adjacent to Netherlands 1991 Texaco/WBV mitigation dike +	Yes (St Charles) +	Yes (lake rim) +	No 0	No -	No +	No -
Simoneaux Ponds (Restore)	Completely within the BA-01 Davis Pond Freshwater Diversion Area +	Yes (St Charles) +	No 0	No 0	No -	No +	No -

Consistency				
Watershed & Ecological - WBV	With State Master Plan	With Coast 2050 Plan	With LCA	With LACPR
WBV ALTERNATIVES	Yes / No (objective)	Yes / No (objective)	Yes / No	Yes / No
Non-Park Fresh Marsh FS				
Dufrene Ponds Restore	Yes. Objective 1 - Addition of marsh outside of levee protection, Objective 2, Objective 3 and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. However plan prefers dredge material from rivers and offshore. Conversion of open water to marsh +	Yes - Regional Ecosystem Strategies (Restore and sustain marsh), Strategic Goals (Create wetlands, dedicated dredging) +	Yes, This project may experience some freshening and increased nutrient load as a result of the LCA Myrtle Grove diversion project as it lies within the area of potential freshwater influence. +	Completely within coastal measure 2-3 Davis Pond Freshwater Diversion reauthorization - run full discharge one year out of 5 years; Project is located on the floodside of WBV levee and proposed planning unit 2, alternative 1, authorized 100-year levees (including ring levees). However, project is located on the protected side of the proposed alternative 2 GIWW barrier weir which adds no benefit to proposed levees. ++
Jean Lafitte Restore	Yes. Objective 1 - Addition of marsh outside of levee protection, Objective 2, Objective 3, Objective 4 (restoration within the Jean Lafitte National Historical Park) and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. However plan prefers dredge material from rivers and offshore. Also Measure LSP-3 Backfilling and/or Plug Non-Essential Oil and Gas Canals. Conversion of open water to marsh +	Yes - Regional Ecosystem Strategies (Restore and sustain marsh, maintain critical landforms), Strategic Goals (Create wetlands, dedicated dredging) +	Yes, This project may experience some increased freshening and nutrient load as a result of the LCA Modification to Davis Pond Diversion. This project may experience some freshening and increased nutrient load as a result of the LCA Myrtle Grove diversion project as it lies within the area of potential freshwater influence. +	Completely within coastal measure 2-3 Davis Pond Freshwater Diversion reauthorization - run full discharge one year out of 5 years; Project is located on the floodside of WBV levee and proposed planning unit 2, alternative 1, authorized 100-year levees but on the protected side of the proposed alternative 1 and 2 Lafitte ring levee. The project is also located on the protected side of the proposed alternative 2 GIWW barrier weir which adds no benefit to proposed levees. ++

Consistency				
Watershed & Ecological - WBV	With State Master Plan	With Coast 2050 Plan	With LCA	With LACPR
WBV ALTERNATIVES	Yes / No (objective)	Yes / No (objective)	Yes / No	Yes / No
Plaquemines Alt. 1 Restore	Yes. Objective 2, Objective 3 and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. However plan prefers dredge material from rivers and offshore. Conversion of open water to marsh +	Yes - Regional Ecosystem Strategies (Restore and sustain marsh), Strategic Goals (Create wetlands, dedicated dredging) +	Yes, This project may experience some freshening and increased nutrient load as a result of the LCA Myrtle Grove diversion project as it lies within the area of potential freshwater influence . +	Completely within coastal measure 2-4 Naomi Diversion – sized to sustain receiving area; Project is located adjacent to and on the floodside of Oakville to La Reussite Non-Federal Levee and on the floodside of proposed planning unit 2, alternative 1 authorized 100-year levees (including ring levees) and alternative 2 GIWW levee (including ring levees) which benefits existing and proposed levees by providing additional marsh acreage to be converted from open water ++
Salvador Timken Restore	Yes. Objective 1 - Addition of marsh outside of levee protection, Objective 2, Objective 3 and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. However plan prefers dredge material from rivers and offshore. Also Measure 2-15 Marsh restoration using dredge material in Barataria Basin. Conversion of open water to marsh +	Yes - Regional Ecosystem Strategies (Restore and sustain marsh, maintain critical landforms), Strategic Goals (Create wetlands, dedicated dredging) +	Yes/No, This project would benefit from increased freshwater and nutrient input, and may experience some sediment deposition as a result of the LCA Modification to Davis Pond diversion project. The proposed marsh mitigation could increase sediment trapping within the project footprint; however, the mitigation project likely duplicates some benefits for marsh creation assigned to the LCA Modification to Davis Pond project. The mitigation project should be designed to facilitate flow-through from the David Pond Diversion consistent with the assumptions of the LCA Modification to Davis Pond feasibility study. This alternative may experience some freshening and increased nutrient load as a result of the LCA Myrtle Grove diversion project as it lies within the area of potential freshwater influence. 0	Completely within coastal measure 2-3 Davis Pond Freshwater Diversion reauthorization - run full discharge one year out of 5 years; Project is located on the floodside of WBV levee and proposed planning unit 2, alternative 1, authorized 100-year levees (including ring levees). However, project is located on the protected side of the proposed alternative 2 GIWW barrier weir which adds no benefit to proposed levees. ++

Consistency				
Watershed & Ecological - WBV	With State Master Plan	With Coast 2050 Plan	With LCA	With LACPR
WBV ALTERNATIVES	Yes / No (objective)	Yes / No (objective)	Yes / No	Yes / No
Simoneaux Ponds Restore	Yes. Objective 1 - Addition of marsh outside of levee protection, Objective 2, Objective 3 and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. However plan prefers dredge material from rivers and offshore. Also Measure 2-15 Marsh restoration using dredge material in Barataria Basin. Conversion of open water to marsh +	Yes - Regional Ecosystem Strategies (Restore and sustain marsh), Strategic Goals (Create wetlands, dedicated dredging) +	Yes, This project may experience some freshening and increased nutrient load as a result of the LCA Myrtle Grove diversion project as it lies within the area of potential freshwater influence. +	Completely within coastal measure 2-3 Davis Pond Freshwater Diversion reauthorization - run full discharge one year out of 5 years; Project is located on the floodside of WBV levee and proposed planning unit 2, alternative 1, authorized 100-year levees (including ring levees). However, project is located on the protected side of the proposed alternative 2 GIWW barrier weir which adds no benefit to proposed levees. ++

Watershed & Ecological - WBV	Watershed Considerations/ Significance in Watershed					Ecological Site Considerations (swamp and marsh only)	
WBV ALTERNATIVES	Contiguous with or within resource managed area	Located in Parish with Impacts	Critical Geomorphic Feature	LaCPR Critical Landscape Feature	Habitat Linkage	fragmentation within site boundary	Habitat connectivity to larger project area given future land use trends
Park/404c BLH Wet							
JLNHPP Atl. 1 Restore	Completely within Jean Lafitte National Historical Park and Preserve Acq Boundary (but not park property) ++	Yes (Jefferson) +	No 0	No 0	No -	Yes --	No -
JLNHPP Alt. 2 Restore	Mostly within Jean Lafitte National Historical Park and Preserve, Partially within the BA-01 Davis Pond Freshwater Diversion Area, Partially within JLNHPP Beneficial Use , Partially within BA-16 Bayou Segnette, Partially within 1997 Lake Salvador Shoreline Protection and Geo-crib +	Yes (Jefferson) +	No 0	No 0	Partial +	Yes --	No -
Park Fresh Marsh							
JLNHPP Marsh	Completely within Jean Lafitte National Historical Park and Preserve, Completely within the BA-01 Davis Pond Freshwater Diversion Area	Yes (Jefferson)	No	No	No	No	No
Park/404c Swamp							
JLNHPP Swamp Restore	Completely within Jean Lafitte National Historical Park and Preserve, Partially within the BA-01 Davis Pond Freshwater Diversion Area	Yes (Jefferson)	No	No	Partial	Yes	No

Consistency				
Watershed & Ecological - WBV	With State Master Plan	With Coast 2050 Plan	With LCA	With LACPR
WBV ALTERNATIVES	Yes / No (objective)	Yes / No (objective)	Yes / No	Yes / No
Park/404c BLH Wet				
JLNHPP Alt. 1 Restore	Yes. Objective 1 - Addition of BLH outside of levee protection, Objective 2, Objective 3, Objective 4 (restoration within the Jean Lafitte National Historical Park) and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. However plan prefers dredge material from rivers and offshore. Also Measure LSP-3 Backfilling and/or Plug Non-Essential Oil and Gas Canals Conversion of open water to BLH +	Yes - Strategic Goals (Create Wetlands, Dedicated Dredging) +	Yes, This project may experience some freshening and increased nutrient load as a result of the LCA Myrtle Grove diversion project as it lies within the area of potential freshwater influence. +	Completely within coastal measure 2-3 Davis Pond Freshwater Diversion reauthorization - run full discharge one year out of 5 years; Project is located on the floodside of WBV levee and proposed planning unit 2, alternative 1, authorized 100-year levees but on the protected side of the proposed alternative 1 and 2 Lafitte ring levee. The project is also located on the protected side of the proposed alternative 2 GIWW barrier weir which adds no benefit to proposed levees. ++
JLNHPP Alt. 2 Restore	Yes. Objective 1 - Addition of BLH outside of levee protection, Objective 2, Objective 3, Objective 4 (restoration within the Jean Lafitte National Historical Park) and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. However plan prefers dredge material from rivers and offshore. Also Measure LSP-3 Backfilling and/or Plug Non-Essential Oil and Gas Canals Conversion of open water to BLH +	Yes - Strategic Goals (Create Wetlands, Dedicated Dredging), Regional Ecosystem Strategies (maintain critical landforms) +	Yes, Portions of this project may experience some increased freshening and nutrient load as a result of the LCA Modification to Davis Pond Diversion. This project may experience some freshening and increased nutrient load as a result of the LCA Myrtle Grove diversion project as it lies within the area of potential freshwater influence. +	Completely within coastal measure 2-3 Davis Pond Freshwater Diversion reauthorization - run full discharge one year out of 5 years; Project is located on the floodside of WBV levee and proposed planning unit 2, alternative 1, authorized 100-year levees but on the protected side of the proposed alternative 1 and 2 Lafitte ring levee. The project is also located on the protected side of the proposed alternative 2 GIWW barrier weir which adds no benefit to proposed levees . ++

Consistency				
Watershed & Ecological - WBV	With State Master Plan	With Coast 2050 Plan	With LCA	With LACPR
WBV ALTERNATIVES	Yes / No (objective)	Yes / No (objective)	Yes / No	Yes / No
Park Fresh Marsh				
JLNHPP Marsh	Yes. Objective 1 - shoreline protection, Objective 2, Objective 3, Objective 4 (restoration within the Jean Lafitte National Historical Park) and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. However plan prefers dredge material from rivers and offshore. Also Measure LSP-3 Backfilling and/or Plug Non-Essential Oil and Gas Canals. Conversion of open water to marsh	Yes - Region 2 Objectives, and Regional Ecosystem Strategies (Restore and sustain marsh Strategic Goals (Create wetlands, dedicated dredging)	This project may experience some increased freshening and nutrient load as a result of the LCA Modification to Davis Pond Diversion. This project may experience some freshening and increased nutrient load as a result of the LCA Myrtle Grove diversion project as it lies within the area of potential freshwater influence.	Completely within coastal measure 2-3 Davis Pond Freshwater Diversion reauthorization - run full discharge one year out of 5 years; Project is located on the floodside of WBV levee and proposed planning unit 2, alternative 1, authorized 100-year levees but on the protected side of the proposed alternative 1 and 2 Lafitte ring levee. The project is also located on the protected side of the proposed alternative 2 GIWW barrier weir which adds no benefit to proposed levees.
Park/404c Swamp				
JLNHPP Swamp Restore	Yes. Objective 1 - Addition of swamp outside of levee protection, Objective 2, Objective 3, Objective 4 (restoration within the Jean Lafitte National Historical Park) and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. However plan prefers dredge material from rivers and offshore. Also Measure LSP-3 Backfilling and/or Plug Non-Essential Oil and Gas Canals Conversion of open water to Swamp	Yes - Regional Ecosystem Strategies (Restore swamps), Strategic Goals (Create wetlands, dedicated dredging)	Yes, This project may experience some freshening and increased nutrient load as a result of the LCA Myrtle Grove diversion project as it lies within the area of potential freshwater influence.	Completely within coastal measure 2-3 Davis Pond Freshwater Diversion reauthorization - run full discharge one year out of 5 years; Project is located on the floodside of WBV levee and proposed planning unit 2, alternative 1, authorized 100-year levees but on the protected side of the proposed alternative 1 and 2 Lafitte ring levee. The project is also located on the protected side of the proposed alternative 2 GIWW barrier weir which adds no benefit to proposed levees.

Table B-4: Environmental Impact Summary Data Matrix

SUBCRITERIA	**Hydrology / Hydraulics**	**Navigable Waters**	**Scenic Rivers**	**Water Quality**	**Wildlife & Habitats**	**Water Bottoms / Benthic Resources**	**T & E Species**	**EFH**
	Qualitative	Yes/No; Extent of impacts; Perm/Temp	Coordination or permitting necessary (yes/no); Perm/Temp	Qualitative	Acreage of habitat by type impacted; acreage of habitat by type created	Acreage; Perm/Temp	Species; Critical habitat	Acreage; Species impacted / life stage; Perm/Temp
Non-Park BLH-Dry/BLH-Wet Protected Side Impacts								
Bayou Segnette BLH-Dry & BLH-Wet Enhancement	Improved hydroperiod in BLH-Wet; No long-term impact in BLH-Dry. +	No 0	No 0	Temporary increased turbidity. -	Covert 1,061 ac. Chinese tallow forest to BLH. Improve habitat for various species. + +	No impacts 0	No impacts 0	No impacts 0
Dufrene Ponds BLH-Wet Restoration	543 ac. open water converted to seasonally inundated /saturated soils. Shoreline erosion reduced. +	Yes. 543 ac. open water permanently converted to BLH. - -	No 0	Temporary increased turbidity. -	543 ac. habitat for waterfowl eliminated. Same ac. habitat created for other birds & terrestrial vertebrates. +	Permanent loss of 543 ac. ; 320 ac. at borrow site temporarily impacted. - -	No impacts 0	Perm. impact juvenile brown shrimp, adult/juvenile white shrimp, adult/juvenile red drum at 543 ac. mit site. Perm impact same species at 320 ac. borrow site. - -
Lake Boeuf BLH-Dry & BLH-Wet Restoration	Perm. conversion of manipulated hydrology to natural hydrology. +	No 0	No 0	Temporary increased turbidity. Long-term water quality improvement. +	504 ac. ag land converted to BLH, improving habitat for various species. +	No impacts 0	No impacts 0	No impacts 0
Plaquemines, Alt. 2 BLH-Wet Restoration	354 ac. open water converted to seasonally inundated /saturated soils. +	Yes. 354 ac. open water permanently converted to BLH. -	No 0	Temporary increased turbidity. -	354 ac. habitat for waterfowl eliminated. Same ac. habitat created for other birds & terrestrial vertebrates. Avoidance measures needed re nearby bird rookery. 0	Permanent loss of 354 ac. ; 155 ac. at borrow site temporarily impacted. -	No impacts by mitigation features. Pallid sturgeon could occur in borrow site. -	Perm. impact adult & juvenile brown & white shrimp, adult/juvenile red drum, juvenile grey snapper at 356 ac. mit site. Perm impact similar species at 155 ac. borrow site. -
General Mitigation Bank	No impacts 0	No impacts 0	No impacts 0	No impacts 0	No impacts 0	No impacts 0	No impacts 0	No impacts 0

SUBCRITERIA	Aquatic / Fisheries	Prime Farmland	Cultural Resources	Recreation	Noise	Aesthetics	HTRW	Environmental Justice	Socioeconomics / Land Use
	Acres habitat created or eliminated	Yes/No; Acreage	Qualitative	Acreage & type of resource impacted; Acreage of resource improved	Residential or commercial within 1,000 feet	Qualitative	Probability of encountering HTRW	Low income / minority populations disproportionately impacted	# Impacted – comm./industrial properties; residential units; public properties. Acres ag or forest converted
Non-Park BLH-Dry/BLH-Wet Protected Side Impacts									
Bayou Segnette BLH-Dry & BLH-Wet Enhancement	None created; none eliminated 0	No 0	Site 16JE26 may be in boundaries. Cultural resource survey needed. - -	1,041 ac. private hunting temporarily impacted. 1,062 ac. improved re hiking & birding. 1,041 ac. improved re hunting. 0	Yes. Few commercial facilities; park campground -	Temp. reduced aesthetics during construction. 0	Very Low. Gas pipeline present. -	No impacts 0	No impacts. Non-silviculture tallow forest converted to BLH forest. 0
Dufrene Ponds BLH-Wet Restoration	543 ac. open water eliminated. - -	No 0	Low probability for impacts. -	543 ac. private boating, fishing, crabbing eliminated. Same ac. improved re hiking, wildlife viewing, hunting. 0	Yes. Few residences & commercial facilities. -	Perm. conversion from open water view to forest view. -	Very Low. 6" pipeline present. -	No impacts 0	No impacts. 0
Lake Boeuf BLH-Dry & BLH-Wet Restoration	None created, none eliminated. 0	Yes. 504 acres permanently impacted. -	Moderate probability for impacts. Cultural resource survey needed. - -	0 ac. existing resource impacted. 504 ac. improved re hiking, wildlife viewing, hunting. +	Yes. Several residences. - -	Improved via conversion of ag fields to BLH. +	Very Low. 1 active well present. -	No impacts 0	504 acres agricultural cropland & pasture converted to BLH forest. -
Plaquemines, Alt. 2 BLH-Wet Restoration	354 ac. open water eliminated. -	No 0	Low probability for impacts. Cultural resource survey needed. -	354 ac. private boating, fishing, crabbing eliminated. Same ac. improved re hiking, wildlife viewing, hunting. 0	Yes. Several residences. - -	No impacts 0	Very Low. -	No impacts 0	No impacts 0
General Mitigation Bank	No impacts 0	No impacts 0	No impacts 0	No impacts 0	No impacts 0	No impacts 0	No impacts 0	No impacts 0	No impacts 0

SUBCRITERIA	Hydrology / Hydraulics	Navigable Waters	Scenic Rivers	Water Quality	Wildlife & Habitats	Water Bottoms / Benthic Resources	T & E Species	EFH
	Qualitative	Yes/No; Extent of impacts; Perm/Temp	Coordination or permitting necessary (yes/no); Perm/Temp	Qualitative	Acreage of habitat by type impacted; acreage of habitat by type created	Acreage; Perm/Temp	Species; Critical habitat	Acreage; Species impacted / life stage; Perm/Temp
Non-Park BLH-Wet Flood Side Impacts								
Dufrene Ponds BLH-Wet Restoration	255 ac. open water converted to seasonally inundated /saturated soils. Shoreline erosion reduced. +	Yes. 255 ac. open water permanently converted to BLH. Temp impact at borrow site. - -	No 0	Temporary increased turbidity. -	255 ac. habitat for waterfowl eliminated. Same ac. habitat created for other birds & terrestrial vertebrates. + +	Permanent loss of 255 ac.; 150 ac. at borrow site temporarily impacted. - -	No impacts 0	Perm. impact juvenile brown shrimp, adult/juvenile red drum & white shrimp, at 255 ac. mit site. Perm impact similar species at 150 ac. borrow site. - -
Lake Boeuf BLH-Wet Restoration	Perm. conversion of manipulated hydrology to natural hydrology. +	No 0	No 0	Temporary increased turbidity. Long-term water quality improvement. +	184 ac. ag land converted to BLH, improving habitat for various species. +	No impacts 0	No impacts 0	No impacts 0
Plaquemines, Alt. 2 BLH-Wet Restoration	163 ac. open water converted to seasonally inundated /saturated soils. 0	Yes. 163 ac. open water permanently converted to BLH. Temp impact at borrow site. -	No 0	Temporary increased turbidity. -	163 ac. habitat for waterfowl eliminated. Same ac. habitat created for other birds & terrestrial vertebrates. Avoidance measures needed re nearby bird rookery. 0	Permanent loss of 163 ac. ; 72 ac. at borrow site temporarily impacted. -	No impacts by mitigation features. Pallid sturgeon could occur in borrow site. -	Perm. impact adult/juvenile brown & white shrimp, adult/juvenile red drum & juvenile grey snapper, at 163 ac. mit site. Perm impact similar species at 72 ac. borrow site. -

SUBCRITERIA	**Aquatic / Fisheries**	**Prime Farmland**	**Cultural Resources**	**Recreation**	**Noise**	**Aesthetics**	**HTRW**	**Environmental Justice**	**Socioeconomics / Land Use**
	Acres habitat created or eliminated	Yes/No; Acreage	Qualitative	Acreage & type of resource impacted; Acreage of resource improved	Residential or commercial within 1,000 feet	Qualitative	Probability of encountering HTRW	Low income / minority populations disproportionately impacted	# Impacted – comm./industrial properties; residential units; public properties. Acres ag or forest converted
Non-Park BLH-Wet Flood Side Impacts									
Dufrene Ponds BLH-Wet Restoration	255 ac. open water eliminated. - -	No 0	Low probability for impacts. Cultural resource survey needed. -	255 ac. private boating, fishing, crabbing eliminated. Same ac. improved re hiking, wildlife viewing, hunting. 0	None 0	Perm. conversion from open water view to forest. -	Very low probability. 6” pipeline present. -	No impacts 0	No impacts 0
Lake Boeuf BLH-Wet Restoration	None created, none eliminated. 0	175 ac. permanently converted to BLH. -	Moderate probability for impacts. Cultural resource survey needed. - -	0 ac. existing resource impacted. 184 ac. improved re hiking, wildlife viewing, hunting. +	Yes. Few residences present. -	Improved via conversion of ag fields to BLH. +	Very low probability. 1 active well present. -	No impacts. 0	184 acres agricultural cropland & pasture converted to BLH forest. -
Plaquemines, Alt. 2 BLH-Wet Restoration	163 ac. open water eliminated. -	No 0	Low probability for impacts. Cultural resource survey needed. -	163 ac. private boating, fishing, crabbing eliminated. Same ac. improved re hiking, wildlife viewing, hunting. 0	Yes. Few residences present. -	No impacts 0	Very low probability -	No impacts 0	No impacts 0

SUBCRITERIA	Hydrology / Hydraulics	Navigable Waters	Scenic Rivers	Water Quality	Wildlife & Habitats	Water Bottoms / Benthic Resources	T & E Species	EFH
	Qualitative	Yes/No; Extent of impacts; Perm/Temp	Coordination or permitting necessary (yes/no); Perm/Temp	Qualitative	Acreage of habitat by type impacted; acreage of habitat by type created	Acreage; Perm/Temp	Species; Critical habitat	Acreage; Species impacted / life stage; Perm/Temp
Non-Park Swamp Flood Side Impacts								
Dufrene Ponds Swamp Restoration	171 ac. open water converted to seasonally flooded soils. Shoreline erosion reduced. +	Yes. 171 ac. open water permanently converted to swamp. Temp impact at borrow site. -	Yes, temp impact to 277 ac. if borrow from Bayou des Allemands. No, if borrow from Lake Salvador. -	Temporary increased turbidity. -	171 ac. habitat for waterfowl eliminated. Same ac. habitat created for other birds & terrestrial vertebrates. +	Permanent loss of 171 ac. ; Borrow site temporarily impacted; 277 ac. if Bayou des Allemands, 92 ac. if Lake Salvador. -	No impacts 0	Perm. impact juvenile brown shrimp, adult/juvenile red drum & white shrimp, at 166 ac. mit site. Perm impact similar species at borrow site -
Lake Boeuf Swamp Restoration	Perm. conversion of manipulated hydrology to natural hydrology. +	No 0	No 0	Temporary increased turbidity. Long-term water quality improvement. +	163 ac. ag land converted to swamp, improving habitat for various species. +	No impacts 0	No impacts 0	No impacts 0
Plaquemines, Alt. 1 Swamp Restoration	165 ac. open water converted to seasonally flooded soils. 0	Yes. 165 ac. open water permanently converted to swamp. Temp impact at borrow site. -	No 0	Temporary increased turbidity. -	165 ac. habitat for waterfowl eliminated. Same ac. habitat created for other birds & terrestrial vertebrates. +	Permanent loss of 165 ac.; 70 ac. borrow site temporarily impacted -	No impacts by mitigation features. Pallid sturgeon could occur in borrow site. -	Perm. impact juvenile brown & white shrimp, adult/juvenile red drum and juvenile grey snapper, at 165 ac. mit site. Perm impact similar species at borrow site. -
Plaquemines, Alt. 2 Swamp Restoration	156 ac. open water converted to seasonally flooded soils. 0	Yes. 156 ac. open water permanently converted to swamp. Temp impact at borrow site. -	No 0	Temporary increased turbidity. -	156 ac. habitat for waterfowl eliminated. Same ac. habitat created for other birds & terrestrial vertebrates Avoidance measures needed re nearby bird rookery. 0	Permanent loss of 156 ac.; 62 ac. borrow site temporarily impacted -	No impacts by mitigation features. Pallid sturgeon could occur in borrow site. -	Perm. impact adult/juvenile brown & white shrimp, adult/juvenile red drum and juvenile grey snapper, at 166 ac. mit site. Perm impact similar species at borrow site. -

SUBCRITERIA	**Hydrology / Hydraulics**	**Navigable Waters**	**Scenic Rivers**	**Water Quality**	**Wildlife & Habitats**	**Water Bottoms / Benthic Resources**	**T & E Species**	**EFH**
	Qualitative	Yes/No; Extent of impacts; Perm/Temp	Coordination or permitting necessary (yes/no); Perm/Temp	Qualitative	Acreage of habitat by type impacted; acreage of habitat by type created	Acreage; Perm/Temp	Species; Critical habitat	Acreage; Species impacted / life stage; Perm/Temp
Non-Park Swamp Flood Side Impacts								
Salvador-Timken Swamp Restoration	170 ac. open water converted to seasonally flooded soils. Shoreline erosion reduced slightly. +	Yes. 170 ac. open water permanently converted to swamp. Temp impact at borrow site. -	No 0	Temporary increased turbidity. -	170 ac. habitat for waterfowl eliminated. Same ac. habitat created for other birds & terrestrial vertebrates. +	Permanent loss of 170 ac.; 72 ac. borrow site temporarily impacted -	No impacts 0	Perm. impact juvenile brown shrimp, juvenile red drum and adult/juvenile white shrimp, at 170 ac. of mit site. Perm impact similar species at borrow site. -
Simoneaux Ponds Swamp Restoration	175 ac. open water converted to seasonally flooded soils. Shoreline erosion reduced slightly. +	Yes. 175 ac. open water permanently converted to swamp. Temp impact at borrow site. -	Yes, temp impact if borrow from Bayou des Allemands. No, if borrow from Lake Salvador. -	Temporary increased turbidity. -	175 ac. habitat for waterfowl eliminated. Same ac. habitat created for other birds & terrestrial vertebrates. +	Permanent loss of 175 ac.; Temp impact at borrow site (75 ac. if Lake Salvador; 224 ac. if Bayou des Allemands). -	No impacts 0	Perm. impact juvenile brown shrimp, juvenile red drum and adult/juvenile white shrimp, at 175 ac. of mit site. Perm impact similar species at borrow site. -

SUBCRITERIA	Aquatic / Fisheries	Prime Farmland	Cultural Resources	Recreation	Noise	Aesthetics	HTRW	Environmental Justice	Socioeconomics / Land Use
	Acres habitat created or eliminated	Yes/No; Acreage	Qualitative	Acreage & type of resource impacted; Acreage of resource improved	Residential or commercial within 1,000 feet	Qualitative	Probability of encountering HTRW	Low income / minority populations disproportionately impacted	# Impacted – comm./industrial properties; residential units; public properties. Acres ag or forest converted
Non-Park Swamp Flood Side Impacts									
Dufrene Ponds Swamp Restoration	171 ac. open water eliminated. Limited fish access to restored swamp. - -	No 0	Low probability for impacts -	171 ac. private boating, fishing, crabbing eliminated. Same ac. improved re hiking, wildlife viewing, hunting. 0	None 0	Perm. conversion from open water view to forest. -	Very low probability -	No impacts 0	No impacts 0
Lake Boeuf Swamp Restoration	None eliminated. 163 ac. swamp restored provides new habitat. +	Yes. 140 ac. permanently converted to swamp. -	Moderate probability for impacts. Cultural resource survey needed. - -	0 ac. existing resource impacted. 163 ac. improved re hiking, wildlife viewing, hunting. +	None 0	Improved via conversion of ag fields to swamp. +	Low probability. 1 active well. 1 active oil/gas facility. - -	No impacts 0	163 acres agricultural cropland & pasture converted to swamp. Potential elimination of 1 oil/gas facility. - -
Plaquemines, Alt. 1 Swamp Restoration	165 ac. open water eliminated. Limited fish access to restored swamp. - -	No 0	Low probability for impacts. Cultural resource survey needed. -	165 ac. private boating, fishing, crabbing eliminated. Same ac. improved re hiking, wildlife viewing, hunting. 0	Yes. Few residences present. -	No impacts 0	Very low probability -	No impacts 0	No impacts 0
Plaquemines, Alt. 2 Swamp Restoration	156 ac. open water eliminated. Limited fish access to restored swamp. - -	No 0	Moderate probability for impacts. Cultural resource survey needed. - -	156 ac. private boating, fishing, crabbing eliminated. 156 ac. improved re hiking, wildlife viewing, hunting. 0	Yes. Several residences present. - -	No impacts 0	Very low probability -	No impacts 0	No impacts 0

SUBCRITERIA	**Aquatic / Fisheries**	**Prime Farmland**	**Cultural Resources**	**Recreation**	**Noise**	**Aesthetics**	**HTRW**	**Environmental Justice**	**Socioeconomics / Land Use**
	Acres habitat created or eliminated	Yes/No; Acreage	Qualitative	Acreage & type of resource impacted; Acreage of resource improved	Residential or commercial within 1,000 feet	Qualitative	Probability of encountering HTRW	Low income / minority populations disproportionately impacted	# Impacted – comm./industrial properties; residential units; public properties. Acres ag or forest converted
Non-Park Swamp Flood Side Impacts									
Salvador-Timken Swamp Restoration	170 ac. open water eliminated. Restored swamp provides limited habitat for various fishes & crabs. -	No 0	Moderate to high probability for impacts. Cultural resource survey needed. - -	170 ac. public boating, fishing, crabbing, duck hunting eliminated. 170 ac. improved re hiking, wildlife viewing, hunting. 0	None 0	No impacts 0	Very low probability -	No impacts 0	No impacts 0
Simoneaux Ponds Swamp Restoration	175 ac. open water eliminated. Limited fish access to restored swamp. - -	No 0	Low probability for impacts -	170 ac. private boating, fishing, crabbing, duck hunting eliminated. 175 ac. improved re hiking, wildlife viewing, hunting. 0	Yes. Several residences present. - -	Perm. conversion from open water view to forest. -	Very low probability -	No impacts 0	No impacts 0

SUBCRITERIA	Hydrology / Hydraulics	Navigable Waters	Scenic Rivers	Water Quality	Wildlife & Habitats	Water Bottoms / Benthic Resources	T & E Species	EFH
	Qualitative	Yes/No; Extent of impacts; Perm/Temp	Coordination or permitting necessary (yes/no); Perm/Temp	Qualitative	Acreage of habitat by type impacted; acreage of habitat by type created	Acreage; Perm/Temp	Species; Critical habitat	Acreage; Species impacted / life stage; Perm/Temp
Non-Park Fresh Marsh Flood Side Impacts								
Dufrene Ponds Marsh Restoration	Reduced wave energy & shoreline erosion +	Yes. 166 ac. open water permanently converted to marsh. Temp impact at borrow site. -	Yes, temp impact if borrow from Bayou des Allemands. No, if borrow from Lake Salvador -	Temporary increased turbidity -.	166 ac. open water habitat eliminated; 166 ac. emergent marsh created increases habitat for birds. ++	Permanent loss of 166 ac. water bottom but benthic organisms temp impacted. Borrow site temp impact (92 ac. if Lake Salvador; 242 ac. if Bayou des Allemands). - -	No impacts 0	Temp. impact juvenile brown shrimp, adult/juvenile red drum and adult/juvenile white shrimp, at 166 ac. of mit site. Perm impact similar species at borrow site. -
Jean Lafitte Marsh Restoration	Reduced wave energy & substantially reduced shoreline erosion + +	Yes. 103 ac. open water permanently converted to marsh. Access to 15 ac. canal blocked. Temp impact at borrow sites. -	No 0	Temporary increased turbidity. -	114 ac. open water habitat eliminated; 114 ac. emergent marsh created increases habitat for birds. Additional 118 ac. marsh protected from erosion. +	Permanent loss of 114 ac. water bottom but benthic organisms temp impacted. Borrow site temp impact (3 ac. in Lake Salvador; 40 ac. in Bayou Segnette). -	No impacts 0	Temp. impact juvenile brown shrimp, adult/juvenile red drum and adult/juvenile white shrimp, at 114 ac. of mit site. Perm impact similar species at borrow site. -
Plaquemines, Alt. 1 Marsh Restoration	Reduced wave energy, potential, reduced circulation in adjacent waters 0	Yes. 205 ac. open water permanently converted to marsh. Temp impact at borrow site. - -	No 0	Temporary increased turbidity. -	205 ac. open water habitat eliminated; 205 ac. emergent marsh created increases habitat for birds. Avoidance measures needed re nearby bird rookery. +	Permanent loss of 205 ac. water bottom but benthic organisms temp impacted. Borrow site temp impact to 91 ac. - -	No impacts by mitigation features. Pallid sturgeon could occur in borrow site. -	Temp. impact adult/juvenile brown & white shrimp, adult/juvenile red drum and juvenile grey snapper, at 205 ac. of mit site. Perm impact similar species at borrow site. -

SUBCRITERIA	**Hydrology / Hydraulics**	**Navigable Waters**	**Scenic Rivers**	**Water Quality**	**Wildlife & Habitats**	**Water Bottoms / Benthic Resources**	**T & E Species**	**EFH**
	Qualitative	Yes/No; Extent of impacts; Perm/Temp	Coordination or permitting necessary (yes/no); Perm/Temp	Qualitative	Acreage of habitat by type impacted; acreage of habitat by type created	Acreage; Perm/Temp	Species; Critical habitat	Acreage; Species impacted / life stage; Perm/Temp
Non-Park Fresh Marsh Flood Side Impacts								
Salvador-Timken Marsh Restoration	Reduced wave energy & reduced shoreline erosion +	Yes. 190 ac. open water permanently converted to marsh. Temp impact at borrow site. - -	No 0	Temporary increased turbidity. -	190 ac. open water habitat eliminated; 190 ac. emergent marsh created increases habitat for birds. ++	Permanent loss of 190 ac. water bottom but benthic organisms temp impacted. Borrow site temp impact to 88 ac. - -	No impacts 0	Temp. impact juvenile brown shrimp, adult/juvenile red drum and adult/juvenile white shrimp, at 190 ac. of mit site. Perm impact similar species at borrow site. -
Simoneaux Ponds Marsh Restoration	Reduced wave energy & reduced shoreline erosion +	Yes. 178 ac. open water permanently converted to marsh. Temp impact at borrow site. - -	Yes, temp impact if borrow from Bayou des Allemands. No, if borrow from Lake Salvador -	Temporary increased turbidity -	178 ac. open water habitat eliminated; 178 ac. emergent marsh created increases habitat for birds. ++	Permanent loss of 178 ac. water bottom but benthic organisms temp impacted. Borrow site temp impact (75 ac. if Lake Salvador; 224 ac. if Bayou des Allemands) - -	No impacts 0	Temp. impact juvenile brown shrimp & red drum, and adult/juvenile white shrimp, at 178 ac. of mit site. Perm impact similar species at borrow site. -

SUBCRITERIA	Aquatic / Fisheries	Prime Farmland	Cultural Resources	Recreation	Noise	Aesthetics	HTRW	Environmental Justice	Socioeconomics / Land Use
	Acres habitat created or eliminated	Yes/No; Acreage	Qualitative	Acreage & type of resource impacted; Acreage of resource improved	Residential or commercial within 1,000 feet	Qualitative	Probability of encountering HTRW	Low income / minority populations disproportionately impacted	# Impacted – comm./industrial properties; residential units; public properties. Acres ag or forest converted
Non-Park Fresh Marsh Flood Side Impacts									
Dufrene Ponds Marsh Restoration	166 ac. open water eliminated. 166 ac. marsh created increases habitat diversity. ++	No 0	Low probability for impacts. Cultural resource survey needed. -	166 ac. private boating, fishing, crabbing eliminated. Same ac. possibly improved re birding & duck hunting. 0	None 0	Perm. conversion from open water view to marsh view. -	Very low probability -	No impacts 0	No impacts 0
Jean Lafitte Marsh Restoration	114 ac. open water eliminated. 114 ac. marsh created increases habitat diversity +	No 0	Moderate probability for impacts. Cultural resource survey needed. - -	114 ac. public boating, fishing, crabbing eliminated. Same ac. possibly improved re birding. 0	None 0	Perm. conversion from open water view to marsh view. -	Very low probability -	No impacts 0	No impacts 0
Plaquemines, Alt. 1 Marsh Restoration	205 ac. open water eliminated. 205 ac. marsh created increases habitat diversity + +	No 0	Low probability for impacts. Cultural resource survey needed. -	205 ac. private boating, fishing, crabbing eliminated. Same ac. possibly improved re birding & duck hunting. 0	Yes. Several residences present. - -	No impacts 0	Very low probability -	No impacts 0	No impacts 0
Salvador-Timken Marsh Restoration	190 ac. open water eliminated. 190 ac. marsh created increases habitat diversity. + +	No 0	Moderate to high probability for impacts. Cultural resource survey needed. - -	190 ac. public boating, fishing, crabbing eliminated. Same ac. possibly improved re birding and duck hunting. 0	None 0	No impacts 0	Very low probability -	No impacts 0	No impacts 0
Simoneaux Ponds Marsh Restoration	178 ac. open water eliminated. 178 ac. marsh created increases habitat diversity. + +	No 0	Low probability for impacts -	178 ac. private boating, fishing, crabbing eliminated. Same ac. possibly improved re birding and duck hunting. 0	Yes. Several residences present. - -	Perm. conversion from open water view to marsh view. -	Very low probability -	No impacts 0	No impacts 0

SUBCRITERIA	Hydrology / Hydraulics	Navigable Waters	Scenic Rivers	Water Quality	Wildlife & Habitats	Water Bottoms / Benthic Resources	T & E Species	EFH
	Qualitative	Yes/No; Extent of impacts; Perm/Temp	Coordination or permitting necessary (yes/no); Perm/Temp	Qualitative	Acreage of habitat by type impacted; acreage of habitat by type created	Acreage; Perm/Temp	Species; Critical habitat	Acreage; Species impacted / life stage; Perm/Temp
Park/404(c) BLH-Wet Impacts								
Jean Lafitte, Alt. 1 BLH-Wet Restoration	54 ac. open water converted to seasonally inundated /saturated soils. Drainage effect of open water features on adjacent wetlands eliminated. **0**	No **0**	No **0**	Temporary increased turbidity. -	54 ac. habitat for waterfowl eliminated. Same ac. habitat created for other birds & terrestrial vertebrates. Avoidance measures needed re nearby bird rookeries. **0**	Permanent loss of 54 ac. - -	No impacts **0**	Potential perm. impact to juvenile brown shrimp, adult/juvenile red drum & white shrimp; but potential is low. **0**
Jean Lafitte, Alt. 2 BLH-Wet Restoration	24 ac. open water & 54 ac. marsh converted to seasonally inundated /saturated soils. Drainage effect of open water features on adjacent wetlands eliminated. **0**	Yes. 24 ac. of canals permanently converted to BLH. Temp impact at JL15 borrow site. -	No **0**	Temporary increased turbidity. -	78 ac. habitat for waterfowl eliminated. Same ac. habitat created for other birds & terrestrial vertebrates. Avoidance measures needed re nearby bird rookeries. **0**	Permanent loss of 24 ac. at mit site. Lake Salvador borrow site temp impact to 9 ac. -	No impacts **0**	Perm. impact to juvenile brown shrimp, adult/juvenile red drum & white shrimp. Perm impact similar species at Lake Salvador borrow site. -

SUBCRITERIA	Aquatic / Fisheries	Prime Farmland	Cultural Resources	Recreation	Noise	Aesthetics	HTRW	Environmental Justice	Socioeconomics / Land Use
	Acres habitat created or eliminated	Yes/No; Acreage	Qualitative	Acreage & type of resource impacted; Acreage of resource improved	Residential or commercial within 1,000 feet	Qualitative	Probability of encountering HTRW	Low income / minority populations disproportionately impacted	# Impacted – comm./industrial properties; residential units; public properties. Acres ag or forest converted
Park/404(c) BLH-Wet Impacts									
Jean Lafitte, Alt. 1 BLH-Wet Restoration	54 ac. open water eliminated. - -	No 0	Low probability for impacts -	No existing recreation eliminated. 54 ac. improved re hiking, wildlife viewing, hunting, plus conversion from private to public land. +	Yes. Several residences & commercial /industrial facilities are present. - -	Conversion from open water view to forested, but areas isolated. 0	Very low probability -	No impacts 0	No impacts 0
Jean Lafitte, Alt. 2 BLH-Wet Restoration	24 ac. open water eliminated. -	No 0	Moderate to high probability for impacts. Cultural resources survey needed. - -	24 ac. public boating, fishing, crabbing eliminated. 78 ac. possibly improved re hiking, wildlife viewing. +	None 0	Conversion from open water view & marsh view to forested. -	Very low probability -	No impacts 0	No impacts 0

SUBCRITERIA	**Hydrology / Hydraulics**	**Navigable Waters**	**Scenic Rivers**	**Water Quality**	**Wildlife & Habitats**	**Water Bottoms / Benthic Resources**	**T & E Species**	**EFH**
	Qualitative	Yes/No; Extent of impacts; Perm/Temp	Coordination or permitting necessary (yes/no); Perm/Temp	Qualitative	Acreage of habitat by type impacted; acreage of habitat by type created	Acreage; Perm/Temp	Species; Critical habitat	Acreage; Species impacted / life stage; Perm/Temp
Park/404(c) Swamp Impacts								
Jean Lafitte Swamp Restoration	77 ac. open water converted to seasonally flooded soils. Hydraulic isolation of a few remnant canals. Drainage effect of open water features on adjacent wetlands eliminated.	Yes. 38 ac. of canals permanently converted to swamp. Temp impact at JL8-JL10 borrow site.	No	Temporary increased turbidity. Potential for decreased dissolved oxygen in some canal segments.	77 ac. habitat for waterfowl eliminated. Same ac. habitat created for other birds & terrestrial vertebrates. Avoidance measures needed re nearby bird rookeries.	Permanent loss of 77 ac. at mit site. GIWW borrow site temp impact to 27 ac.	No impacts	Perm. impact to juvenile brown shrimp, adult/juvenile red drum & white shrimp. Perm impact similar species at GIWW borrow site.
Park Fresh Marsh Impacts								
Jean Lafitte Marsh Restoration	Reduced wave energy & reduced shoreline erosion	Yes. 15 ac. of open water permanently converted to swamp. Block access to 24 ac. of canal. Temp impact at borrow site.	No	Temporary increased turbidity.	15 ac. open water habitat eliminated; 15 ac. emergent marsh created increases habitat for birds.	Permanent loss of 15 ac. water bottom but benthic organisms temp impacted. Temp impact at 6 ac. borrow site.	No impacts	Temp. impact juvenile brown shrimp, adult/juvenile red drum and adult/juvenile white shrimp, at 15 ac. mit site. Perm impact similar species at borrow site.

SUBCRITERIA	Aquatic / Fisheries	Prime Farmland	Cultural Resources	Recreation	Noise	Aesthetics	HTRW	Environmental Justice	Socioeconomics / Land Use
	Acres habitat created or eliminated	Yes/No; Acreage	Qualitative	Acreage & type of resource impacted; Acreage of resource improved	Residential or commercial within 1,000 feet	Qualitative	Probability of encountering HTRW	Low income / minority populations disproportionately impacted	# Impacted – comm./industrial properties; residential units; public properties. Acres ag or forest converted
Park/404(c) Swamp Impacts									
Jean Lafitte Swamp Restoration	77 ac. open water eliminated. Same ac. new swamp provides fish habitat when flooded.	No	Moderate to high probability for impacts. Cultural resources survey needed.	20 ac. public boating, fishing, crabbing eliminated. 77 ac. possibly improved re hiking, wildlife viewing.	Yes. Several residences are present.	Conversion from open water view to forested, but most affected areas isolated.	Very low probability	No impacts	No impacts
Park Fresh Marsh Impacts									
Jean Lafitte Marsh Restoration	15 ac. open water eliminated. 15 ac. marsh created increases habitat diversity	No	Low probability for impacts	15 ac. public boating, fishing, crabbing eliminated. Same ac. possibly improved re birding & duck hunting.	None	Conversion from open water view to marsh view.	Very low probability	No impacts	No impacts

Table B-5: Time to Contract Award Matrix

Project Alternative	Total Duration
Non-Park/404(c) PS BLH-Dry and BLH-Wet	
Mitigation Bank	1 year, 3 mos
Lake Boeuf	2 yrs, 7 mos
Bayou Segnette	2 yrs, 7 mos
Plaquemines, Alternative 2	2 yrs, 7 mos
Dufrene Ponds	2 yrs, 7 mos
Non-Park/404(c) FS BLH-Wet	
Lake Boeuf	2 yrs, 7 mos
Plaquemines, Alternative 2	2 yrs, 7 mos
Dufrene Ponds	2 yrs, 7 mos
Non-Park/404(c) FS Swamp	
Lake Boeuf	2 yrs, 7 mos
Plaquemines, Alternative 1	2 yrs, 7 mos
Plaquemines, Alternative 2	2 yrs, 7 mos
Salvador-Timken	1 yrs, 5 mos
Simoneaux Ponds	2 yrs, 7 mos
Dufrene Ponds	2 yrs, 7 mos
Non-Park/404(c) FS Marsh	
Jean Lafitte	1 yrs, 5 mos
Plaquemines, Alternative 1	2 yrs, 7 mos
Salvador-Timken	1 yrs, 5 mos
Simoneaux Ponds	2 yrs, 7 mos
Dufrene Ponds	2 yrs, 7 mos

Table B-6: Time to NCC Matrix

Project Alternative	Total Duration
Non-Park/404(c) PS BLH-Dry and BLH-Wet	
Mitigation Bank	1 year, 3 mos
Lake Boeuf	7 yrs, 7 mos
Bayou Segnette	7 yrs, 7 mos
Plaquemines, Alternative 2	8 yrs, 7 mos
Dufrene Ponds	9 yrs, 7 mos
Non-Park/404(c) FS BLH-Wet	
Lake Boeuf	7 yrs, 7 mos
Plaquemines, Alternative 2	8 yrs, 7 mos
Dufrene Ponds	8 yrs, 7 mos
Non-Park/404(c) FS Swamp	
Lake Boeuf	7 yrs, 7 mos
Plaquemines, Alternative 1	8 yrs, 7 mos
Plaquemines, Alternative 2	8 yrs, 7 mos
Salvador-Timken	7 yrs, 7 mos
Simoneaux Ponds	8 yrs, 7 mos
Dufrene Ponds	8 yrs, 7 mos
Non-Park/404(c) FS Marsh	
Jean Lafitte	4 yrs, 7 mos
Plaquemines, Alternative 1	5 yrs, 7 mos
Salvador-Timken	4 yrs, 7 mos
Simoneaux Ponds	5 yrs, 7 mos
Dufrene Ponds	6 yrs, 7 mos

Table B-7: Other Cost Considerations Matrices

BLH –Dry and BLH-Wet OCC			
		Total Project Cost	Average Annual Cost
Mitigation Bank	Low	Least Cost	~1% > least cost
	High	~21% > least cost	~23% > least cost
Lake Boeuf		~5% > least cost	Least Cost
Bayou Segnette		~180% > least cost	~168% > least cost
Plaquemines, Alt. 2		~422% > least cost	~453% > least cost
Dufrene Ponds		~1,496% > least cost	~1,648% > least cost

BLH-Wet OCC		
	Total Project Cost	Average Annual Cost
Lake Boeuf	Least Cost	Least Cost
Plaquemines, Alt. 2	~333% > least cost	~389% > least cost
Dufrene Ponds	~1,116% > least cost	~1,282% > least cost

Swamp OCC		
	Total Project Cost	Average Annual Cost
Lake Boeuf	Least Cost	Least Cost
Plaquemines, Alt. 1	~278% > least cost	~311% > least cost
Plaquemines, Alt. 2	~250% > least cost	~281% > least cost
Salvador-Timken	~133% > least cost	~153% > least cost
Simoneaux Ponds	~437% > least cost	~488% > least cost
Dufrene Ponds	~608% > least cost	~680% > least cost

Fresh Marsh OCC		
	Total Project Cost	Average Annual Cost
Jean Lafitte	Least Cost	Least Cost
Plaquemines, Alt.1	~142% > least cost	~153% > least cost
Salvador-Timken	~14% > least cost	~11% > least cost
Simoneaux Ponds	~150% > least cost	~165% > least cost
Dufrene Ponds	~219% > least cost	~235% > least cost

Table B-8: Cost Effectiveness Matrices

BLH –Dry and BLH-Wet CE (AAHUs/$)		
Mitigation Bank	Low	~13% > least cost
	High	~36% > least cost
Lake Boeuf		Least Cost
Bayou Segnette		~169% > least cost
Plaquemines, Alternative 2		~456% > least cost
Dufrene Ponds		~1,402% > least cost

BLH-Wet CE	
Lake Boeuf	Least Cost
Plaquemines, Alternative 2	~388% > least cost
Dufrene Ponds	~1,086% > least cost

Swamp CE	
Lake Boeuf	Least Cost
Plaquemines, Alternative 1	~293% > least cost
Plaquemines, Alternative 2	~287% > least cost
Salvador-Timken	~151% > least cost
Simoneaux Ponds	~442% > least cost
Dufrene Ponds	~657% > least cost

Fresh Marsh CE	
Jean Lafitte	Least Cost
Plaquemines, Alternative 1	~129% > least cost
Salvador-Timken	~10% > least cost
Simoneaux Ponds	~142% > least cost
Dufrene Ponds	~209% > least cost

Table B-9: Three SLR Scenario Analysis

Mitigation Site	Proposed Habitat	Mitigation Feature ID	Acres	Total Net Gain AAHUs			Mitigation Potential (AAHUs / acre)			HSI at End of Period of Analysis (forested habitats; FWP)			Variable V1 Value (%) At End of Period of Analysis (marsh habitats; FWP)		
				Low SLR	Int. SLR	High SLR	Low SLR	Int. SLR	High SLR	Low SLR	Int. SLR	High SLR	Low SLR	Int. SLR	High SLR
Bayou Segnette	BLH-Dry	BS2 (D1)	1121.03	232.26	232.26	232.26	0.21	0.21	0.21	0.68	0.68	0.68	--	--	--
Bayou Segnette	BLH-Dry	BS4 (D3)	21.56	4.62	4.62	4.62	0.21	0.21	0.21	0.68	0.68	0.68	--	--	--
Bayou Segnette	BLH-Dry	BS6 (D2)	68.84	14.49	14.49	14.49	0.21	0.21	0.21	0.68	0.68	0.68	--	--	--
Bayou Segnette	BLH-Wet	BS3 (W3), HSDRRS	253.19	76.76	76.76	76.76	0.30	0.30	0.30	0.96	0.96	0.96	--	--	--
Dufrene Ponds	BLH-Wet	DP1 (B2)	471.88	307.69	305.50	299.19	0.65	0.65	0.63	0.68	0.67	0.64	--	--	--
Dufrene Ponds	BLH-Wet	DP4 (B1)	190.63	90.90	90.26	87.96	0.48	0.47	0.46	0.66	0.65	0.62	--	--	--
Dufrene Ponds	Swamp	DP2 (S1)	210.08	88.99	89.00	74.40	0.42	0.42	0.35	0.60	0.60	0.32	--	--	--
Dufrene Ponds	Fresh Marsh	DP3 (M2)	220.74	117.97	114.24	90.38	0.53	0.52	0.41	--	--	--	95.43	91.90	0.00
Dufrene Ponds	Fresh Marsh	DP5 (M1)	108.32	56.57	55.11	46.15	0.52	0.51	0.43	--	--	--	97.73	95.33	0.00
Lake Boeuf	BLH-Dry	LB3 (D1)	375.77	169.89	169.89	169.89	0.45	0.45	0.45	0.66	0.66	0.66	--	--	--
Lake Boeuf	BLH-Wet	LB1 (W1)	145.65	86.59	86.59	86.59	0.59	0.59	0.59	0.86	0.86	0.86	--	--	--
Lake Boeuf	BLH-Wet	LB2 (W2)	66.59	37.83	37.83	37.83	0.57	0.57	0.57	0.82	0.82	0.82	--	--	--
Lake Boeuf	BLH-Wet	LB4 (W5)	110.04	64.53	64.53	64.53	0.59	0.59	0.59	0.85	0.85	0.85	--	--	--
Lake Boeuf	BLH-Wet	LB5 (W3)	51.38	31.03	31.03	31.03	0.60	0.60	0.60	0.87	0.87	0.87	--	--	--
Lake Boeuf	BLH-Wet	LB7 (W4)	90.69	51.38	51.38	51.38	0.57	0.57	0.57	0.82	0.82	0.82	--	--	--
Lake Boeuf	Swamp	LB6 (S1)	13.15	6.07	5.80	5.42	0.46	0.44	0.41	0.85	0.68	0.54	--	--	--
Lake Boeuf	Swamp	LB8 (S2)	26.71	11.95	11.88	11.10	0.45	0.44	0.42	0.73	0.68	0.53	--	--	--
Lake Boeuf	Swamp	LB9 (S3)	91.61	42.64	40.76	38.08	0.47	0.44	0.42	0.85	0.68	0.53	--	--	--

Mitigation Site	Proposed Habitat	Mitigation Feature ID	Acres	Total Net Gain AAHUs			Mitigation Potential (AAHUs / acre)			HSI at End of Period of Analysis (forested habitats; FWP)			Variable V1 Value (%) At End of Period of Analysis (marsh habitats; FWP)		
				Low SLR	Int. SLR	High SLR	Low SLR	Int. SLR	High SLR	Low SLR	Int. SLR	High SLR	Low SLR	Int. SLR	High SLR
Plaquemines Alt. 1	Swamp	P1 (S1)	150.35	68.39	65.87	61.49	0.45	0.44	0.41	0.79	0.68	0.67	--	--	--
Plaquemines Alt. 1	Fresh Marsh	P2 (M1)	312.18	129.53	132.99	102.93	0.41	0.43	0.33	--	--	--	97.53	96.34	0.00
Plaquemines Alt. 2	BLH-Wet	P3 (B1)	566.25	356.33	356.33	356.33	0.63	0.63	0.63	0.93	0.93	0.93	--	--	--
Plaquemines Alt. 2	Swamp	P4 (S1)	106.36	48.39	46.60	43.50	0.45	0.44	0.41	0.79	0.68	0.67	--	--	--
Salvador - Timken	Swamp	ST1 (S1)	183.78	81.23	78.47	69.28	0.44	0.43	0.38	0.71	0.60	0.33	--	--	--
Salvador - Timken	Fresh Marsh	ST2 (M1)	324.89	147.90	146.00	115.09	0.46	0.45	0.35	--	--	--	99.00	95.33	0.00
Jean Lafitte, General Mitigation	Fresh Marsh	JL1B (M4B), Mitigation Feature Portion	117.58	56.21	51.81	46.68	0.48	0.44	0.40	--	--	--	97.78	93.85	0.00
Jean Lafitte, General Mitigation	Fresh Marsh	JL4 (M3), Mitigation Feature Portion	46.62	8.52	8.32	6.49	0.18	0.18	0.14	--	--	--	0.00	0.00	0.00
Jean Lafitte, General Mitigation	Existing Fresh Marsh	JL1B (M4B), Shoreline Protection Portion	13.70	6.55	6.04	5.44	0.48	0.44	0.40	--	--	--	100.00	100.00	0.00

Mitigation Site	Proposed Habitat	Mitigation Feature ID	Acres	Total Net Gain AAHUs			Mitigation Potential (AAHUs / acre)			HSI at End of Period of Analysis (forested habitats; FWP)			Variable V1 Value (%) At End of Period of Analysis (marsh habitats; FWP)		
				Low SLR	Int. SLR	High SLR	Low SLR	Int. SLR	High SLR	Low SLR	Int. SLR	High SLR	Low SLR	Int. SLR	High SLR
Jean Lafitte, General Mitigation	Existing Fresh Marsh	JL4 (M3), Shoreline Protection Portion	329.59	60.21	58.85	45.91	0.18	0.18	0.14	--	--	--	39.14	35.11	0.00
Jean Lafitte, Park/404c Mitigation, BLH Alt. 1	BLH-Wet	JL12 (B2)	16.83	10.46	10.56	10.35	0.62	0.63	0.62	0.91	0.93	0.88	--	--	--
Jean Lafitte, Park/404c Mitigation, BLH Alt. 1	BLH-Wet	JL13 (B3)	20.55	12.72	12.85	12.60	0.62	0.63	0.61	0.91	0.93	0.87	--	--	--
Jean Lafitte, Park/404c Mitigation, BLH Alt. 1	BLH-Wet	JL14 (B4)	16.75	10.63	10.73	10.52	0.63	0.64	0.63	0.93	0.95	0.90	--	--	--
Jean Lafitte, Park/404c Mitigation, BLH Alt. 2	BLH-Wet	JL15 (B1)	54.00	20.16	20.16	19.37	0.37	0.37	0.36	0.89	0.89	0.83	--	--	--
Jean Lafitte, Park/404c Mitigation, BLH Alt. 2	BLH-Wet	JL17 (B3)	5.4	3.45	3.45	3.38	0.64	0.64	0.63	0.94	0.94	0.90	--	--	--
Jean Lafitte, Park/404c Mitigation, BLH Alt. 2	BLH-Wet	JL18	18.6	11.90	11.90	11.67	0.64	0.64	0.63	0.94	0.94	0.90	--	--	--

Table B-10. Previously Constructed Wetland or Ecosystem Restoration Projects in Barataria Basin

Program	Parish	Year Constructed	Description	Direct Overlap	Extended Boundary Overlap
CIAP BA-15x-2 (EB): EB-Lake Salvador Shoreline Protection Phase III	St Charles	2009	A shoreline protection located near Bayou des Allemands along the northwestern Lake Salvador shoreline tying into the western BA-15 CWPPRA shoreline protection feature and extending approximately 3 miles east. *+#	No	No
CIAP BA-59: Waterline Booster Pump Station, West Bank	St. James	2010	Constructed in 2010, the project includes the installation of a waterline booster pump station in Welcome, Louisiana along Louisiana Highway 18 on the west bank of the Mississippi River in St. James Parish.*+#	No	No
CIAP BA-61: West Bank Wetland Conservation and Protection	St. James	2010	Acquisition and preservation of approximately 235 acres of existing wetlands along Louisiana Highway 20 in St. James Parish near the communities of South Vacherie and Chackbay to protect the natural habitat from future development. The purchase was completed in 2010. *+#	No	No
CWPPRA BA-03c: Naomi Outfall Management	Jefferson, Plaquemines	2002	The management of freshwater, sediment and nutrients diverted from the Mississippi River via the Naomi Siphon (BA-03) into the project area located between the communities of Naomi/La Reusitte and Lafitte in Jefferson Parish, Louisiana including The Pen. The project goal is to decrease salinities and reduce marsh loss.*	No	Yes

CWPPRA BA-02: GIWW (Gulf Intracoastal Waterway) to Clovelly Hydrologic Restoration	Lafourche	2000	Inhibit salinity increases within the project area by the use of hydrologic restoration features such as plugs and weirs to prevent salt water intrusion and decrease marsh loss. Shoreline protection features along the Bay L'Ours were also constructed to prevent wave induced erosion and reduce marsh loss. The project is located east of the communities of Larose and Cutoff in Lafourche Parish, Louisiana and adjacent to Little Lake. *	No	No
CWPPRA BA-15: Lake Salvador Shore Protection Demonstration	St Charles	1998	The project was constructed in two Phases. The first phase included the construction of shoreline protection features along the northern shoreline of Lake Salvador east of Baie du Cabanage to investigate the performance of various structural shoreline protection designs in unstable soil conditions and high wave energy environments. Phase II of the project included a continuous rock structure approximately 8,000 feet in length along the western section of the lake near the entrance of Bayou des Allemands. The objective of this project was to maintain the shoreline integrity and prevent interior marsh loss. *	No	No

CWPPRA BA-39: Mississippi River Sediment Delivery System - Bayou Dupont	Jefferson, Plaquemines	2010	Dredged material from the Mississippi River near La Reussite, Louisiana was pumped into confined open water areas south of Cheniere Traverse Bayou and adjacent to the West Plaquemines non-federal levee using a pipeline conveyance system to create and restore marsh. Additional grant funded received by the State of Louisiana from The American Recovery and Reinvestment Act of 2009 (ARRA) was added to this project to create approximately 100 additional acres of marsh. *	No	No
National Park Service/USACE: Lake Salvador Shoreline Protection 1997 Shoreline Protection	Jefferson	1997	A shoreline protection barrier was built by the USACE under the authority of the National Parks and Recreation Act of November 10, 1978 (PL 95-625) to protect the Jean Lafitte National Historical Park and Preserve lands from wave induced erosion in an area of the central eastern Lake Salvador shoreline where potential breaching was possible between the Lake Salvador shoreline and the Bayou Segnette Waterway. The wave break is approximately 8,000 feet long (USACE, 1995).	Yes	No

National Park Service/USACE: Lake Salvador Shoreline Protection 2005	Jefferson	2004-2005	Shoreline protection features were constructed by the USACE within the Jean Lafitte National Historical Park and Preserve along the northeastern Lake Salvador shoreline from the entrance of Bayou Bardeaux southeast along the Lake Salvador shoreline until it meets the National Park Service breakwater constructed in 1997. The goal of this project is to protect the JLNHPP lands and archaeological sites from wave induced erosion (USACE, 2004b).	No	No
National Park Service: 2002 Jean Lafitte National Historical Park & Preserve Canal Partial Back Fillings	Jefferson	2002	Jean Lafitte National Historical Park & Preserve canals backfilled in 2002 to restore marsh integrity (Haigler, 2011).	No	Yes
National Park Service: 2010 Jean Lafitte National Historical Park & Preserve Canal Partial Back Fillings	Jefferson	2010	Jean Lafitte National Historical Park & Preserve canals partially backfilled in 2010 to restore marsh integrity (Haigler, 2011).	No	Yes

National Park Service/USACE: Jean Lafitte National Historical Park & Preserve Beneficial Use Site	Jefferson	2011	The beneficial use of dredged material from Bayou Segnette Waterway and additional material from Algiers Canal associated with the construction of the West Closure Complex/HSDRSS were placed in the site bounded by the 1997 NPS wave break features on the west, existing marsh lands to the north and south, and the 1994 State of Louisiana BA-16 rock dike to the east. The project will provide improved shoreline stability (Minton, 2011).	Yes	No
National Park Service/USACE: Lake Salvador Shoreline Protection 2011	Jefferson	2011	Construction consisted of placement of rock on the floodside of the geocrib area and repairing existing rock dike on the Jean Lafitte National Historical Park and Preserve -along the eastern Lake Salvador shoreline adjacent to the geocrib constructed in 1997. The feature is owned by NPS (O'Cain, 2012).	Yes	No
State of Louisiana BA-03: Naomi Siphon Diversion	Jefferson, Plaquemines	1992	The Naomi Siphon diversion is located on the west bank of the Mississippi River near the communities of Naomi and LaReussitte, Louisiana. The maximum flow capacity of the diversion is 2,100 cfs and is designed to divert freshwater, nutrients and sediment from the Mississippi River into the adjacent wetlands near Naomi, Louisiana. *	No	Yes
State of Louisiana BA05c: Baie de Chactas	St Charles	1990	Construction of a rock shoreline protection feature between the northwest shoreline of Lake Salvador and Baie du Cabanage in order to reduce erosion, stabilize the shoreline, and prevent shoreline breaching. *	No	Yes

State of Louisiana BA-15x1: Lake Salvador Shoreline Protection Extension Project	St Charles	2005	The shoreline protection project included the construction of a rock dike along the northeastern shoreline of Lake Salvador tying into the BA-15 Phase II CWPPRA project and extending approximately 10,000 feet northeast. The project is designed to maintain the shoreline integrity and reduce interior marsh loss. *	No	No
State of Louisiana BA-16: Bayou Segnette	Jefferson	1994; 1998	A shoreline protection feature along a narrow strip of spoil bank and marsh which separates the Bayou Segnette Waterway from Lake Salvador and a barrier across an abandoned canal that connects the two water bodies was constructed in 1994 to reduce wave induced erosion of marsh habitats within the JLNHPP. Maintenance of the structure occurred in 1998-1999. *	Yes	Overlap was taken into considerati on in USGS analysis
State of Louisiana LA-01a: Dedicated Dredging Program - Lake Salvador	St Charles	1999	A Dedicated Dredging Program project which included the placement of dredged material in open water areas of Baie du Cabanage within the Salvador Wildlife Management Area where narrow marsh strips exists between Lake Salvador and the bay. The project goal is the restoration of marsh habitat and the reduction of shoreline breaching into the adjacent open water bodies. *	No	No

Texaco Oil Spill Mitigation: Texaco Oil Discharge Mitigation 1991 (Netherlands Area)	St Charles	1991	Mitigation for the 1991 Texaco oil well discharge into southwestern portion of Lake Salvador. The mitigation feature was constructed in the Netherlands area and consists of a timber pile/tire breakwater approximately 835 feet in length separating the Netherlands area from Lake Cataouatche. The objective of the project is to reduce erosion and enhance submerged aquatic vegetation habitat. The breakwater is anticipated to maintain existing conditions for 50 years (USDOI, 1991).	No	Yes
US Army Corps of Engineers: Davis Pond Freshwater Diversion Structure and Guide Levees	St Charles	2002	The Davis Pond Freshwater Diversion Structure is located on the west bank of the Mississippi River near Luling, Louisiana in St Charles Parish. Approximately 19 miles of guide levees were also constructed to control the diverted freshwater, nutrients and sediments from the Missisisppi River through the diversion structure into the Barataria Basin for the enhancement of the wetland habitat. The maximum flow capacity of the diversion is 10,650 cfs (USACE, 2000).	No	No
WRDA BA-01: Davis Pond Freshwater Diversion and Forced Drainage Area	Jefferson, Lafourche, Plaquemines, St Charles	2002	The management of the diverted freshwater, nutrients and sediment from the Mississippi River through the Davis Pond freshwater diversion structure into the surrounding marsh areas to maintain and enhance the ecosystem of the Barataria Basin. *	Yes	Yes

Table B-11: Reasonably Foreseeable Future Wetland or Ecosystem Restoration Projects in Barataria Basin

Program	Parish	Description	Direct Overlap	Extended Boundary Overlap
CIAP BA-43 (EB): EB-Long Distance Mississippi River Sediment Pipeline	Jefferson, Lafourche, Plaquemines	The deposition of dredged material from the Mississippi River by long distance pipeline from the Mississippi River to locations within central Barataria Basin for marsh creation and restoration. Project is currently under construction and is expected to be completed by December 2015.*+ #	No	No
CIAP BA-62: West Bank Wastewater Assimilation Plant	St. James	Construction of a wetland assimilation treatment plant in Vacherie, Louisiana for disbursement of treated sewerage effluent into a predominantly cypress/tupelo forested wetland area in St James Parish to increase wetland vegetation health. Grant application is anticipated in the near future with construction scheduled to begin in June 2014 and anticipated construction completed in June 2015.*+#	No	No
CIAP PO-90: West Lac Des Allemands Shoreline Protection	St John the Baptist	Shoreline protection is to be constructed along the western shore of Lac des Allemands from "Pleasure Bend" westward to Pointe Aux Herbes in St John the Baptist Parish, Louisiana. The goal of the project is reduce shoreline erosion. Construction began in January 2013 and is anticipated of completion in August 2014.*+#	No	No
CWPPRA LA-16 Non-rock Alternatives to Shoreline Protection Demonstration	Jefferson	Project goals are to demonstrate different alternatives to rock shoreline protection methods by testing several different products along highly erosive shorelines in areas that are not conducive to construction with rock (CPRA, 2013b)	No	No

Pre-Katrina WBV Mitigation: Land Acquisition and BLH Mitigation	St Charles	Mitigation for Pre-Katrina West Bank and Vicinity Hurricane Protection project impacts by land acquisition, preservation, and management of lands along the St Charles Parish ridge and adjacent to Bayou Segnette State Park. Anticipated Bayou Segnette land acquisition completed by July 2014 and anticipated construction complete by Winter 2016. Anticipated St Charles land acquisition completed by March 2015 and anticipated completion date prior to Winter 2016. (USACE, 2012b).	No	Yes

Table B-12: Additional Authorized Projects in Barataria Basin

Program	Parish	Description	Direct Overlap	Extended Boundary Overlap
Louisiana DOTD/FHWA: Future I-49 South, Raceland to the Westbank Expressway (700-92-0011)	St. Charles; Lafourche	Proposed construction of an elevated extension to US Interstate 49 South along the US 90 corridor from the Louisiana Highway 1 interchange in Raceland, Louisiana to the Westbank Expressway near Ames Boulevard in Marrero, Louisiana. The project also includes the connection of the southern terminus of US Interstate 310 with US Interstate 49. The Record of Decision for the project was signed in January 2008 (USDOT, 2008).	No	Yes
US Department of Justice: St Charles Levee Conservation Easement	St. Charles	St Charles Levee Conservation Easement was authorized and created in 1999 by the U.S. Department of Justice as a conservation area resulting from a federal settlement with Rathborne Land Company to resolve allegations of unpermitted development of wetlands (Scallan, 2010).	No	No

([*]Data source is CPRA, 2012a; [+]Data source is CPRA, 2010)

Table B-13: Plant Species Referenced in PIER 37

Common Name	Scientific Name
American elm	*Ulmus americana*
American sycamore	*Platanus occidentalis*
Bald cypress	*Taxodium distichum*
Black willow	*Salix nigra*
Boxelder	*Acer negundo*
Bulltongue	*Sagittaria lancifolia*
Buttonbush	*Cephalanthus occidentalis*
California bullwhip	*Scirpus californicus*
Cattail	*Typha latifolia*
Cedar elm	*Ulmus crassifolia*
cutgrass	*Zizaniopsis miliaceae*
Common persimmon	*Diospyros virginiana*
duckweed	*Lemna sp.*
Eastern cottonwood	*Populus deltoides*
Green ash	*fraxinus pennsylvanica*
Honey locust	*Gleditsia triacanthos*
Iris	*Iris L.*
Nuttall oak	*Quercus nuttallii*
Pignut hickory	*Carya glabra*
Planertree	*Planera aquatica*
Red maple	*Acer rubrum*
Red mulberry	*Morus rubra*
Sugarberry	*Celtis laevigata*
Sweetgum	*Liquidambar styraciflua*
Water lily	*Nymphaea odorata*
Water Oak	*Quercus nigra*
Water tupelo/tupelogum	*Nyssa aquatica*
Wild rice	*Zizania aquatica*

Table B-14: Common Wildlife Species Found in the WBV Basin

Common Name	Scientific Name
American alligator	*Alligator missippiensis*
American beaver	*Castor canadensis*
American coot	*Fulica americana*
American kestrel	*Falco sparverius*
American white pelican	*Pelecanus erythrorhynchos*
American widgeon	*Anas americana*
Bald eagle	*Haliaeetus leucocephalus*
Banded water snake	*Nerodia fasciata*
Barred owl	*Strix varia*
Belted kingfisher	*Ceryle alcyon*
Black skimmer	*Rynchops niger*
Black-necked stilt	*Himantopus mexicanus*
Blue-winged teal	*Anas discors*
Boat-tailed grackle	*Quiscalus major*
Bobcat	*Lynx rufus*
Brazilian free-tailed bat	*Tadarida brasiliensis*
Bronze frog	*Rana clamitans*
Brown pelican	*Pelecanus occidentalis*
Bufflehead	*Bucephala albeola*
Bullfrog	*Rana catesbeiana*
Carolina wren	*Thryothorus ludovicianus*
Cattle egret	*Bubulcus ibis*
Clapper rail	*Rallus longirostris*
Common grackle	*Quiscalus quiscalus*
Common moorhen	*Gallinula chloropus*
Common snapping turtle	*Chelydra serpentine*
Common yellowthroat	*Geothlypis trichas*
Cotton mouse	*Peromyscus gossypinus*
Coyote	*Canis latrans*
Diamondback terrapin	*Malaclemys terrapin*
Double-crested cormorant	*Phalacrocorax auritus*
Eastern pipistrelle	*Pipistrellus subflavus*
Eastern cottontail rabbit	*Sylvilagus floridanus*
Eastern wood-pewee	*Contopus virens*
Evening bat	*Nycticeius humeralis*
Feral hog	*Sus scrofa*
Forster’s tern	*Sterna forsteri*
Fulvous harvest mouse	*Reithrodontomys fulvescens*
Gadwall	*Anas strepera*
Glossy ibis	*Plegadis falcinellus*
Gray fox	*Urocyon cinereoargenteus*
Great blue heron	*Ardea herodias*
Great egret	*Casmerodius albus*

Greater yellowlegs	*Tringa melanoleuca*
Green anole	*Anolis carolinensis*
Green-backed heron	*Butorides striatus*
Green sea turtle	*Chelonia mydas*
Green treefrogs	*Hyla cinerea*
Green-winged teal,	*Anas crecca*
Ground skink	*Scincella lateralis*
Gulf coast toad	*Bufo valliceps*
Gull-billed tern	*Sterna nilotica*
Herring gull	*Larus argentatus*
Hispid cotton rat	*Sigmodon hispidus*
House mouse	*Mus musculus*
Kemp's ridley sea turtle	*Lepidochelys kempii*
Killdeer	*Chardrius vociferous*
Laughing gull	*Larus atricilla*
Lesser scaup	*Aythya affinis*
Lesser yellowlegs	*Tringa flavipes*
Loggerhead sea turtle	*Caretta caretta*
Lesser Scaup	*Aythya affinis*
Mallard	*Anas platyrhyncos*
Marsh rice rat	*Oryzomys palustris*
Marsh wren	*Cistothorus palustris*
Mink	*Mustela vison*
Mottled duck	*Anas fulvigula*
Mourning Dove	*Zenaida macroura*
Muskrat	*Ondatra zibethicus*
Nine-banded armadillo	*Dasypus novemcinctus*
Northern cardinal	*Cardinalis cardinalis*
Northern mockingbird	*Mimus polyglottos*
Northern pintail	*Anas acuta*
Northern raccoon	*Procyon lotor*
Northern Shoveler	*Anas clypeata*
Northern yellow bat	*Lasiurus intermedius*
Norway rat	*Rattus norvegicus*
Nutria	*Myocastor coypus*
Olivaceous cormorant	*Phalacrocorax brasilianus*
Pig frog	*Rana grylio*
Rafinesque's big-eared bat	*Plecotus rafinesquii*
Red bat	*Lasiurus borealis*
Red-eared slider	*Trachemys scripta*
River otter	*Lutra canadensis*
Red fox	*Vulpes vulpes*
Redhead	*Aythya americana*
Red-shouldered hawk	*Buteo lineatus*
Red-tailed hawk	*Buteo jamaicensis*

Red-winged blackbird	*Agelaius phoeniceus*
Ring-billed gull	*Larus delawarensis*
Roof rat	*Rattus rattus*
Seaside sparrow	*Ammodramus maritimus*
Shovelnose Sturgeon	*Scaphirhynchus platorynchus*
Snowy egret	*Egretta thula*
Southern leopard frog	*Rana sphenocephala*
Squirrel treefrogs	*Hyla squirella*
Stinkpot	*Sternotherus odoratus*
Swamp rabbit	*Sylvilagus aquaticus*
Tricolored heron	*Egretta tricolor*
West Indian manatee	*Trichechus manatus*
Western cottonmouth	*Agkistrodon piscivorus*
White-eyed vireo	*Vireo griseus*
White-faced ibis	*Plegadis chihi*
White-footed mouse	*Peromyscus leucopus*
White ibis	*Eudocimus albus*
White-tail deer	*Odocoileus virginiana*
Wood duck	*Aix sponsa*
Yellow-crowned night-heron	*Nycticorax violaceus*

Table B-15: Project Parishes and LA Threatened and Endangered Species

Species	Parish	Critical Habitat	Status	Jurisdiction	
				USFWS	NFMS
Animal					
Louisiana Black Bear (*Ursus americanus luteolus*)	St. C, St. J, O, Pl	X	T	X	
*West Indian Manatee (*Trichechus manatus*)	Asc, J, L, O, Pl, St. C, St. J, St. JB,		E	X	
Alabama Heelsplitter Mussel (*Potamilus inflatus*)	Asc, St. JB,		T	X	
Gulf sturgeon (*Acipenser oxyrinchus desotoi*)	Asc, J, L, Pl, St. J, St. C, St. JB,		T	X	X
*Pallid sturgeon (*Scaphirhynchus albus*)	Asc, J, O, Pl, St. J, St. C, St. JB,		E	X	
Piping plover (*Charadrius melodus)*	J, L, O, Pl	X	T	X	
Red knot *(Calidris canutus)*	J, L, Pl		T	X	
Green Sea Turtle (*Chelonia mydas*)	J, L, Pl		T	X	X
Hawksbill Sea Turtle (*Eretomchelys imbricata*)	J, L, Pl		E	X	X
Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)	J, L, Pl		E	X	X
Leatherback Sea Turtle (*Dermochelys coriacea*)	J, L, Pl		E	X	X
Loggerhead Sea Turtle (*Caretta caretta*)	J, L, Pl		T	X	X

Table B-16: Fish and Aquatic Species Found in the WBV Basin

Common Name	Scientific Name
Atlantic croaker	*Micropogonias undulatus*
American oyster	*Crassostrea virginica*
Asiatic clam	*Corbicula fluminea*
bay anchovy	*Anchoa mitchilli*
bighead carp	*Hypophthalmichthys nobilis*
black drum	*Pogonias cromis*
blue crab	*Callinectes sapidus*
blue catfish	*Ictalurus furcatus*
bluegill	*Lepomis macrochirus*
bowfin	*Amia calva*
brown shrimp	*Farfantepenaeus aztecus*
buffalo	*Ictiobus bubalus*
channel catfish	*Ictalurus punctatu*s
common carp	*Cyprinus carpio*
crawfish	*Procambarus sp.*
freshwater drum	*Aplodinotus grunniens*
Gizzard shad	*Dorosoma cepedianum*
grass carp	*Ctenopharyngodon idella*
Gulf menhaden	*Brevoortia patronus*
Gulf sturgeon	*Acipenser oxyrinchus desotoi*
hardhead catfish	*Ariopsis felis*
inland silverside	*Menidia beryllina*
largemouth bass	*Micropterus salmoides*
least killifish	*Heterandria formosa*
mosquitofish	*Gambusia affinis*
paddlefish	*Polyodon spathula*
pallid sturgeon	*Scaphirhynchus albus*
rainwater killifish	*Lucania parva*
redear sunfish	*Lepomis microlophus*
redfish/ red drum	*Sciaenops ocellatus*
Rio Grande cichlid	*Cichlasoma cyanoguttatum*
sand sea trout	*Cynoscion arenarius*
sailfin molly	*Poecilia latipinna*
sheepshead	*Archosargus probatocephalus*
sheepshead minnow	*Cyprinodon variegatus*
shovelnose sturgeon	*Scaphirhynchus platorynchus*
silver carp	*Hypophthalmichthys molitrix*
southern flounder	*Paralichthys lethostigma*
Spanish mackerel	*Scomberomorus maculatus*
spot	*Leiostomus xanthurus*
Spotted gar	*Lepisosteus oculatus*
spotted sea trout	*Cynoscion nebulosus*
striped mullet	*Mugil cephalus*

warmouth	*Lepomis gulosus*
white shrimp	*Litopenaeus setiferus*
Yellow bass	*Morone mississippiensis*
yellow bullhead	*Ameiurus natalis*
Zebra mussel	*Dreissena polymorpha*

Table B-17. Construction Equipment Noise Emission Levels

Equipment	Typical Noise Level (dBA) 50 ft., U. S. Dept. of Trans. study 1979	Average Noise Level (dBA) 50 ft., CA/T Project study 1994	Typical Noise Level (dBA) 50 ft., U. S. Dept. of Trans. study 1995	Lmax Noise (dBA) 50 ft., CA/T Project Spec. 721.560
Air Compressor		85	81	80
Backhoe	84	83	80	80
Chain Saw				85
Compactor	82		82	80
Compressor	90	85		80
Concrete Truck		81		85
Concrete Mixer			85	85
Concrete Pump			82	82
Concrete Vibrator			76	80
Crane, Derrick	86	87	88	85
Crane, Mobile		87	83	85
Dozer	88	84	85	85
Drill Rig		88		85
Dump Truck		84		84
Excavator				85
Generator	84	78	81	82
Gradall		86		85
Grader	83		85	85
Hoe Ram		85		90
Impact Wrench			85	85
Jackhammer*		89	88	85

Loader	87	86	85	80
Paver	80		89	85
Pile Driver, Impact		101	101	95
Pile Driver, Sonic			96	95
Pump	80		85	77
Rock Drill			98	85
Roller			74	80
Scraper	89		89	85
Slurry Machine		91		82
Slurry Plant				78
Truck	89	85	88	84
Vacuum Excavator				85

* There are 82 dBA @ 7 meter rated jackhammers (90 lb. class) available. This would be equivalent to 74 dBA @ 50 ft. These are silenced with molded intricate muffler tools.

Table B-18. Prime Farmland Soils

Parish	Acreage*	% of All Soils*
Ascension	8,499.6	83.7
Assumption	30,431.9	55.3
Jefferson	28,231.3	30.8
Lafourche	60,877.7	20.2
Orleans	7,036.5	52.7
Plaquemines	8,467.9	23.2
St Bernard	0.0	0
St Charles	31,360.9	17.3
St James	37,011.4	41.9
St John the Baptist	15,324.5	25.9
TOTAL	227,241.7	27.1

*Acreages and percentages are based on the portions of the parish that fall within the WBV mitigation basin boundary.

Table 19: **2012 Fishing, Hunting Licenses & 2011 Boating Licenses Sold by Parish and in the WBV Basin**

Parish	Resident Salt *	NR Salt*	Resident Fresh*	NR Fresh*	Residential Hunting*	NR Hunting *	Boat
Assumption	1,833	13	2,971	3	1,186	0	3,607
St. James	2,027	1	2,456	1	763	0	2,135
St. John the Baptist	3,609	7	3,973	7	861	0	2,269
La Fourche	14,628	33	15,556	33	4,464	2	11,878
St. Charles	5,519	17	5,930	19	1,477	0	4,343
Jefferson	30,860	171	31,707	184	4,935	5	18,627
Orleans	11,544	98	12,059	122	1,466	6	4,649
Plaquemines	3,400	15	3,464	16	1,100	1	3,937
Total WBV Basin	**73,420**	**355**	**78,116**	**385**	**16,252**	**14**	**51,445**

Information is provided by the Louisiana Dep artment of Wildlife and Fisheries (www.wlf.louisiana.gov)
* Numbers are for one license per year per individual; Salt= salt water fishing; Fresh =fresh water fishing; NR =Non-resident; Boat= boat licenses

Table B-20: Cumulative Impacts of Past Present and Reasonably Foreseeable Projects in the WBV Basin

Project Name	Project Type	Wetlands and Other Surface Waters	Wildlife	Threatened and Endangered Species	Fisheries, Aquatic Resources, and Water Quality	Essential Fish Habitat	Cultural Resources	Recreational Resources	Aesthetic Resources	Air Quality	Noise	Socioeconomics	Environmental Justice
CIAP BA-43 (EB): EB-Long Distance Mississippi River Sediment Pipeline	Diversion	+	+/-	o	+/-	+/-	o	+/-	o	o	o	o	o
CWPPRA BA-39: Mississippi River Sediment Delivery System - Bayou Dupont	Diversion	+	+/-	o	+/-	+/-	o	+/-	o	o	o	o	o
State of Louisiana BA-03: Naomi Siphon Diversion	Diversion	+	+/-	o	+/-	+/-	o	+/-	o	o	o	o	o
WRDA BA-01: Davis Pond Freshwater Diversion and Forced Drainage Area	Diversion	+	+/-	o	+/-	+/-	o	+/-	o	o	o	o	o
CIAP BA-62: West Bank Wastewater Assimilation Plant	Habitat Enhancement	+	+	o	o	+/-	o	+/-	o	o	o	o	o
CIAP (PO-90) WLDS-SP: West Lac Des Allemands Shoreline Protection	Habitat Preservation	+	+	o	+/-	+/-	o	o	+	o	o	o	o
CIAP BA-61: West Bank Wetland Conservation and Protection	Habitat Preservation	+	+	o	o	o	o	o	+	o	o	o	o
CWPPRA LA-16 Non-rock Alternatives to Shoreline Protection Demonstration	Habitat Preservation	+	+	o	+/-	+/-	o	o	+	o	o	o	o
National Park Service: Jean Lafitte National Historic Park Beneficial Use Site	Habitat Preservation	+	+	o	-	-	o	o	o	o	o	o	o
National Park Service: Lake Salvador Shoreline Protection 2011	Habitat Preservation	+	+	o	+/-	+/-	o	o	o	o	o	o	o
Pre-Katrina WBV Mitigation: Land Acquisition and BLH Mitigation	Habitat Preservation	+	+	o	o	o	o	o	+	o	o	o	o
State of Louisiana BA05c: Baie de Chactas	Habitat Preservation	+	+	o	+/-	+/-	o	o	o	o	o	o	o
State of Louisiana BA-15x1: Lake Salvador Shoreline Protection Extension Project	Habitat Preservation	+	+	o	+/-	+/-	o	o	o	o	o	o	o

Project Name	Project Type	Wetlands and Other Surface Waters	Wildlife	Threatened and Endangered Species	Fisheries, Aquatic Resources, and Water Quality	Essential Fish Habitat	Cultural Resources	Recreational Resources	Aesthetic Resources	Air Quality	Noise	Socioeconomics	Environmental Justice
State of Louisiana BA-16: Bayou Segnette	Habitat Preservation	+	+	o	+/-	+/-	o	o	o	o	o	o	o
Surplus Funds 2007 BA-75-1: Jean Lafitte Tidal Protection/Fishers basin	Habitat Preservation	+	+	o	+/-	+/-	o	o	o	o	o	o	o
Texaco Oil Spill Mitigation: Texaco Oil Discharge Mitigation 1991 (Netherlands Area)	Habitat Preservation	+	+	o	+/-	+/-	o	o	o	o	o	o	o
US Department of Justice: St Charles Levee Conservation Easement	Habitat Preservation	+	+	o	o	o	o	o	+	o	o	o	o
National Park Service: Lake Salvador Shoreline Protection 1997 shoreline protection and geocrib	Habitat Preservation	+	+	o	+/-	+/-	o	o	o	o	o	o	o
National Park Service: Lake Salvador Shoreline Protection 2005	Habitat Preservation	+	+	o	+/-	+/-	+	+	o	o	o	o	o
CIAP BA-15x-2 (EB): EB-Lake Salvador Shoreline Protection Phase III	Habitat Restoration	+	+	o	+/-	+/-	o	+	o	o	o	o	o
CWPPRA BA-15: Lake Salvador Shore Protection Demonstration	Habitat Restoration	+	+	o	+/-	+/-	o	+	o	o	o	o	o
CWPPRA BA-03c: Naomi Outfall Management	Hydrologic Restoration	+	+	o	+/-	+/-	o	o	o	o	o	o	o
CWPPRA BA-02: GIWW (Gulf Intracoastal Waterway) to Clovelly Hydrologic Restoration	Hydrologic Restoration	+	+	o	+/-	+/-	o	o	o	o	o	o	o
National Park Service: 2002 Jean Lafitte National Historic Park Canal Partial Back Fillings	Marsh Creation	+	+	o	-	-	o	+	o	o	o	o	o
National Park Service: 2010 Jean Lafitte National Historic Park Canal Partial Back Fillings	Marsh Creation	+	+	o	-	-	o	+	o	o	o	o	o
State of Louisiana LA-01a: Dedicated Dredging Program - Lake Salvador	Marsh Creation	+	+	o	+/-	-	o	+	o	o	o	o	o
CIAP BA-59: Waterline Booster Pump Station, West Bank	Structure	+/-	+/-	o	+/-	o	o	-	-	o	o	+	o

Project Name	Project Type	Wetlands and Other Surface Waters	Wildlife	Threatened and Endangered Species	Fisheries, Aquatic Resources, and Water Quality	Essential Fish Habitat	Cultural Resources	Recreational Resources	Aesthetic Resources	Air Quality	Noise	Socioeconomics	Environmental Justice
Louisiana DOTD: Future I-49 Corridor	Structure	+/-	+/-	o	o	-	o	-	-	o	+	+	o
US Army Corps of Engineers: Davis Pond Freshwater Diversion Structure	Structure	+/-	+/-	o	o	o	o	-	-	o	o	o	o
Algiers Lock	Structure	+/-	+/-	o	-	-	o	+/-	-	o	o	-	o
Algiers Non-federal Levee (Donner Canal Levee)	Structure	+/-	+/-	o	o	o	o	-	-	o	o	+	o
Bayou Gauche Ring Levee (Sunset Levee)	Structure	+/-	+/-	o	o	o	o	-	-	o	o	+	o
Coastal Protection and Restoration Authority (CPRA) and North Lafourche Conservation, Levee and Drainage District, Valentine to Larose Levee, TE-111	Structure	+/-	+/-	o	o	o	o	-	-	o	o	+	o
Empire Lock	Structure	+/-	+/-	o	-	-	o	+/-	-	o	o	-	o
English Turn Non-federal Levee (Donner Canal Levee)	Structure	+/-	+/-	o	o	o	o	-	-	o	o	+	o
GIWW Navigation System	Structure	+/-	+/-	o	+/-	+/-	+/-	+/-	o	o	o	+	o
Harvey Canal Lock	Structure	+/-	+/-	o	-	-	o	+/-	-	o	o	-	o
Hurricane and Storm Damage Risk Reduction System (HSDRRS), West Bank and Vacinity	Structure	+/-	+/-	o	o	o	o	-	-	o	o	+	o
Larose to Golden Meadow, Louisiana, Hurricane Protection Project (LGM)	Structure	+/-	+/-	o	o	o	o	-	-	o	o	+	o
Mississippi River Levees : MR&T Project	Structure	+/-	+/-	o	-	-	+/-	-	-	o	o	+	o
Mississippi River Navigation Operations and Maintenance	Structure	+/-	+/-	o	+/-	+/-	o	-	o	o	o	+	o
New Orleans to Venice (NOV) levee project, Incorporation of Non-fedeal Levees (NFL) into NOV	Structure	+/-	+/-	o	o	o	o	-	-	o	o	+	o
New Orleans to Venice (NOV) levee project, St. Jude to Venice	Structure	+/-	+/-	o	o	o	o	-	-	o	o	+	o
Oakville to La Reussite Non-federal Levee	Structure	+/-	+/-	o	o	o	o	-	-	o	o	+	o

Project Name	Project Type	Wetlands and Other Surface Waters	Wildlife	Threatened and Endangered Species	Fisheries, Aquatic Resources, and Water Quality	Essential Fish Habitat	Cultural Resources	Recreational Resources	Aesthetic Resources	Air Quality	Noise	Socioeconomics	Environmental Justice
St. Charles Parish Levee - West Bank Ellington Phase 3 (BA-85-3)	Structure	+/-	+/-	o	o	o	o	-	-	o	o	+	o
St. Charles Parish Levee - West Bank Magnolida Ridge Phase 1 (BA-85-1)	Structure	+/-	+/-	o	o	o	o	-	-	o	o	+	o
St. Charles Parish Levee - West Bank Willow Ridge Phase 2 (BA-85-2)	Structure	+/-	+/-	o	o	o	o	-	-	o	o	+	o
State of Louisiana - Surplus Fund 2007 project, Lafitte Tidal Protection, BA-75-3, 2007	Structure	+/-	+/-	o	o	o	o	-	-	o	o	+	o
State of Louisiana Surplus Fund 2007 Project - East of Harvey Canal Interim Hurricane Protection - Phase 1	Structure	+/-	+/-	o	o	o	o	-	-	o	o	+	o
State of Louisiana- Surplus Fund 2007 project, Jean Lafitte Tidal Protection, BA-75-1, 2007	Structure	+/-	+/-	o	o	o	o	-	-	o	o	+	o
West Plaquemines Non-federal Levee	Structure	+/-	+/-	o	o	o	o	-	-	o	o	+	o

+ positive effect, - negative effect, o no effect, +/- both positive and negative effects

Appendix C

Impacts as Documented in the IERs

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APPENDIX C-1
Summary of WBV HSDRRS
Construction Impacts as Documented in the IERs

IER 12

IER12, Decision Record signed by the CEMVN Commander on 18 February 2009, entitled "GIWW, Harvey, and Algiers Levees and Floodwalls, Jefferson, Orleans, and Plaquemines Parishes, Louisiana." The document was prepared to evaluate potential impacts associated with the proposed construction and upgrades of levees, floodwalls, floodgates, and pumping station(s) within a portion of the WBV HSDRRS, including the areas of Harvey-Westwego, Gretna-Algiers, and Belle Chase.

Based on preliminary assessments, the Decision Record dated 18 February 2009 and IER12 impact discussions included a total impact to 328.9 acres (217.7 AAHUs) of BLH and swamp, however the final CAR dated 18 February 2009 revised those impacts and disclosed the corrected total impact to 328.8 acres (215.5 AAHUs) of BLH and swamp. This total included anticipated losses to 251.7 acres (175.1 AAHUs) of PS BLH, 2.4 acres (2 AAHUs) FS BLH-Wet, and 74.7 acres (38.4 AAHUs) of FS swamp. Of the total impact, approximately 9.6 acres (6.1 AAHUs) of FS habitat would be permanently impacted within the Bayou aux Carpes CWA Section 404 (c) area comprising 2.3 acres (1.9 AAHUs) of BLH-Wet and 7.3 acres (4.2 AAHUs) of swamp. Impacted forested wetland acreage would require in-kind mitigation.

IERS 12 Addendum, Decision Record signed by the CEMVN Commander on 20 November 2010, entitled the Addendum to Draft IER Supplemental #12 "GIWW, Harvey and Algiers Levees and Floodwalls, Jefferson, Orleans and Plaquemines Parishes, Louisiana". Design changes which occurred prior to the final release of Draft IERS 12 resulted in this Addendum which addressed the potential impacts associated with the use of the Westbank Site N borrow site for disposal as proposed in the Draft IERS 12. Also, it evaluated impacts due to additional design changes not assessed in IER12 including the construction of floodwalls and the relocation of the Barriere Golf Course access road in the vicinity of the Belle Chasse Tunnel, as well as the proposed temporary tunnel.

Modifications to the proposed actions in IER12 was not anticipated to result in significant adverse impacts to fish and wildlife resources as stated in the DR, IER and USFWS letter to CEMVN dated 29 October 2010.

IERS 12.a, Decision Record signed by the CEMVN Commander on 22 February 2011, entitled "GIWW, Harvey and Algiers Levees and Floodwalls, Jefferson, Orleans and Plaquemines Parishes, Louisiana." The document was prepared to evaluate the potential impacts associated with the construction of an access road, the use of a pontoon bridge in the V-Line Levee Canal, and the placement of riprap along approximately 850 feet of the V-Line Canal.

An impact reduction of 27.5 acres (19.25 AAHUs) for non-jurisdictional BLH as described in IER #12.a, was anticipated to occur as a result of the proposed design changes at the WBV 14e.2 Levee Reaches and the V-Line Levee Canal area. No additional significant environmental impacts were expected as a result of the proposed action as stated in DR, IERS12.a and draft USFWS CAR dated 3 January 2011.

Total IER12 impact discussion
The total impact associated with the proposed actions in IER 12 and supplements is 301.3 acres (196.25 AAHUs) including 224.2 acres (155.85 AAHUs) of PS BLH-Dry, 74.7 acres (38.4 AAHUs) of FS swamp, 2.4 acres (2 acres) of FS BLH-Wet. Of the total impact, approximately 9.6 acres (6.1 AAHUs) of FS habitat would be permanently impacted within the Bayou aux Carpes CWA Section 404 (c) area comprising 2.3 acres (1.9 AAHUs) of BLH-Wet and 7.3 acres (4.2 AAHUs) of swamp.

IER 12/13
IER12/13, Decision Record signed by the CEMVN Commander on 2 February 2011, entitled "GIWW, Harvey and Algiers Levees and Floodwalls/Hero Canal Levee and Eastern Tie-in, Plaquemines Parish, IERS12/13 Waterline." The document was prepared to evaluate the potential impacts associated with operations and maintenance of the Western Closure Complex.

Total temporary impact as a result of the proposed action would include impacts to 0.34 acres (0.12 AAHUs) of PS, BLH-Dry as stated in the DR, IER, and final CAR dated 3 January 2011.

IER 13
IER13 and Final Addendum, Decision Record signed by the CEMVN Commander on 4 December 2009, entitled "West Bank and Vicinity, Hero Canal Levee and Eastern Tie-In, Plaquemines Parish, Louisiana." These documents evaluate the potential effects associated with the proposed enlargement to the Hero Canal levee, and construction of the Eastern Tie-In portion of the West Bank and Vicinity. Due to written and verbal comments received during the public review period for draft IER13, the Addendum was prepared by the USACE to address comments and provide additional information concerning the alternatives presented in IER 13 including clarifications and inclusion of addition hydraulic and engineering information.

The total of 71 acres (46.66 AAHUs) wetland habitat would be impacted as a result of the proposed action including 13 acres (7.80 AAHUs) of PS BLH-Dry, 19 acres (10.59 AAHUs) of FS BLH-Wet, and 39 acres (28.27 AAHUs) of FS swamp. The final CAR provided by USFWS on 24 November 2009 concurs with the final impact totals as stated in the DR and IER.

IERS 13a, Decision Record signed by the CEMVN Commander on 21 April 2011, entitled "West Bank and Vicinity Hero Canal Levee and Eastern Tie-in, Plaquemines Parish, Louisiana." IERS 13a contains a modification to the original plan as stated in IER13 which includes the potential closing of Hero Canal for a maximum of approximately 60 days and a minimum of approximately 30 days within a 90 day time frame. The proposed action is located in Plaquemines Parish near New Orleans, Louisiana.

Modifications to the proposed actions in IER13 would not result in significant adverse impacts to fish and wildlife resources as stated in the DR, IER, Final CAR dated 15 April 2011.

Total IER13 impact discussion
Therefore, the total impact as a result of IER13 and IER13 Supplement 13a include a total of 71 acres (46.66 AAHUs) of swamp and bottomland hardwoods habitat including 13 acres (7.80) of PS BLH-Dry, 19 acres (10.59 AAHUs) of FS BLH-Wet, and 39 acres (28.27 AAHUs) of FS swamp.

IER 14
IER14, Decision Record signed by the CEMVN Commander on 26 August 2008, entitled "Westwego to Harvey Levee, Jefferson Parish, Louisiana." The proposed action included

enlarging eart`hen levees, rebuilding floodwalls, constructing fronting protection for three pump stations, replacing a floodgate with a swing gate, and raising an existing ramp to ensure a continuous line of risk reduction in the levee and floodwall system.

The total of 120.25 acres (84.19 AAHUs) of swamp and bottomland hardwoods habitat were anticipated to be impacted as a result of the proposed action including 45 acres (30 AAHUs) of PS BLH-Wet, 45.5 acres (37.17 AAHUs) of FS BLH-Wet, and 29.75 acres (17.02 AAHUs) of FS cypress-tupelo swamp as stated in the final CAR provided by USFWS on 13 January 2010. An incorrect BLH AAHU impact value (18.58) within reach WBV14f was disclosed by USFWS in the original IER14 CAR dated 18 August 2008 and incorporated into the IER and DR impact discussions. However, this value (18.58 AAHUs) was corrected by USFWS in the IER14.a Supplemental final CAR dated 13 January 2010 as 37.17 AAHUs of FS BLH-Wet habitat for reach WBV14f.

IERS 14.a, Decision Record signed by the CEMVN Commander on 9 February 2010, entitled "West Bank and Vicinity, Westwego to Harvey Levee, Jefferson Parish, Louisiana." The document evaluated the potential effects associated with proposed project revisions to the original IER14, including a proposed FS shift of approximately 3.29 miles of earthen levees, and proposed revisions to fronting protection and floodwall alignment at the Ames and Mount Kennedy Pumping Stations.

Modifications to the proposed actions documented in IER14 would result in a total of 42 acres (24 AAHUs) of FS cypress-tupelo swamp habitat impact. In addition, temporary and permanent impacts to 1.38 acres of open water was anticipated to occur including 1.1 acres permanently filled within the Millaudon Canal for floodwall construction and 0.28 acres of temporary fill for the construction of temporary retention structures.

Total IER14 impact discussion
Total impact as a result of the proposed actions of IER14 and IER14.a Supplement was 162.25 acres (108.19 AAHUs) including 45 acres (30 AAHUs) of PS BLH-Wet, 45.5 acres (37.17 AAHUs) of FS BLH-Wet, and 71.75 acres (41.02 AAHUs) of FS cypress-tupelo swamp. In addition, temporary and permanent impacts to 1.38 acres of open water were expected.

IER 15
IER15, Decision Record signed by the CEMVN Commander on 12 June 2008, entitled "Lake Cataouatche Levee, Jefferson and Plaquemines Parishes, Louisiana." The proposed action included constructing and maintaining a 100-year level of protection along the project area in Jefferson Parish, Louisiana.

Total impacts as a result of the proposed actions disclosed in IER15 are 27.1 acres (7.47 AAHUs) of BLH-Wet as stated in the IER, DR, and final CAR dated 28 July 2008 comprising 3.6 acres (1.35 AAHUs) of BLH-Wet habitat along the Outer Cataouatche Canal on the FS of the BFI landfill and 23.5 acres (6.12 AAHUs) of PS BLH-Wet habitat east of the Cataouatche pump stations between the Bridgeline pipeline and the Bayou Segnette State Park. Additionally, 6.5 acres of aquatic habitat in the Outer Cataouatche Canal were anticipated to be permanently lost.

IERS 15.a and Final Addendum, Decision Record signed by the CEMVN Commander on 7 September 2011, entitled "Lake Cataouatche Levee Jefferson Parish, Louisiana." The document evaluated the relocation of a Chevron pipeline. Due to significant comments received during the public review period for draft IERS15.a and NPS intent to conduct its own environmental assessment of the proposed action in accordance with NEPA (EA FONSI signed 30 August 2011), the Addendum was prepared by the USACE to further evaluate the alternatives initially considered in IERS 15.a but eliminated and evaluated additional alternatives identified by the NPS.

Approximately 23 acres (3.85 AAHUs) of wetlands as stated in the final CAR dated 14 November 2011 was anticipated to be impacted as a result of the proposed action and included temporary impacts to 8 acres (0.82 AAHUs) of PS BLH-Dry north of the Lake Cataouatche levee and 15 acres (3.03 AAHUs) of temporary impact to FS high quality fresh marsh within JLNHPP to be mitigated at Yankee Pond. Additionally, 13.1 acres of water bottoms in the Outer Cataouatche Canal, at the temporary access wheel wash/dredging stockpile area, and in the pontoon bridge areas were anticipated to be impacted. The final CAR updated values disclosed in the IER and DR, including the correction of impacted habitat from BLH-Wet to BLH-Dry. Temporary impacts to 0.29 acres of BLH-Dry due to the construction of an access road and staging area are mentioned in the IER and DR; however, these impacts are not discussed in the final CAR.

Total IER15 impact discussion
Total impact as a result of the proposed actions of IER15 and IER15.a Supplement and Final Addendum was 50.1 acres (11.32 AAHUs) including 23.5 acres (6.12 AAHUs) of PS BLH-Wet, 8.29 acres (0.82 AAHUs) of PS BLH-Dry, 15 acres (3.03 AAHUs) of FS fresh marsh, and 3.6 acres (1.35 AAHUs) of BLH-Wet. Also, temporary impacts to 19.6 acres of open water were incurred. Of the total impacts, 15 acres (3.03 AAHUs) of FS fresh marsh would be temporarily impacted within JLNHPP.

IER 16
IER16, Decision Record signed by the CEMVN Commander on 12 June 2009, entitled "Western Tie-In, Jefferson and St. Charles Parishes, Louisiana." The document evaluated the potential impacts associated with constructing levees, floodwalls and a closure structure to meet the 100-year level of risk reduction from the Lake Cataouatche Levee westerly to the Davis Pond Freshwater Diversion's east guide levee.

Approximately 212.7 acres (101.7 AAHUs) of FS wetlands as stated in the Final CAR dated 8 June 2009 were anticipated for impact as a result of the proposed action including 78.6 acres (36.2 AAHUs) of BLH-Wet and 134.1 acres (65.5 AAHUs) of fresh marsh. Impact totals to fresh marsh 137.8 acres (66.3 AAHUs) disclosed within the DR and IER impact discussions were updated by the final CAR (8 June 2009) to 134.1 acres (65.5 AAHUs). Additionally, permanent lost of 12 acres of aquatic habitat was anticipated and the isolation of the western portion of the Outer Cataouatche Canal from flow-through was expected to indirectly affect water quality within the 60 acre partially enclosed area.

IER16S 16.a, Decision Record signed by the CEMVN Commander on 24 August 2010, entitled "Western Tie-In, Jefferson and St. Charles Parishes, Louisiana." The document evaluated the potential impacts associated with utility relocations, replacing the Highway 90 pump station, adding bank stabilization to some areas, retaining the detour roads as permanent access for Highway 90 and the construction of a ramp at Highway 18 instead of a floodgate.

Modifications to the proposed actions disclosed in IER16 would have a total impact to 93.2 acres (46.26 AAHUs) of FS wetlands as stated in the IER, DR, and final CAR 11 August 2010 comprising 79.1 acres (37.26 AAHUs) of BLH-Wet and 14.1 acres (9 AAHUs) of fresh marsh habitat. In addition, permanent lost of 16.5 acres of aquatic habitat was anticipated.

Total IER16 impact discussion
Therefore, the total impacts from the proposed actions of IER16 and supplement included 148.2 acres (74.5 AAHUs) of fresh/intermediate marsh and 157.7 acres (73.46 AAHUs) of BLH-Wet for a total impact of 305.9 acres (147.96 AAHUs) on the FS. Also, 28.5 acres of open water impact was expected.

IER 17
IER17, Decision Record signed by the CEMVN Commander on 21 January 2009, entitled "West Bank and Vicinity, Company Canal Floodwall, Jefferson Parish, Louisiana." The document evaluated the potential impacts associated with the proposed construction and maintenance of a 100-year level of risk reduction along the WBV, Company Canal Floodwall from the Bayou Segnette State Park to the New Westwego Pumping Station including the construction of a new alignment, sector gate and pumping station.

Approximately 24.5 acres (19.78 AAHUs) of wetlands as stated in DR, IER Section 3.2.6 and Final CAR dated 22 December 2008 would be impacted as a result of the proposed action including 5.5 acres (2.69 AAHUs) of PS BLH-Wet and 19 acres (17.09 AAHUs) of FS cypress-tupelo swamp on the dredge disposal island north of Lapalco Boulevard. In addition, 9 acres of aquatic habitat would be impacted including 4 acres of temporary impact north of Lapalco Boulevard and 5 acres of permanent impact due to fill placed within an existing PS canal in reach 1. The Mitigation Section 7.0 of the IER incorrectly attributed 24.5 acres of impact to swamp habitat which should have been disclosed as 5.5 acres of impact to BLH-Wet and 19 acres of impact to swamp as listed from the final CAR.

IER 33
IERS 33, Decision Record signed by the CEMVN Commander on 31 December 2010, entitled "West Bank and Vicinity and Mississippi River Levee Co-Located Levees, Plaquemines Parish and Orleans Parish, Louisiana." The document evaluated the proposed construction and maintenance of the 100-year level of hurricane damage risk reduction along the Mississippi River Levee on the west bank of the Mississippi River, from the Eastern Tie-in of the West Bank and Vicinity project with the MRL at Oakville in Plaquemines Parish to a point approximately 15.5 miles upriver southeast of the Algiers Lock in Orleans Parish.

Temporary impacts to 27 acres of wetlands within the currently maintained ROW would not require compensatory wetland mitigation since the habitat exist as regularly moved grasses and herbs as confirmed in the IER, DR, and final CAR dated 30 December 2010.

IERS 33.a, Decision Record signed by the CEMVN Commander on 11 January 2012, entitled "West Bank and Vicinity and Mississippi River Levee Co-Located Levees, Plaquemines Parish and Orleans Parish, Louisiana." The document evaluated the potential impacts associated with modifications to the proposed action of IER33 for the proposed construction and maintenance of Resilient Features in order to improve the resiliency and longevity of previously implemented Engineered Alternative Measures (EAM), addressed under IER33, along the West Bank and Vicinity – Mississippi River Levee (WBV-MRL) Co-Located Project.

The total of 162 acres (99.06 AAHUs) of bottomland hardwoods habitat would be impacted as a result of the proposed action including 80 acres (48.93 AAHUs) of PS BLH-Dry and 82 acres (50.13 AAHUs) of FS BLH-Wet as stated in the final CAR dated 9 January 2012. The IER and DR are in agreement with the total acreage for impacts to BLH-Wet and BLH-Dry with the exception of the Mitigation Section of the IER which fails to mention mitigation for 80 acres of non-wet forested habitat. Also, 2 acres of aquatic habitat would temporarily be impacted by the proposed action within reaches WBV-MRL 1.2b and WBV-MRL 3.2.

Total IER33 impact discussion
The total impacts from the proposed actions of IER33 and supplement include 162 acres (99.06 AAHUs) of bottomland hardwoods including 80 acres (48.93 AAHUs) of PS BLH-Dry and 82 acres (50.13 AAHUs) of FS BLH-Wet. Two acres of aquatic habitat would also be temporarily impacted.

Government Furnished Borrow IERs and Impacts

In order to raise the level of risk reduction for the HSDRRS system, large quantities of earthen material (borrow) were required. In 2007, CEMVN began an unprecedented search for suitable material to rebuild and reinforce the HSDRRS in the Greater New Orleans Metropolitan Area. Approximately 93 million cubic yards of material was estimated to be required for the HSDRRS construction borrow program. To date, no wetlands have been impacted in the acquisition of borrow for the HSDRRS. Thus far, the only impacted habitat type requiring mitigation for the HSDRRS borrow is BLH-Dry.

The first stages of borrow procurement for the HSDRRS work utilized identification of sites with appropriate material for acquisition by the Federal Government (Government). Once the sites were either acquired or an easement over them obtained, they were then provided to the HSDRRS construction contractors as potential sources of borrow material. Because the government is providing these sites for borrow excavation in connection with a Federal action, mitigation for habitat impacts if these sites are utilized is the responsibility of the Government. Below are the IERs that assessed the borrow sites located in the WBV basin and the potential habitat impacts that would occur if they are fully utilized.

IER 18
IER18, Decision Record signed by CEMVN Commander on 21 February 2008, entitled "Government Furnished Borrow Material, Jefferson, Orleans, Plaquemines, St. Charles, and St. Bernard Parishes, Louisiana". The document evaluates the potential impacts associated with approving twelve government furnished borrow areas throughout the New Orleans Metropolitan area for use in construction of the HSDRRS.

Four of the 12 proposed borrow sites evaluated in IER18 fall within the WBV mitigation basin; however, only three of these sites would require mitigation for impacts if selected for use in HSDRRS construction (Table 1).

Table 1: Impacts to non-jurisdictional BLH

Proposed Borrow Area	Parish	BLH Impacted (acres)	AAHUs Needed
Belle Chasse	Plaquemines	8.0	3.68
Churchill Farms Pit A	Jefferson	29.9	10.62
Westbank G Site	Jefferson	82.0	45.52
Total		119.9	59.82

The total potential impact to PS non-jurisdictional BLH within the WBV mitigation basin for the proposed action is 119.9 acres (59.82 AAHUs) as noted in the DR, IER and final November 15, 2010 CAR.

IER 22

IER22, Decision Record signed by CEMVN Commander on 30 May 2008, entitled "Government Furnished Borrow Material, Plaquemines and Jefferson Parishes, Louisiana". The document evaluates the potential impacts associated with approving five government furnished borrow areas located in Jefferson and Plaquemines Parishes for use in construction of the HSDRRS.

Four of the five proposed borrow sites evaluated in IER22 fall within the WBV mitigation basin; however, the Brad Buras site and Westbank N Site located in Plaquemines Parish would not have impacts which required mitigation. The two remaining sites, located in northern Jefferson Parish, would require mitigation for non-jurisdictional BLH impact if selected for use in HSDRRS construction and include 148 acres (85 AAHUs) at Westbank F Site and 9.76 acres (4.64 AAHUs) at Westbank I Site.

The total potential impact to PS non-jurisdictional BLH within the WBV mitigation basin for the proposed action is 157.76 acres (89.64 AAHUs) as noted in the DR, IER and final November 15, 2010 CAR.

IER 25

IER25 Decision Record signed by CEMVN Commander on 3 February 2009, entitled "Government Furnished Borrow Material #3, Orleans, Jefferson, and Plaquemines Parishes, Louisiana". The document was prepared to evaluate the potential impacts associated with the possible excavation of four government furnished borrow areas.

Three of the 4 proposed borrow sites evaluated in IER25 fall within the WBV mitigation basin; however, only 2 would require mitigation for impacts if selected for use in HSDRRS construction. The Westbank E Site located in Jefferson Parish requires mitigation for 25.1 acres (13.10 AAHUs) of non-jurisdictional BLH in Phase 1 and 53.2 acres (27.8 AAHUs) of non-jurisdictional BLH in Phase 2. The second borrow site, Tac Carrere, located in Plaquemines Parish requires mitigation for 17.7 acres (12.10 AAHUs) of non-jurisdictional BLH.

The total potential impact to PS non-jurisdictional BLH within the WBV mitigation basin is 96 acres (53 AAHUs) as noted in the DR, IER Mitigation Section, and the Final CAR dated November 15, 2010. Please note, an error in the impact discussions within the IER inaccurately states the impact total for all proposed actions in IER25 to non-jurisdictional BLH as 942.1 acres; however, this number was based on a preliminary WVA assessment. The correct value should be 933 acres as reflected in the DR, Mitigation Section of the IER, and Final CAR dated 15 November 2010.

IERS 25.a Decision Record signed by CEMVN Commander on 13 January 2012, entitled "Government Furnished Borrow Material #3, Orleans Parish, Louisiana." The document evaluates the "after the fact" modifications to IER25, which include placing approximately 105,000 cubic yards of excess material, known as Recycled Embankment Material (REM), on a 22.4-acre site. Of the 22.4 acres utilized for the stockpiling of REM, 7.93 acres had been previously authorized under IER # 25 for the purposes of vegetative clearing and excavation of suitable borrow material to be used in the LPV 109 and LPV 111 levee sections.

IER 28

IER28, Decision Record signed by CEMVN Commander on 31 July 2009, entitled "Government Furnished Borrow material # 4 Plaquemines, St Bernard and Jefferson Parishes, Louisiana." The document was prepared to evaluate the potential impacts associated with the possible excavation of three government furnished borrow areas and the construction of a separate borrow access road.

The proposed Westbank F site access route evaluated in IER28 is located within the WBV mitigation basin in upper Jefferson Parish. The proposed action at this site would impact 0.29 acres (0.17 AAHUs) of non-jurisdictional BLH as noted in the DR, IER, and final CAR dated 27 July 2009 if selected for use in HSDRRS construction. Impacts to the two borrow areas, Bazile and Johnson/Crovette, located within the LPV mitigation basin will be addressed in the LPV mitigation IER36.

<u>WBV Original Construction</u>

EA437
EA 437 entitled "West Bank and Vicinity, New Orleans, Louisiana Hurricane Protection Project, Lake Cataouatche Levee Enlargement Highway 90 to Cataouatche Pump Stations" was prepared to evaluate the potential impacts associated with the proposed enlargement to the Lake Cataouatche Area levee, relocation of the drainage canal, excavation of a new borrow pit, and construction of a new haul road and fence.

The proposed action was anticipated to result in impacts to 162 acres (130 AAHUs) of early successional, protected side (PS) BLH-Dry including 129 acres (102.5 AAHUs) of forested wetlands and 33.1 acres (27.5 AAHUs) of no-canopy/highly-disturbed BLH forest based on preliminary analysis disclosed in the EA and CAR letter dated 29 September 2006. The AAHU values were modified by the final supplement CAR dated 6 June 2011 to correct the impact calculation based on 57 year period of analysis required per changes to ER 1105-2-100. The corrected impacts were disclosed as 129 acres (37.39 AAHUs) young BLH and 33.1 acres (14.24 AAHUs) of disturbed BLH for a total of 162.1 acres (51.63 AAHUs). The final CAR dated 26 October 2012 recalculated the impacts. The corrected impacts were disclosed as 162.10 acres (58.95) of PS BLH-Dry including 129 acres (44.71 AAHUs) of young BLH and 33.1 acres (14.24 AAHUs) of disturbed BLH.

EA439
EA439 entitled "West Bank and Vicinity, New Orleans, Louisiana Hurricane Protection Project: Westwego to Harvey Canal Highway 45 Borrow Pits, Jefferson Parish, Louisiana" was prepared to retroactively identify the environmental impacts and propose mitigation for six borrow pits excavated on the FS of the levee along Highway 45 for levee enlargement. EA439 is a modification to a prior authorized project entitled, "West Bank of the Mississippi River in the Vicinity of New Orleans, La., Feasibility Report and EIS," dated December 1986.

The total impact from the proposed action resulted in the loss of 110 acres of mixed bottomland hardwoods and cypress swamps as stated in the EA, however, AAHU values were not provided in the EA due to the anticipated completion of a mitigation plan which would include AAHU calculations for mitigation of WBV HPP impacts. The mitigation plan was never finalized; therefore these impacts were to be included in HSDRRS mitigation. The AAHU values were later quantified and amended by the CAR dated 29 April 2011 as (63.53 AAHUs) of FS mixed BLH wetlands and cypress swamps including 21.5 acres (15.09 AAHUs) of BLH and 88.5 acres (48.44 AAHUs) of swamp. However, the impact analysis in the CAR was calculated on a temporal range used for the original FR/FEIS rather than the period of analysis required per changes to ER 1105-2-100. In addition, the AAHU value used in the analysis for swamp impacts was calculated on an inaccurate acreage value (85.8 instead of 88.5). The draft CAR dated 31 October 2011 recalculated the swamp impacts based on the corrected acreage value of 88.5 and updated the AAHU values for the required period of analysis. The disclosed values included 21.5 acres (15.20 AAHUs) of FS BLH-Wet and 88.5 acres (50.71 AAHUs) of FS swamp for a total of 110 acres (65.91 AAHUs). The final CAR dated 26 October 2012 recalculated the impacts. The corrected impacts were disclosed as 110 acres (65.81) of FS mixed swamp and BLH including 21.5 acres (15.1 AAHUs) of young BLH and 88.5 acres (50.71 AAHUs) of swamp.

APPENDIX C-2
IER IMPACT DISCREPANCY MEMO

CEMVN-PDN-CEP 18 December 2013

MEMORANDUM FOR RECORD

SUBJECT: Discrepancies in public disclosure of West Bank and Vicinity (WBV) Hurricane Storm Damage Risk Reduction System (HSDRRS) impact acreages and Average Annual Habitat Units (AAHUs)

1. Reference the construction of the WBV HSDRRS projects beginning in March 2007. During the National Environmental Policy Act (NEPA) process, a number of documents were released disclosing the potential construction impact acres and AAHUs of the HSDRRS projects [ie. Individual Environmental Reports (IERs) and USFWS Coordination Act Reports (CAR)]. At the time, acreages and AAHUs presented in the IERs were estimates of anticipated impacts based on early conceptual designs. In some cases, there were noted discrepancies in the impact numbers disclosed within and among these documents. This memo identifies those discrepancies and corrects the impact numbers to be reported when referencing the WBV HSDRRS IERs (attachment 1).

2. A forthcoming Mitigation IER will disclose the updated impacted acreages and AAHUs, based on 100% project plans and as-built drawings (if available). In addition, an analysis of aerial imagery will be conducted on the footprints identified in these plans to verify the HSDRRS construction impacts have been correctly quantified. Once As-Builts for the whole HSDRRS are available, this process will be repeated to determine the final mitigation requirement for the HSDRRS work.

3. The discrepancies, and their respective resolutions, are provided below:

Project	Discrepancy	Resolution
IER12	The Decision Record dated 18 February 2009 and IER12 impact discussions included a total wetland impact as 328.9 acres (217.7 AAHUs) including 251.7 acres (177.3 AAHUs) of PS BLH, 2.4 acres (1.9 AAHUs) of BLH FS, and 74.9 acres (38.5 AAHUs) of swamp which were based on preliminary assessments from the Draft CAR dated 24 December 2008. ******************************** Impacts to 404c area only included 9.8 acres (6.1 AAHUs) based on preliminary assessments from the Draft CAR dated 24 December 2008.	Final CAR dated 18 February 2009 revised those impacts and disclosed the corrected impacts as 328.8 acres (215.5 AAHUs) including 251.7 acres (175.1 AAHUs) of PS BLH, 2.4 acres (2 AAHUs) of BLH FS, and 74.7 acres (38.4 AAHUs) of swamp. ******************************** Impacts to 404c area only included 9.6 acres (6.1 AAHUs) were corrected with the final CAR .

Project	Discrepancy	Resolution
IER 14	An incorrect BLH AAHU impact value (18.58 AAHUs) was provided by USFWS in the original IER14 CAR dated 18 August 2008 for levee reach WBV14f and also disclosed in IER14 and IER14 DR signed 26 August 2008.	In IER14.a Supplemental final CAR dated 13 January 2010, USFWS corrected the total floodside wet BLH habitat AAHUs as 37.17 for reach WBV14f as a result of the proposed actions in IER14.
IERS15.a	The IERS15.a and decision record disclosed total wetland habitat impact of 22.5 acres (4.02 AAHUs) including 8 acres (0.82 AAHUs) of PS wet BLH and 14.5 acres (3.2 AAHUs) of FS fresh marsh based on preliminary impact assessments. ********************************** Additional, temporary impacts to 0.29 acres of dry BLH are mentioned in the IER; however, these impacts are not discussed in the final CAR.	These totals were updated by the final USFWS CAR dated 14 November 2011 as total wetland habitat impact of 23 acres (3.85 AAHUs) including 8 acres (0.82 AAHUs) of PS dry BLH and 15 acres (3.03 AAHUs) of FS fresh marsh. ********************************** These impacts were added to the total IER impact total after the fact to be considered in HSDRRS mitigation.
IER 16	The total wetland habitat impact of 211 acres stated in the decision record dated 12 June 2009 and IER impact discussions were based on preliminary impact assessments. Additionally, the impacts from the draft CAR dated 13 March 2009 were disclosed in Table 1 of the DR and throughout the IER with the total wetland habitat impact of 216.4 acres (102.48 AAHUs) including 78.6 acres (36.18 AAHUs) of wet BLH and 137.8 acres (66.3 AAHUs) of fresh marsh.	The impacts were updated by the final CAR dated 8 June 2009. This assessment corrected the total impact as a result of the proposed action to 212.7 acres (101.7 AAHUs) including 78.6 acres (36.2 AAHUs) of wet BLH and 134.1 acres (65.5 AAHUs) of fresh marsh.
IERS16.a	Wetland impact discussions within section 3.2.5 and 3.2.6 of IER 16.a Supplemental, discuss maximum impact values (119 acres of wetlands impacted) based on the worst case scenario for the proposed action. ********************************** In IER16.a supplement, the impact discussions for Significant Resources mention a total of 211 acres of wetland impacts from IER16 ********************************** Also, impact discussions within the Section 3.2.3.1.2 "Terrestrial Habitat" disclosed general habitat and potential maximum impacts within the project area, but not necessarily the habitats impacted by the proposed action. ********************************** Section 3.2.4.1.2 of IER16.a supplement was mis-titled "No Action"	The correct impacts are noted in the mitigation section, DR, and final CAR dated 11 August 2010 comprising 79.1 acres (37.26 AAHUs) of wet BLH and 14.1 acres (9 AAHUs) of fresh marsh habitat. ********************************** The correct total is 212.7 acres as updated in the final CAR dated 8 June 2009 ********************************** The correct impacts are noted in the mitigation section, DR, and final CAR dated 11 August 2010 comprising 79.1 acres (37.26 AAHUs) of wet BLH and 14.1 acres (9 AAHUs) of fresh marsh habitat. ********************************** Section 3.2.4.1.2 of IER16.a supplement should be titled "Proposed Action" instead of "No Action"

Project	Discrepancy	Resolution
IER17	In the Mitigation Section 7.0 of IER17, 24.5 acres of impact were incorrectly attributed to swamp habitat. ********************************* In Section 9.1 "Final Decision" of IER17, permanent loss to aquatic habitat was disclosed as 9 acres including 5.5 acres in Bayou Segnette State Park and 5 acres in Bayou Segnette. However, the 5.5 acres was mistakenly attributed to aquatic habitat instead of wet BLH.	The correct total impacts are 5.5 acres of impact to wet BLH and 19 acres of impact to swamp. ********************************* The correct impact totals should be 9 acres of aquatic habitat impacted including 4 acres of temporary impact north of Lapalco Boulevard and 5 acres of permanent impact due to fill placed within an existing protected side canal in reach 1.
IERS33.a	IER supplement 33.a did not include a discussion of mitigation for 80 acres of non-wet forested habitat; however, it provided discussion of mitigation for 82 acres of forested wetland habitat. Only the overall AAHUs impact total of 99.06 AAHUs for both wet bottomland forest and non-wet bottomland hardwoods was provided.	The final CAR dated 9 January 2012 disclosed the final impact totals for 82 acres (50.13 AAHUs) of floodside, wet BLH and 80 acres (48.93 AAHUs) of protected side, dry BLH.
EA437	EA437 and draft CAR letter dated 29 September 2006 disclosed preliminary impact values for 162 acres (130 AAHUs) of early successional, protected side dry BLH including 129 acres (102.5 AAHUs) of forested wetlands and 33.1 acres (27.5 AAHUs) of no-canopy/highly-disturbed BLH forest. ********************************* The 29 April 2011 draft CAR supplemental for EA437 was calculated with a 100 year period of analysis. Due to changes per ER 1105-2-100, the period of analysis needed to be changed to 57 years for HSDRRS mitigation. ********************************* The draft CAR dated 6 June 2011 contained a calculation error for PS Dry, young BLH (EA437) within the analysis resulting in an incorrect AAHU value of 37.39 AAHUs. ********************************* The 26 October 2012 letter date was mistakenly submitted as 26 October 2011 for the draft CAR supplemental for EA437 and EA439.	The USFWS draft CAR dated 29 April 2011 updated the impact totals as 129 acres (51.63 AAHUs) of PS Dry young BLH and 33.1 acres (13.6 AAHUs) of PS Dry disturbed BLH. WVA values calculated on 100 year period of analysis. ********************************* The USFWS final CAR dated 6 June 2011 updated the impact totals as 129 acres (37.39 AAHUs) of PS Dry young BLH and 33.1 acres (14.24 AAHUs) of PS Dry disturbed BLH to reflect the WVA recalculation based on 57 year period of analysis. ********************************* The final Amended USFWS CAR dated 26 October 2012 disclosed the corrected impact totals as 129 acres (44.71 AAHUs) of PS Dry young BLH and 33.1 acres (14.24 AAHUs) of PS Dry disturbed BLH. WVA value calculations based on a 57 year period of analysis. ********************************* The draft supplemental CAR should be dated 26 October 2012.

Project	Discrepancy	Resolution
EA439	EA439 disclosed a loss of 110 acres of mixed bottomland hardwoods and cypress swamps; however, AAHU values were not provided in the EA due to the anticipated completion of a mitigation plan which would include AAHU calculations for mitigation of WBV HPP impacts. The mitigation plan was never finalized; therefore these impacts were to be included in HSDRRS mitigation. ********************************** The 29 April 2011 draft CAR supplemental EA439 was calculated with a 100 year period of analysis. Due to changes per ER 1105-2-100, the period of analysis needed to be changed to 57 years for HSDRRS mitigation. In addition, an error occurred when the acreage value 88.5 for EA439 swamp was transposed to 85.8 and used to calculate AAHUs in the analysis. ********************************* The USFWS final CAR dated 6 June 2011 for EA439 did not resolve the calculation errors to swamp impacts as a result of an incorrect acreage value of 85.8 as noted in the 29 April 2011 draft CAR supplemental, prior to recalculating impacts based on 57 year period of analysis. ********************************* The 26 October 2012 letter date was mistakenly submitted as 2011 for the final CAR supplemental for EA437 and EA439.	The draft USFWS CAR dated 29 April 2011 disclosed the updated impact totals as 21.5 acres (15.09 AAHUs) of FS BLH and 88.5 acres (48.44 AAHUs) of FS swamp. WVA values were calculated on a 100 year period of analysis. ********************************** The USFWS final CAR dated 6 June 2011 recalculated the impacts based on the 57 year period of analysis resulting in impacts to 21.5 acres (15.1 AAHUs) of FS BLH and 88.5 acres (46.97 AAHUs) of FS swamp. ********************************** The 31 October 2011 draft CAR supplemental for EA439 resolved the calculation errors to swamp impacts using the correct acreage value of 88.5. Therefore the correct impact totals based on a 57 year period of analysis are 21.5 acres (15.1 AAHUs) of FS BLH and 88.5 acres (50.71 AAHUs) of FS swamp. ********************************* The draft supplemental CAR should be dated 26 October 2012.

4. The point of contact for this analysis is Ms. Elizabeth Behrens, x2025

Sandra Stiles

Sandra Stiles
Chief, Coastal Environmental Planning Section
Environmental Planning Branch

Attachment

WBV FINAL IMPACTS BASED from IERs

	Protected Side										Flood Side													
IER*	Fresh/ Intermediate Marsh		Brackish Marsh		Swamp		BLH wet		BLH dry		Fresh/ Intermediate Marsh		Brackish Marsh		Swamp		BLH wet		BLH dry		Open Water	**TOTAL**	
	Acres	AAHUs	Acres	AAHUs	Acres	AAHUs	Acres	AAHUs	Acres	AAHUs	Acres	AAHUs	Acres	AAHUs	Acres	AAHUs	Acres	AAHUs	Acres	AAHUs	Acres	Acres	AAHUs
12	0	0	0	0	0	0	0	0	224.20	155.85	0	0	0	0	74.70	38.40	2.40	2.00	0	0	0	301.30	196.25
IER12-13	0	0	0	0	0	0	0	0	0.34	0.12	0	0	0	0	0	0	0	0	0	0	0	0.34	0.12
13	0	0	0	0	0	0	0	0	13.00	7.80	0	0	0	0	39.00	28.27	19.00	10.59	0	0	0	71.00	46.66
14	0	0	0	0	0	0	45.00	30.00	0	0	0	0	0	0	71.75	41.02	45.50	37.17	0	0	1.38	162.25	108.19
15	0	0	0	0	0	0	23.50	6.12	8.29	0.82	15.00	3.03	0	0	0	0	3.60	1.35	0	0	19:60	50.39	11.32
16	0	0	0	0	0	0	0	0	0	0	148.20	74.50	0	0	0	0	157.70	73.46	0	0	28.50	305.90	147.96
17	0	0	0	0	0	0	5.50	2.69	0	0	0	0	0	0	19.00	17.09	0	0	0	0	9.00	24.50	19.78
33	0	0	0	0	0	0	0	0	80.00	48.93	0	0	0	0	0	0	82.00	50.13	0	0	2.00	162.00	99.06
EA 437	0	0	0	0	0	0	0	0	162.10	58.95	0	0	0	0	0	0	0	0	0	0	0	162.10	58.95
EA 439	0	0	0	0	0	0	0	0	0	0	0	0	0	0	88.50	50.71	21.50	15.10	0	0	0	110.00	65.81
18 (Churchhill Farms)	0	0	0	0	0	0	0	0	29.90	10.62	0	0	0	0	0	0	0	0	0	0	0	29.90	10.62
TOTAL	*0*	*0*	*0*	*0*	*0*	*0*	*74.00*	*38.81*	*517.83*	*283.09*	*163.20*	*77.53*	*0*	*0*	*292.95*	*175.49*	*331.70*	*189.80*	*0*	*0*	*60.48*	*1379.68*	*764.72*

APPENDIX D

DRAFT GUIDELINES CONCERNING MITIGATION OF IMPACTS TO OPEN WATER HABITATS AND THE USE OF WVA MODELS TO EVALUATE SUCH IMPACTS
(2 March 2012)

1 INTRODUCTION

This document is intended to provide draft guidance concerning mitigation of impacts to open water habitats resulting from Hurricane & Storm Damage Risk Reduction System (HSDRRS) civil works projects, including impacts generated by HSDRRS mitigation activities. It also provides draft guidance concerning the use of Wetland Value Assessment (WVA) models to evaluate these impacts. These guidelines were developed by the US Army Corps of Engineers, New Orleans District (CEMVN) in coordination with US Fish and Wildlife Service (USFWS) staff and National Marine Fisheries Service (NMFS) staff.

The guidance contained herein is <u>not</u> applicable to the evaluation of impacts to open water areas within marsh habitats, or to mitigation of such impacts. Coastal marsh habitats frequently include open water areas that are interspersed with the vegetated marsh features, forming a mosaic of marsh (land) areas and open water areas. Impacts to open water areas within marsh habitats will continue to be addressed as part of the overall marsh landscape. For now, the appropriate WVA marsh community model will continue to be used to evaluate proposed impacts to the marsh/open water complex, since the marsh community models already incorporate a means of assessing project impacts to both the marsh components and the open water components of marsh habitats. At this time, the guidance contained herein is also not applicable to the evaluation and mitigation of impacts to open water areas involving CEMVN civil works projects other than HSDRRS projects.

It is emphasized that the guidelines contained herein are preliminary. They will be refined and finalized during the course of preparing the Tiered Individual Environmental Report(s) (TIERs) covering the constructible portions of the Tentatively Selected Mitigation Plan. The final guidelines will be prepared by CEMVN in coordination with the Interagency Environmental Team and the Non-Federal Sponsor.

2 MITIGATION FOR IMPACTS TO OPEN WATER HABITATS

<u>2.1 Determination of Whether Mitigation Is or Is Not Required</u>

Mitigation of impacts to open water habitats <u>will</u> typically be required for the following scenarios:

A. Any fill impact (deposition of fill) that will:
   (a) Affect open water habitat that is classified by the National Marine Fisheries Service (NMFS) as Essential Fish Habitat (EFH; i.e. NMFS asserts EFH jurisdiction over the affected habitat), <u>and</u>;
   (b) The impact will cause the affected open water area to become non-aquatic habitat.
   Note that, as a very general rule of thumb, NMFS may or may not assert EFH jurisdiction over open water areas in freshwater settings that are non-tidal, but typically will assert EFH jurisdiction over open water areas found in other salinity regimes (i.e. intermediate, brackish, saline) and may assert EFH jurisdiction over open water areas in tidal freshwater settings. Also note that the exception to mitigation requirements addressed in item (3) below may be applicable to the impact scenario described above.

B. Any fill impact to an open water area containing Submerged Aquatic Vegetation (SAV), regardless of the percent cover accounted for by SAV, provided that the impact is anticipated to result in the permanent loss of SAV.

Note that for this scenario, the WVA model used to evaluate the impact would encompass the entire impact footprint (i.e. areas with SAV patches and areas lacking SAV). Also note that when determining SAV presence and coverage, both native and invasive/exotic SAV species will be considered (i.e. the total SAV cover will include the cover accounted for by native species and the cover accounted for by invasive/exotic species combined). Also note that the exception to mitigation requirements addressed in item (3) below may be applicable to the impact scenario described above.

C. Any excavation (dredging) impact to an open water area containing SAV, regardless of the percent cover accounted for by SAV, which adversely affects the SAV but will not result in the creation of anoxic conditions in the affected area.
Note that for this scenario, the WVA model used to evaluate the impact would only be applicable to the SAV patches (i.e. the impacts to the open water areas lacking SAV would not be considered in the model). Note that the exception to mitigation requirements addressed in item (3) below may be applicable to the impact scenario described above.

D. Any excavation impact to an open water area designated as EFH that will result in the creation of permanent anoxic conditions in the affected area, regardless of whether SAV is present or not.
Note that it may be difficult to predict whether a proposed action would result in permanent anoxic conditions. Rather than assuming mitigation will be necessary when there are uncertainties, the approach may be to conduct monitoring of the affected area following implementation of the proposed action to determine whether anoxic conditions have developed and then determine mitigation requirements based on this monitoring. Coordinate with NMFS during project planning to determine the best approach. Note that the exception to mitigation requirements addressed in item (3) below may be applicable to the impact scenario described above.

E. Any fill or excavation impact that adversely affects open water habitat where SAV is present <u>and</u> the SAV species include seagrasses, regardless of the percent cover accounted for by the SAV and regardless of the percentage of the total SAV cover accounted for by seagrasses. As used herein, seagrass species include; turtle grass (*Thalassia testudinum*), Manatee grass (*Syringodium filiforme*), shoal grass (*Halodule wrightii*), star grass (*Halophila englemannii*), and paddle grass (*Halophilia decipiens*).
Note that for this scenario, the WVA model used to evaluate the impact would encompass the entire impact footprint (i.e. areas with SAV patches and areas lacking SAV).

F. Any fill or excavation impact that adversely affects open water habitat that is designated as oyster seed grounds by the Louisiana Department of Wildlife and Fisheries (LDWF).

Mitigation of impacts to open water habitats will <u>not</u> typically be required for the following scenarios:

(1) The proposed action involves dredging that will only impact an open water area where no SAV is present, even if the affected area is EFH. This does <u>not</u> apply to dredging that will: (a) adversely impact open water areas designated as oyster seed grounds by LDWF, or; (b) result in the creation of permanent anoxic conditions in the affected area and the affected area is EFH.

(2) The proposed action involves filling an open water area such that the affected area will <u>not</u> be converted to non-aquatic habitat. This does <u>not</u> apply to: (a) fill activities that will result in the permanent loss of SAV, even though the affected area may remain inter-tidal, or; (b) fill activities that will adversely impact open water areas designated as oyster seed grounds by LDWF.

(3) The proposed action will adversely impact <1 acre within a single open water area (i.e. one impact encompassing <1 acre), even if SAV is present, <u>or</u>; the proposed action will adversely impact multiple open water areas but the total of the impact polygons will affect <1 acre (i.e. cumulative impact is <1 acre), even if SAV is present. This does <u>not</u> apply to actions that will adversely impact: (a) open water areas designated as oyster seed grounds by LDWF; (b) open water areas with SAV and the SAV includes seagrasses; (c) open water areas classified by NMFS as EFH,

although there may be limited cases when the stated mitigation exemption may be applied to EFH. The reader is cautioned that the exemption to mitigation requirements addressed in this item may not be applicable to other situations not specifically addressed in (3)(a) through (3)(c). One should coordinate directly with US Fish and Wildlife Service (USFWS) and NMFS regarding specifics of the proposed action before assuming this exemption is applicable.

Mitigation for temporary impacts to open water areas through actions such as excavating (dredging) temporary construction access canals, followed by back-filling of the affected area, may or may not be required even in cases where SAV, excluding seagrasses, and/or EFH will be impacted. The need for mitigation will be assessed on a case-by-case basis.

Be aware that there could be special circumstances that mandate mitigation of adverse impacts to open water habitats, regardless of the exceptions to mitigation discussed in items (1) through (3) above. Examples include, but are not necessarily limited to: actions that would also adversely affect threatened or endangered species; actions that would also adversely affect federally designated critical habitat; actions that would also adversely affect federally managed species. Another example involves proposed dredging of EFH whereby a substantial acreage of open water habitat lacking SAV will be permanently impacted in such a way that the depth of dredging will preclude colonization by SAV.

Before mitigation will be considered, one should also note that any proposed project that will adversely impact open water habitats will still be subject to demonstrating that all practicable measures to avoid the impact have been taken, that the proposed impact is not avoidable, and that all practicable measures to minimize unavoidable impacts have been taken.

2.2 Type and Location of Mitigation

As a preface to the following discussion, keep in mind that the guidance contained in the Federal Register, Vol. 73, No. 70, Section 332.3(b) concerning the type and location of compensatory mitigation will be applicable to mitigation proposed as compensation for impacts to open water habitats. In general, this guidance indicates that: (a) Mitigation should be within the same watershed as the impact, or, in the case of marine impacts, within the same marine ecological system; (b) The preferential order (i.e. preferred hierarchy) for mitigation is: use of a mitigation bank; use of in-lieu fee program credits; a watershed approach where the goal is to provide the greatest benefits to the watershed (includes on-site mitigation, off-site mitigation, mitigation banks, in-lieu fee program, out-of-kind mitigation); on-site, in-kind mitigation; off-site and/or out-of-kind mitigation.

In general, the preferred method of compensating impacts to open water habitats containing SAV will be in-kind (type-for-type) mitigation through measures such as creation or restoration of SAV beds in existing open water areas or enhancement of open water areas to promote development of SAV beds. However, out-of-kind mitigation in the form of marsh creation, restoration, or enhancement will also be acceptable in most cases. Factors that will be considered in determining whether the mitigation should be in-kind may include, but are not limited to: (a) the relative prevalence of SAV beds within the watershed/basin; (b) the density of SAV species in the area that will be impacted; (c) the persistence of SAV beds in the area that will be impacted (e.g. how persistent SAV cover is during a typical year); (d) the ability to achieve successful in-kind mitigation.

If mitigation will be provided through marsh creation, restoration, or enhancement activities, the marsh should be similar to the predominant marsh type (i.e. fresh, intermediate, brackish, or saline) in the area where the open water impact occurs, provided that this marsh type is capable of replacing most of the functions and values of the affected open water habitat (particularly as regards the fish and wildlife species that could utilize the affected open water habitat). The marsh mitigation feature should include components that allow access to the marsh by fish and other aquatic organisms and must be intertidal. The location of the marsh mitigation feature should be within the same watershed/basin as the impacted habitat.

In some cases, a proposed action that will impact open water habitats may also impact marsh habitats, thereby requiring mitigation for the marsh impact. There may also be cases where the establishment of proposed mitigation features used to compensate for project impacts to non-open water habitats (ex.

mitigation for impacts to marsh, swamp, and/or bottomland hardwood habitats) will impact open water habitats. Assuming one or more marsh mitigation features will be included as part of the overall project mitigation plan, the proposed marsh mitigation may be utilized to compensate for the open water habitat impacts as well as for the marsh impacts. In this case, the marsh mitigation feature(s) used as compensation for the open water impacts should be the feature(s) closest to the location of the open water impacts.

3 EVALUATION OF IMPACTS TO OPEN WATER HABITATS

If mitigation of adverse impacts to open water habitats is required, the open water component of the appropriate WVA marsh model will typically be used to determine the net loss of functions and values (net loss of Average Annual Habitat Units or AAHUs) that will result from the impacts. It must be demonstrated that the proposed mitigation for such impacts will fully compensate for the lost functions and values. This will be accomplished through use of the appropriate WVA marsh model (all components of the marsh model if mitigation will be provided via marsh creation, restoration, or enhancement; the open water component of the marsh model if mitigation will be provide via open water habitat creation, restoration, or enhancement). If the net gain in AAHUs that will result from the proposed mitigation is equal to or greater than the net loss of AAHUs that will result from the impact, then it will typically be assumed that the proposed mitigation adequately compensates for the proposed impact.

One should note that impact/mitigation assessment methods other than the WVA methodology may be used. Such methods will need to be approved on a case-by-case basis.

In situations where mitigation of impacts to open water habitats is not required, such impacts must still be quantified, evaluated, and discussed in an appropriate NEPA document. However, WVA models (or other impact assessment methods) will not need to be used as part of the impact evaluation.

Federal Register, Vol. 46, No. 15 (USFWS Mitigation Policy) sets forth guidance concerning how USFWS may make recommendations concerning mitigation. This guidance is not applicable to mitigation for impacts to threatened or endangered species. Within the cited document, four “resource categories” are used to indicate that the level of mitigation recommended will be consistent with the fish and wildlife resource values involved.

In general, USFWS categorization of impacts to open water habitats will be as follows. The reader is cautioned, however, that there may be exceptions to the generalizations that follow; hence, direct coordination with USFWS is always recommended.

Resource Category 4
Impacts to open water bottoms, regardless of depth, with no SAV present (even if the proposed action causes the affected area to become non-tidal). Typically, USFWS would not recommend mitigation for such impacts unless the impact will adversely affect LDWF oyster seed grounds or NMFS requests mitigation for EFH impacts. USFWS would discourage impacts, to the extent feasible, and would advise that measures to minimize impacts to water quality (particularly in the case of proposed borrow areas) be taken as part of the proposed action.

Resource Category 3
Impacts to SAV beds in open water habitats. Typically, USFWS would recommend mitigation for such impacts and would require that appropriate mitigation sequencing be employed (impact avoidance and minimization) prior to considering mitigation. USFWS would seek to ensure the mitigation proposed adequately replaces the lost functions and values that would result from the impact, but would not necessarily require in-kind mitigation. USFWS may not require mitigation in cases described under the mitigation exemption described in section 2.1(3).

4 WVA MODELS FOR IMPACTS TO OPEN WATER HABITATS

Components of the WVA models for coastal marsh communities will be utilized to determine the net loss of AAHUs that will result from the proposed impacts to existing open water habitats. Note that all of the formulas addressed herein are directly obtained from the document entitled “Coastal Wetlands Planning, Protection and Restoration Act, Wetland Value Assessment Methodology, Coastal Marsh Community Models”, dated March 19, 2010. This methodology is presently being considered for interim regional approval by the USACE, with the interim approval period lasting 3 years. It is possible that the WVA Marsh Community Model may ultimately be revised for USACE final certification. Such a revision may alter the formulas set forth below.

The reader is further advised that the guidance that follows indicates one can use either the predominant marsh type present near the area where the open water impact or open water mitigation will occur, or one can use the average annual salinity near the impact/mitigation area to determine which formulas should be used. The average annual salinity should be used only in cases where there are no nearby marsh habitats present. Otherwise, the predominant marsh habitat type should be used to determine the appropriate formulas.

4.1 Habitat Suitability Index (HSI) Formulas for Open Water Habitats

The following formulas will be used to determine Habitat Suitability Index (HSI) values for affected open water areas:

(A) If the majority of nearby marsh habitats are fresh or intermediate marshes and/or the average annual salinity in the affected open water area ranges from 0 to <5 ppt:

$$HSI = [\{ 3.5 \text{ x } (SIV_2^3 \text{ x } SIV_6)^{(1/4)} \} + (SIV_3 + SIV_4 + SIV_5) / 3] / 4.5$$

(B) If the majority of nearby marsh habitats are brackish marshes and/or the average annual salinity in the affected open water area is ranges from 5 to 16 ppt:

$$HSI = [\{ 3.5 \text{ x } (SIV_2^3 \text{ x } SIV_6^2)^{(1/5)} \} + (SIV_3 + SIV_4 + SIV_5) / 3] / 4.5$$

(C) If the majority of nearby marsh habitats are saline marshes and/or the average annual salinity in the affected open water area is >16 ppt:

$$HSI = [\{ 3.5 \text{ x } (SIV_2^3 \text{ x } SIV_6^{2.5})^{(1/3.5)} \} + (SIV_3 + SIV_4 + SIV_5) / 3] / 4.5$$

where $SIV_{\#}$ is the Suitability Index (SI) value for the indicated model variable ($V_{\#}$, i.e. variables V_2 through V_6), as determined from applicable suitability index graphs set forth in the marsh community model. V_2 = % SAV cover; V_3 = marsh edge & interspersion; V_4 = % of open water area ≤ 1.5 feet deep; V_5 = mean salinity, in ppt, during the growing season; V_6 = aquatic organism access.

4.2 Benefit Assessment Formulas (AAHU Formulas) for Open Water Habitats

The typical formulas for calculating net AAHUs for marsh habitats are:

(A) Formula for fresh and intermediate marshes:

AAHUs = [(2.1 x (Marsh AAHUs)) + (Open Water AAHUs)] / 3.1

(B) Formula for brackish marshes:

AAHUs = [(2.6 x (Marsh AAHUs)) + (Open Water AAHUs)] / 3.6

(C) Formula for saline marshes:

AAHUs = [(3.5 x (Marsh AAHUs)) + (Open Water AAHUs)] / 4.5

When evaluating strictly open water habitats, there would be no marsh habitats interspersed within the boundaries of the open water habitats being considered. Given this, the number of marsh AAHUs would be zero and the preceding formulas are reduced to the following when computing the final AAHUs for open water habitats:

(A) If the majority of nearby marsh habitats are fresh or intermediate marshes and/or the average annual salinity in the affected open water area ranges from 0 to <5 ppt:

Final Open Water AAHUs = Open Water AAHUs / 3.1

(B) If the majority of nearby marsh habitats are brackish marshes and/or the average annual salinity in the affected open water area is ranges from 5 to 16 ppt:

Final Open Water AAHUs = Open Water AAHUs / 3.6

(C) If the majority of nearby marsh habitats are saline marshes and/or the average annual salinity in the affected open water area is >16 ppt:

Final Open Water AAHUs = Open Water AAHUs / 4.5

<u>4.3 Example of Using Weighted Averages for Model Variable Input</u>

Conditions may vary considerably within a given open water habitat being evaluated, particularly as regards SAV cover. The following provides an example of using weighted averages to arrive at appropriate SI values when performing WVA analyses for such conditions.

<u>Example Scenario:</u>
Project will impact a single open water area. The overall impact “footprint” (polygon) encompasses 200 acres. Within this footprint, 3 separate areas (polygons A, B, and C) contain SAV whereas the remainder of the footprint area contains no SAV. The water depth varies. Data for impact acreages, SAV cover, and water depth are:

- Polygon A – 10 acres, SAV cover = 90%, water depth = 3 feet.
- Polygon B – 40 acres, SAV cover = 10%, water depth = 1 foot.
- Polygon C – 20 acres, SAV cover = 70%, water depth = 2 feet.
- Polygon D (remainder of overall impact footprint excluding polygons A thru C) – 130 acres, SAV cover = 0%, water depth = 3 feet.

Assuming the WVA analysis will only be run for the areas containing SAV (a total of 70 acres), weighted averages would be as follows:

- V2 (% SAV) = [(90% x 10/70) + (10% x 40/70) + (70% x 20/70)] = 38.6% weighted avg. SAV cover.
- V4 (% Open Water ≤1.5 feet deep) = [(0% x 10/70) + (100% x 40/70) + (0% x 20/70)] = 57% weighted avg. open water ≤1.5 feet deep.

If the WVA analysis will be run for the entire impact footprint, weighted averages would be as follows:

- V2 (% SAV) = [(90% x 10/200) + (10% x 40/200) + (70% x 20/200) + (0% x 130/200)] = 13.5% weighted avg. SAV cover.
- V4 (% Open Water ≤1.5 feet deep) = [(0% x 10/200) + (100% x 40/200) + (0% x 20/200) + (0% x 130/200)] = 20% weighted avg. open water ≤1.5 feet deep.

APPENDIX E

PROJECT DESCRIPTIONS

EAR DESIGN

NON-PARK/404(C) BLH-DRY/BLH-WET PROTECTED SIDE IMPACTS

Bayou Segnette BLH-Dry & BLH-Wet Enhancement – EAR Design

This project would involve enhancing an existing degraded bottomland hardwood habitat as mitigation for BLH-Wet and BLH-Dry protected side general impacts. The project would be located adjacent to the Bayou Segnette State Park in Jefferson Parish. The project would be bounded to the south by the existing Westbank Hurricane Protection Levee (HPL) and to the north by Nicolle Boulevard and the NOLA Motorsports Park. The proposed BLH restoration features are identified in plan as BS2 (approximately 878.0 acres; a BLH-Dry restoration feature), BS3A (approximately 110.2 acres; a BLH-Wet restoration feature), BS4 (approximately 52.0 acres; a BLH-Dry restoration feature), and BS6 (approximately 21.6 acres; a BLH-Dry restoration feature), and would encompass approximately 1,062 acres combined (see Appendix A). The forest is currently populated with invasive plant species (mainly Chinese tallow) that would be eradicated and the restoration areas proposed would be subsequently planted with desired native, high-quality species. This invasive species essentially constitutes a monoculture with very few native hardwood species remaining. There are only a few exceptions to this generalization. Remnant bald cypress trees are co-dominant with the Chinese tallow trees in the northwestern and north central portions of mitigation feature BS2 and in the northern half of mitigation feature BS4.In addition, the mitigation activities would include measures designed to restore wetland hydrology in areas slated to be BLH-Wet habitats (e.g. feature BS3A). The sites are located on the protected side of the HPL.

In addition, enhancement for the proposed BLH-Wet mitigation feature would also include restoration of wetland hydrology (i.e. hydrologic enhancement). Attaining the desired hydro-period in proposed BLH-Wet enhancement features would be accomplished by construction of perimeter dikes to help retain surface runoff and other alterations to existing drainage patterns. Jefferson Parish currently operates the Lake Cataouatche Pump Station at the south end of the Avondale Garden Canal. This pump station is operated until the water in the inflow channel (Inner Cataouatche Canal) reaches elevation (-) 10.43 feet. Pumps cannot be run below this elevation but often pump to this elevation in anticipation of rain events. The regional water table has been lowered as a result of pumping. This drawdown of the water table combined with the effects of past alterations to area sheet-flow patterns (construction of canals, drainage ditches, developments, etc.) has adversely affected the historic hydroperiod once typical of the area. It appears these effects have degraded the water regime in existing bottomland hardwood habitats to the extent that most areas no longer have wetland hydrology. As a result, the BLH habitats in the area have converted from BLH-Wet to BLH-Dry.

The project design in appendix A depicts two mitigation features in addition to the four that comprise the subject project. Features BS3B (approximately 86.4 acres) and BS5 (approximately 60.0 acres) are proposed BLH-Wet enhancement areas that would serve as mitigation for WBV pre-Katrina impacts to BLH habitats rather than as mitigation for WBV

HSDRRS impacts to BLH habitats. The pre-Katrina mitigation features would be provided pursuant to previously authorized plans, and it is anticipated that these features would be established prior to establishment of the subject WBV HSDRRS mitigation features. While the two pre-Katrina mitigation features are not part of the proposed project, designers assumed these features would be separately approved and therefore designed the components of the subject project accordingly. Hence, the pre-Katrina mitigation features are shown in Appendix A due to their interrelationship with the four proposed HSDRRS mitigation features.

The majority of proposed BLH-Dry mitigation features would not require significant alterations to the existing topography since the current hydroperiod is satisfactory.

The proposed project area drains from Nicole Boulevard southward toward the hurricane protection levee (HPL). As a protected side project, there is no dedicated water source for the area other than rain events. In order to restore appropriate wetland hydrology within proposed BLH-Wet mitigation features, various structures would be added to help retain water. An earthen retention dike is proposed along the southern perimeter of features BS3B and BS5, and continuing northward near the western boundaries of features BS3A and BS3B and near the eastern boundary of feature BS5. The purpose of the dike is to retain water before draining into the Inner Cataouatche Canal (ICC). Available LIDAR (Light Detection and Ranging) elevation data show a ridge on the west side of the proposed features. LIDAR shows the area adjacent to the canal is the lowest with existing elevations of approximately (-) 8.0 feet. A water retention dike would be constructed to elevation (-) 6.0 feet. The dike would retain two feet of water but would not prevent water caused by heavy rain events from overflowing the dike and discharging into the Inner Cataouatche Canal. Due to the expected large number of overtopping events (times when retained surface water would be sufficiently high to flow over the water retention dike), the water retention dike would be built with a wide crown and gradual side-slopes. Sheet piles may also be incorporated into the retention dike if it is determined that this is necessary to counteract groundwater seepage effects. Approximately 15,000 cubic yards of borrow for both existing ditch closure and construction of the retention dike would be obtained from the Bonnet Carre' Spillway and truck hauled to the project site.

An existing Entergy transmission line runs along the eastern boundary of features BS2, BS3A, and BS3B, separating these elements from features BS4 and BS5. An existing dirt maintenance road runs within the power line easement. This road is slightly raised and thus tends to block sheet-flow. To counter this effect, drainage culverts or shallow flow-ways (swales) would be installed through the roadway at various locations.

In addition, potential alterations to existing drainage ditches and canals (filling or closures on some, possible re-routing others) and possibility of constructing new ditches, with the purpose being to help route surface flows to the BLH-Wet features while preventing adverse drainage effects.

Due to the high density of invasive plant species, the project area would receive multiple herbicidal treatments prior to the initial planting of native, high-quality species. Initially the entire area would be aerial sprayed. Approximately one month after spraying, the mitigation features would be mechanically cleared without grubbing. Large native trees and shrubs would be preserved during the clearing process to the greatest degree practicable. Woody debris generated during the clearing operations would be chipped and left within the mitigation features, although some may be burned on-site if conditions allow. Following the clearing activities, a second herbicidal treatment would be applied from the ground targeting the remaining invasive plants. The mitigation features would subsequently be planted with native BLH tree and shrub species in accordance with the BLH-Wet and BLH-Dry planting guidelines set forth in appendix L. It is anticipated that a third ground application of herbicides would be conducted shortly after completion of plantings to eradicate invasive plants that develop after the first ground treatment event. The initial construction phase of the project would require approximately 2 to 3 years.

It is anticipated that several plants installed at the time of the initial planting would not survive for a year; thus, it was estimated that about 20% of the total number of plants initially installed would need to be re-planted one year after completion of the initial planting. Additional activities that would occur during the project construction phase following the initial planting event would include periodic eradication of invasive/nuisance plant species within the mitigation features as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of monitoring responsibilities to the NFS).

Various activities would be necessary during the OMRR&R (Operation and Maintenance, Repair, Replacement and Rehabilitation) phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation features and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L). The elevation of the water retention dike is low by design and therefore, subject to frequent overtopping. Annual inspection of the dike would be necessary and repairs would need to be made if necessary. Culverts would need to be replaced about every 20 years. Any realigned ditches would need to be maintained to prevent reduced flow due to vegetation and siltation.

Dufrene Ponds BLH-Wet Restoration – EAR Design

The site established for restoration would be located along the right descending bank (RDB) of Bayou des Allemands and immediately south of US Highway 90 in Lafourche Parish. The sites established for restoration are currently open water areas. This project would involve restoring wet bottomland hardwood habitat as mitigation for BLH-Dry and BLH-Wet protected side general impacts. There are two proposed restoration features. The proposed BLH-Wet restoration features are identified in plan view as DP1A (approximately 103.1 acres) and DP4 (approximately 439.8 acres), and would encompass approximately 542.9 acres combined (see appendix A). These two features are divided by a corridor, approximately 200 feet wide, which runs predominately east to west along a curve that splits the mitigation features. This corridor is the proposed alignment of the future expansion of Interstate 49. None of the proposed mitigation features are within the I-49 corridor.

Earthen retention dikes would first be mechanically constructed along the perimeter of the proposed restoration features. The retention dike borrow would be obtained from within the restoration footprints. Dikes would be built with barge mounted equipment. The length of the dikes would be approximately 30,000 linear feet. Due to high clay content expected in the Lake Salvador borrow site (see below), a bulking factor of 60 percent was used in the design of the retention dikes. Additionally, a freeboard of one foot is required on the dike. The dike would be built to an elevation of +8.2 feet, with a five foot crown and 1V:4H side slopes. Initial settlement expected for the dike is assumed to be 30%. Total dike volume would be 950,000 cubic yards.

The two restoration features would be filled to an initial target elevation of +3.0 feet. The assumed average existing elevation of the DP1A and DP4 footprints is -4.0 feet. The initial target elevation would require an earthen lift of seven feet. Assuming one foot of foundation settlement, the total fill quantity required for the BLH-Wet land platforms would be approximately 6,200,000 cubic yards.

Borrow for earthen fill for the restoration features would be obtained from an 820-acre borrow site in Lake Salvador. Borrow would be obtained a minimum distance of 2,000 feet from the lake's shoreline using a hydraulic cutter-head dredge. Existing lake bottom elevations vary. The project designer assumed an existing average lake bottom elevation within the footprint of the borrow site of -8.0 feet. The borrow site would be dredged to an elevation of -20 feet or shallower. Grain size distribution of borrow materials was assumed to be 10 percent silty sand and 90 percent silty clay. The borrow site designs used a 2:1 pit to fill ratio to allow for unknown utilities, anomalies, and cultural sites. If potential long-term environmental impacts are anticipated, dissolved oxygen and rate of infilling would be monitored at the borrow site following construction.

The fill material dredged from Lake Salvador would be piped to the restoration features in slurry. The pipeline corridor would be 100 feet wide and roughly 84,000 feet long (see appendix A). The corridor would be placed near the banks of Bayou des Allemands in an effort to minimally impact navigation in the bayou. Floating pipeline would be used, which is a dredge discharge pipe positioned on pontoons. The floating pipeline would be marked on 150 foot centers to prevent boat hazards in the lake and along the bayou. Markers would include lighted and reflective buoys. As the pipeline would need to cross the bayou, a small segment of submerged pipeline would be installed at the crossing with signage to ensure safe passage over the line. Adjustable spill boxes would be placed to the retention dikes to drain excess water from the restoration sites during the hydraulic fill operation. Marsh tracked vehicles would move the discharge pipeline within the restoration sites when pumping, and maintain the retention dikes as needed for the duration on the dredge fill operation. The estimated construction duration for constructing the retention system and dredge filling the restoration features would be 27 to 30 months.

There is an existing tank battery (oil/gas tanks) within feature DP4. Construction of feature DP4 as shown in appendix A would impact access to the site by the utility owner. An open water access corridor could be incorporated into the proposed restoration feature encompassing the tank battery to allow access to these facilities. A 60 foot bottom width access corridor and a 400 foot by 400 foot platform area yield an area of less than 11 acres. It is assumed that not all of the potential mitigation projects situated in the Dufrene Ponds site would be selected as components of the final overall mitigation plan. Thus, the configuration of proposed feature DP4 could easily be adjusted to accommodate an open water access corridor to the tank battery.

Once the dredge and fill operation required to establish the land platforms for the restoration features is complete, an idle period of approximately one year would allow hydraulically placed fill time to settle and dewater to the desired final target elevation of +2.0 feet. A second construction contract would be awarded at the end of the idle period to degrade the perimeter dikes and plant desired species. Perimeter dikes would be degraded to equal the final target elevation of the BLH-Wet platforms. The dikes would be degraded with marsh tracked vehicles and barge mounted backhoe. Material removed would be used where possible to fill low areas within the restoration area, or placed in the adjacent open water area outside of the restoration features. The open water face of the retention dike along the eastern boundary of feature DP4 would be armored adjacent to Bayou des Allemands with a two foot blanket of stone. The armored reach of DP4 would be approximately 11,650 linear feet. The stone would be a well graded riprap with a proposed top size stone of 650 pounds. The armoring would include a two foot lift of stone on a separator geotextile. The armoring would not exceed the target elevation of the proposed BLH restoration.

After degrading the retention dikes, each restoration features would be planted with native BLH-Wet canopy and mid-story species. The plantings would be in accordance with the BLH-Wet planting guidelines contained in appendix L. The duration for the subsequent construction project for degrading the retention dikes and planting the features would be 6 to 9 months.

It is anticipated that several plants installed at the time of the initial planting would not survive for a year; thus, it was estimated that about 20% of the total number of plants initially installed in each feature would need to be re-planted one year after completion of the initial plantings. Additional activities that would occur during the project construction phase would include periodic eradication of invasive/nuisance plant species within the mitigation feature as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in Appendix L (i.e. monitoring and reporting necessary prior to transfer of the project to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation feature and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L).

Lake Boeuf BLH-Dry & BLH-Wet Restoration Project – EAR Design

This project would involve restoration of existing agricultural fields to BLH-Wet and BLH-Dry forests. As shown in appendix A, it would include two proposed BLH-Dry restoration features, LB2 (77.6 acres) and LB3 (375.8 acres), and one BLH-Wet restoration feature, LB4B (50.3 acres). These three restoration features would encompass a total of approximately 503.7 acres. The proposed restoration features would be located in Lafourche Parish, just north of Bayou Lafourche and immediately west of the town Raceland. The Lake Boeuf Wildlife Management Area (WMA) is located a short distance north/northwest from this proposed project site.

The proposed BLH-Dry features are at an elevation conducive to growth of BLH-Dry plant species and would require neither fill nor excavation of existing material. These features would be graded and tilled to remove existing furrows, berms, and similar topographic anomalies in order to create a relatively level surface prior to planting.

The existing BLH-Wet habitats in the general area appear to have elevations ranging from approximately +1.9 feet to +2.5 feet. Based on existing LIDAR data, the footprint for proposed BLH-Wet feature LB4B ranges from approximately +3.5 feet to +2.5 feet. This restoration feature would first be degraded to meet a proposed target elevation ranging from +2.0 feet to +2.5 feet. It is estimated that approximately 90,000 cubic yards of soil would be removed during this process. The excavated material would be disposed of in lower portions of the adjacent BLH-Dry feature LB3. This excavated soil would be spread in manner such that the grade in the disposal areas would not exceed elevation +5.5 feet.

Existing dirt/gravel roads run through some of the proposed mitigation features. Many of these roads that lead to off-site lands not slated for mitigation would need to be retained within the affected mitigation feature to avoid adversely impacting the accessibility to these off-site parcels. The access roads running north/south through LB3 would remain and would be used for project construction and maintenance access. An existing road runs north/south through proposed feature LB4B. Two corrugated metal culverts would be placed under the road upon completion of the required excavation to assure unimpeded east/west water flow through the BLH-Wet restoration feature.

Following completion of the construction activities described above, all the restoration features would be planted with native canopy and midstory species. The two BLH-Dry restoration features would be planted in accordance with the BLH-Dry planting guidelines contained in appendix L, while the single BLH-Wet feature would be planted in accordance with the BLH-Wet planting guidelines contained in this same appendix.

It is anticipated that several trees and shrubs installed at the time of initial planting would not survive for a year; thus, it was estimated that about 20% of the total number of plants initially installed would need to be planted one year after completion of initial plantings. Additional activities that would occur during the project construction phase following the initial planting event would include periodic eradication of invasive/nuisance plant species within the mitigation features as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of monitoring responsibilities to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation features and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L). Any drainage culverts installed as part of the project would likely need to be replaced once every twenty years.

Plaquemines, Alt. 2 BLH-Wet Restoration – EAR Design

This proposed project would consist of a single mitigation feature (P3A) that would occupy approximately 354.3 acres. This project would involve restoring BLH-Wet habitat from existing open water. The project would be located in Plaquemines Parish on the flood side of the Mississippi River Levee (MRL) near Jesuit Bend. See appendix A for a depiction of this project.

At this 35% design level, it was assumed that approximately 3,500 linear feet of retention dikes would need to be constructed along the southern perimeter of feature P3A. Along the western perimeter of feature P3A is an existing spoil berm, thus a new retention dike would likely not be required here. Instead, the existing berm (roughly 6,600 linear feet) would simply be capped with additional fill to achieve the desired crest elevation. On the eastern side of the feature where the feature abuts the existing levee, no dike construction would be required. The required retention dikes would be constructed to maintain a minimum of 1 foot of freeboard during dredging operations. The retention dikes would be constructed to elevation +6.5 feet, with a 5-foot crown to ensure dike integrity. Borrow for these retention dikes would come from within the footprint of feature P3A. The borrow ditch would be offset a minimum of 40' from the dike to ensure dike stability. For initial quantity estimates, the dikes were assumed to have 1 vertical on 4 horizontal side slopes. Spill boxes or weirs would be constructed at pre-determined locations within the retention dike to allow for effluent water release from within the BLH-Wet restoration area. If deemed necessary by the construction contractor, a low level interior weir could be constructed to assist in vertical stacking of the dredged material.

An assumed existing bottom elevation of -3.5 feet was used for design of the proposed BLH-Wet feature. The borrow quantity that would be needed to construct the proposed BLH-Wet feature is approximately 3,750,000 cubic yards. The fill needed would be excavated from an 80- acre borrow site located in the Mississippi River at approximate river mile 69.0 on the left descending bank, using a hydraulic cutter-head dredge. The borrow would be excavated to elevation -70.0 feet in the River. Borrow would be transported to the proposed borrow site via pipeline in slurry. Submerged pipeline would be required to cross the river, and would be laid on the river bottom as to not impede navigation. Coordination with the US Coast Guard would also be required while all operations in the River are ongoing.

Once the pipeline crosses the River it would run along the ground within a 100 foot wide pipeline access corridor from the river bank to the proposed feature. The current proposed design would utilize the existing Atmos Energy pipeline corridor as the primary access corridor. The width of this corridor would be reduced in areas where there are existing structures in order to minimize impacts. The pipeline corridor includes existing culverts at highway and railroad crossings. All culverts, however, are likely too small to thread the pipeline needed to transport borrow material (sediment) to the mitigation feature. A larger 36-inch diameter pipe would be jack-and-bored at each crossing and the pipeline would be routed through these new culverts. Jack and bore at the railroad locations would not be situated immediately adjacent to the Mississippi River Levee (MRL). Some clearing of vegetation and debris may be required along the corridor. All vegetation debris would be placed in the bottom of the mitigation feature and buried under the fill from the River.

The fill material would be placed to an initial slurry elevation of +4.0 feet. The initial construction duration is estimated to be 12 to 14 months. Once the fill operation is complete, an idle period of approximately one year would allow the hydraulically placed fill time to settle and dewater to the desired final target elevation of +2.0 to +2.5 feet. The entire length of the newly constructed dikes would be degraded to equal the final target grade of the BLH-Wet platform. The material degraded would be placed into the original borrow ditch used to acquire dike construction material. Once the mitigation feature has settled to the desired target grade, the entire feature would be planted with native canopy and midstory species. The plantings would be in accordance with the BLH-Wet planting guidelines contained in appendix L. The second construction phase (degrading dikes, initial plantings) would require approximately 3 to 4 months to complete.

It is anticipated that several trees and shrubs installed at the time of initial planting would not survive for a year; thus, it was estimated that about 20% of the total number of plants initially installed would need to be re-planted one year after completion of initial plantings. Additional activities that would occur during the project construction phase would include periodic eradication of invasive/nuisance plant species within the mitigation features as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of the project to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation features and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L).

NON-PARK/404(C) BLH-WET FLOOD SIDE IMPACTS

Dufrene Ponds BLH-Wet Restoration – EAR Design

This project would involve restoring wet bottomland hardwood habitat as mitigation for BLH-Wet flood side general impacts. The project would be located along the right descending bank (RDB) of Bayou des Allemands and immediately south of US Highway 90 in Lafourche Parish. The proposed BLH-Wet restoration feature is bounded to the north by a corridor, approximately 200 feet wide, which runs predominately east to west along a curve. This corridor is the proposed alignment of the future expansion of Interstate 49. None of the proposed mitigation feature extends into the I-49 corridor. The proposed BLH-Wet restoration feature is identified in plan as DP1B and would encompass approximately 245.7 acres (see appendix A). The site established for restoration is currently an open water site.

The current 35% submittal analysis does not include engineering data. Quantities are based on limited reconnaissance site visits or stated assumptions. A reconnaissance survey was taken to determine existing water depths. The designer used assumptions to determine stability and settlement.

A retention dike would be mechanically constructed along the perimeter of the proposed restoration feature. The retention dikes needed to support filling of the restoration platform would be constructed with earthen material borrowed from within the mitigation feature. Dikes would be built with barge mounted equipment. The length of the dike would be 13,600 linear feet. Due to high clay content expected in the borrow site, a bulking factor of 60 percent was used in the design of the retention dikes. Additionally, a freeboard of 1 foot is required on the dike. The dike would be built to an elevation of +8.2 feet. The dike section would have a five-foot crown and 1V:4H side slopes. Initial settlement expected for the dike is assumed to be 30%. Total dike volume would be 430,000 cubic yards.

The assumed existing average elevation of the DP1B footprint is -4.0 feet. The initial target elevation for the slurry fill within the feature would be +3.0 feet. A target elevation of +3.0 feet yields a neat lift of 7 feet. Assuming one foot of foundation settlement, the total fill quantity required to build the restoration feature platform would be 2,900,000 cubic yards.

Borrow for earthen fill for the restoration site would be obtained from an approximately 370-acre borrow site in Lake Salvador. Borrow would be obtained a minimum distance of 2,000 feet from the lake's shoreline using a hydraulic cutter-head dredge. Existing lake bottom elevations vary. The project designer assumed an existing average lake bottom elevation within the footprint of the borrow site of -8.0 feet. Maximum excavation elevation in the borrow site would be -20 feet. Grain size distribution of borrow materials was assumed to be 10 percent silty sand and 90 percent silty clay. The borrow site design used a 2:1 pit to fill ratio to allow for unknown utilities, anomalies, and cultural sites. If potential long-term environmental impacts are anticipated, dissolved oxygen and rate of infilling would be monitored at the open water borrow areas following construction.

The dredged borrow material (sediment) would piped to the restoration features in a slurry. A pipeline corridor is shown in plan. The pipeline corridor would be 100 feet wide and roughly 82,000 long. The corridor would be placed near the banks of Bayou des Allemands in an effort to minimally impact boat navigation in the bayou. Floating pipeline would be used which is a dredge discharge pipe positioned on pontoons. Floating pipeline would be marked on 150 foot centers to prevent boat hazards in the lake and along the bayou. Markers would include lighted and reflective buoys. As the pipeline would need to cross the bayou, a small segment of submerged pipeline would be installed at the crossing with signage to ensure safe passage over the line. Marsh tracked vehicles would move the discharge line in the restoration site when pumping and maintain the retention dikes as needed for the duration on the dredge fill operation. An adjustable spill box(s) would be placed to drain excess water from the restoration site during the hydraulic fill operation. The estimated construction duration for constructing the retention system and dredge filling the site would be 12 to 15 months.

Once the fill operation is complete on the initial construction, an idle period of approximately one year would allow hydraulically placed fill time to settle and dewater to the desired final target elevation of +2.0 feet. A second construction contract would be awarded at the end of the idle period to degrade the perimeter dikes. Perimeter dikes would be degraded to equal the final target elevation of the BLH-Wet platform. The dikes would be degraded with marsh tracked vehicles and barge mounted backhoe. Material removed would be placed in the adjacent open water area outside of the restoration feature. The restoration feature would be planted with native BLH-Wet canopy and mid-story species in accordance with the BLH-Wet planting guidelines contained in appendix L. The duration for the subsequent construction project for degrading the retention dikes and planting the feature would be three to five months.

It is anticipated that several trees and shrubs installed at the time of initial planting would not survive for a year; thus, it was estimated that about 20% of the total number of plants initially installed would need to be re-planted one year after completion of the initial plantings. Additional activities that would occur during the project construction phase would include periodic eradication of invasive/nuisance plant species within the mitigation feature as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of monitoring responsibilities to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation feature and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L).

Lake Boeuf BLH-Wet Restoration

This project would involve restoration of BLH-Wet forests in existing agricultural fields, as shown in appendix A. The three BLH-Wet restoration features would include LB4A (74.4 acres), LB5B (19.0 acres), and LB7 (90.7 acres). Altogether, these three restoration features would encompass a total of approximately 184.1 acres. The proposed restoration features would be located in Lafourche Parish, just north of Bayou Lafourche and immediately west of the town Raceland. The Southern Pacific Railroad, running east/west, divides the proposed mitigation features. The Lake Boeuf Wildlife Management Area is located a short distance north/northwest from this proposed project site.

Existing available LiDAR data indicates that existing BLH-Wet habitats in the general area have elevations ranging from approximately +1.9 feet to +2.5 feet; thus it was assumed that such elevations would likely be necessary to achieve wetland hydroperiods sufficient to support the BLH-Wet forests proposed in the restoration features. Existing elevations within feature LB4A appear to be within the desired target elevation range needed to support BLH-Wet forests. This feature would be cleared, grubbed, and graded/tilled as necessary to prepare the feature for planting.

It appears that existing elevations within the restoration features LB5B and LB7are at or above that desired target elevation range of +2.0 feet to +2.5 feet. Existing grade elevations in feature LB7 appear to range from approximately +2.7 feet to +4.0 feet, with elevations tending to decrease from north to south. The existing grade in feature LB5B potentially slopes to the west with elevations ranging from approximately +3.5 feet to +2.4 feet. Features LB5B and LB7 would require degrading (excavation) to achieve the desired target elevations prior to planting of these features. The estimated quantities of excavation are 15,000 cubic yards for feature LB5B and 85,000 cubic yards for feature LB7. The excavated soil would be hauled off-site to a duly licensed disposal facility. All vegetation debris generated during the initial preparation of all the proposed restoration features would be burned on-site within the features themselves.

An existing road runs east/west through the proposed features LB5B and LB7, and an existing road runs north/south through feature LB4A. The proposed project would include installation of culverts beneath these roadways so that the roads do not inhibit sheetflow within the restoration features. The project design in appendix A indicates the anticipated locations of these culverts, which would include two in feature LB4A, two in feature LB5B, and three in feature LB&. Six (6) culverts are included in the cost estimate and are proposed to be placed under the road at approximate 500 foot intervals upon completion of the required excavation to assure unimpeded water flow through the bottomland hardwood wet site. All of the cited roadways would be retained as part of the project to allow construction and maintenance access and to allow use of the roadways by off-site property owners.

Following completion of the construction work described above, all three of the proposed restoration features would be planted in accordance with the BLH-Wet planting guidelines found in appendix L. It is anticipated that several trees and shrubs installed at the time of initial planting would not survive for a year; thus, it was estimated that about 20% of the total number of plants initially installed in each feature would need to be re-planted about one year after completion of initial plantings. Additional activities that would occur during the project construction phase following the initial planting event would include periodic eradication of invasive/nuisance plant species within the mitigation features as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of monitoring responsibilities to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation features and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L). Drainage culverts installed as part of the project would likely need to be replaced once every twenty years.

Plaquemines, Alt. 2 BLH-Wet Restoration – EAR Design

This project would consist of a single mitigation feature (P3B) that would occupy approximately 163.4 acres. This project would involve restoring BLH-Wet habitat from existing open water. See appendix A for a depiction of this project. The project would be located in Plaquemines Parish on the flood side of the Mississippi River Levee (MRL) near Jesuit Bend.

At this 35% design level, it was assumed that total perimeter retention would be required to retain dredge material and allow for vertical accretion. Approximately 12,250 linear feet of retention dike would be required. Retention dikes would be constructed to maintain a minimum of 1 foot of freeboard during dredging operations. The retention dikes would be constructed to elevation +6.5 feet, with a 5-foot crown to ensure dike integrity. Borrow for these retention dikes would come from within the mitigation feature footprint. The borrow ditch would be offset a minimum of 40' from the dike to ensure dike stability. For initial quantity estimates, the dikes were assumed to have 1 vertical on 4 horizontal side slopes. Spill boxes or weirs would be constructed at pre-determined locations within the retention dike to allow for effluent water release from within the BLH-Wet restoration area. If deemed necessary by the construction contractor, a low level interior weir could be constructed to assist in vertical stacking of dredged material.

An assumed existing bottom elevation of -4.0 feet was used for the design of the proposed BLH-Wet restoration feature. The borrow quantity that would be needed to construct the proposed restoration feature is 1,740,000 cubic yards. The fill needed would be excavated from an 80-acre borrow site located at approximate river mile 69.0 on the left descending bank of the Mississippi River, using a hydraulic cutter-head dredge. The borrow would be excavated to elevation -70.0 feet in the River. It is anticipated that the borrow source proposed from the Mississippi River would contain approximately 70 percent sand, which would greatly improve retention of pumped borrow material. Borrow would be transported to the proposed borrow site via pipeline in slurry. Submerged pipeline would be required to cross the river and would be laid on the river bottom as to not impede navigation. Coordination with the US Coast Guard would also be required while all operations in the River are ongoing. Once the pipeline crosses the River it would run along the ground within a 100 foot wide pipeline access corridor from the river bank to the proposed feature.

The current proposed design would utilize the existing Atmos Energy pipeline corridor as the primary access corridor. This width of this 100 ft corridor would be reduced in areas where there are existing structures in order to minimize impacts. The pipeline corridor includes existing culverts at highway and railroad crossings. All culverts, however, are likely too small to thread the pipeline needed to transport borrow material (sediment) to the mitigation features. A larger 36-inch pipe would be jack-and-bored at each crossing. Jack and bore at the railroad locations would not be located immediately adjacent to the Mississippi River Levee (MRL). Some clearing of vegetation and debris maybe required along the corridor. All vegetation would be placed in the bottom of the mitigation feature and buried under the fill from the River.

The fill material would be placed to an initial slurry elevation of +4.0 feet. The initial construction phase would require approximately 8.5 to 10.5 months. Once the initial fill operation is complete, an idle period of approximately one year would allow the hydraulically placed fill time to settle and dewater to the final target elevation of +2.0 to +2.5 feet. A second construction contract would be awarded at the end of the idle period to degrade the retention dikes. These dikes would be degraded to match the elevation of the constructed BLH-Wet restoration platform.   After the dikes have been degraded, the entire restoration feature would be planted with native canopy and midstory species. The plantings would be in accordance with the BLH-Wet planting guidelines contained in appendix L. This second phase of construction would require roughly 3 to 4 months.

It is anticipated that several trees and shrubs installed at the time of initial planting would not survive for a year; thus, it was estimated that about 20% of the total number of plants initially installed would need to be re-planted one year after completion of initial plantings. Additional activities that would occur during the project construction phase would include periodic eradication of invasive/nuisance plant species within the mitigation features as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of the project to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation features and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L).

NON-PARK/404(C) SWAMP FLOOD SIDE IMPACTS

Dufrene Ponds Swamp Restoration – EAR Design

The site established for restoration is located along the right descending bank (RDB) of Bayou des Allemands and immediately south of US Highway 90 in Lafourche Parish. The site established for restoration is currently an open water site. This project would involve restoring swamp habitat as mitigation for swamp flood side general impacts. The proposed swamp restoration feature is identified in plan as DP2 and would encompass approximately 170.5 acres (see appendix A). The proposed swamp restoration feature is bounded to the north by a corridor, approximately 200 feet wide, which runs predominately east to west along a curve. This corridor is the proposed alignment of the future expansion of Interstate 49. None of the proposed mitigation feature would extend into the I-49 corridor.

Earthen retention dikes would first be mechanically constructed along the perimeter of the proposed restoration feature. The retention dikes needed to support filling of the restoration platform would be built using earthen material borrowed from within the mitigation feature. Dikes would be built with barge mounted equipment. The length of the dike would be 11,800 linear feet. Due to high clay content expected in the borrow site, a bulking factor of 60 percent was used in the design of the retention dikes. Additionally, a freeboard of 1 foot is required on the dike. The dike would be built to an elevation of +8.2 feet, with a five foot crown and 1V:4H side slopes. Initial settlement expected for the dike is assumed to be 30%. Total dike volume would be 373,000 cubic yards.

The swamp restoration feature would have an initial target elevation of +3.0 feet. The assumed average existing elevation of the DP2 footprint is - 4.0 feet. The initial target elevation would require an earthen lift of seven feet. Assuming one foot of foundation settlement, the total fill quantity required to establish the swamp platform would be approximately 2,200,000 cubic yards.

Once construction of the dikes is completed, the restoration fill would be dredged with a hydraulic cutter head from the borrow site and piped to the restoration feature in slurry. There are two options for borrow site location. One option would be to obtain borrow from Petit Lac des Allemands as shown on appendix A, while the other option would be to obtain borrow from Lake Salvador (not shown on the project design in appendix A).

Borrow obtained from Petit Lac des Allemands would require a stability analysis to determine the final shoreline offset and elevation for the borrow site. Additional concern for use of this site is its scenic river designation. A borrow site in Petit Lac des Allemands would likely encompass about 482 acres. The design of this site was based on an assumed average existing elevation of -8.0 feet. The project designers assumed permissible excavation to elevation -12.0 feet. Grain size distribution of borrow materials was assumed to be 10 percent silty sand and 90 percent silty clay.

Borrow obtained from Lake Salvador would be obtained a minimum distance of 2,000 feet from the lake's shoreline. Existing lake bottom elevations vary. The project designers assumed an existing average lake bottom elevation within the footprint of the borrow site of -8.0 feet. The borrow site, which would occupy approximately 270 acres, would be dredged to an elevation of

-20 feet or shallower. Grain size distribution of borrow materials was assumed to be 10 percent silty sand and 90 percent silty clay. The borrow site design used a 2:1 pit to fill ratio to allow for unknown utilities, anomalies, and cultural sites. If potential long-term environmental impacts are anticipated, dissolved oxygen and rate of infilling would be monitored at the borrow site following construction.

Regardless of the borrow site location, borrow would be excavated using a hydraulic cutter-head dredge and piped to the restoration feature as a slurry. Floating pipeline would be used, which is a dredge discharge pipe positioned on pontoons. This floating pipeline corridor would be 100 feet wide and would be marked on 150 foot centers to prevent boat hazards in the lake and along the bayou. Markers would include lighted and reflective buoys. The corridor would be placed near the banks of the bayou in an effort to minimally impact navigation in Bayou des Allemands. As the pipeline would need to cross the bayou to reach feature DP2, a small segment of submerged pipeline would be installed at the crossing with signage to ensure safe passage of vessels over the line.

Marsh tracked vehicles would move the discharge pipeline within the restoration site when pumping, and maintain the retention dikes as needed for the duration on the dredge fill operation. An adjustable spill box(s) would be placed to drain excess water from the restoration site during the hydraulic fill operation. The estimated construction duration for constructing the retention system and dredge filling the site would be 11 to 14 months.

Once the fill operation is complete, an idle period of approximately one year would allow the hydraulically placed fill time to settle and dewater to the desired final target elevation of +2.0 feet. A second construction contract would be awarded at the end of the idle period to degrade the perimeter dikes. Perimeter dikes would be degraded to an elevation of approximately one foot above the final target elevation of the swamp platform. The amount of dike degradation along the perimeter of the swamp would be determined post construction through monitoring of the site to allow determination of an elevation that provides an appropriate hydroperiod for swamp habitat. The dikes would be degraded with marsh tracked vehicles and barge mounted backhoe. Material removed would be placed in the adjacent open water area outside of the restoration feature. Once the restoration feature has settled to the desired target elevation, it would be planted with native swamp canopy and midstory species. The plantings would be in accordance with the swamp planting guidelines contained in appendix L. The duration for the subsequent construction project for degrading the retention dikes and for the initial plantings would be 6 to 9 months.

It is anticipated that several plants installed at the time of the initial planting would not survive for a year; thus, it was estimated that about 20% of the total number of plants initially installed would need to be re-planted one year after completion of the initial planting. Additional activities that would occur during the project construction phase would include periodic eradication of invasive/nuisance plant species within the mitigation feature as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of monitoring responsibilities to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation feature and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L. It is not anticipated that additional fill would need to be added to the restoration feature during the 50-year period of analysis.

Lake Boeuf Swamp Restoration – EAR Design

This project would involve restoring swamp habitats in existing agricultural lands. It would include four proposed swamp restoration features; LB5A (32.4 acres), LB6 (13.1 acres), LB8 (26.7 acres), and LB9 (90.3 acres), as shown in appendix A. The total acreage of these 4 elements would be approximately 162.5 acres. The proposed project would be located in Lafourche Parish, just north of Bayou Lafourche and immediately west of the town Raceland. The Southern Pacific Railroad, running east/west, divides some of the proposed mitigation features. The Lake Boeuf Wildlife Management Area (WMA) is located a short distance north/northwest from this proposed project site.

Existing available LiDAR data indicates that existing swamp habitats in the general area have elevations ranging from approximately +1.1 feet to +2.0 feet, with many swamp areas typically ranging from elevation +1.3 to +1.5 feet. Thus it was assumed that such elevations would likely be necessary to achieve wetland hydroperiods sufficient to support the swamp forests proposed in the restoration features. Except for feature LB6, existing elevations within the proposed swamp restoration features appear to be higher than desired target elevation range of +1.1 feet to a maximum of +1.8 feet.

Feature LB6 (13 acres) appears to average existing elevation of approximately +1.5 feet, which would not require excavation to meet the desired target grade. Existing topography in feature LB8 (27 acres) slopes downward from elevation +3.5 feet on the south to elevation +1.5 feet to the north. Existing topography in feature LB9 (90 acres) ranges from elevation +3.0 feet to the south, +1.0 feet to the east, and +1.7 feet to the north. Existing grades within feature LB5A also appear to be slightly high on the south and west borders, with elevations ranging from +2.8 feet and sloping to the northeast to +1.5 feet. Given these exiting grades, portions of features LB5A, LB8, and LB9 would need to be degraded (excavated) to establish desired target grades. Feature LB6 would be cleared, grubbed, and graded/tilled as necessary to prepare the feature for planting. Clearing, grubbing, and tilling would also be conducted in the other restoration features in addition to the degrading activities.

Excavation quantity estimates for the features where degrading would be required are as follows: LB5A - 40,000 cubic yards; LB8 – 44,000 cubic yards; LB9 – 53,000 cubic yards. An existing drainage ditch extends east from the Theriot Canal into and along portions of feature

LB8. Spoil dikes along this ditch would be degraded to aid in the distribution of surface water within the feature. Portions of berms (dikes) along the Theriot Canal may also be lowered where this canal borders other mitigation features. The crest elevation of these dikes would be lowered to help water from the canal to flow into adjacent restoration footprints during peak stages. However, the elevation would not be lowered to the degree that the hydroperiod in the restoration features might be adversely affected. For feature LB9, excavation would commence at the base of the existing railroad embankment and proceed north to the intersection with the existing +1.8 contour. Additional hydrologic improvements may be required to achieve an optimal hydroperiod within the feature and improve water interchange.

Excavated soil generated during the process of degrading the restoration features and degrading existing berms would be hauled off-site to a duly licensed disposal facility. All vegetation debris generated during the initial preparation of all the proposed restoration features would be burned on-site within the features themselves. Following completion of the clearing and grading activities, all the proposed swamp features would be planted with native canopy and midstory species in accordance with the swamp planting guidelines contained in appendix L.

Existing dirt/gravel roads run through swamp mitigation features LB5A and LB9. Many of these roads that lead to off-site lands not slated for mitigation would need to be retained within the affected mitigation feature to avoid adversely impacting the accessibility of these off-site parcels. Where possible, these roads would be removed and the resulting debris would be hauled offsite. It is possible that portions of some of these roads could be realigned within a particular mitigation feature if necessary to accommodate a more desirable restoration design. If not, culverts at 500 foot intervals would be installed under the north/south road within the LB5A footprint. It may also be necessary to construct new gravel roads through certain mitigation features in order to provide a means of access to off-site lands. The retention and possible realignment of existing roads within the mitigation features, as well as the need for establishing new roads within the features would be addressed during the PED phase.

It is anticipated that several trees and shrubs installed at the time of initial planting would not survive for a year; thus, it was estimated that about 20% of the total number of plants initially installed would need to be re-planted one year after completion of initial plantings. Additional activities that would occur during the project construction phase following the initial planting event would include periodic eradication of invasive/nuisance plant species within the mitigation features as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of monitoring responsibilities to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation features and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L). Any drainage culverts installed as part of the project would likely need to be replaced once every twenty years.

Plaquemines, Alt. 1 Swamp Restoration – EAR Design

This project would consist of a single mitigation feature, P1, which would occupy approximately 165 acres. This project would involve restoring swamp habitat from existing open water. It would be located in Plaquemines Parish on the flood side of the existing levee system near Jesuit Bend. See appendix A for a depiction of this project.

The project would include a retention dike built along the perimeter of the proposed feature to retain fill necessary to establish an earthen platform for the restored swamp habitat. Earthen retention dikes would be constructed as the first order of work. The retention dike would be approximately 11,300 linear feet in length. The dike would be built to elevation +6.5 feet, with a 5-foot crown and 1V:4H side slopes. The material needed to build these dikes would be excavated from within the footprint of the proposed swamp feature.

An assumed existing bottom elevation of -3.5 feet was used for designing the proposed swamp feature. The total borrow quantity that would be needed to construct the proposed swamp feature is 1,700,000 cubic yards. The fill needed would be excavated from an 80-acre borrow site located in the Mississippi River at approximate river mile 69.0 on the left descending bank. The borrow would be excavated to elevation -70.0 feet using a hydraulic cutter-head dredge. Borrow would be transported to the proposed borrow site via pipeline in slurry. Submerged pipeline would be required to cross the river, and it would be laid on the river bottom so as to not impede navigation. Coordination with the US Coast Guard would be required while all operations in the river are ongoing.

Once the pipeline crosses the river it would run along the ground within a 100 foot wide pipeline access corridor from the river bank to the proposed feature. The current proposed design would utilize the existing Atmos Energy pipeline corridor as the primary access corridor. This 100 ft corridor would be reduced in areas where there are existing structures in order to minimize impacts. The pipeline corridor includes culverts at highway and railroad crossings. All culverts, however, are likely too small to thread the pipeline needed to transport borrow material (sediment) to the mitigation features. A larger 36-inch pipe would be jack-and-bored at each crossing. Jack and bore at the railroad locations would not be located immediately adjacent to the Mississippi River Levee (MRL). Some clearing of vegetation may be required along the corridor. All vegetation debris would be placed in the bottom of the mitigation feature and buried under the fill from the river.

The fill material would be placed to an initial slurry elevation of +3.0 feet. The initial construction duration is estimated to be roughly 7 to 9 months. Once the initial fill operation is complete, an idle period of approximately one year would allow hydraulically placed fill time to settle and dewater to the final target elevation of +1.0. A second construction contract would be awarded at the end of the idle period to degrade dikes to an elevation that would provide an appropriate hydroperiod for the swamp. This degrade elevation would be set to provide an appropriate hydroperiod for the new swamp. Once the fill material has settled to the desired target grade and the retention dikes are degraded, the mitigation feature would be planted with native canopy and midstory species. The plantings would be in accordance with the swamp planting guidelines contained in appendix L. It is estimated that this second phase of construction would require 3 to 4 months to complete.

It is anticipated that several trees and shrubs installed at the time of initial planting would not survive for a year; thus, it was estimated that about 20% of the total number of plants initially installed would need to be re-planted one year after completion of the initial plantings. Additional activities that would occur during the project construction phase would include periodic eradication of invasive/nuisance plant species within the mitigation feature as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of the project to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation feature and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L).

Plaquemines, Alt. 2 Swamp Restoration – EAR Design

This project would consist of a single mitigation feature, P6, which would occupy approximately 155.8 acres. This project would involve restoring swamp habitat from existing open water. It would be located in Plaquemines Parish on the flood side of the existing levee system near Jesuit Bend. See appendix A for a depiction of this project.

The project would include a retention dike built along the perimeter of the proposed feature to retain fill necessary to establish an earthen platform for the restored swamp habitat. Earthen retention dikes would be constructed as the first order of work. The retention dike would be approximately 16,500 linear feet in length. The dike would be built to elevation +6.0 feet, with a 5-foot crown and 1V:4H side slopes. The material needed to build these dikes would be excavated from within the footprint of the proposed swamp feature. The borrow ditch would be offset a minimum of 40 feet from the retention dike to ensure dike integrity.

An assumed existing bottom elevation of -3.5 feet was used for designing the proposed swamp feature. The total borrow quantity that would be needed to construct the proposed swamp feature is 1,500,000 cubic yards. The fill needed would be excavated from an 80-acre borrow site located in the Mississippi River at approximate river mile 69.0 on the left descending bank. Grain size distribution of borrow materials was assumed to be 70 percent fine sand and 30 percent silty clay. Due to moderate clay content in the borrow site, a bulking factor of 40 percent was used in the design. The borrow site would be excavated to elevation -70.0 feet using a hydraulic cutter-head dredge. Borrow would be transported to the proposed borrow site via pipeline in slurry. Submerged pipeline would be required to cross the river, and it would be laid on the river bottom so as to not impede navigation. Coordination with the US Coast Guard would be required while all operations in the river are ongoing.

Once the pipeline crosses the river it would run along the ground within a 100 foot wide pipeline access corridor from the river bank to the proposed feature. The current proposed design would utilize the existing Atmos Energy pipeline corridor as the primary access corridor. This 100 ft corridor would be reduced in areas where there are existing structures in order to minimize impacts. The pipeline corridor includes culverts at highway and railroad crossings. All culverts, however, are likely too small to thread the pipeline needed to transport borrow material (sediment) to the mitigation features. A larger 36-inch pipe would be jack-and-bored at each crossing. Jack and bore at the railroad locations would not be located immediately adjacent to the Mississippi River Levee (MRL). Some clearing of vegetation may be required along the corridor. All vegetation debris would be placed in the bottom of the mitigation feature and buried under the fill from the river.

The fill material would be placed to an initial slurry elevation of +3.0 feet. The initial construction duration is estimated to be roughly 6 to 8 months. Once the initial fill operation is complete, an idle period of approximately one year would allow hydraulically placed fill time to settle and dewater to the final target elevation of +1.0 feet. A second construction contract would be awarded at the end of the idle period to degrade dikes to an elevation that would provide an appropriate hydroperiod for the swamp. This degrade elevation would be set to provide an appropriate hydroperiod for the new swamp. Once the fill material has settled to the desired target grade and the retention dikes are degraded, the mitigation feature would be planted with native canopy and midstory species. The plantings would be in accordance with the swamp planting guidelines contained in appendix L. It is estimated that this second phase of construction would require 3 to 4 months to complete.

It is anticipated that several trees and shrubs installed at the time of initial planting would not survive for a year; thus, it was estimated that about 20% of the total number of plants initially installed would need to be re-planted one year after completion of the initial plantings. Additional activities that would occur during the project construction phase would include periodic eradication of invasive/nuisance plant species within the mitigation feature as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of the project to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation feature and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L).

Salvador-Timken Swamp Restoration – EAR Design

The site established for restoration would be located along the western shore of Lake Cataouatche and south of the Louisiana Cypress Lumber Canal in Saint Charles Parish. The location of the proposed restoration feature is currently an open water area. This project would involve restoring swamp habitat as mitigation for swamp flood side general impacts. The project would be located in a portion of the Salvador-Timken Wildlife Management Area (WMA). The proposed swamp restoration feature is identified in plan as ST1 (see appendix A) and would encompass approximately 170 acres.

An earthen retention dike would first be mechanically constructed along the perimeter of the proposed restoration feature. The retention dike borrow would be obtained from within the restoration footprint. Dikes would be built with a combination of marsh tracked and barge mounted equipment. The length of the dike would be 13,700 linear feet. Due to high clay content expected in the Lake Cataouatche borrow site (see below), a bulking factor of 60 percent will be used in the design of the retention dikes. Additionally, a freeboard of one foot is required on the dike. The dike would be built to an elevation of +7.0 feet, with a five foot crown and 1V:4H side slopes. Initial settlement expected for the dike is assumed to be 30%. The total dike volume would be roughly 243,300 cubic yards.

Feature ST1 would be filled to an initial target elevation (slurry elevation) of +3.0 feet. The assumed existing average elevation of the ST1 footprint is -2.0 feet. The final target elevation of +2.0 feet yields a required earthen lift of 5.0 feet. Assuming one foot of foundation settlement, the total fill quantity required to create the swamp platform would be approximately 1,400,000 cubic yards.

Borrow for earthen fill for the restoration site would be obtained from Lake Cataouatche. Using a hydraulic cutter-head dredge, borrow would be dredged (excavated) from an approximately 200-acre borrow site situated a minimum distance of 2,000 feet from the lake's shoreline. Existing lake bottom elevations vary. The project designer assumed an existing average lake bottom elevation within the footprint of the borrow site of -8.0 feet. The borrow site would be dredged to elevation -20 feet or shallower. Grain size distribution of borrow materials was assumed to be 10 percent silty sand and 90 percent silty clay. The borrow site designs used a 2:1 pit to fill ratio to allow for unknown utilities, anomalies, and cultural sites. If potential long-term environmental impacts are anticipated, dissolved oxygen and rate of infilling would be monitored at the borrow site following construction.

The dredged borrow material (sediment) would be piped to the restoration feature in slurry. The pipeline corridor would be 100 feet wide and about 10,600 long (see appendix A). Floating pipeline would be used, which is a dredge discharge pipe positioned on pontoons. The floating pipeline would be marked on 150 foot centers to prevent navigation hazards in the lake. Markers would include lighted and reflective buoys. The overall pipeline corridor would traverse a short section of wetland near the east boundary of feature ST1. The pipeline corridor here (approximately 1,100 feet long) would be aligned such that it would coincide with an existing canal that bisects the adacjent wetland habitats to minimize wetland impacts. Marsh tracked vehicles would lay, maintain, and remove the pipeline within the canal/wetland corridor. Marsh tracked vehicles would also handle the pipeline and maintain dikes during dredge fill operations within the restoration feature. Adjustable spill boxes would be placed in the ST1 retention dikes to drain excess water from the restoration site during the hydraulic fill operation. The estimated construction duration for constructing the retention system and dredge filling the site is 6 to 9 months.

Once the fill operation is complete, an idle period of approximately one year would allow the hydraulically placed fill time to settle and dewater to the desired final target elevation of +2.0 feet. A second construction contract would be awarded at the end of the idle period to degrade the retention dikes and plant feature ST1. The perimeter dikes would be degraded to an elevation of approximately one foot above the final swamp target elevation in order to establish the desired hydroperiod for the restored swamp habitat. The amount of dike degradation needed would be determined during this second phase of construction through monitoring of swamp water levels and topographic surveys of the completed swamp platform. The dikes would be degraded with a combination of marsh tracked vehicles and barge mounted equipment. Material removed would be used where possible to fill low areas within the restoration area, or placed in the adjacent open water area outside of the restoration feature. After the perimeter dikes have been degraded, the mitigation feature would be planted with native swamp canopy and mid-story species. The plantings would be in accordance with the swamp planting guidelines contained in appendix L. The duration for the construction phase that includes degrading the retention dikes and the initial planting of feature ST1 is 6 to 9 months.

It is anticipated that several plants installed at the time of the initial planting would not survive for a year; thus, it was estimated that about 20% of the total number of plants initially installed would need to be re-planted one year after completion of the initial planting. Additional activities that would occur during the overall project construction phase would include periodic eradication of invasive/nuisance plant species within the mitigation feature as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of monitoring responsibilities to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation feature and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L).

Simoneaux Ponds Swamp Restoration – EAR Design

This project would involve restoring swamp habitat as mitigation for swamp flood side general impacts. The proposed swamp restoration feature is identified as feature SP3 and would occupy approximately 176 acres (see appendix A). The site established for restoration would be located along the northern shore of Bayou Gauche, a small outlet of Bayou des Allemands at Black Prince Island. The site established for restoration is currently an open water area in St. Charles Parish.

Earthen retention dikes would be mechanically constructed along the perimeter of the proposed restoration feature. The retention dike borrow would be obtained from within the restoration footprints. Dikes would be built with marsh tracked equipment. The length of the perimeter dike would be 13,500 linear feet. Due to high clay content expected in the borrow site (see below), a bulking factor of 60 percent was used in the design of the retention dikes. Additionally, a freeboard of one foot is required on the dike. The dike would be built to an elevation of +7.5 feet, with a five foot crown and 1V:4H side slopes. Initial settlement expected for the dike is assumed to be 30%. Total dike volume would be 292,500 cubic yards.

The swamp restoration feature would be filled to an initial target elevation of +3.0 feet. The assumed average existing elevation of the SP3 footprint is -2.5 feet. The initial target elevation would require an earthen lift of 5.5 feet. Assuming one foot of foundation settlement, the total fill quantity required to establish the marsh platform would be approximately 1,600,000 cubic yards.

Once dike construction is completed, the fill material would be dredged from the borrow source with a hydraulic cutter-head dredge and piped to the restoration features in slurry. The borrow site in would be located in Lake Salvador and would be positioned a minimum distance of 2,000 feet from the lake's shoreline. Existing lake bottom elevations vary. The project designer assumed an existing average lake bottom elevation of -8.0 feet within the footprint of the borrow site. This site would be dredged (excavated) to an elevation of -20.0 feet or shallower. Grain size distribution of borrow materials was assumed to be 10 percent silty sand and 90 percent silty clay. The borrow site design used a 2:1 pit to fill ratio to allow for unknown utilities, anomalies, and cultural sites. This site would occupy approximately 220 acres to yield the 4,277,000 cubic yards of borrow required. If potential long-term environmental impacts are anticipated, dissolved oxygen and rate of infilling would be monitored at the borrow site.

The dredged borrow material (sediment) would be piped to the restoration feature in a slurry. The pipeline corridor would be 100 feet wide. The corridor would be placed near the banks of Bayou des Allemands in an effort to minimally impact boat navigation in the bayou. In the segment of the pipeline from the borrow site to the shoreline immediately south of Bayou Gauche Road (LA 306), floating pipeline would be used which is a dredge discharge pipe positioned on pontoons. Floating pipeline would be marked on 150 foot centers to prevent boat hazards in the lake and along the bayou. Markers would include lighted and reflective buoys. The pipeline corridor would include a short land crossing at the entrance from Bayou Gauche to Simoneaux Ponds. The land crossing would be approximately 1,600 linear feet long and the pipeline corridor here would be reduced to a 50 foot width. The land crossing includes a jack-and-bore beneath Bayou Gauche Road. A permanent culvert would be installed beneath the highway and the slurry pipeline would be routed through this culvert. Once through the new highway crossing, the pipeline would continue north on existing land to reach the restoration site. The corridor north of the highway crossing would intercept undeveloped wetland approximately 125 feet from the highway. Marsh tracked vehicles and dozers would handle the pipeline within the land crossing. Marsh tracked vehicles would also move the discharge pipeline within the restoration site when pumping, and maintain the retention dikes as needed for the duration on the dredge fill operation.

The estimated construction duration for constructing the retention system and dredge filling the site is 7 to 10 months. Once the dredge and fill operation required to establish the land platform for the restoration feature is complete, an idle period of approximately one year would allow hydraulically placed fill time to settle and dewater to the desired final target elevation of +2.0 feet. A second construction contract would be awarded at the end of the idle period to degrade the perimeter dikes and plant the restoration feature. Perimeter dikes would be degraded to an elevation roughly 1 foot above the final target elevation of the swamp platform. The dikes would be degraded with marsh tracked vehicles. The amount of dike degradation would be determined post-construction through monitoring of the site in order to establish a dike elevation that provides an appropriate hydroperiod for the restored swamp. Material removed would be used where possible to fill low areas within the restoration area, or placed in the adjacent open water area outside of the restoration feature. After the initial degrading of the perimeter dikes, the mitigation feature would be planted with native canopy and midstory species. The plantings would be in accordance with the swamp planting guidelines contained in appendix L. The duration for the subsequent construction project for degrading the retention dike and planting the feature would be from 6 to 9 months.

It is anticipated that several trees and shrubs installed at the time of initial planting would not survive for a year; thus, it was estimated that about 20% of the total number of plants initially installed would need to be re-planted one year after completion of initial plantings. Additional activities that would occur during the project construction phase would include periodic eradication of invasive/nuisance plant species within the mitigation feature as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of monitoring responsibilities to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation feature and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L).

NON-PARK/404(C) FRESH MARSH FLOOD SIDE IMPACTS

Dufrene Ponds Marsh Restoration – EAR Design

This project would involve restoring fresh marsh habitat as mitigation for fresh marsh flood side general impacts. The sites established for restoration would be located along the right descending bank (RDB) of Bayou des Allemands and immediately south of US Highway 90 in Lafourche Parish. The sites established for restoration are currently open water sites. The proposed marsh restoration features are identified in plan as DP3 (approximately 93.1 acres) and DP5 (approximately 72.6 acres), and would encompass approximately 165.7 acres combined (see appendix A). The two proposed fresh marsh restoration features are divided by a corridor, approximately 200 feet wide, which runs predominately east to west along a curve that splits the mitigation features. This corridor is the proposed alignment of the future expansion of Interstate 49. None of the proposed mitigation features would be within the I-49 corridor.

Earthen retention dikes would be mechanically constructed along the perimeter of the proposed restoration features. The retention dike borrow would be obtained from within the restoration footprints. Dikes would be built with a combination of marsh tracked and barge mounted equipment. The length of the perimeter dike for both elements combined would be 17,500 linear feet. Due to high clay content expected in the borrow site (see below), a bulking factor of 60 percent was used in the design of the retention dikes. This project, however, has two restoration sites with the ability to pump fill into one while letting slurry fill placed in the second site drain. The ability to drain one of the elements while pumping the other resulted in a reduction in the bulking factor needed. A 50% factor was used for this project due to the two elements. Additionally, a freeboard of one foot is required on the dike. The dike would be built to an elevation of +7.0 feet, with a five foot crown and 1V:4H side slopes. Initial settlement expected for the dike is assumed to be 30%. Total dike volume would be 455,000 cubic yards.

The fresh marsh restoration features would be filled to an initial target elevation of +2.5 feet. The assumed average existing elevation of the DP3 and DP5 footprints is -4.0 feet. The initial target elevation would require an earthen lift of 6.5 feet. Assuming one foot of foundation settlement, the total fill quantity required to establish the marsh platforms would be approximately 1,600,000 cubic yards.

Once dike construction is completed, the fill material would be dredged from the borrow source with a hydraulic cutter-head dredge and piped to the restoration features in slurry. The project design includes two options for borrow locations; either Bayou des Allemands or Lake Salvador. Final selection would be made based on the mitigation projects selected to comprise the overall mitigation plan. A borrow site in Lake Salvador (most likely site) would be situated a minimum distance of 2,000 feet from the lake's shoreline. Existing lake bottom elevations vary. The project designer assumed an existing average lake bottom elevation of -8.0 feet within the footprint of the borrow site. This site would be dredged (excavated) to an elevation of -20.0 feet or shallower. Grain size distribution of borrow materials was assumed to be 10 percent silty sand and 90 percent silty clay. The borrow site design used a 2:1 pit to fill ratio to allow for unknown utilities, anomalies, and cultural sites. If potential long-term environmental impacts are anticipated, dissolved oxygen and rate of infilling would be monitored at the borrow site.

Regardless of the borrow site location, the dredged borrow material (sediment) would be piped to the restoration features in a slurry. The pipeline corridor would be 100 feet wide. The corridor would be placed near the banks of Bayou des Allemands in an effort to minimally impact boat navigation in the bayou. Floating pipeline would be used which is a dredge discharge pipe positioned on pontoons. Floating pipeline would be marked on 150 foot centers to prevent boat hazards in the lake and along the bayou. Markers would include lighted and reflective buoys. As the pipeline would need to cross the bayou, a small segment of submerged pipeline would be installed at the crossing with signage to ensure safe passage over the line. Marsh tracked vehicles would move the discharge line in the restoration site when pumping and maintain the retention dikes as needed for the duration on the dredge fill operation. An adjustable spill box(s) would be placed to drain excess water from the restoration site during the hydraulic fill operation. The estimated construction duration for constructing the retention system and dredge filling the site would be 9 to 12 months.

Once the dredge and fill operation required to establish the land platforms for the restoration features is complete, an idle period of approximately one year would allow hydraulically placed fill time to settle and dewater to the desired final target elevation of +1.5 feet. A second construction contract would be awarded at the end of the idle period to degrade the perimeter dikes and install dike armoring. Perimeter dikes would be degraded to equal the final target elevation of the fresh marsh platforms. The dikes would be degraded with marsh tracked vehicles and barge mounted backhoe. Material removed would be used where possible to fill low areas within the restoration area, or placed in the adjacent open water area outside of the restoration features. The open water face of the retention dike along the eastern boundary of feature DP5 would be armored adjacent to Bayou des Allemands with a two foot blanket of stone. The stone would be a well graded riprap with a proposed top size stone of 650 pounds. The armoring would include a two foot lift of stone on a separator geotextile. The armoring would not exceed the final target elevation of the proposed marsh feature.

Feature DP3 would be located adjacent to an existing spoil berm running along the eastern side of DP3. Gaps would be excavated in this spoil berm to allow aquatic organisms to access marsh DP3 from marsh and open water habitats situated east of the berm. These gaps would have a bottom elevation of 0.0 feet, would be roughly 100 feet wide, and would be spaced every 500 feet along the eastern edge of DP3. In addition, this phase of project construction would include excavating trenasses or similar shallow water depressions within the two marsh restoration features to create areas of shallow water interspersion. Mitigation activities in restoration features slated for fresh marsh restoration would not include planting native vegetation. The duration of this construction phase (degrading and armoring dikes, excavating gaps, installation of armoring) would last roughly 2 to 3 months.

Additional activities that would occur during the project construction phase would include periodic eradication of invasive/nuisance plant species within the mitigation feature as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of the monitoring responsibilities to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation feature and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L). It is not anticipated that additional fill would need to be added to the restoration features during the 50-year period of analysis.

Jean Lafitte Marsh Restoration – EAR Design

This mitigation project would involve restoring fresh marsh habitats from open water (see appendix A). There are two proposed marsh restoration features; JL1B2 (approximately 102.7 acres) and JL4B (approximately 11.3 acres). These features would be located in Jefferson Parish and within the Park. Restoration work would involve establishing a land platform for the new marsh habitats proposed.

Feature JL1B2 would be located in Yankee Pond. It was assumed that total perimeter retention would be required to retain dredge material and allow for vertical accretion. Approximately 8,680 linear feet of retention dike would be required. It is anticipated that the borrow source proposed would contain approximately 10 percent sand. Retention dikes would be constructed to maintain a minimum of one foot of freeboard during dredging operations. The retention dikes would be constructed to elevation +5.0 feet, with a 5-foot crown to assure dike integrity. Borrow for these retention dikes would come from within the marsh creation footprint. The borrow ditch would be offset a minimum of 40 feet from the dike to assure dike stability. The initial target marsh elevation would be +2.5 feet with the final target elevation being +1.5 feet. For initial quantity estimates, the dikes were assumed to have 1 vertical on 4 horizontal side slopes. The retention dike abutting Bayou Segnette would be constructed with a 2-foot stone cap to elevation +3.0 feet on the eastern face adjacent to Bayou Segnette during the second construction phase. Armoring proposed is a top sized stone of 650 pounds. Spill boxes or weirs would be constructed along the western boundary of the site within the retention dike to allow for effluent water release from within the marsh creation area and potentially nourish the adjacent existing marsh. If deemed necessary by the construction contractor, a low level interior weir could be constructed to assist in vertical stacking of dredged material.

Marsh restoration would require 650,000 cubic yards of material hydraulically dredged from Bayou Segnette and pumped via pipeline to the JL1B2 marsh restoration feature. A pipeline corridor (100 feet wide) from the borrow site to the marsh feature running along the bank of the Bayou Segnette Waterway (BSWW) would be required. The pipeline would be marked at 150 ft intervals for the entire length of the pipeline with Coast Guard approved fluorescent orange buoys. The borrow site within the BSSW would be an estimated 8.3 miles long and 80 feet in width, occupying roughly 80 acres. The BSWW is currently a federally authorized navigation channel. Current project maintenance uses an 80 foot bottom width at approximate elevation -6.0 feet. The BSWW project is authorized to a 60 foot bottom width at approximate elevation -9.0 feet. The designers used a mean bottom elevation of -4.0 feet. Grain size distribution of borrow materials was assumed to be 10 percent silty sand and 90 percent silty clay. Due to high clay content in the borrow site, a bulking factor of 60 percent was used in the design of the retention dikes.

It is estimated that the initial project construction activities discussed above would require approximately 6 to 8 months to complete. Once these activities are completed there would be an idle period of approximately 1 year to allow the marsh feature to settle to the desired final target elevation of approximately 1.5 feet.

The final construction phase would begin following settlement and dewatering of the created marsh platform. Dikes along the north and west boundaries of the restoration feature would be degraded to match the final target elevation of the marsh itself. The armored dike segment would have the armoring (rip rap) installed at this stage and would remain in place. The material degraded from the dikes would be placed into the original borrow ditch with a marsh buggy. In conjunction with this dike degrading effort, trenasses would be established within feature JL1B2. In conjunction with this dike degrading effort, trenasses would be constructed as necessary to serve as tidal creeks to facilitate water exchange and create shallow water interspersion features. The trenasses would be rutted to a lower than marsh elevation by performing two passes of a marsh buggy along the desired alignment. The acceptable trenasse width, if constructed in this fashion, would be the width of marsh buggy. If the resulting depression is not adequate for minimal water flow, the marsh equipment can excavate material along the proposed alignment, not to exceed a 5-foot bottom width by 1-foot deep channel. Fish dips (essentially armored gaps) would be created within the armored dike segment to allow water exchange and provide aquatic organisms access to feature JL1B2. Each fish dip would have a bottom width of 50 feet, a bottom elevation no greater than 0 feet, and 1V:3H side slopes. At this design phase, it was assumed there would be one fish dip established for every 1,000 linear feet of armored dike (e.g. 1,000-foot spacing. The marsh feature would not be planted, since it was assumed that native herbaceous marsh plants would rapidly colonize the marsh naturally. It was assumed that appropriate fresh marsh plant species would naturally colonize the marsh restoration feature; hence, no planting of the feature is proposed. Completion of this second phase of project construction would require about 4 to 5 months.

Feature JL4B would be located along the shoreline of Lake Salvador (see appendix A), and would include construction of a foreshore rock dike along the western boundary of feature JL4B with the restored marsh habitat situated behind (east of) this armored protection.

The design of the proposed shoreline protection (foreshore rock dike) was based on building the rock dike along the existing -1.0 foot elevation contour within the lake. Existing survey cross-sections along Lake Salvador were used to estimate the contours for the shoreline reach. Approximately 4,800 linear feet of foreshore dike would be required and approximately 5,650 linear feet of retention dikes would also be constructed along the eastern side of feature JL4B to contain the borrow (fill)material that would be installed behind the rock dike.

The foreshore dike would be constructed with a 650-lb stone to elevation +4.0 feet. It would have a 4-foot crown to assure dike integrity and 1V:2H side slopes. The retention dikes would be constructed to maintain a minimum of one foot of freeboard during dredging operations. The retention dikes would be constructed to elevation +4.5 feet, with a 5-foot crown to assure dike integrity and 1V:4H side slopes. Borrow for these retention dikes would come from within the marsh restoration footprint. The borrow ditch would be offset a minimum of 40 feet from the dikes to assure dike stability. For initial quantity estimates, the dikes were assumed to have 1 vertical on 4 horizontal side slopes. Weirs would be constructed at pre-determined locations within the retention dike to allow for effluent water release from within the marsh restoration area.

Borrow material (sediment) needed to construct the marsh platform would be obtained from a 6-acre borrow site in Lake Salvador. The borrow would be obtained a minimum distance of 2000 feet from the lake's shoreline mechanical dredge (bucket dredge). Approximately 60,000 cys of material would be dredged. Existing lake bottom elevations vary. Until surveys are taken during the PED phase, the designers assumed an existing lake bottom elevation of -8.0 feet. Maximum excavation in the borrow site would be to elevation -20 feet. Grain size distribution of borrow materials was assumed to be 10 percent silty sand and 90 percent silty clay. Due to high clay content in the borrow site, a bulking factor of 60 percent was used in the design of the retention dikes. The dredged material would be placed on a barge for transport to the restoration feature. It would then be placed in the marsh feature using barge-mounted dragline. The initial target marsh elevation would be roughly +3.5 feet. During the fill process, marsh tracked vehicles positioned in the marsh would spread the borrow material uniformly throughout feature JL4B. It is estimated that the initial project construction activities discussed above would require approximately 4 to 5 months.

Once these activities are completed there would be an idle period of approximately 9 to 12 months to allow the marsh feature to settle to the desired final target elevation of approximately +1.5 feet. The final construction phase would begin following settlement and dewatering of the created marsh platform.

The earthen retention dikes would be degraded with a marsh buggy such that the crest of the dikes would be the same as the final target elevation of the marsh platform. Sediment generated during the dike degrading process would be placed back into the depression left from the original borrow ditch within the restoration feature, or placed in Lake Salvador just west of the foreshore rock dike. The rock dike would not be degraded and is anticipated to settle to a long-term crest elevation of 3.5 feet. "Fish dips" (essentially armored gaps) would be constructed in the foreshore rock dike. The fish dips would allow water exchange and provide aquatic organisms access to the marsh feature. Each fish dip would have a bottom width of approximately 50 feet, a bottom elevation no greater than 0 feet, and 1V:3H side slopes. At this phase of design, it was assumed that there would be one fish dip established for every 1,000 feet of dike (i.e. 1,000-foot spacing). It was assumed that appropriate fresh marsh plant species would naturally colonize the marsh restoration feature; hence, no planting of the feature is proposed. It is anticipated that the final phase of construction activities (degrading dikes, constructing fish dips) would require approximately 3 to 4 months.

Additional activities that would occur during the project construction phase for both features JL1B2 and JL4B would include periodic eradication of invasive/nuisance plant species within the mitigation feature as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of monitoring responsibilities to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation feature and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L). The foreshore rock dike of JL4B and the armored dike of JL1B2 should be maintained but the cost estimate and WVA models assumed these dikes would not be maintained.

Plaquemines, Alt. 1 Marsh Restoration – EAR Design

This project consists of a single mitigation feature, P2, which would occupy approximately 205 acres. This project would involve restoring fresh marsh habitat from existing open water. This would be accomplished by creating a land platform in the open water area to support marsh habitat. The project would be located in Plaquemines Parish near Jesuit Bend. See appendix A for a depiction of this project.

Retention dikes would first be built along the entire perimeter of the proposed feature to retain marsh fill. The retention dike would be approximately 12,400 linear feet in length. The dikes would be built to elevation + 6.1 feet. Dikes would be constructed with a 5-foot crown and 1V:4H side slopes. The material needed to build these dikes would be excavated from within the footprint of the proposed marsh feature. The borrow ditch would be offset a minimum of 40 ft from the dike to assure dike stability. An assumed existing bottom elevation of -4.0 feet was used for the design of the proposed marsh feature.

The borrow quantity that would be needed to construct the proposed marsh feature is 2,300,000 cubic yards. The fill needed would be excavated from an 80-acre borrow site located at approximate river mile 69.0 on the left descending bank of the Mississippi River, using a hydraulic cutter-head dredge. The borrow would be excavated to elevation -70.0 feet in the River. Borrow would be transported to the proposed borrow site via pipeline in slurry. Submerged pipeline would be required to cross the river and would be laid on the river bottom as to not impede navigation. Coordination with the US Coast Guard would also be required while all operations in the River are ongoing. Once the pipeline crosses the River it would run along the ground within a 100 foot wide pipeline access corridor from the river bank to the proposed feature.

The current proposed design would utilize the existing Atmos Energy pipeline corridor as the primary access corridor. This width of this 100 ft corridor would be reduced in areas where there are existing structures in order to minimize impacts. The pipeline corridor includes existing culverts at highway and railroad crossings. All culverts, however, are likely too small to thread the pipeline needed to transport borrow material (sediment) to the mitigation features. A larger 36-inch pipe would be jack-and-bored at each crossing. Jack and bore at the railroad locations would not be located immediately adjacent to the Mississippi River Levee (MRL). Some clearing of vegetation and debris maybe required along the corridor. All vegetation would be placed in the bottom of the mitigation feature and buried under the fill from the River.

The fill material would be placed to an initial slurry elevation of +3.5 feet. The initial construction phase would require approximately 7 to 9 months. Once the initial fill operation is complete, an idle period of approximately one year would allow the hydraulically placed fill time to settle and dewater to the final target elevation of +1.5. A second construction contract would be awarded at the end of the idle period to degrade dikes that are adjacent to open water. These dike segments would be degraded to match the elevation of the constructed marsh platform. The dikes along the western boundary of feature P2 would also be degraded and the existing spoil berm adjacent to the boundary would be gapped. This second phase of construction would require roughly 3 to 4 months. It was assumed that appropriate fresh marsh plant species would naturally colonize the marsh restoration feature; hence, no planting of the feature is proposed.

Additional activities that would occur during the overall project construction phase would include periodic eradication of invasive/nuisance plant species within the mitigation feature as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of the project to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation feature and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L).

Salvador-Timken Marsh Restoration – EAR Design

The site established for restoration would be located along the western shore of Lake Cataouatche and south of the Louisiana Cypress Lumber Canal in Saint Charles Parish. The location of the proposed restoration feature is currently an open water area. This project would involve restoring fresh marsh habitat as mitigation for fresh marsh flood side general impacts. The project would be located in a portion of the Salvador-Timken Wildlife Management Area (WMA). The fresh marsh restoration feature is identified in plan as ST2 (see appendix A) and would encompass approximately 190 acres.

An earthen retention dike would first be mechanically constructed along the perimeter of the proposed restoration feature. The retention dike borrow would be obtained from within the restoration footprint. Dikes would be built with a combination of marsh tracked and barge mounted equipment. The length of the dike would be 13,500 linear feet. Due to high clay content expected in the Lake Cataouatche borrow site (see below), a bulking factor of 60 percent will be used in the design of the retention dikes. Additionally, a freeboard of one foot is required on the dike. The dike would be built to an elevation of +7.0 feet, with a five foot crown and 1V:4H side slopes. Initial settlement expected for the dike is assumed to be 30%. The total dike volume would be roughly 292,500 cubic yards.

Feature ST2 would be filled to an initial target elevation (slurry elevation) of +2.5 feet. The assumed existing average elevation of the ST2 footprint is -3.0 feet. The final target elevation of +1.5 feet yields a required earthen lift of 5.5 feet. Assuming one foot of foundation settlement, the total fill quantity required to create the marsh platform would be approximately 1,700,000 cubic yards.

Borrow for earthen fill for the restoration site would be obtained from Lake Cataouatche. Using a hydraulic cutter-head dredge, borrow would be dredged (excavated) from an approximately 240-acre borrow site situated a minimum distance of 2,000 feet from the lake's shoreline. Existing lake bottom elevations vary. The project designer assumed an existing average lake bottom elevation within the footprint of the borrow site of -8.0 feet. The borrow site would be dredged to elevation -20 feet or shallower. Grain size distribution of borrow materials was assumed to be 10 percent silty sand and 90 percent silty clay. The borrow site designs used a 2:1 pit to fill ratio to allow for unknown utilities, anomalies, and cultural sites. If potential long-term environmental impacts are anticipated, dissolved oxygen and rate of infilling would be monitored at the borrow site following construction.

The dredged borrow material (sediment) would be piped to the restoration feature in slurry. The pipeline corridor would be 100 feet wide and about 7,400 long (see appendix A). Floating pipeline would be used, which is a dredge discharge pipe positioned on pontoons. The floating pipeline would be marked on 150 foot centers to prevent navigation hazards in the lake. Markers would include lighted and reflective buoys. Marsh tracked vehicles would handle the pipeline and maintain dikes during dredge fill operations within the restoration feature. An adjustable spill box(s) would be placed to drain excess water from the restoration site during the hydraulic fill operation. The estimated construction duration for constructing the retention system and dredge filling the site is 7 to 10 months.

Once the fill operation is complete, an idle period of approximately one year would allow the hydraulically placed fill time to settle and dewater to the desired final target elevation of 1.5 feet. A second construction contract would be awarded at the end of the idle period to degrade the retention dikes and construct a trenasse. The perimeter retention dikes would be completely degraded to match the final target grade elevation of the marsh platform. A trenasse would be constructed during this construction phase. The trenasse would be sinuous in alignment, with branches to connect tidal pools that form during the dewatering period. There is an existing canal extending southward from the Louisiana Cypress Lumber Canal to the open water area that would contain feature ST2. The constructed trenasse would connect with this branch canal where it intersects the north perimeter of feature ST2. The trenasse would be excavated to an approximate elevation of 0.0 feet. The bottom width would be approximately six feet. Materials excavated from the trenasse and the material degraded from the northern retention dike would be cast into adjacent low areas within the feature footprint. Trenasse construction and north retention dikes would be performed with a marsh tracked backhoe. Material degraded from the south dike would be placed in the adjacent open water outside of the feature footprint. The south dike would be degraded with a combination of marsh tracked vehicles and barge mounted excavators.

The proposed fresh marsh restoration would not include planting native marsh vegetation, since it is anticipated that sufficient herbaceous marsh vegetation would rapidly colonize feature ST2 naturally. If the feature does not vegetate naturally, the area would be planted to meet mitigation success requirements. The duration for the construction phase for degrading the retention dikes and constructing the trenasse would be 3 to 6 months.

Additional activities that would occur during the overall project construction phase would include periodic eradication of invasive/nuisance plant species within the mitigation feature as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of monitoring responsibilities to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation feature and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L).

Simoneaux Ponds Marsh Restoration – EAR Design

This project would involve restoring fresh marsh habitat as mitigation for fresh marsh flood side general impacts. The proposed fresh marsh restoration feature is identified as feature SP2 and would occupy approximately 178 acres (see appendix A). The site established for restoration would be located along the northern shore of Bayou Gauche, a small outlet of Bayou des Allemands at Black Prince Island. The site established for restoration is currently an open water area in St. Charles Parish.

Earthen retention dikes would be mechanically constructed along the perimeter of the proposed restoration feature. The retention dike borrow would be obtained from within the restoration footprints. Dikes would be built with marsh tracked equipment. The length of the perimeter dike would be 13,500 linear feet. Due to high clay content expected in the borrow site (see below), a bulking factor of 60 percent was used in the design of the retention dikes.

Additionally, a freeboard of one foot is required on the dike. The dike would be built to an elevation of +6.5 feet, with a five foot crown and 1V:4H side slopes. Initial settlement expected for the dike is assumed to be 30%. Total dike volume would be 244,000 cubic yards.

The fresh marsh restoration feature would be filled to an initial target elevation of +2.5 feet. The assumed average existing elevation of the SP2 footprint is -2.5 feet. The initial target elevation would require an earthen lift of 5 feet. Assuming one foot of foundation settlement, the total fill quantity required to establish the marsh platform would be approximately 1,500,000 cubic yards.

Once dike construction is completed, the fill material would be dredged from the borrow source with a hydraulic cutter-head dredge and piped to the restoration features in slurry. The project design includes two options for borrow locations; either Petit Lac des Allemands or Lake Salvador. Final selection would be made based on the mitigation projects selected to comprise the overall mitigation plan. A borrow site in Lake Salvador (most likely site) would be obtained a minimum distance of 2,000 feet from the lake's shoreline. Existing lake bottom elevations vary. The project designer assumed an existing average lake bottom elevation of -8.0 feet within the footprint of the borrow site. This site would be dredged (excavated) to an elevation of -20.0 feet or shallower. Grain size distribution of borrow materials was assumed to be 10 percent silty sand and 90 percent silty clay. The borrow site design used a 2:1 pit to fill ratio to allow for unknown utilities, anomalies, and cultural sites. This site would occupy approximately 210 acres. If potential long-term environmental impacts are anticipated, dissolved oxygen and rate of infilling would be monitored at the borrow site.

A borrow site located in Petit Lac des Allemands would require a stability analysis to determine the final lake shoreline offset and depth of dredging. Additional concern for use of this site is its scenic river designation. Project designers assumed the existing average bottom elevation of Petit Lac des Allemands is -8.0 feet. The designers assumed permissible excavation to elevation -12.0 feet. Grain size distribution of borrow materials was assumed to be 10 percent silty sand and 90 percent silty clay. Given these assumptions, the Petit Lac des Allemands borrow site would occupy roughly 482 acres.

Regardless of the borrow site location, the dredged borrow material (sediment) would be piped to the restoration feature in a slurry. The pipeline corridor would be 100 feet wide. The corridor would be placed near the banks of Bayou des Allemands in an effort to minimally impact boat navigation in the bayou. In the segment of the pipeline from the borrow site to the shoreline immediately south of Bayou Gauche Road (LA 306), floating pipeline would be used which is a dredge discharge pipe positioned on pontoons. Floating pipeline would be marked on 150 foot centers to prevent boat hazards in the lake and along the bayou. Markers would include lighted and reflective buoys. The pipeline corridor would include a short land crossing at the entrance from Bayou Gauche to Simoneaux Ponds. The land crossing would be approximately 1,600 linear feet long and the pipeline corridor here would be to a 50 foot width. The land crossing includes a jack-and-bore beneath Bayou Gauche Road. A permanent culvert would be installed beneath the highway and the slurry pipeline would be routed through this culvert. Once through the new highway crossing, the pipeline would continue north on existing land to reach the restoration site. The corridor north of the highway crossing would intercept undeveloped wetland approximately 125 feet from the highway. Marsh tracked vehicles and dozers would handle the pipeline within the land crossing. Marsh tracked vehicles would also move the discharge pipeline within the restoration site when pumping, and maintain the retention dikes as needed for the duration on the dredge fill operation.

The estimated construction duration for constructing the retention system and dredge filling the site is 6 to 9 months. Once the dredge and fill operation required to establish the land platforms for the restoration features is complete, an idle period of approximately one year would allow hydraulically placed fill time to settle and dewater to the desired final target elevation of +1.5 feet. A second construction contract would be awarded at the end of the idle period to degrade the perimeter dikes. Perimeter dikes would be degraded to equal the final target elevation of the fresh marsh platform. The dikes would be degraded with marsh tracked vehicles. Material removed would be used where possible to fill low areas within the restoration area, or placed in the adjacent open water area outside of the restoration feature. A trenasse would be excavated on a sinuous alignment within feature SP2. The alignment would be set to connect tidal pools that form during the year of settlement and dewatering. The trenasse would be cut to an elevation 0.0 feet with a six foot bottom width. Material excavated from the trenasse would be cast into adjacent low areas within the feature footprint. Mitigation activities would not include planting the marsh with native herbaceous species. The duration for the subsequent construction project for degrading the retention dike and construction the trenasse would be from 4 to 6 months.

Additional activities that would occur during the project construction phase would include periodic eradication of invasive/nuisance plant species within the mitigation feature as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of monitoring responsibilities to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation feature and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L).

PARK/404(C) BLH-WET IMPACTS

Jean Lafitte BLH-Wet Restoration – EAR Design

This project would involve restoring BLH-Wet habitats from existing open water areas. The three BLH-Wet restoration features would include JL12 (16.8 acres), JL13 (20.6 acres), and JL14 (16.8 acres). These features would encompass a total of approximately 54 acres. Refer to appendix A for a depiction of these features. All features would be located in Jefferson Parish and within the boundaries of the Park.

The mitigation features would serve as compensation for WBV HSDRRS impacts to BLH-Wet habitats within the boundaries of JLNHPP and within the Bayou aux Carpes 404(c) area. The design of these features was coordinated with staff from the National Park Service (NPS) and the US Environmental Protection Agency (EPA). Coordination with these agencies would continue during the Preconstruction Engineering & Design (PED) phase, wherein the design would be further refined. One should note that approval of the design by both the NPS and the EPA is required. These approvals would be sought during the PED phase.

This project would require filling three existing borrow pits. It was assumed that the existing bottom elevation of the pits is -20.0 feet. These pits would first be filled with 20 feet of sand to elevation 0.0. A clay cap will be placed to the initial target elevation of +3.5 on top of the sand fill. It is anticipated that it would take approximately one year for the fill materials to settle to the desired final target grade of elevation +2.0 feet. Clearing of vegetation and debris from within the pits, and trimming of overhanging trees along the edges of the mitigation features would be required prior to placement of fill.

The proposed features would require approximately 2,200,000 cubic yards of sand and 385,000 cubic yards of clay hauled from contractor furnished and/or government furnished borrow pits. The borrow would be obtained from such off-site borrow pits. Specific borrow pits have not been established for the 35% designs and cost estimates. Both sand and clay borrow pits would be needed for proposed mitigation features. The included costs assumed a 20 mile, one-way, haul distance for clay fill and a 40-mile one-way haul distance for sand fill. A detailed list and location of borrow sources will be developed during PED phase.

Construction equipment, including dump trucks, would access the project site via an access roadway along an existing levee access roadway situated about 0.3 miles south of Tusa Drive off Barataria Blvd. After reaching the levee, construction equipment would follow the West Bank Hurricane Protection Levee west to JL14 and/or south to JL12 and JL13. A temporary road would be required along the floodside berm of the levee.

The initial construction phase would require an estimated 3 years. There would then be an estimated period of 9 months to a year to allow the fill material to settle to the final target elevation of +2.0 feet. Once the mitigation features have settled to the desired target grade, each feature would be planted with native canopy and midstory species. The plantings would be in accordance with the BLH-Wet planting guidelines contained in appendix L.

It is anticipated that several trees and shrubs installed at the time of initial planting would not survive for a year; thus, it was estimated that about 20% of the total number of plants initially installed would need to be planted one year after completion of initial plantings. Additional activities that would occur during the project construction phase would include periodic eradication of invasive/nuisance plant species within the mitigation features as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of the project to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation features and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L).

PARK/404(C) SWAMP IMPACTS

Jean Lafitte Swamp Restoration – EAR Design

This project would entail the restoration of swamp habitats as mitigation for Park/404c swamp impacts (see appendix A). The six swamp restoration features proposed would include JL5 (approximately 22.6 acres), JL6 (approximately 10.5 acres), JL7 (approximately 29.8 acres), JL8 (approximately 5.5 acres), JL9 (approximately 4.4 acres), and JL10 (approximately 4.5 acres). Combined, these features would encompass a total of roughly 77 acres. All the mitigation features would be located in Jefferson Parish and within the boundaries of the Park. Restoration features JL8, JL9, and JL10 would also be located within the 404c area.

The proposed mitigation features encompass existing open water areas including: segments of man-made canals (all of feature JL5 except far eastern end; linear central portion of feature JL7, excluding far east end), and; borrow pits (far eastern end of feature JL5; all of feature JL6; northeastern end and southeastern end of feature JL7). It was assumed that the existing bottom elevation of the cited canals is -8.0 feet and that the existing bottom elevation of the borrow pits is -20.0 feet. The canal portions would be filled with approximately 8 feet of sand to elevation 0.0 feet and the borrow pits would be filled with about 20 feet of sand to elevation 0.0 feet. A clay cap to elevation +3.5 feet would then be placed on top of the sand fill for all features. Clearing of vegetation and debris from within the canals, and trimming of overhanging trees along the edges of the mitigation feature would be required prior to placement of fill.

For features JL5, JL6, and JL7, borrow would be obtained from off-site borrow pits. Specific government and/or commercial borrow pits have not been established for the 35% designs and cost estimates. Both sand and clay borrow pits would be needed for proposed mitigation features. The included costs assumed a 20 mile, one-way, haul distance for clay fill and a 40-mile one-way haul distance for sand fill. A detailed list and location of borrow sources would be developed during PED phase.

Following settlement of the fill to the desired target grade (elevation +1.5 feet), existing spoil berms along the canal segment portion the features would be gapped (degraded to mimic adjacent natural grade) to improve exchange of surface water between the restored swamp and adjacent swamp habitats. Truck access to haul and place the fill material would be via Barataria Blvd. and Lapalco Blvd. A haul road would be required for access along the adjacent West Bank Hurricane Protection levee.

The proposed mitigation features also encompass other existing open water areas including: segments of man-made canals (all of feature JL10), and; isolated "keyhole" canals (all of features JL8 and JL9) It was assumed the bottom elevation of these canals is -8.0 feet. These three features would be filled with approximately 12 feet of dredged material to an initial target elevation of +4.0 feet. Clearing of vegetation and debris from within the canals, and trimming of overhanging trees along the edges of the mitigation feature would be required prior to placement of fill. Following settlement of this fill to the desired final target grade (elevation +2.0 feet), the existing spoil berms along the canals would be gapped to improve exchange of surface water between the restored swamp and adjacent swamp habitats.

Features JL8, JL9, and JL10 would require approximately 175,000 cubic yards of material mechanically bucket dredged from the Gulf Intracoastal Waterway (GIWW). The narrow canals limit the ability to place the material hydraulically. The GIWW is currently a federally authorized navigation channel. Current maintenance uses a 125 feet bottom width at an approximate elevation of -12.0 feet NAVD88. The GIWW project is authorized to a full 150 feet bottom width at an approximate elevation -16.0 feet NAVD88. The designers used a mean bottom elevation of -15.0 feet. Borrow would be obtained between approximate Mile 13.0 to Mile 15.0. Grain size distribution of borrow materials was assumed to be 10 percent silty sand and 90 percent silty clay. Due to high clay content in the borrow site, a bulking factor of 60 percent was used in the design of the retention dikes.

Once the mitigation features have settled to the desired target grade, each feature would be planted with native canopy and midstory species. The plantings would be in accordance with the swamp planting guidelines contained in appendix L It is anticipated that several trees and shrubs installed at the time of initial planting would not survive for a year; thus, it was estimated that about 20% of the total number of plants initially installed would need to be planted one year after completion of initial plantings. Additional activities that would occur during the project construction phase would include periodic eradication of invasive/nuisance plant species within the mitigation features as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of the project to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation features and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L).

The proposed mitigation features would serve as compensation for WBV HSDRRS impacts to swamp habitats within the boundaries of JLNHPP and within the Bayou aux Carpes 404(c) area.

The design of these features was coordinated with staff from the NPS and the EPA. Coordination with these agencies would continue during the PED phase, wherein the design would be further refined. One should note that approval of the design by both the NPS and the EPA is required. These approvals would be sought during the PED phase.

PARK/404(C) MARSH IMPACTS

Jean Lafitte Marsh Restoration – EAR Design

This mitigation project would involve restoring fresh marsh habitat from open water. The single proposed marsh restoration feature, JL1B1, would encompass approximately 14.5 acres, and would be located in Jefferson Parish within the Park (see appendix A). Restoration work would involve establishing a land platform for the new marsh habitat proposed.

It was assumed that total perimeter retention would be required to retain dredge material and allow for vertical accretion. Approximately 3,675 linear feet of retention dike would be required. It is anticipated that the borrow source proposed would contain approximately 10 percent sand. The initial target marsh elevation (initial slurry elevation) would be +2.5 feet with the desired final target elevation being +1.5 feet. Retention dikes would be constructed to maintain a minimum of one foot of freeboard during dredging operations. The retention dikes would be constructed to elevation +5.0 feet using a marsh buggy. These dikes would have a 5-foot crown to assure dike integrity. Borrow for these retention dikes would come from within the marsh restoration footprint. The borrow ditch would be offset a minimum of 40 feet from the dike to assure dike stability. For initial quantity estimates, the dikes were assumed to have 1 vertical on 4 horizontal side slopes. The retention dike abutting Bayou Segnette, approximately 2,000 linear feet along the southeast perimeter of feature JL1B1, would be constructed with a 2-foot stone cap to elevation +3.0 feet on the eastern face adjacent to Bayou Segnette. Armoring proposed is a top sized stone of 650 pounds. Stone would be well graded riprap. A low level weir would be constructed in the northwest corner of the site to allow for effluent water release from within the marsh restoration area and potentially nourish the adjacent existing marsh through the existing canal. If deemed necessary by the construction contractor, a low level interior weir could be constructed to assist in vertical stacking of dredged material.

Marsh creation would require approximately 100,000 cubic yards of material hydraulically dredged from Bayou Segnette and pumped via pipeline to feature JL1B1. A pipeline corridor (100 feet wide) from the 12-acre borrow site to the marsh feature running along the bank of the BSWW would be required. The pipeline would be marked at 150 ft intervals for the entire length of the pipeline with Coast Guard approved fluorescent orange buoys. The Bayou Segnette Waterway (BSWW) is currently a federally authorized navigation channel. Current project maintenance uses an 80 foot bottom width at approximate elevation - 6.0 feet. The BSWW project is authorized to a 60 foot bottom width at approximate elevation -9.0 feet. The project designers used a mean bottom elevation of -4.0 feet. Grain size distribution of borrow materials was assumed to be 10 percent silty sand and 90 percent silty clay. Due to high clay content in the borrow site, a bulking factor of 60 percent was used in the design of the retention dikes.

It is estimated that the initial project construction activities discussed above would require approximately 3 to 4 months to complete. Once these activities are completed there would be an idle period of approximately 1 year to allow the marsh feature to settle to the desired final target elevation of approximately 1.5 feet.

The final construction phase would begin following settlement and dewatering of the created marsh platform. Dikes along the north and west boundaries of the restoration feature would be degraded to match the final target elevation of the marsh itself. The armored dike segment would have the armoring (rip rap) installed at this stage and would remain in place. The material degraded from the dikes would be placed into the original borrow ditch with a marsh buggy. In conjunction with this dike degrading effort, trenasses would be established within feature JL1B1. The trenasses would be rutted to a lower than marsh elevation by performing two passes of a marsh buggy along the desired alignment. The acceptable trenasse width, if constructed in this fashion, would be the width of marsh buggy. It was assumed that appropriate fresh marsh plant species would naturally colonize the marsh restoration feature; hence, no planting of the feature is proposed. Completion of this second phase of project construction would require about 3 to 4 months.

Additional activities that would occur during the project construction phase would include periodic eradication of invasive/nuisance plant species within the mitigation feature as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of monitoring responsibilities to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation feature and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L). The armored dike should be maintained but the cost estimate and WVA models assumed it would not be maintained.

PIER DESIGN

NON-PARK/404(C) BLH-DRY/BLH-WET PROTECTED SIDE IMPACTS

Bayou Segnette BLH-Dry & BLH-Wet Enhancement – PIER Design

This project would involve enhancing an existing degraded bottomland hardwood habitat as mitigation for BLH-Wet and BLH-Dry protected side general impacts. The project would be located adjacent to the Bayou Segnette State Park, in Jefferson Parish. The project would be bounded to the south by the existing Westbank Hurricane Protection Levee (HPL) and to the north by Nicolle Boulevard and the NOLA Motorsports Park. The proposed BLH restoration features are identified in plan as BS2 (approximately 1,141.2 acres), BS3A (approximately 37.6 acres), BS4 (approximately 63.4 acres), and BS6 (approximately 21.6 acres), and would encompass approximately 1,263.8 acres combined (see appendix A). The sites established for restoration are currently BLH habitats which have been overtaken by invasive plant species, mainly Chinese tallow. The sites are located on the protected side of the HPL. Proposed features BS2, BS4, and BS6 would be enhanced to restore native BLH-Dry habitats. Proposed feature BS3A would be enhanced to restore native BLH-Wet habitat. It is noted that feature BS6 would be located within the boundaries of Bayou Segnette State Park (BSSP), while all other proposed features would be located outside this park.

The plan (see appendix A) also depicts an element identified as "Pre-Katrina Enhancement". This BLH-Wet enhancement project mitigates for pre-Katrina habitat impacts rather than HSDRRS habitat impacts, and involves converting existing degraded BLH-Dry forest to native BLH-Wet forest. It also includes restoration of an appropriate wetland hydroperiod with the mitigation features comprising the project. This project was covered in Revised Supplemental Environmental Assessment (SEA) #498 (USACE, 2011) and has been authorized for construction. It is anticipated that project construction will commence in late 2014 or early 2015.

The location of proposed BLH-Wet enhancement feature BS3A was positioned to align with the Pre-Katrina mitigation project. The Pre-Katrina element will be bounded to the south and west by a proposed water retention dike that was designed to pool additional water in the project's mitigation features without adversely impacting drainage of the area. This adjacent project will occupy approximately 125 acres immediately adjacent to proposed HSDRRS mitigation enhancement features BLS3A, BS2, BS4, and BS6. The Pre-Katrina mitigation project is shown in appendix A due to its interrelationships with components of the proposed HSDRRS mitigation project.

The proposed enhancement features would be located on the protected side of the adjacent HSDRRS levee. Jefferson Parish currently operates the Lake Cataouatche Pump Station at the south end of the Avondale Garden Canal. This pump station is operated until the water in the inflow channel reaches elevation (-) 10.43 feet. Pumps cannot be run below this elevation but often pump to this elevation in anticipation of rain events. The regional water table has been lowered as a result of pumping. This drawdown of the water table combined with the effects of past alterations to area sheetflow patterns (construction of canals, drainage ditches, developments, etc.) has adversely affected the historic hydroperiod once typical of the area. It appears these effects have degraded the water regime in existing bottomland hardwood habitats to the extent that most areas no longer have wetland hydrology. As a result, the BLH habitats in the area have converted from BLH-Wet to BLH-Dry.

The proposed project area drains from Highway 90 southward toward the HSDRRS (HPL) levee. Elevations near the levee are approximately (-) 8.0 feet. Available LIDAR (Light Detection and Ranging) elevation data show a ridge on the west side of the proposed features. With no dedicated water source, the project area's water depth would be affected by rain events. In an effort to restore wetland conditions, the proposed pre-Katrina retention dike (berm) would pool water in the lower areas. This structure would not modify the local drainage, and would restore an appropriate wetland hydroperiod within the Pre-Katrina mitigation site.

As mentioned, the retention dike to be built for the Pre-Katrina mitigation project would run along the project's west boundary, along a portion of the project's south boundary, and then would turn south to connect with the HSDRRS levee. Besides restoring wetland hydrology within the Pre-Katrina project, this dike is anticipated to be adequate to restore wetland hydrology/hydroperiod within proposed feature BS3A as well. Because of this, there would be no need to extend or otherwise alter the Pre-Katrina retention dike as part of the proposed HSDRRS mitigation project. The hydrologic alterations generated by the Pre-Katrina project would be sufficient to establish a native BLH-Wet forest within proposed feature BS3A.

Lands encompassed by the proposed mitigation features are forested, with Chinese tallow dominating both the canopy and midstory strata. This invasive species essentially constitutes a monoculture with very few native hardwood species remaining. There are only a few exceptions to this generalization. Remnant bald cypress trees are co-dominant with the Chinese tallow trees in the northwestern and north central portions of mitigation feature BS2.

Proposed enhancement activities involved in the proposed project would include the eradication of invasive and nuisance plant species and subsequent planting of native BLH canopy and midstory species in all the enhancement features. As discussed above, enhancement of feature BLS3A would include restoring wetland hydrology but no work would be necessary in the proposed project to achieve this objective since construction of the nearby Pre-Katrina project will automatically accomplish this. The majority of proposed BLH-Dry mitigation features in the various project groups would not require significant alterations to the existing topography since the current hydroperiod is satisfactory to support BLH-Dry habitats.

Existing invasive and nuisance plants would first be cleared (cut down to ground surface) primarily using a hydro-axe, gyro-track, or similar equipment. Large native trees and shrubs would be preserved during the clearing process to the greatest degree practicable. Vegetation debris generated during this process would be: mechanically chipped (mulched) and the resulting mulch spread in a relatively thin layer throughout the enhancement features, and/or temporarily stockpiled within the mitigation features and subsequently burned. During the course of the clearing process (mechanical eradication process), appropriate herbicides would be immediately applied to the remnant stumps and other remaining invasive and nuisance plants. These would be ground-based herbicide applications whereby the applicators follow in the wake of the mechanical eradication equipment.

An existing Entergy electrical transmission line runs along the eastern boundary of features BS2and BS3A, separating these elements from feature BS4 and the eastern portion of the Pre-Katrina mitigation project. An existing dirt maintenance road runs within the power line easement. This road is slightly raised and thus tends to block sheet-flow. To counter this effect, drainage culverts or shallow flowways (swales) would be installed through the roadway at various locations adjacent to features BS2 and BS3A as part of the proposed project

A few remnant drainage ditches are presently located within proposed feature BS2 and BS3A, with some of these ditches extending off-site. The proposed project may include filling of some of these ditches and/or realignment of ditch segments. It may also include construction of new shallow drainage ditches/swales within feature BS2. The purpose of such actions would be to help route surface flows to feature BS3A and the Pre-Katrina mitigation site, to help prevent adverse drainage effects that could hinder the restoration of wetland hydrology in feature BS3A, and to accommodate stormwater runoff from lands abutting feature BS2. The need for these activities and design of stormwater management features, if required, would be determined during the PED phase. If these activities are necessary and fill is required to close existing drainage ditches, the fill (borrow) would be obtained from the Bonnet Carre' Spillway and hauled to the project site with dump trucks. A preliminary estimate of the potential borrow that might be needed is 10,000 cubic yards. It is emphasized, however, that this is a preliminary estimate. It is possible that that some of the borrow (fill) needed could be obtained by degrading existing spoil berms located within the proposed mitigation features.

Following completion of the preceding activities, the three BLH-Dry features would be planted with native canopy and midstory species in accordance with the BLH-Dry planting guidelines contained in appendix L. The single BLH-Wet feature would be planted with native canopy and midstory species in accordance with the BLH-Wet planting guidelines contained in appendix L. Completion of these plantings would mark the end of the initial primary construction phase of the project. It is estimated that this phase would require approximately two to three years to complete.

The construction access routes that would be used during this phase and subsequently are illustrated in appendix A. The primary construction access entry would be from Nicolle Boulevard. It is noted that construction access to feature BS6 would be from the western side of this feature; thus there would be no construction access through Bayou Segnette State Park. Temporary fencing would be installed along the north and east boundaries of feature BS6 to prohibit park visitors from entering feature BS6. This fencing would be removed once trees and shrubs planted in the feature are sufficiently tall. The minimum height of trees and shrubs allowed before the fencing is removed would be determined during the PED phase in conjunction with park officials.

It is anticipated that several plants installed at the time of the initial planting would not survive for a year; thus, it was estimated that about 20% of the total number of plants initially installed in each enhancement feature would need to be re-planted one year after completion of the initial planting. Additional activities that would occur during the extended project construction phase following the initial planting event would include periodic eradication of invasive/nuisance plant species within the mitigation features as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of monitoring responsibilities to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation features and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L). Any culverts installed beneath the Entergy maintenance road would need to be replaced about once every 20 years. Any drainage ditches remaining within the mitigation features would need to be periodically maintained to prevent reduced flow due to vegetation and siltation.

Dufrene Ponds BLH-Wet Restoration – PIER Design

The site established for restoration would be located along the right descending bank (RDB) of Bayou des Allemands and immediately south of US Highway 90 in Lafourche Parish. The sites established for restoration are currently open water sites. This project would involve restoring BLH-Wet habitat as mitigation for BLH-Dry and BLH-Wet protected side general impacts. The two proposed BLH-Wet restoration features are identified in plan view as DP1A (approximately 251.1 acres) and DP4A (approximately 321.5 acres), and would encompass approximately 572.6 acres combined (see appendix A). The proposed BLH-Wet restoration features are divided by a corridor, approximately 200 feet wide, which runs predominately east to west along a curve that splits the mitigation features. This corridor is the proposed alignment of the future expansion of Interstate 49. None of the proposed mitigation features would encroach into the I-49 corridor.

Earthen retention dikes would first be mechanically constructed along the perimeter of the proposed restoration features. The retention dike borrow would be obtained from within the restoration footprints. Dikes would be built with barge mounted equipment. The length of the dikes would be approximately 36,000 linear feet. Due to high clay content expected in the Lake Salvador borrow site (see below), a bulking factor of 60 percent was used in the design of the retention dikes. Additionally, a freeboard of one foot is required on the dike. The dike would be built to an elevation of +8.2 feet, with a five foot crown and 1V:4H side slopes. Initial settlement expected for the dike is assumed to be 30%. Total dike volume would be 1,200,000 cubic yards.

The two restoration features would be filled to an initial target elevation of +3.0 feet. The assumed average existing elevation of the DP1A and DP4A footprints is -4.0 feet. The initial target elevation would require an earthen lift of seven feet. Assuming one foot of foundation settlement, the total fill quantity required for the BLH-Wet land platforms would be approximately 7,400,000 cubic yards.

Borrow for earthen fill for the restoration features would be obtained from a 927-acre borrow site in Lake Salvador. Borrow would be obtained a minimum distance of 2,000 feet from the lake's shoreline using a hydraulic cutter-head dredge. Existing lake bottom elevations vary. The project designer assumed an existing average lake bottom elevation within the footprint of the borrow site of -8.0 feet. The borrow site would be dredged to an elevation of -20 feet or shallower. Grain size distribution of borrow materials was assumed to be 10 percent silty sand and 90 percent silty clay. The borrow site designs used a 2:1 pit to fill ratio to allow for unknown utilities, anomalies, and cultural sites. If potential long-term environmental impacts are anticipated, dissolved oxygen and rate of infilling would be monitored at the borrow site following construction

The fill material dredged from Lake Salvador would be piped to the restoration features in slurry. The pipeline corridor would be 100 feet wide and roughly 84,000 feet long (see appendix A). The corridor would be placed near the banks of Bayou des Allemands in an effort to minimally impact navigation in the bayou. Floating pipeline would be used, which is a dredge discharge pipe positioned on pontoons. The floating pipeline would be marked on 150 foot centers to prevent boat hazards in the lake and along the bayou. Markers would include lighted and reflective buoys. As the pipeline would need to cross the bayou, a small segment of submerged pipeline would be installed at the crossing with signage to ensure safe passage over the line. Adjustable spill boxes would be placed to the retention dikes to drain excess water from the restoration sites during the hydraulic fill operation. Marsh tracked vehicles would move the discharge pipeline within the restoration sites when pumping, and maintain the retention dikes as needed for the duration on the dredge fill operation. The estimated construction duration for constructing the retention system and dredge filling the restoration features would be 29 to 32 months.

Once the dredge and fill operation required to establish the land platforms for the restoration features is complete, an idle period of approximately one year would allow hydraulically placed fill time to settle and dewater to the desired final target elevation of +2.0 feet. A second construction contract would be awarded at the end of the idle period to degrade the perimeter dikes and plant desired species. Perimeter dikes would be degraded to equal the final target elevation of the BLH-Wet platforms. The dikes would be degraded with marsh tracked vehicles and barge mounted backhoe. Material removed would be used where possible to fill low areas within the restoration area, or placed in the adjacent open water area outside of the restoration features.

After degrading the retention dikes, each restoration feature would be planted with native BLH-Wet canopy and mid-story species. The plantings would be in accordance with the BLH-Wet planting guidelines contained in appendix L. The duration for the subsequent construction project for degrading the retention dikes and planting the features would be 6 to 9 months.

It is anticipated that several plants installed at the time of the initial planting would not survive for a year; thus, it was estimated that about 20% of the total number of plants initially installed in each feature would need to be re-planted one year after completion of the initial plantings. Additional activities that would occur during the project construction phase would include periodic eradication of invasive/nuisance plant species within the mitigation feature as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of the project to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation feature and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L).

Lake Boeuf BLH-Dry & BLH-Wet Restoration – PIER Design

This project would involve restoring BLH-Dry forests and BLH-Wet forests within existing agricultural fields as shown in appendix A. Three BLH-Dry restoration features are proposed; BDP1 (approximately 96.0 acres), BDP2 (approximately 270.3 acres), and BDP3 (approximately 207.3 acres). One BLH-Wet restoration feature is proposed, which is identified as feature BWP1 (approximately 18.1 acres). These proposed restoration features would encompass a total of approximately 591.6 acres, and would be located in Lafourche Parish, just north of Bayou Lafourche and roughly 2 miles west of Raceland. Another component of the project would involve the establishment of “mitigation roadways” (see appendix A) as discussed below.

Based on a review of existing LiDAR topography, the existing grades within the three proposed BLH-Dry restoration features range from roughly elevation +3.1 feet to elevation +6.2 feet. These elevations are conducive to establishing BLH-Dry forests, thus these features would not need to be degraded to establish such forests. Activities necessary prior to planting these features would include: clearing and grubbing; grading and tilling necessary to level the surface and prepare the area for planting (ex. degrading agricultural berms and row crop beds, filling agricultural furrows, filling existing agricultural drainage ditches and swales, etc.); if necessary, limited application of herbicides to eradicate invasive and nuisance plant species. All vegetation debris generated during the initial project construction phase would be temporarily stockpiled and subsequently burned at various locations within the restoration features. This would apply to vegetation debris generated during construction of BLH-Wet feature BWP1 as well.

The existing BLH-Wet habitats in the general project area appear to have elevations ranging from approximately +1.9 feet to +2.5 feet. The existing grades within the single proposed BLH-Wet restoration feature range from approximately elevation +4.2 feet to elevation +4.6 feet, based on a review of existing LiDAR topography. Since BLH-Wet forests require a wetland hydrologic regime, it is estimated that approximately 100 percent of the area within feature BWP1 would need to be degraded (excavated) to reach the desired target grade elevation of approximately 2.0 to 2.5 feet in order to achieve an appropriate wetland hydroperiod. In addition to the degrading necessary, construction activities required prior to planting this feature would include the same activities described above for the proposed BLH-Dry features. Scarification of the upper soil profile may also be performed in some areas if deemed necessary to reduce soil compaction.

It is estimated that approximately 63,000 cubic yards of soil would need to be excavated (degraded) to establish the desired grades in feature BWP1. The excavated soil would be hauled to feature BDP2 and spread as a relatively thin layer over portions of the soil surface in this feature. If necessary, some of the excavated soil may be used to fill agricultural ditches within feature BWP1.

The proposed project would require three “mitigation roadways” as depicted in appendix A. These roadways would be required for several purposes, including: access for construction of the mitigation features; access for long-term management and maintenance of the mitigation features; to maintain access routes (ingress/egress) to off-site properties abutting and/or in the general vicinity of the proposed mitigation features. The 3 mitigation roadways involved would total approximately 2.7 miles and would encompass a total of roughly 9.7 acres based on an assumed right-of-way width of 30 feet.

All of the proposed mitigation roadways would coincide with existing roadways; however various improvements to these roads would likely be required. Roughly 0.34 miles of the mitigation roadways consist of existing dirt roads. Improvements to these roadway segments would include converting them to gravel roadways in conjunction with roadway widening. Approximately 2.33 miles of the mitigation roadways consist of existing gravel/limerock roads. Improvements to these roadway segments could include roadway widening, resurfacing with gravel, and/or raising the road crown elevation. Additional improvements to all of the mitigation roadways could include installation of culverts beneath the roads, modifying existing drainage swales adjacent to the roads, and/or constructing drainage swales adjacent to the roads to improve or maintain appropriate drainage.

Other initial construction activities performed prior to planting could include construction of various stormwater management features. The purpose of such features would be: to help ensure the proposed project does not adversely affect surface water (stormwater) drainage on lands adjacent to the project features; to appropriately route and manage stormwater runoff from the proposed features themselves, and; to help ensure the proposed project does not adversely affect floodplain storage and peak flood elevations on lands adjacent to the project. Such stormwater management features could include things such as drainage ditches and swales, spreader swales and berms, detention areas, drainage culverts, water control structures, etc. It is anticipated that all such features would be built within the footprints of the mitigation features themselves and within the rights-of-way for the mitigation roadways. If this project were eventually selected, the design and composition of any stormwater management features would be determined during the PED phase of the project. The same is true for the establishment of final grading elevations and contours within feature BWP1 as well as for the final design for deposition and grading of the soil excavated from this feature.

After all the initial clearing/grubbing, grading, and related earthwork activities are completed within the mitigation features themselves, each feature would be planted with native canopy and midstory species. The BLH-Dry restoration features would be planted in accordance with the BLH-Dry planting guidelines contained in appendix M to restore BLH-Dry forest communities. The single BLH-Wet restoration feature would be planted in accordance with the BLH-Wet planting guidelines contained in appendix M to restore a BLH-Wet forest.

Construction equipment necessary for the initial project construction phase would include dump trucks, bulldozers, tractors, graders, and similar equipment. Construction work would be allowed to occur 6 days per week (Monday through Saturday) during daylight hours. Construction access to the features would be via the 3 mitigation roadways and Highway 308. An appropriate traffic control plan would be implemented during construction to help minimize traffic congestion on Highway 308 near the project mitigation roadways and to help minimize traffic safety hazards. It is estimated that the initial project construction phase would last approximately 9 to 12 months.

It is anticipated that several trees and shrubs installed at the time of initial planting would not survive for a year; thus, it was estimated that about 20% of the total number of plants initially installed in each restoration feature would need to be re-planted about one year after completion of initial plantings. Additional activities that would occur during the final project construction phase after the initial planting event would include periodic eradication of invasive/nuisance plant species within the mitigation features as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix M (i.e. monitoring and reporting necessary prior to transfer of project monitoring responsibilities to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation features and mitigation monitoring and reporting as prescribed in appendix M. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix M). Any drainage culverts installed as part of the project would likely need to be replaced once every twenty years. The mitigation roadways would require periodic maintenance work such as addition of gravel or limerock, minor grading to correct erosion problems and potholes, etc. At a minimum, these roadways would likely need to be resurfaced once every five years. Periodic maintenance of other stormwater management features employed would be necessary, but it is not possible to estimate the maintenance activities or frequency of these activities prior to stormwater management design.

Plaquemines, Option 2 BLH-Wet Restoration – PIER Design

This project would consist of a single mitigation feature, P3D, that would occupy approximately 417.5 acres. This project would involve restoring BLH-Wet habitat in an existing open water area located in Plaquemines Parish near Jesuit Bend. The proposed restoration feature would be created by placing fill to establish a land platform and then planting the feature with native BLH-Wet species. See appendix A for a depiction of this project.

A retention dike would first be built along the east and south perimeter of the proposed feature to retain fill. The retention dike would be approximately 20,000 linear feet in length. Feature P3D is bordered on its western boundary by an existing spoil berm and is bordered on its northern boundary by a segment of this same berm and a portion of the MRL; thus, construction of retention dikes would not be necessary along these edges of feature P3D. The new retention dike would be built to elevation +7.0 feet, and would be constructed with a 5-foot crown and 1V:4H side slopes. The fill (borrow) necessary to construct the dike would be excavated from within the footprint of feature P3D. The borrow ditch would be offset a minimum of 40 feet from the dike to help ensure dike stability.

The remaining borrow needed would be obtained from the Mississippi River near Jesuit Bend Two borrow sites, each occupying approximately 115 acres, would be used; one at approximately River Mile 69 and one at approximately River Mile 67 on the left descending bank (LDB) of the river. Grain size distribution of borrow materials was assumed to be 70 percent fine sand and 30 percent silty clay. Due to moderate clay content in the borrow site, a bulking factor of 40 percent was used in the design. The borrow quantity that would be needed to construct the proposed BLH-Wet feature is approximately 4,600,000 cubic yards. Each borrow site would be excavated to elevation -85.0 feet using a hydraulic cutter-head dredge. The borrow (sediment) would then be transported to feature P3D through a pipeline. The pipeline segment extending from the borrow site to the right descending bank of the river would be submerged along the river bottom and coordinated with the US Coast Guard so as to not adversely impact river navigation.

The remainder of the pipeline from the river bank to the mitigation feature would primarily be above ground, using a corridor 100 feet wide. From the river westward to feature P3D, the pipeline would follow the existing Atmos Energy pipeline corridor. In this segment, the pipeline corridor width would be reduced as necessary to avoid impacts to existing structures. This pipeline segment would be routed beneath Highways 11 and 23 and beneath an existing railroad. Thirty-six inch diameter culverts would be jack-and-bored at each of these crossings and the pipeline routed through the culverts. Some clearing of vegetation and debris may be required along the access corridor. All vegetation cleared for access would be placed in the bottom of the mitigation feature and buried with fill material. The fill would be placed to an initial slurry elevation of +4.0 feet. The estimated construction duration for constructing the retention system and dredge filling the site is approximately 12 to 14 months.

Once the fill operation is complete, an idle period of approximately one year would allow the hydraulically placed fill time to settle and dewater to a desired final target grade of elevation +2.0 to +2.5 feet. A second construction contract would be awarded at the end of the idle period to degrade dikes to an elevation equal to the final target grade of the BLH-Wet platform. The degraded material from the dikes will be placed back into feature P3D in areas where borrow was required for the dikes and the material settled below target elevation. Once the fill material has settled to the desired target grade and the retention dikes have been degraded, the mitigation feature would be planted with native canopy and midstory species. The plantings would be in accordance with the swamp planting guidelines contained in appendix L. The duration for the construction phase that involves degrading the retention dike and installing plants would be approximately 3 to 4 months

It is anticipated that several trees and shrubs installed at the time of initial planting would not survive for a year; thus, it was estimated that about 20% of the total number of plants initially installed would need to be re-planted about one year after completion of the initial plantings. Additional activities that would occur during the project construction phase would include periodic eradication of invasive/nuisance plant species within the mitigation feature as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of the project to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation feature and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L).

NON-PARK/404(C) BLH-WET FLOOD SIDE IMPACTS

Dufrene Ponds BLH-Wet Restoration – PIER Design

This project would involve restoring wet bottomland hardwood habitat as mitigation for BLH-Wet flood side general impacts. The project would be located along the right descending bank (RDB) of Bayou des Allemands and immediately south of US Highway 90 in Lafourche Parish. The proposed BLH-Wet restoration feature is bounded to the north by a corridor, approximately 200 feet wide, which runs predominately east to west along a curve. This corridor is the proposed alignment of the future expansion of Interstate 49. None of the proposed mitigation feature extends into the I-49 corridor. The proposed BLH-Wet restoration feature is identified in plan as DP1B and would encompass approximately 276.2 acres (see appendix A). The site established for restoration is currently an open water site.

A retention dike would be mechanically constructed along the perimeter of the proposed restoration feature to support filling of the BLH-Wet platform. The retention dike borrow would be obtained from within the restoration footprint. Dikes would be built with barge mounted equipment. The length of the dike would be approximately 14,600 linear feet. Due to high clay content expected in the borrow site, a bulking factor of 60 percent will be used in the design of the retention dikes. Additionally, a freeboard of 1 foot is required on the dike. The dike would be built to an elevation of +8.2 feet, with a 5-foot wide crown and 1V:4H side slopes. Initial settlement expected for the dike is assumed to be 30%. The total dike volume would be roughly 462,000 cy.

The assumed average existing elevation of the DP1B footprint is -4.0 feet. An intial fill (slurry) target elevation of +3.0 feet yields a neat lift of 7 feet. Assuming 1 foot of foundation settlement, the total fill quantity required to establish the BLH-Wet platform would be approximately 4,100,000 cubic yards.

Borrow for earthen fill of the restoration feature would be obtained from Lake Salvador using a hydraulic cutter-head dredge. Borrow would be obtained from a borrow site occupying approximately 415 acres, located a minimum distance of 2000 feet from the lake's shoreline. Existing lake bottom elevations vary. The project designer assumed an existing average lake bottom elevation of -8.0 feet within the footprint of the borrow site. The borrow site would be excavated (dredged) to an elevation of -20.0 feet, or shallower. Grain size distribution of borrow materials was assumed to be 10 percent silty sand and 90 percent silty clay. The borrow site design used a 2:1 pit to fill ratio to allow for unknown utilities, anomalies, and cultural sites. If potential long-term environmental impacts are anticipated, dissolved oxygen and rate of infilling would be monitored at open water borrow area following construction.

The dredged borrow (sediment) would be piped to the restoration features in slurry. The pipeline corridor would be 100 feet wide and roughly 82,000 long (see appendix A). Floating pipeline would be primarily be used, which is a dredge discharge pipe positioned on pontoons. Floating pipeline would be marked on 150 foot centers to prevent boat hazards in the lake and along the bayou. Markers would include lighted and reflective buoys. The floating pipeline corridor would be positioned along the bank of Bayou des Allemands in a effort to minimize impacts to navigation. As the pipeline would need to cross the bayou in one location, a small segment of submerged pipeline would be installed at this crossing and appropriate signage would be installed to ensure safe passage of vessels over the line. Marsh tracked vehicles would move the discharge line in the restoration site when pumping and would maintain the retention dikes as needed for the duration on the dredge fill operation. Adjustable spill boxes would be placed at various locations along the retention dike to drain excess water from the restoration site during the hydraulic fill operation. The estimated construction duration for constructing the retention system and dredge filling the site is 14 to 17 months.

Once the above fill operation is complete, an idle period of approximately one year would allow the hydraulically placed fill time to settle and dewater to the desired final target elevation of +2.0 feet. A second construction contract would be awarded at the end of the idle period to degrade the perimeter dikes. Perimeter dikes would be degraded to equal the final target elevation of the BLH-Wet platform. The dikes would be degraded with marsh tracked vehicles and barge mounted backhoe. Material removed would be placed in the adjacent open water area outside of the restoration feature. Once the restoration feature has settled to the desired target elevation, it would be planted with native canopy and mid-story species in accordance with the BLH-Wet planting guidelines contained in appendix L. The duration for the subsequent construction project for degrading the retention dikes and planting feature DP1B would be approximately three to five months.

OMRR&R. No future lifts for the restoration site as a component of an OMRR&R are included in this early submittal. It is anticipated that several plants installed at the time of the initial planting would not survive for a year; thus, it was estimated that about 20% of the total number of plants initially installed would need to be planted one year after completion of the initial planting. Additional activities that could occur during the project life on additional construction contracts in out years would include periodic eradication of invasive/nuisance plant species within the mitigation feature. No projection of number of contracts is provided for eradication of invasive/nuisance plant species.

It is anticipated that several trees and shrubs installed at the time of initial planting would not survive for a year; thus, it was estimated that about 20% of the total number of plants initially installed would need to be re-planted roughly one year after completion of the initial plantings. Additional activities that would occur during the project construction phase would include periodic eradication of invasive/nuisance plant species within the mitigation feature as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of the project monitoring responsibilities to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation feature and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L).

Lake Boeuf BLH-Wet Restoration – PIER Design

This project would involve restoring BLH-Wet forests within existing agricultural fields as shown in appendix A. Five BLH-Wet restoration features are proposed; BWF1 (approximately 42.8 acres), BWF2 (approximately 21.9 acres), BWF3 (approximately 55.6 acres), BWF4 (approximately 57.5 acres), and BWF5 (approximately 44.1 acres). These proposed restoration features would encompass a total of 221.9 acres, and would be located in Lafourche Parish, just north of Bayou Lafourche and roughly 2 miles west of Raceland. Another component of the project would involve the establishment of "mitigation roadways" (see appendix A) as discussed below.

Existing available LiDAR topographic data indicates that existing BLH-Wet habitats in the general area have elevations ranging from approximately +1.9 feet to +2.5 feet; thus it was assumed that such elevations would likely be necessary to achieve wetland hydroperiods sufficient to support the BLH-Wet forests proposed in the restoration features. The desired target grade elevation for the proposed BLH-Wet features was therefore set to be in the range of +2.0 feet to +2.5 feet, with a preference for elevations closer to +2.0 feet.

Based on a review of the existing LiDAR data, it was determined that the majority of the proposed restoration features would need to be degraded to obtain the desired target grade elevation. The table below indicates the approximate range in existing grade elevations in each feature and the estimated percentage of each feature that would need to be degraded.

Feature ID	**Existing Elevation Range (feet NAVD88)**	**Percent of Feature To be Degraded**
BWF1	2.9 to 3.7	100 %
BWF2	2.5 to 3.7	95 %
BWF3	3.1 to 4.5	100 %
BWF4	3.4 to 3.5	100 %
BWF5	2.2 to 3.6	90%

It is estimated that a total of approximately 519,000 cubic yards of soil would need to be excavated (degraded) to establish the desired grades within the restoration features. Some of this soil might be used in the construction of the new mitigation roadways required (see below). Some might be hauled off-site for use in the construction of other proposed WBV HSDRRS mitigation projects. Excavated soil not utilized for such proposes would be hauled off-site to a duly licensed disposal facility. The final plan for use and disposal of the excavated soil would be determined during the PED phase of the project, as would be the final degrading elevations and contours.

In addition to the degrading work, other construction activities necessary prior to planting the restoration features would likely include: clearing and grubbing; grading and tilling necessary to level the surface and prepare the area for planting (ex. degrading agricultural berms and row crop beds, filling agricultural furrows, filling existing agricultural drainage ditches and swales, etc.); if necessary, limited application of herbicides to eradicate invasive and nuisance plant species. Scarification of the upper soil profile may also be performed in some areas if deemed necessary to reduce soil compaction. Vegetation debris generated during the initial project construction phase would be temporarily stockpiled and subsequently burned at various locations within the restoration features.

The proposed project would require five “mitigation roadways” as depicted in appendix A. These roadways would be required for several purposes, including: access for construction of the mitigation features; access for long-term management and maintenance of the mitigation features; to maintain access routes (ingress/egress) to off-site properties abutting and/or in the general vicinity of the proposed mitigation features. The 5 mitigation roadways involved would total approximately 6.1 miles and would encompass a total of roughly 22.2 acres based on an assumed right-of-way width of 30 feet.

The majority of the proposed mitigation roadways would coincide with existing roadways; however various improvements to these roads would likely be required. Approximately 0.82 miles of new roadway construction would also be necessary. These new roadway segments would be built with gravel and appropriate sub-grade materials. Roughly 0.60 miles of the mitigation roadways consist of existing dirt roads. Improvements to these roadway segments would include converting them to gravel roadways in conjunction with roadway widening. Approximately 3.65 miles of the mitigation roadways consist of existing gravel/limerock roads. Improvements to these roadway segments could include roadway widening, resurfacing with gravel, and/or raising the road crown elevation. Approximately 1.02 miles of the mitigation roadway system consists of an existing paved road (Peltier Drive) and would not require any modifications or improvements. Additional improvements to all of the existing mitigation roadways excluding Peltier Drive could include installation of culverts beneath the roads, modifying existing drainage swales adjacent to the roads, and/or constructing drainage swales adjacent to the roads to improve or maintain appropriate drainage.

Other initial construction activities performed prior to planting could include construction of various stormwater management features. The purpose of such features would be: to help ensure the proposed project does not adversely affect surface water (stormwater) drainage on lands adjacent to the project features; to appropriately route and manage stormwater runoff from the proposed features themselves, and to help ensure the proposed project does not adversely affect floodplain storage and peak flood elevations on lands adjacent to the project. Such stormwater management features could include things such as drainage ditches and swales, spreader swales and berms, detention areas, drainage culverts, water control structures, etc. It is anticipated that all such features would be built within the footprints of the mitigation features themselves and within the rights-of-way for the mitigation roadways. The design and composition of any stormwater management features would be determined during the PED phase of the project.

After all the initial clearing/grubbing, grading, and related earthwork activities are completed within the mitigation features themselves, each feature would be planted with native canopy and midstory species. The restoration features would be planted in accordance with the BLH-Wet planting guidelines contained in appendix L to restore a BLH-Wet forest.

Construction equipment necessary for the initial project construction phase would include dump trucks, bulldozers, tractors, excavators, graders, and similar equipment. Construction work would be allowed to occur 6 days per week (Monday through Saturday) during daylight hours. Construction access to the features would be via the 5 mitigation roadways and Highway 308. An appropriate traffic control plan would be implanted during construction to help minimize traffic congestion on Highway 308 near the project mitigation roadways and to help minimize traffic safety hazards. It is estimated that the initial project construction phase would last approximately 10 to 15 months.

It is anticipated that several trees and shrubs installed at the time of initial planting would not survive for a year; thus, it was estimated that about 20% of the total number of plants initially installed in each restoration feature would need to be planted about one year after completion of initial plantings. Additional activities that would occur during the final project construction phase after the initial planting event would include periodic eradication of invasive/nuisance plant species within the mitigation features as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of project monitoring responsibilities to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation features and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L). Any drainage culverts installed as part of the project would likely need to be replaced once every twenty years. The unpaved mitigation roadways would require periodic maintenance work such as addition of gravel or limerock, minor grading to correct erosion problems and potholes, etc. At a minimum, these roadways would likely need to be resurfaced once every five years. Periodic maintenance of other stormwater management features employed would be necessary, but it is not possible to estimate the maintenance activities or frequency of these activities prior to stormwater management design.

Plaquemines, Option 2 BLH-Wet Restoration – PIER Design

This proposed project consists of a single mitigation (restoration) feature, P3C, which would occupy approximately 206.2 acres. This project would involve restoring BLH-Wet habitat in an existing open water area located off the right descending bank (RDB) of the Mississippi River at River Mile 68, in Plaquemines Parish near Jesuit Bend. See appendix A for a depiction of this project. The proposed restoration feature would be created by placing fill to establish a land platform and then planting the feature with native BLH-Wet species.

A retention dike would first be built along the perimeter of the proposed feature to retain fill. The retention dike would be approximately 11,000 linear feet in length. The northern and eastern boundaries of feature P3C directly abut the existing Mississippi River Levee (MRL). No retention dike would be necessary along these boundaries. The required retention dike would be built to elevation +7.0 feet and would be constructed with a 5-foot crown and 1V:4H side slopes. All borrow material for the dike construction would come from within the footprint of the restoration feature. The borrow area would be offset a minimum 40 feet from the perimeter retention dikes and the MRL for stability.

The remaining borrow needed would be obtained from the Mississippi River near Jesuit Bend. Two borrow sites, each occupying approximately 115 acres, would be used; one at approximately River Mile 69 and one at approximately River Mile 67 on the left descending bank (LDB) of the river. Grain size distribution of borrow materials was assumed to be 70 percent fine sand and 30 percent silty clay. Due to the moderate clay content in the borrow sites, a bulking factor of 40 percent was used in the design. The borrow quantity that would be needed to construct the proposed BLH-Wet feature is approximately 2,300,000 cubic yards. Each borrow site would be excavated to elevation -70.0 feet using a hydraulic cutter-head dredge. The borrow (sediment) would then be transported to feature P3C through a pipeline. The pipeline segment extending from the borrow site to the right descending bank of the river would be submerged along the river bottom and coordinated with the US Coast Guard so as to not adversely impact river navigation.

The remainder of the pipeline from the river bank to the mitigation feature would primarily be above ground, using a corridor 100 feet wide. From the river westward to the MRL, the pipeline would follow the existing Atmos Energy pipeline corridor. In this segment, the pipeline corridor width would be reduced as necessary to avoid impacts to existing structures. This pipeline segment would be routed beneath Highways 11 and 23 and beneath an existing railroad. Thirty-six inch diameter culverts would be jack-and-bored at each of these crossings and the pipeline routed through the culverts. Trees and other vegetation cleared to install the pipeline would be disposed of within the footprint of feature P3C. All trees would first be cut to a maximum length of 8 feet prior to disposal. After reaching the flood side of the MRL, the pipeline would be routed within the existing levee right-of-way until reaching feature P3C.

The fill would be placed to an initial slurry elevation of +4.0 feet. Once this fill operation is complete, an idle period of approximately one year would allow the hydraulically placed fill time to settle and dewater to a final target grade of approximately +2.0 to +2.5 feet. The estimated construction duration for constructing the retention system and dredge filling the site is 9 to 10 months. A second construction contract would be awarded at the end of the idle period to degrade dikes to an elevation equal to the final target grade of the BLH-Wet platform. The degraded material from the dikes would be placed back into the feature in areas where borrow was required for the dikes and the material settled below the final target elevation. Once the fill material has settled to the desired target grade and the dikes degraded, the mitigation feature would be planted with native canopy and midstory species. The plantings would be in accordance with the BLH-Wet planting guidelines contained in appendix L. The duration for the subsequent construction phase for degrading the retention dike and initial planting would require approximately 3 to 4 months.

It is anticipated that several trees and shrubs installed at the time of initial planting would not survive for a year; thus, it was estimated that about 20% of the total number of plants initially installed would need to be re-planted one year after completion of initial plantings. Additional activities that would occur during the project construction phase would include periodic eradication of invasive/nuisance plant species within the mitigation feature as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of the project to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation feature and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L).

NON-PARK/404(C) SWAMP FLOOD SIDE IMPACTS

Lake Boeuf Swamp Restoration – PIER Design

This project would involve restoring agricultural fields, pastures, rangelands, and agricultural ponds (detention areas) to native swamp habitats as shown in appendix A. Ten swamp restoration features are proposed; S1 (approximately 13.1 acres), S2 (approximately 26.3 acres), S3 (approximately 19.5 acres), S4 (approximately 33.5 acres), S5 (approximately 60.5 acres), S6 (approximately 5.4 acres), S7 (approximately 7.1 acres), S8 (approximately

47.1 acres), S9 (approximately 35.5 acres), and S10 (approximately 71.8 acres). These proposed restoration features would encompass a total of approximately 319.9 acres, and would be located in Lafourche Parish, just north of Bayou Lafourche and roughly 2 miles west of Raceland. Another component of the project would involve the establishment of "mitigation roadways" (see appendix A) as discussed below.

Existing available LiDAR data indicates that existing swamp habitats in the general area have elevations ranging from approximately +1.1 feet to +2.0 feet, with many swamp areas typically ranging from elevation +1.3 to +1.5 feet. It was assumed that such elevations would likely be necessary to achieve wetland hydroperiods sufficient to support the swamp forests proposed in the restoration features. Given this, a desired target grade elevation ranging from +1.1 feet to a maximum of +1.8 feet was established for the design of the restoration features.

Based on a review of the existing LiDAR data, it was determined that the majority of the proposed restoration features would need to be degraded to obtain the desired target grade elevation. The table below indicates the approximate range in existing grade elevations in each feature and the estimated percentage of each feature that would need to be degraded.

Feature ID	**Existing Elevation Range (feet NAVD88)**	**Percent of Feature To be Degraded**
S1	1.0 to 1.5	0 %
S2	1.6 to 2.8	100 %
S3	2.2 to 2.9	100 %
S4	1.0 to 3.3	85 %
S5	2.9 to 4.0	100 %
S6	2.0 to 3.0	100 %
S7	3.3 to 4.0	100 %
S8	1.2 to 2.0	10 %
S9	1.4 to 3.0	95 %
S10	2.0 to 3.5	100 %

It is estimated that a total of approximately 475,000 cubic yards of soil would need to be excavated (degraded) to establish the desired grades within those restoration features where grade changes are necessary. Some of this soil might be used in the construction of the new mitigation roadways required (see below). Some might be hauled off-site for use in the construction of other proposed WBV HSDRRS mitigation projects. Excavated soil not utilized for such proposes would be hauled off-site to a duly licensed disposal facility. The final plan for use and disposal of the excavated soil would be determined during the PED phase of the project, as would be the final degrading elevations and contours.

In addition to the degrading work, other construction activities necessary prior to planting the restoration features would likely include: clearing and grubbing; grading and tilling necessary to level the surface and prepare the area for planting (ex. degrading agricultural berms and row crop beds, filling agricultural furrows, filling existing agricultural drainage ditches and swales, etc.); if necessary, limited application of herbicides to eradicate invasive and nuisance plant species. Scarification of the upper soil profile may also be performed in some areas if deemed necessary to reduce soil compaction. Vegetation debris generated during the initial project construction phase would be temporarily stockpiled and subsequently burned at various locations within the restoration features.

The Theriot Canal borders portions of proposed restoration features S1 through S5. As part of this project, existing spoil berms (dikes) along the canal might be degraded (gapped) in places to help water from the canal to flow into the adjacent restoration features during peak canal stages. The need for and desirability of such actions would be determined during the PED phase. Additional hydrologic improvements may be required to achieve an optimal hydroperiod within the features and improve surface water flow and interchange. The need for such improvements would also be examined further during the project's PED phase.

The proposed project would require a network of "mitigation roadways" as depicted in appendix A. These roadways would be required for several purposes, including: access for construction of the mitigation features; access for long-term management and maintenance of the mitigation features; to maintain access routes (ingress/egress) to off-site properties abutting and/or in the general vicinity of the proposed mitigation features. The mitigation roadways involved would total approximately 6.7 miles and would encompass a total of roughly 24.3 acres based on an assumed right-of-way width of 30 feet.

The majority of the proposed mitigation roadways would coincide with existing roadways; however various improvements to these roads would likely be required. Approximately 1.87 miles of new roadway construction would also be necessary. These new roadway segments would be built with gravel and appropriate sub-grade materials. Roughly 0.52 miles of the mitigation roadways consist of existing dirt roads. Improvements to these roadway segments would include converting them to gravel roadways in conjunction with roadway widening. Approximately 4.27 miles of the mitigation roadways consist of existing gravel/limerock roads. Improvements to these roadway segments could include roadway widening, resurfacing with gravel, and/or raising the road crown elevation. Additional improvements to the existing mitigation roadway segments could include installation of culverts beneath the roads, modifying existing drainage swales adjacent to the roads, and/or constructing drainage swales adjacent to the roads to improve or maintain appropriate drainage.

Other initial construction activities performed prior to planting could include construction of various stormwater management features. The purpose of such features would be: to help ensure the proposed project does not adversely affect surface water (stormwater) drainage on lands adjacent to the project features; to appropriately route and manage stormwater runoff from the proposed features themselves, and to help ensure the proposed project does not adversely affect floodplain storage and peak flood elevations on lands adjacent to the project. Such stormwater management features could include things such as drainage ditches and swales, spreader swales and berms, detention areas, drainage culverts, water control structures, etc. It is anticipated that all such features would be built within the footprints of the mitigation features themselves and within the rights-of-way for the mitigation roadways. If this project were eventually selected, the design and composition of any stormwater management features would be determined during the PED phase of the project.

After all the initial clearing/grubbing, grading, and related earthwork activities are completed within the mitigation features themselves, each feature would be planted with native canopy and midstory species. The restoration features would be planted in accordance with the swamp planting guidelines contained in appendix L.

Construction equipment necessary for the initial project construction phase would include dump trucks, bulldozers, tractors, graders, excavators, and similar equipment. Construction work would be allowed to occur 6 days per week (Monday through Saturday) during daylight hours. Construction access to the features would be via the 3 mitigation roadway segments that extend northward from Highway 308 (primary access routes), and via the other mitigation roadway segments. An existing Entergy electrical transmission line right-of-way, running east/west, separates restoration features S2, S4, S6, and S8 from restoration features S3, S5, S7, and S9. One of the new mitigation roadway segments would be built within this right-of-way (see appendix A). However, other portions of the right-of-way abutting the proposed mitigation features may also be used for project construction access. An appropriate traffic control plan would be implanted during construction to help minimize traffic congestion on Highway 308 near the project mitigation roadways and to help minimize traffic safety hazards. It is estimated that the initial project construction phase would last approximately 9 to 14 months.

It is anticipated that several trees and shrubs installed at the time of initial planting would not survive for a year; thus, it was estimated that about 20% of the total number of plants initially installed in each restoration feature would need to be re-planted about one year after completion of initial plantings. Additional activities that would occur during the final project construction phase after the initial planting event would include periodic eradication of invasive/nuisance plant species within the mitigation features as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of project monitoring responsibilities to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation features and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L). Any drainage culverts installed as part of the project would likely need to be replaced once every twenty years. The mitigation roadways would require periodic maintenance work such as addition of gravel or limerock, minor grading to correct erosion problems and potholes, etc. At a minimum, these roadways would likely need to be resurfaced once every five years. Periodic maintenance of other stormwater management features employed would be necessary, but it is not possible to estimate the maintenance activities or frequency of these activities prior to stormwater management design.

Plaquemines, Option 1 Swamp Restoration – PIER Design

The proposed project would be located off the right descending bank (RDB) of the Mississippi River at River Mile 68, in Plaquemines Parish near Jesuit Bend. The project would involve restoring swamp habitat in an existing open water area to mitigate for general impacts to swamp habitats. A single restoration feature, feature P1, occupying approximately 310.8 acres would be created by placing fill to establish a land platform and then planting the feature with native swamp species.

A retention dike would first be built along the perimeter of the proposed feature to retain fill. This dike would be approximately 18,500 linear feet in length. The dike would be built to elevation +6.5 feet, and would be constructed with a 5-foot crown and 1V:4H side slopes. On the eastern side of the feature, where the feature abuts the existing levee no dike construction would be required. All borrow material for the dike construction would come from within the mitigation feature itself, with the borrow area located a minimum 40 feet from the perimeter dike and levee for stability purposes.

The borrow needed to fill feature P1 would be obtained from the Mississippi River near Jesuit Bend. There would be two borrow sites with each site occupying approximately 115 acres. One would be located at approximately River Mile 69 and other would be located at Mile 67 on the left descending bank (LDB). Grain size distribution of borrow materials was assumed to be 70 percent fine sand and 30 percent silty clay. Due to moderate clay content in the borrow site, a bulking factor of 40 percent was used in the design. The borrow quantity that would be needed to construct the proposed swamp feature is approximately 3,100,000 cubic yards. Each borrow site would be excavated to elevation -75.0 feet using a hydraulic cutter-head dredge. The borrow (sediment) would then transported to feature P1 through a pipeline. The pipeline segment extending from the borrow site to the right descending bank of the river would be submerged along the river bottom and coordinated with the US Coast Guard so as to not adversely impact river navigation.

A 100 ft wide pipeline access corridor would be needed to transport fill material from the Mississippi River over land to the proposed feature. The current proposed design would utilize the existing Atmos Energy pipeline corridor as the primary access corridor. The width of this corridor would be reduced in areas where there are existing structures in order to minimize impacts. The pipeline corridor includes existing culverts at highway and railroad crossings. All culverts, however, are likely too small to thread the pipeline needed to transport borrow material (sediment) to the mitigation feature. A larger 36-inch diameter pipe would be jack-and-bored at each crossing. Jack and bore at the railroad location would not be located immediately adjacent to the Mississippi River Levee (MRL). The remainder of the pipeline would be routed above ground. Some clearing of vegetation and debris may be required along the access corridor. All vegetation cleared for access would be placed in the bottom of the mitigation feature and buried with the fill material. The fill would be placed to an initial slurry elevation of +3.0 feet.

The estimated construction duration for constructing the retention system and dredge filling the site is approximately 11 to 12 months. Once the fill operation is complete, an idle period of approximately one year would allow hydraulically placed fill time to settle and dewater to a final target grade of +1.0 feet . A second construction contract would be awarded at the end of the idle period to degrade dikes to an elevation that would provide an appropriate hydroperiod for the swamp. The entire length of the dike would be degraded. The degraded material from the dikes would be placed back into the feature in areas where borrow was acquired for the dikes and the material settled below target elevation.

Once the fill material has settled to the desired final target grade and the retention dikes are degraded, the mitigation feature would be planted with native canopy and midstory species. The plantings would be in accordance with the swamp planting guidelines contained in appendix L. The duration for the subsequent construction phase for degrading the retention dike and initial planting is approximately 3 to 4 months.

It is anticipated that several trees and shrubs installed at the time of initial planting would not survive for a year; thus, it was estimated that about 20% of the total number of plants initially installed would need to be re-planted about one year after completion of the initial plantings. Additional activities that would occur during the project construction phase would include periodic eradication of invasive/nuisance plant species within the mitigation feature as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of the project to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation feature and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L).

Salvador-Timken Swamp Restoration – PIER Design

This project would involve restoring swamp habitat as mitigation for swamp flood side general impacts. The site established for restoration would be located along the western shore of Lake Cataouatche and south of the Louisiana Cypress Lumber Canal in Saint Charles Parish. The project would be located in an existing open water portion of the Salvador-Timken Wildlife Management Area (WMA). The proposed swamp restoration feature is identified in plan as ST1 (see appendix A) and would encompass approximately 314.8 acres.

An earthen retention dike would first be mechanically constructed along the perimeter of the proposed restoration feature. The retention dike borrow would be obtained from within the restoration footprint. Dikes would be built with a combination of marsh tracked and barge mounted equipment. The length of the dike would be 18,500 linear feet. Due to high clay content expected in the Lake Cataouatche borrow site (see below), a bulking factor of 60 percent will be used in the design of the retention dikes. Additionally, a freeboard of one foot is required on the dike. The dike would be built to an elevation of +7.0 feet, with a five foot crown and 1V:4H side slopes. Initial settlement expected for the dike is assumed to be 30%. The total dike volume would be roughly 329,000 cubic yards.

Feature ST1 would be filled to an initial target elevation (slurry elevation) of +3.0 feet. The assumed existing average elevation of the ST1 footprint is -2.0 feet. The final target elevation of +2.0 feet yields a required earthen lift of 5.0 feet. Assuming one foot of foundation settlement, the total fill quantity required to create the swamp platform would be approximately 3,100,000 cubic yards.

Borrow for earthen fill for the restoration site would be obtained from Lake Cataouatche. Using a hydraulic cutter-head dredge, borrow would be dredged (excavated) from an approximately 365-acre borrow site situated a minimum distance of 2,000 feet from the lake's shoreline. Existing lake bottom elevations vary. The project designer assumed an existing average lake bottom elevation within the footprint of the borrow site of -8.0 feet. The borrow site would be dredged to elevation -20 feet or shallower. Grain size distribution of borrow materials was assumed to be 10 percent silty sand and 90 percent silty clay. The borrow site designs used a 2:1 pit to fill ratio to allow for unknown utilities, anomalies, and cultural sites. If potential long-term environmental impacts are anticipated, dissolved oxygen and rate of infilling would be monitored at the borrow site following construction.

The dredged borrow material (sediment) would be piped to the restoration feature in slurry. The pipeline corridor would be 100 feet wide and about 9,300 long (see appendix A). Floating pipeline would be used, which is a dredge discharge pipe positioned on pontoons. The floating pipeline would be marked on 150 foot centers to prevent navigation hazards in the lake. Markers would include lighted and reflective buoys. The overall pipeline corridor would traverse a short section of wetland near the east boundary of feature ST1. The pipeline corridor here (approximately 1,100 feet long) would be aligned such that it would coincide with an existing canal that bisects the adjacent wetland habitats to minimize wetland impacts. Marsh tracked vehicles would lay, maintain, and remove the pipeline within the canal/wetland corridor. Marsh tracked vehicles would also handle the pipeline and maintain dikes during dredge fill operations within the restoration feature. Adjustable spill boxes would be placed in the ST1 retention dikes to drain excess water from the restoration site during the hydraulic fill operation. The estimated construction duration for constructing the retention system and dredge filling the site is 11 to 14 months.

Once the fill operation is complete, an idle period of approximately one year would allow the hydraulically placed fill time to settle and dewater to the desired final target elevation of +2.0 feet. A second construction contract would be awarded at the end of the idle period to degrade the retention dikes and plant feature ST1. The perimeter dikes would be degraded to an elevation of approximately one foot above the final swamp target elevation in order to establish the desired hydroperiod for the restored swamp habitat. The amount of dike degradation needed would be determined during this second phase of construction through monitoring of swamp water levels and topographic surveys of the completed swamp platform. The dikes would be degraded with a combination of marsh tracked vehicles and barge mounted equipment. Material removed would be used where possible to fill low areas within the restoration area, or placed in the adjacent open water area outside of the restoration feature. After the perimeter dikes have been degraded, the mitigation feature would be planted with native swamp canopy and mid-story species. The plantings would be in accordance with the swamp planting guidelines contained in appendix L. The duration for the construction phase that includes degrading the retention dikes and the initial planting of feature ST1 is 6 to 9 months.

It is anticipated that several plants installed at the time of the initial planting would not survive for a year; thus, it was estimated that about 20% of the total number of plants initially installed would need to be re-planted one year after completion of the initial planting. Additional activities that would occur during the overall project construction phase would include periodic eradication of invasive/nuisance plant species within the mitigation feature as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of monitoring responsibilities to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation feature and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L).

Simoneaux Ponds Swamp Restoration – PIER Design

This project would involve restoring swamp habitat as mitigation for swamp flood side general impacts. The proposed swamp restoration feature is identified as feature SP3 and would occupy approximately 314.8 acres (see appendix A). The site established for restoration would be located along the northern shore of Bayou Gauche, a small outlet of

Bayou des Allemands at Black Prince Island. The site established for restoration is currently an open water area in St. Charles Parish.

Earthen retention dikes would be mechanically constructed along the perimeter of the proposed restoration feature. The retention dike borrow would be obtained from within the restoration footprints. Dikes would be built with marsh tracked equipment. The length of the perimeter dike would be 19,900 linear feet. Due to high clay content expected in the borrow site (see below), a bulking factor of 60 percent was used in the design of the retention dikes. Additionally, a freeboard of one foot is required on the dike. The dike would be built to an elevation of +7.5 feet, with a five foot crown and 1V:4H side slopes. Initial settlement expected for the dike is assumed to be 30%. Total dike volume would be 431,200 cubic yards.

The swamp restoration feature would be filled to an initial target elevation of +3.0 feet. The assumed average existing elevation of the SP3 footprint is -2.5 feet. The initial target elevation would require an earthen lift of 5.5 feet. Assuming one foot of foundation settlement, the total fill quantity required to establish the marsh platform would be approximately 3,733,200 cubic yards. This quantity includes compensation for the 431,200 cubic yards that would be excavated within feature SP3 to build the retention dikes.

Once dike construction is completed, the fill material needed would be dredged from the borrow source with a hydraulic cutter-head dredge and piped to the restoration features in slurry. The borrow site would be located in Lake Salvador and would be positioned a minimum distance of 2,000 feet from the lake's shoreline. Existing lake bottom elevations vary. The project designer assumed an existing average lake bottom elevation of -8.0 feet within the footprint of the borrow site. This site would be dredged (excavated) to an elevation of -20.0 feet or shallower. Grain size distribution of borrow materials was assumed to be 10 percent silty sand and 90 percent silty clay. The borrow site design used a 2:1 pit to fill ratio to allow for unknown utilities, anomalies, and cultural sites. This borrow site would occupy approximately 442 acres to yield the 7,466,400 cubic yards of borrow required. If potential long-term environmental impacts are anticipated, dissolved oxygen and rate of infilling would be monitored at the borrow site.

The dredged borrow material (sediment) would be piped to the restoration feature in a slurry. The pipeline corridor would typically be 100 feet wide and its total length would be approximately 57,000 feet. The corridor would be placed near the banks of Bayou des Allemands in an effort to minimally impact boat navigation in the bayou. In the segment of the pipeline from the borrow site to the shoreline immediately south of Bayou Gauche Road (LA 306), floating pipeline would be used which is a dredge discharge pipe positioned on pontoons. Floating pipeline would be marked on 150 foot centers to prevent boat hazards in the lake and along the bayou. Markers would include lighted and reflective buoys.

The pipeline corridor would include a short land crossing at the entrance from Bayou Gauche to Simoneaux Ponds. The land crossing would be approximately 1,600 linear feet long and the pipeline corridor here would be reduced to a 50 foot width. The land crossing includes a jack-and-bore beneath Bayou Gauche Road. A permanent culvert would be installed beneath the highway and the slurry pipeline would be routed through this culvert. Once through the new highway crossing, the pipeline would continue north over existing land, including an existing wetland area before reaching the open water of Simoneaux Ponds. Marsh tracked vehicles and dozers would handle the pipeline within the land/wetland crossing. At the northern end of the land/wetland crossing, the pipeline corridor would extend another 2,660 feet over open water before reaching feature SP3, This pipeline segment would be a floating pipeline, again marked on 150 centers to minimize hazards to watercraft using Simoneaux Ponds. Marsh tracked vehicles would move the discharge pipeline within the restoration site when pumping, and maintain the retention dikes as needed for the duration on the dredge fill operation. Adjustable spill boxes would be placed in the SP3 retention dikes drain excess water from the restoration site during the hydraulic fill operation.

The estimated construction duration for constructing the retention system and dredge filling the site is 11 to 14 months. Once the dredge and fill operation required to establish the land platform for the restoration feature is complete, an idle period of approximately one year would allow the hydraulically placed fill time to settle and dewater to the desired final target elevation of +2.0 feet. A second construction contract would be awarded at the end of the idle period to degrade the perimeter dikes and plant the restoration feature. Perimeter dikes would be degraded to an elevation roughly 1 foot above the final target elevation of the swamp platform. The dikes would be degraded with marsh tracked vehicles. The amount of dike degradation would be determined post-construction through monitoring of the site in order to establish a dike elevation that provides an appropriate hydroperiod for the restored swamp. Material removed would be used where possible to fill low areas within the restoration area, or placed in the adjacent open water area outside of the restoration feature. After the initial degrading of the perimeter dikes, the mitigation feature would be planted with native canopy and midstory species. The plantings would be in accordance with the swamp planting guidelines contained in appendix L. The duration for the subsequent construction project for degrading the retention dike and planting the feature would be from 6 to 9 months.

It is anticipated that several trees and shrubs installed at the time of initial planting would not survive for a year; thus, it was estimated that about 20% of the total number of plants initially installed would need to be re-planted one year after completion of initial plantings. Additional activities that would occur during the project construction phase would include periodic eradication of invasive/nuisance plant species within the mitigation feature as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of monitoring responsibilities to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation feature and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L).

NON-PARK/404(C) FRESH MARSH FLOOD SIDE IMPACTS

Dufrene Ponds Marsh Restoration – PIER Design

The proposed project would entail restoration of fresh marsh habitats as mitigation for fresh marsh general impacts. The proposed marsh restoration features are identified as DP3 (approximately 94.7 acres) and DP5 (approximately 43.9 acres), as shown in appendix A, and together would total approximately 138.6 acres. The sites established for restoration would be located along the right descending bank (RDB) of Bayou des Allemands and immediately south of US Highway 90 in Lafourche Parish. The features are currently open water sites. The two proposed fresh marsh restoration features are divided by a corridor, approximately 200 feet wide, which runs predominately east to west along a curve that splits the mitigation features. This corridor is the proposed alignment of the future expansion of Interstate 49. None of the proposed mitigation features would be within the I-49 corridor.

Earthen retention dikes would be mechanically constructed along the perimeter of the proposed restoration features. The retention dike borrow would be obtained from within the restoration footprints. Dikes would be built with a combination of marsh tracked and barge mounted equipment. The length of the perimeter dike for both elements combined would be 15,900 linear feet. Due to high clay content expected in the borrow site (see below), a bulking factor of 60 percent was used in the design of the retention dikes. This project, however, has two restoration sites with the ability to pump fill into one while letting slurry fill placed in the second site drain. The ability to drain one of the elements while pumping the other resulted in a reduction in the bulking factor needed. A 50% factor was used for this project due to the two elements. Additionally, a freeboard of one foot is required on the dike. The dike would be built to an elevation of +7.0 feet, with a five foot crown and 1V:4H side slopes. Initial settlement expected for the dike is assumed to be 30%. Total dike volume would be 413,000 cubic yards.

The two restoration features would be filled to an initial target elevation of +2.5 feet. The assumed average existing elevation within the DP3 and DP5 footprints is -4.0 feet. The initial target elevation would require an earthen lift of 6.5 feet. Assuming one foot of foundation settlement, the total fill quantity required would be approximately 1,678,000 cubic yards.

Borrow for earthen fill for the restoration features would be obtained from a 220-acre borrow site in Lake Salvador. The total volume of borrow needed would be approximately 4,182,000 cubic yards. Borrow would be obtained a minimum distance of 2,000 feet from the lake's shoreline using a hydraulic cutter-head dredge. Existing lake bottom elevations vary. The project designer assumed an existing average lake bottom elevation within the footprint of the borrow site of -8.0 feet. The borrow site would be dredged to an elevation of -20 feet or shallower. Grain size distribution of borrow materials was assumed to be 10 percent silty sand and 90 percent silty clay. The borrow site designs used a 2:1 pit to fill ratio to allow for unknown utilities, anomalies, and cultural sites. If potential long-term environmental impacts are anticipated, dissolved oxygen and rate of infilling would be monitored at the borrow site following construction

The fill material dredged from Lake Salvador would be piped to the restoration features in slurry. The pipeline corridor would be 100 feet wide and roughly 78,000 feet long (see appendix A). The corridor would be placed near the banks of Bayou des Allemands in an effort to minimally impact navigation in the bayou. Floating pipeline would be used, which is a dredge discharge pipe positioned on pontoons. The floating pipeline would be marked on 150 foot centers to prevent boat hazards in the lake and along the bayou. Markers would include lighted and reflective buoys.

The pipeline would need to cross from the east side of the bayou to the west side near the west end of Black Prince Island. A small segment of submerged pipeline rather than floating pipeline would be installed at the crossing with signage to ensure safe passage over the line. The crossing width would be set to accommodate the existing boat and barge traffic in the bayou. Adjustable spill boxes would be placed to the retention dikes to drain excess water from the restoration sites during the hydraulic fill operation. Marsh tracked vehicles would move the discharge pipeline within the restoration sites when pumping, and maintain the retention dikes as needed for the duration on the dredge fill operation. The estimated construction duration for constructing the retention system and dredge filling the restoration features would be 9 to 12 months.

Once the dredge and fill operation required to establish the land platforms for the restoration features is complete, an idle period of approximately one year would allow hydraulically placed fill time to settle and dewater to the desired final target elevation of +1.5 feet. A second construction contract would be awarded at the end of the idle period to degrade the perimeter dikes and install dike armoring. Perimeter dikes would be degraded to equal the final target elevation of the fresh marsh platforms. The dikes would be degraded with marsh tracked vehicles and barge mounted backhoe. Material removed would be used where possible to fill low areas within the restoration area, or placed in the adjacent open water area outside of the restoration features. The open water face of the retention dike along the eastern boundary of feature DP5 would be armored adjacent to Bayou des Allemands with a two foot blanket of stone. The stone would be a well graded riprap with a proposed top size stone of 650 pounds. The armoring would include a two foot lift of stone on a separator geotextile. The armoring would not exceed the final target elevation of the proposed marsh feature.

Feature DP3 would be located adjacent to an existing spoil berm running along the eastern side of DP3. Gaps would be excavated in this spoil berm to allow aquatic organisms to access marsh DP3 from marsh and open water habitats situated east of the berm. These gaps would have a bottom elevation of 0.0 feet, would be roughly 100 feet wide, and would be spaced every 500 feet along the eastern edge of DP3. In addition, this phase of project construction would include excavating trenasses or similar shallow water depressions within the two marsh restoration features to create areas of shallow water interspersion. Mitigation activities in restoration features slated for fresh marsh restoration would not include planting native vegetation. It is anticipated that native herbaceous marsh plants would rapidly colonize the area rapidly. The duration of this construction phase (degrading and armoring dikes, excavating gaps, installation of armoring) would last roughly 2 to 3 months.

Additional activities that would occur during the project construction phase would include periodic eradication of invasive/nuisance plant species within the mitigation feature as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of monitoring responsibilities to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation feature and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L). It is not anticipated that additional fill would need to be added to the restoration features during the 50-year period of analysis.

Jean Lafitte Marsh Restoration – PIER Design

This mitigation project would involve restoration fresh marsh habitats. Two restoration features are proposed (see appendix A). Feature JL1B5 would be built in an open water portion of Yankee pond, would occupy approximately 91.2 acres, and would be located within the Park. Feature JL15 would be situated in an area along the shoreline of Lake Salvador where prior work has already largely established a marsh platform that was previously an open water portion of the lake. Feature JL15 would encompass a total of approximately 55.5 acres. Portions of this feature would overlap Park property, while the remaining portions would overlap lands not currently owned by NPS. Both of the marsh restoration features would be located in Jefferson Parish.

In constructing feature JL1B5, the first step would be to build an earthen retention dike along the perimeter of the feature. It was assumed that total perimeter retention would be required to retain dredge material and allow for vertical accretion. Approximately 8,400 linear feet of retention dike would be required. Of the total 8,400 linear feet of dikes, approximately 3,100 linear feet would be armored/capped with stone (well graded riprap with a proposed top size stone of 650 pounds) during the second project construction phase. This armored dike segment would be located along the eastern boundary of feature of JL1B5 adjacent to Bayou Segnette (see appendix A).

Retention dikes would be constructed to maintain a minimum of one foot of freeboard during dredging operations. The retention dikes would be constructed to elevation +5.0 feet, with a 5-foot crown to assure dike integrity. Borrow for these retention dikes would be excavated with a marsh buggy from within the marsh creation footprint. The borrow ditch would be offset a minimum of 40 feet from the dike to assure dike stability. For initial quantity estimates, the dikes were assumed to have 1V:4H side slopes. A low level weir or spill boxes would be constructed in the western retention dike where it borders existing marsh habitats to allow for effluent water release from within the marsh restoration area and potentially nourish the adjacent existing marsh. If deemed necessary by the construction contractor, a low level interior weir could be constructed to assist in vertical stacking of dredged material.

Marsh restoration would require approximately 600,000 cubic yards of material hydraulically dredged from Lake Cataouatche. It is anticipated that the borrow source proposed would contain approximately 10 percent sand. The borrow site would be situated a minimum 2,000 feet from the lake shoreline and borrow would be removed by a hydraulic cutter-head dredge. The borrow site would be approximately 1,200 ft X 1,500 ft (roughly 42.0 acres) with a maximum cut of 10 feet. The material would be hydraulically pumped from the borrow site to feature JL1B5 via 18,000 linear feet of pipeline routed adjacent to the western bank of Bayou Segnette. Floating pipeline would be used which is a dredge discharge pipe positioned on pontoons. The pipeline corridor would be 100 feet wide. This corridor would be marked on 150 foot centers to prevent boat hazards in the lake and along the bayou. Markers would include lighted and reflective buoys. As the pipeline would need to cross a portion of Lake Cataouatche, a small segment of submerged pipeline would be installed at the crossing with appropriate signage to ensure safe passage of vessels over the line.

The main navigation channel in the Bayou Segnette Waterway (BSSW) ranges from 300 to 450 feet wide. As noted, that portion of the slurry pipeline routed adjacent to the west bank of the BSSW would have a pipeline corridor width of 100 feet. The eastern boundary of this corridor would not extend into the limits of the main BSSW navigation channel. Since proposed marsh JL1B5 would be located on the western side of Bayou Segnette, the sediment pipeline would not need to cross the BSSW navigation channel. Throughout the initial construction phase, project construction would be coordinated with the US Coast Guard.

The initial target marsh elevation (elevation of slurry fill) in JJL1B5 would be +3.5 feet. It is estimated that the initial project construction activities discussed above would require approximately 5 to 6 months. Once these activities are completed there would be an idle period of approximately 1 year to allow the marsh feature to settle to the desired final target elevation of approximately +1.0 to +1.5 feet. The final construction phase would begin following settlement and dewatering of the created marsh platform.

All perimeter dikes except for the one bordering Bayou Segnette (e.g. east dike) would be degraded with a marsh buggy such that the crest of the dikes would be the same as the final target elevation of the marsh platform. Approximately 2-feet of dike degrading is anticipated after the initial year of settlement to revert the dike footprint to desired marsh elevation. The dike segment along the eastern edge of feature JL1B5 would first be degraded to elevation +3.0 feet. Armoring would then be placed along the eastern face of this dike, constructed with a 2-foot stone cap to elevation +3.0 feet. During this process, fish dips" (essentially armored gaps) would be constructed in the armored dike segment. The fish dips would allow water exchange and provide aquatic organisms access to the marsh feature. Each fish dip would have a bottom width of approximately 100 feet, a bottom elevation no greater than 0 feet, and 1V:3H side slopes. At this phase of design, it was assumed that there would be one fish dip established for every 500 feet of armored dike (i.e. 500-foot spacing). Sediment generated during the dike degrading process would be placed back into the depression left from the original borrow ditch within the restoration feature.

In conjunction with the dike degrading efforts, trenasses would be constructed as necessary to serve as tidal creeks to facilitate water exchange and create shallow water interspersion features within JL1B5. The trenasses would be rutted to a lower than marsh elevation by performing two passes of a marsh buggy along the desired alignment. The acceptable trenasse width, if constructed in this fashion, would be the width of marsh buggy. If the resulting depression is not adequate for minimal water flow, the marsh equipment can excavate material along the proposed alignment, not to exceed a 5-foot bottom width by 1-foot deep channel. It is anticipated that the final phase of construction activities (degrading dikes, constructing trenasses and fish dips, installation of dike armoring) would require approximately 3 to 4 months.

Additional activities that would occur during the project construction phase would include periodic eradication of invasive/nuisance plant species within the mitigation feature as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of monitoring responsibilities to the NFS). It was assumed that appropriate fresh marsh plant species would naturally colonize the marsh restoration feature; hence, no planting of the feature is proposed.

One should note that another marsh restoration feature, feature JL1B4, is proposed in Yankee Pond immediately adjacent to the southwest subject marsh feature JL1B5. If this other marsh restoration project is authorized, feature JL1B4 would merge with feature JL1B5 to create one overall marsh restoration feature occupying approximately 109.5 acres (see appendix A). Under this scenario, there would be no dike constructed along the southwestern edge of JL1B5 since this area would become part of the overall marsh platform. The other earthen perimeter retention dikes along the boundaries of feature JL1B5 would remain and would tie into the western and southern earthen retention dikes required to construct feature JL1B4.

Marsh restoration feature JL15 is currently a man-made marsh platform with an average elevation of roughly +2.0 feet. This area was formerly a portion of Lake Salvador (i.e. was previously an open water area). It was referred to in IER 12 as the JLNHPP "geocrib" site, and the initial concept for this area was to create roughly 28 acres of fresh marsh at the site through deposition of dredged material from the Algiers Canal and subsequent planting of marsh species.

The initial construction phase of the original project design was completed by CEMVN in 2009. A geocrib barrier was constructed along the western boundary of feature JL15 and an earthen retention dike was built immediately east of and adjacent to the geocrib barrier. Borrow was then pumped into the feature as fill, covering an area of approximately 54 acres rather than the 28 acres discussed in IER 12. The final phase of this prior work was recently completed by CEMVN. This phase involved the construction of a riprap dike (foreshore rock dike) along the western edge of feature JL15 to help protect the area landward of the dike from erosion (see appendix A).

The proposed project would restore fresh marsh habitat in feature JL15. IER 12 was a NEPA document prepared for a particular portion of the proposed HSDRRS improvements to the WBV levee system. IER 12 identified mitigation feature JL15 as a possible mitigation site for HSDRRS impacts, indicating that this site could be used in the future as a means of mitigating some of the WBV HSDRRS impacts). Although construction of feature JL15 was initiated in the past, it was never used as or counted toward mitigation for any other civil works project. It was always intended to serve as one of the mitigation components necessary to compensate for WBV HSDRRS impacts. Hence, proposed feature JL15 remains available for use as a means of compensating for these impacts.

As stated above, the average existing grade of the geo-crib site is elevation +2.0 feet, which is above the desired marsh platform elevation of +1.0 feet to +1.5 feet. There are also places immediately east of the existing foreshore rock dike where the previously placed fill is much higher than elevation +2.0 feet and few isolated areas where the existing grade is much lower than desired. As part of the proposed project, track equipment and bull dozers would be placed within the JL15 footprint to work the existing fill material to achieve a uniform design grade elevation of +1.0 to +1.5 feet. It is estimated that approximately 41,000 cubic yards of material would be involved in this re-grading process. Clearing and grubbing would also be necessary to remove existing trees and shrubs from the marsh feature. The vegetation debris generated would be burned on-site, or disposed of in the open water outside of the foreshore rock dike.

Portions of the existing rock dike adjacent to the west boundary of feature JL15 would need to capped to the original design elevation of +6.0 feet as part of the proposed project. It was assumed that roughly 30% of full length of the foreshore rock dike would need to be replaced and/or refurbished. During the process of refurbishing the foreshore rock dike, "fish dips" (essentially armored gaps) would be constructed in this dike. The fish dips would allow water exchange and provide aquatic organisms access to the marsh feature. Each fish dip would have a bottom width of approximately 100 feet, a bottom elevation no greater than 0 feet, and 1V:3H side slopes. At this phase of design, it was assumed that at least 5 armored fish dips would be constructed at roughly equal intervals along the length of the rock dike. These would be in addition to an existing fish dip previously constructed near the south end of the subject dike segment. This existing fish dip may require refurbishment (ex. adjust for acceptable bottom elevation and side slopes, addition of additional stone armoring, etc.). It is anticipated that the final phase of JL15 construction activities (re-grading the marsh platform, refurbishment of rock dike, constructing fish dips would require approximately 4 to 5 months.

Additional activities that would occur during the project construction phase would include periodic eradication of invasive/nuisance plant species within the mitigation feature as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of monitoring responsibilities to the NFS). It was assumed that appropriate fresh marsh plant species would naturally colonize the JL15 marsh restoration feature after completion of the earthwork/regarding activities; hence, no planting of the feature is proposed.

Various activities would be necessary during the OMRR&R phase of this overall project (restoration features JL1B5 and JL15). At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation features and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L). The armored dike along feature JL1B5 would likely need to be maintained once every 15 years through the addition of armoring (stone/rip-rap). Approximately 2,000 tons of stone may be required each 15-year maintenance cycle. The foreshore rock dike along feature JL15 would also likely need to be maintained once every 15 years through the addition of armoring. Approximately 2,000 tons of stone may be require each 15-year maintenance cycle.

Plaquemines, Option 1 Marsh Restoration – PIER Design

The proposed project would involve restoration of fresh marsh habitat in an existing open water area, through creating an earthen platform for the new marsh. The proposed mitigation feature would be located off the right descending bank (RDB) of the Mississippi River at River Mile 68, in Plaquemines Parish near Jesuit Bend. The proposed marsh, feature P2, would encompass approximately 171.2 acres and would serve as mitigation for general fresh marsh impacts.

A retention dike would first be built along the perimeter of the proposed feature to retain fill. There is an existing spoil berm adjacent to the west and north sides of feature P2. Where P2 borders this berm, a new retention dike would likely not be required. Instead, the existing berm (roughly 7,000 linear feet) would simply be capped with additional fill to achieve the desired crest elevation. A completely new retention dike (roughly 15,000 linear feet) would be built along the eastern and southern boundaries of feature P2. This dike would be built to elevation +6.1 feet and would be constructed with a 5-foot crown and 1V:4H side slopes. All borrow material for the dike construction would come from within the mitigation feature. The borrow area would be offset a minimum 40 feet from the perimeter retention dikes for stability.

The borrow needed would be obtained from the Mississippi River near Jesuit Bend. Two 115-acre borrow sites would be located at approximately River Mile 69 and Mile 67 on the left descending bank (LDB) of the river. Grain size distribution of borrow materials was assumed to be 70 percent fine sand and 30 percent silty clay. Due to moderate clay content in the borrow site, a bulking factor of 40 percent was used in the design of the project. The borrow quantity that would be needed to construct the proposed marsh feature is approximately 1,800,000 cubic yards. The borrow areas would be excavated to elevation -68.0 feet using a hydraulic cutter-head dredge. The resulting borrow material (sediment) would be transported to feature P2 via a pipeline. The pipeline segment extending from the borrow site to the right descending bank of the river would be submerged along the river bottom and coordinated with the US Coast Guard so as to not adversely impact river navigation.

The remainder of the pipeline from the river bank to the mitigation feature would primarily be above ground, using a corridor 100 feet wide. From the river westward to the Mississippi River Levee, the pipeline would follow the existing Atmos Energy pipeline corridor. In this segment, the pipeline corridor width would be reduced as necessary to avoid impacts to existing structures. This pipeline segment would be routed beneath Highways 11 and 23 and beneath an existing railroad. Thirty-six inch diameter culverts would be jack-and-bored at each of these crossings and the pipeline routed through the culverts. Trees and other vegetation cleared to install the pipeline would be disposed of within a portion of the open water area immediately south of feature P2.

After reaching the west end of the Atmos Energy corridor, the pipeline would be routed along the flood side of the MRL for a distance of roughly 3,360 feet. It would then cross the open water area to reach feature P2. The pipeline portion crossing the open water area would be floated on pontoons, with lighted marker buoys installed every 100 linear feet on each side of the pipeline corridor. Overall, the total length of pipeline required would be between 10,000 and 12,000 linear feet.

The fill would be placed to an initial slurry elevation of +3.75 feet. Once the fill operation is complete, an idle period of approximately one year would allow the hydraulically placed fill time to settle and dewater to a final target grade elevation of +1.5 feet. The estimated construction duration for constructing the retention system and dredge filling the site is approximately 8 to 9 months.

A second construction contract would be awarded at the end of the idle period to degrade the retention dikes. The dikes along the east and south sides of feature P2 would be completely degraded to match the final target elevation of the marsh platform. "Gaps" would be excavated through the perimeter dikes (remnant spoil berms) along the west and north sides of P2 to allow water flow/exchange between the restored marsh and adjacent existing marsh habitats. These gaps would be constructed at 1,000-foot intervals and would each be roughly 100 feet wide. The bottom elevation of each gap would be set to match the final target grade of feature P2. The material generated from degrading and gapping dikes would be placed into feature P2 where borrow was acquired for the initial dike construction

In conjunction with this dike degrading effort, trenasses would be constructed as necessary to serve as tidal creeks to facilitate water exchange and create shallow water interspersion features. The trenasses would be rutted to a lower than marsh elevation by performing two passes of a marsh buggy along the desired alignment. The acceptable trenasse width, if constructed in this fashion, would be the width of marsh buggy. If the resulting depression is not adequate for minimal water flow, the marsh equipment can excavate material along the proposed alignment, not to exceed a 5-foot bottom width by 1-foot deep channel.

The restored marsh feature would not be planted. Instead, it is anticipated that adequate herbaceous vegetation would colonize the feature naturally. The duration for the subsequent construction project for degrading the retention dike, spoil berm gapping, and construction of trenasses would be approximately 2 to 3 months.

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation feature and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L).

Salvador-Timken Marsh Restoration – PIER Design

This project would involve restoring fresh marsh habitat as mitigation for fresh marsh flood side general impacts. The project would be located in an existing open water portion of the Salvador-Timken Wildlife Management Area (WMA). The fresh marsh restoration feature is identified in plan as ST2 (see appendix A) and would encompass approximately 163.3 acres. The site established for restoration is located along the western shore of Lake Cataouatche and south of the Louisiana Cypress Lumber Canal in Saint Charles Parish.

An earthen retention dike would first be mechanically constructed along the perimeter of the proposed restoration feature. The retention dike borrow would be obtained from within the restoration footprint. Dikes would be built with a combination of marsh tracked and barge mounted equipment. The length of the dike would be approximately 13,100 linear feet. Due to high clay content expected in the Lake Cataouatche borrow site (see below), a bulking factor of 60 percent will be used in the design of the retention dikes. Additionally, a freeboard of one foot is required on the dike. The dike would be built to an elevation of +7.0 feet, with a five foot crown and 1V:4H side slopes. Initial settlement expected for the dike is assumed to be 30%. The total dike volume would be roughly 284,000 cubic yards.

Feature ST2 would be filled to an initial target elevation (slurry elevation) of +2.5 feet. The assumed existing average elevation of the ST2 footprint is -3.0 feet. The final target elevation of +1.5 feet yields a required earthen lift of 5.5 feet. Assuming one foot of foundation settlement, the total fill quantity required to create the marsh platform would be approximately 1,750,000 cubic yards.

Borrow for earthen fill for the restoration site would be obtained from Lake Cataouatche. Using a hydraulic cutter-head dredge, borrow would be dredged (excavated) from an approximately 211-acre borrow site situated a minimum distance of 2,000 feet from the lake's shoreline. The total borrow quantity needed would be approximately 4,068,000 cubic yards. Existing lake bottom elevations vary. The project designer assumed an existing average lake bottom elevation within the footprint of the borrow site of -8.0 feet. The borrow site would be dredged to elevation -20 feet or shallower. Grain size distribution of borrow materials was assumed to be 10 percent silty sand and 90 percent silty clay. The borrow site designs used a 2:1 pit to fill ratio to allow for unknown utilities, anomalies, and cultural sites. If potential long-term environmental impacts are anticipated, dissolved oxygen and rate of infilling would be monitored at the borrow site following construction.

The dredged borrow material (sediment) would be piped to the restoration feature in slurry. The pipeline corridor would be 100 feet wide and about 7,600 long (see appendix A). Floating pipeline would be used, which is a dredge discharge pipe positioned on pontoons. The floating pipeline would be marked on 150 foot centers to prevent navigation hazards in the lake. Markers would include lighted and reflective buoys. Marsh tracked vehicles would handle the pipeline and maintain dikes during dredge fill operations within the restoration feature. An adjustable spill box(s) would be placed to drain excess water from the restoration site during the hydraulic fill operation. The estimated construction duration for constructing the retention system and dredge filling the site is 6 to 9 months.

Once the fill operation is complete, an idle period of approximately one year would allow the hydraulically placed fill time to settle and dewater to the desired final target elevation of 1.5 feet. A second construction contract would be awarded at the end of the idle period to degrade the retention dikes and construct a trenasse. The perimeter retention dikes would be completely degraded to match the final target grade elevation of the marsh platform. A trenasse would be constructed during this construction phase. The trenasse would be sinuous in alignment, with branches to connect tidal pools that form during the dewatering period. There is an existing canal extending southward from the Louisiana Cypress Lumber Canal to the open water area that would contain feature ST2. The constructed trenasse would connect with this branch canal where it intersects the north perimeter of feature ST2. The trenasse would be excavated to an approximate elevation of 0.0 feet. The bottom width would be approximately six feet. Materials excavated from the trenasse and the material degraded from the northern retention dike would be cast into adjacent low areas within the feature footprint. Trenasse construction and north retention dikes would be performed with a marsh tracked backhoe. Material degraded from the south dike would be placed in the adjacent open water outside of the feature footprint. The south dike would be degraded with a combination of marsh tracked vehicles and barge mounted excavators.

The proposed fresh marsh restoration would not include planting native marsh vegetation, since it is anticipated that sufficient herbaceous marsh vegetation would rapidly colonize feature ST2 naturally. If the feature does not vegetate naturally, the area would be planted to meet mitigation success requirements. The duration for the construction phase for degrading the retention dikes and constructing the trenasse would be 3 to 6 months.

Additional activities that would occur during the overall project construction phase would include periodic eradication of invasive/nuisance plant species within the mitigation feature as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of monitoring responsibilities to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation feature and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L).

Simoneaux Ponds Marsh Restoration – PIER Design

This project would involve restoring fresh marsh habitat as mitigation for fresh marsh flood side general impacts. The proposed fresh marsh restoration feature is identified as feature SP2 and would occupy approximately 163.3 acres (see appendix A). The site established for restoration would be located along the northern shore of Bayou Gauche, a small outlet of Bayou des Allemands at Black Prince Island, in St. Charles Parish. The site established for restoration is currently an open water site.

Earthen retention dikes would be mechanically constructed along the perimeter of the proposed restoration feature. The retention dike borrow would be obtained from within the restoration footprints. Dikes would be built with marsh tracked equipment. The length of the perimeter dike would be 13,000 linear feet. Due to high clay content expected in the borrow site (see below), a bulking factor of 60 percent was used in the design of the retention dikes. Additionally, a freeboard of one foot is required on the dike. The dike would be built to an elevation of +6.5 feet, with a five foot crown and 1V:4H side slopes.

Initial settlement expected for the dike is assumed to be 30%. Total dike volume would be 231,000 cubic yards.

The fresh marsh restoration feature would be filled to an initial target elevation of +2.5 feet. The assumed average existing elevation of the SP2 footprint is -2.5 feet. The initial target elevation would require an earthen lift of 5 feet. Assuming one foot of foundation settlement, the total fill quantity required to establish the marsh platform would be approximately 1,581,000 cubic yards.

Borrow for earthen fill for the restoration features would be obtained from a 184-acre borrow site in Lake Salvador. Borrow would be obtained a minimum distance of 2,000 feet from the lake's shoreline using a hydraulic cutter-head dredge. Existing lake bottom elevations vary. The project designer assumed an existing average lake bottom elevation within the footprint of the borrow site of -8.0 feet. The borrow site would be dredged to an elevation of -20 feet or shallower. Grain size distribution of borrow materials was assumed to be 10 percent silty sand and 90 percent silty clay. The borrow site designs used a 2:1 pit to fill ratio to allow for unknown utilities, anomalies, and cultural sites. If potential long-term environmental impacts are anticipated, dissolved oxygen and rate of infilling would be monitored at the borrow site following construction

The dredged borrow material (sediment) would be piped from the borrow site to the restoration feature in a slurry. Most of the pipeline corridor would be 100 feet wide. The corridor would be placed near the banks of Bayou des Allemands in an effort to minimally impact boat navigation in the bayou. In the segment of the pipeline from the borrow site to the shoreline immediately south of Bayou Gauche Road (LA 306), floating pipeline would be used which is a dredge discharge pipe positioned on pontoons. This 57,000 feet long floating pipeline segment (corridor) would be marked on 150 foot centers to prevent boat hazards in the lake and along the bayou. Markers would include lighted and reflective buoys. The pipeline corridor would include a short land crossing at the entrance from Bayou Gauche to Simoneaux Ponds. The land crossing would be approximately 1,600 linear feet long and the pipeline corridor here would be to a 50 foot width. The land crossing includes a jack-and-bore beneath Bayou Gauche Road. A permanent culvert would be installed beneath the highway and the slurry pipeline would be routed through this culvert. Once through the new highway crossing, the pipeline would continue north on existing land to reach the restoration site. The corridor north of the highway crossing would intercept undeveloped wetland approximately 125 feet from the highway. Marsh tracked vehicles and dozers would handle the pipeline within the land crossing.

Marsh tracked vehicles would also move the discharge pipeline within the restoration site when pumping, and maintain the retention dikes as needed for the duration on the dredge fill operation. Adjustable spill boxes would be placed in the restoration feature perimeter retention dikes to drain excess water from the restoration site during the hydraulic fill operation. The estimated construction duration for constructing the retention system and dredge filling the site is 6 to 9 months.

Once the dredge and fill operation required to establish the land platforms for the restoration features is complete, an idle period of approximately one year would allow hydraulically placed fill time to settle and dewater to the desired final target elevation of +1.5 feet. A second construction contract would be awarded at the end of the idle period to degrade the perimeter dikes. Perimeter dikes would be degraded to equal the final target elevation of the fresh marsh platform. The dikes would be degraded with marsh tracked vehicles. Material removed would be used where possible to fill low areas within the restoration area, or placed in the adjacent open water area outside of the restoration feature. A trenasse would be excavated on a sinuous alignment within feature SP2. The alignment would be set to connect tidal pools that form during the year of settlement and dewatering, and such that the west end of the trenasse aligns with an existing east/west canal located near the far northwest corner of SP2. The trenasse would be cut to an elevation 0.0 feet with a six foot bottom width. Material excavated from the trenasse would be cast into adjacent low areas within the feature footprint. Mitigation activities would not include planting the marsh with native herbaceous species. The duration for the subsequent construction project for degrading the retention dike and construction the trenasse would be from 4 to 6 months.

Additional activities that would occur during the project construction phase would include periodic eradication of invasive/nuisance plant species within the mitigation feature as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of monitoring responsibilities to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation feature and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L).

PARK/404(C) BLH-WET IMPACTS

Jean Lafitte BLH-Wet Restoration – PIER Design

This project would be located in Jefferson Parish and would involve restoring native BLH-Wet habitats in an existing open water area (an existing borrow pit). The proposed restoration features would include JL14A (approximately 6.28 acres), and JL14B (approximately 5.88 acres), as shown in appendix A. Both features would be located within the Park, adjacent to the West Bank Hurricane Protection Levee.

Features JL14A and JL14B would be constructed by hauling in fill material with dump trucks and placing this material in the borrow pit to establish earthen platforms for the restored habitats. Once placed, the material would be worked with dozers and track equipment to achieve the desired initial target grade.

The borrow pit where JL14A and JL14B are proposed is estimated to be approximately 20 feet deep. The mitigation features would be filled with an estimated 18 feet of sand to elevation -0.0 feet. A four foot clay cap to elevation +3.5 feet would then be placed on top of the sand fill. Clearing of vegetation and debris from within the mitigation features and for access from the hurricane protection levee, and trimming of overhanging trees along the edges of the mitigation features would be required prior to placement of fill. All vegetation debris generated from clearing and grubbing would be cut to maximum 8 ft lengths and placed in an adjacent borrow pit to the northwest of the features. It is anticipated that it would take approximately one year for the fill materials to settle to the desired final target grade of elevation +2.0 feet.

Approximately 400,000 cubic yards of sand fill and 80,000 cubic yards of the clay cap would be required to fill the 12.2 acres being restored to BLH-Wet habitats. These borrow materials would be obtained from off-site government furnished and/or contractor furnished borrow pits. Specific borrow pits have not been established for the 35% designs and cost estimates. Both sand and clay borrow pits would be needed for the proposed mitigation features. The included costs assumed a 20 mile, one-way, haul distance for clay fill and a 40-mile one-way haul distance for sand fill.

Construction equipment, including dump trucks, would access the project site via two roadways extending west from Barataria Boulevard (see appendix A). The northern access roadway would be along a segment of Tusa Drive (about 0.3 miles) until turning north onto the existing Hurricane Protection Levee. The southern access roadway would be along an existing levee access roadway situated about 0.3 miles south of Tusa Drive. After reaching the levee, construction equipment would follow a semicircular access route along the levee itself that connects with the two entry access roadways. A construction access route with two connections to Barataria Boulevard was deemed necessary to maximize construction efficiency and to minimize construction traffic on Tusa Drive as much as possible.

Due to the dump truck traffic volume anticipated, construction traffic on area roadways would be limited to daylight hours, six days per week (Monday through Saturday); however, construction activities on the flood side of the levee would continue seven days per week. Construction traffic would use the southern entry roadway as much as possible rather than Tusa Drive, but there would likely be many occasions when at least half or more of this traffic would need to use Tusa Drive on a particular day. An appropriate traffic control plan would be implemented during the initial construction phase to minimize traffic congestion and safety hazards.

The proposed construction access route would require building three temporary earthen levee access ramps; one on the flood side of the levee east of feature JL14A, one on the flood side of the levee near feature JL14B, and one on the protected side of the levee near the southern access roadway. One of the two access ramps built on the flood side of the levee would remain in place for future maintenance. This would require coordination with the West Jefferson Levee District. The other two ramps would be removed. The material would be removed with a track hoe and placed in trucks to be hauled and placed in an existing borrow pit located immediately north of feature JL14A. The affected levee areas would then be regarded, fertilized, and seeded with grass.

Establishment of the construction access route would also require clearing a corridor through existing wetland habitat situated between the southern levee right-of-way and the northwestern corner of feature JL14B, and clearing a corridor through disturbed upland and existing wetland habitats between the southern levee right-of-way and the northeastern corner of feature JL14A. Each of these corridors would be roughly 20 feet wide.

The initial construction phase would last roughly 9 to 10 months. There would then be an idle period of roughly 9 to 12 months required to allow the fill in features JL14A and JL14B to settle to the final desired target elevation of approximately +2.0 feet. Once the mitigation features have settled to the desired final target grade, each feature would be planted with native canopy and midstory species. The plantings would be in accordance with the BLH-Wet planting guidelines contained in appendix L. This secondary construction phase, which would include removing the 2 temporary levee access ramps, would likely last approximately 3 to 4 months.

The temporary construction access corridors extending from the two restoration features to the southern levee right-of-way would not be replanted, but instead would be allowed to naturally re-vegetate with herbaceous species. The growth of woody species would be suppressed for at least several years so that these corridors could be used to access features JL14A and JL14B for long-term maintenance/management activities within the features.

It is anticipated that several trees and shrubs installed at the time of initial planting would not survive for a year; thus, it was estimated that about 20% of the total number of plants initially installed in each feature would need to be planted about one year after completion of the initial plantings. Additional activities that would occur during the overall project construction phase would include periodic eradication of invasive/nuisance plant species within the mitigation features as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of the project to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation feature and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L). As discussed, the growth of woody plant species would need to be periodically suppressed in the construction access corridors extending from features JL14A and JL14B to the southern levee right-of-way.

PARK/404(C) SWAMP IMPACTS

Jean Lafitte Swamp Restoration – PIER Design

This project would be located in Jefferson Parish and would mainly involve restoring native swamp habitats in primarily existing open water areas. The proposed restoration features would include JL7 (approximately 11.31 acres), JL8 (approximately 5.00 acres), and JL9 (approximately 4.13 acres), as shown in appendix A. All three features would be located in the Park, while features JL8 and JL9 would also be located within the 404c area.

Proposed feature JL7 would mainly encompass a segment of an existing man-made canal, although the far eastern end of this feature would encompass a previously filled and disturbed upland area. There is an existing spoil berm running along the north side of JL7. A portion of this spoil berm (approximately 11.9 acres; see appendix A) would be cleared and degraded (excavated) to use as a source of fill to establish feature JL7. The existing upland area within the eastern end of JL7's footprint would also be cleared and degraded, with the excavated soil also placed within the canal portion of JL7. The cited spoil berm and the upland area would first be cleared of all trees and vegetation. The trees and vegetation would be hauled and placed in the borrow pit on the southeast end of JL7 and/or in the borrow pit northeast end of mitigation feature JL7. The trees would be cut to a maximum 8 ft length prior to placement in the borrow pits. The spoil berm and upland area would then be degraded approximately 2 feet, to elevation +1.0 to match the final target grade elevation for feature JL7 and typical elevations found in existing swamp habitats near this feature. The material would then be pushed into the canal portion of mitigation feature JL7 using bull dozers or similar equipment.

Another component of the JL7 swamp restoration would involve excavating "gaps" in the existing spoil berms adjacent to both sides of Millaudon Canal. These berms presently inhibit natural surface water flow in the general area situated south of the canal, including proposed feature JL7. Establishing gaps in the spoil berms would improve surface water flow and exchange both north and south of the canal, which is vital for swamp habitats as well as other natural habitats.

Spoil berm gaps would be excavated (cut) at 3 locations along Millaudon Canal (see appendix A), with cuts made in the berms on each side of the canal at these locations. Each gap would be degraded to approximately elevation 1.0 feet to match the existing grades typically found in nearby swamp habitats. Each gap would have a bottom width of approximately 100 feet, as measured parallel to the canal, and 1:3 side slopes. The gaps would be constructed concurrently with construction of feature JL7. Construction equipment, consisting of long reach marsh buggies, would access the gap locations by traveling along the spoil berm adjacent to the north side of JL7 until reaching the canal. The equipment would then track along the canal toe to reach the gap locations. Vegetation present in the gap footprints would first be cleared and transported for disposal within the one of the borrow pits adjacent to the east end of JL7. The gaps would then be excavated and the excavated soil (approximately 1,600 cubic yards) would be placed in the canal portion of feature JL7 to help establish the platform for this feature.

The assumed bottom elevation of the canal portion of JL7 is -8.0 feet. While the final target grade desired in JL7 is roughly elevation 1.0 feet, the canal portion of this feature would first need to be filled to an initial target elevation of approximately 2.5 feet. This higher elevation is necessary to allow fill materials (borrow materials) to settle over time to the final target elevation.

The approximate quantity of fill that would be obtained from the degrading of the spoil berm adjacent to JL7 and from degrading the existing upland portion of JL7 is approximately 35,000 cys. Combining this with the material obtained from degrading the Millaudon Canal gaps would yield a total of roughly 36,600 cys that would be placed in the existing canal portion of JL7 to establish the platform for the proposed JL7 swamp. However, it is estimated that an additional 140,000 cubic yards of fill (borrow) would be required to bring the canal portion of JL7 to the initial target grade elevation.

Both sand and clay materials would be used to achieve the initial target grade. The goal would be to place the clay fill in a manner such that the clay layer lies directly on top of the prior fill (e.g. fill obtained from degrading spoil berm, degrading upland portion of JL7, constructing Millaudon Canal gaps) in places where such placement would achieve the initial target grade elevation. In other areas, a minimum 4 feet thick clay layer would be placed on top of imported sand fill where necessary to achieve the initial target grade. The sand and clay fill required would be obtained from contractor and/or government furnished borrow pits located off-site. These materials would be hauled in dump trucks to the mitigation feature.

Construction equipment, including dump trucks, would access the project site via two roadways extending west from Barataria Boulevard (see appendix A). The northern access roadway would be along a segment of Tusa Drive (about 0.3 miles) until turning north onto the existing Hurricane Protection Levee. The southern access roadway would be along an existing levee access roadway situated about 0.3 miles south of Tusa Drive. After reaching the levee, construction equipment would follow a semicircular access route along the levee itself that connects with the two entry access roadways. A construction access route with two connections to Barataria Boulevard was deemed necessary to maximize construction efficiency and to minimize construction traffic on Tusa Drive as much as possible.

Due to the dump truck traffic volume anticipated, construction traffic on area roadways would be limited to daylight hours, six days per week (Monday through Saturday); however, construction activities on the flood side of the levee would continue seven days per week. Construction traffic would use the southern entry roadway as much as possible rather than

Tusa Drive, but there would likely be many occasions when at least half or more of this traffic would need to use Tusa Drive on a particular day. An appropriate traffic control plan would be implemented during the initial construction phase to minimize traffic congestion and safety hazards.

The proposed construction access route would require building three temporary earthen levee access ramps; one on the flood side of the levee near feature JL7, one on the flood side of the levee just south of feature JL7, and one on the protected side of the levee near the southern access roadway. The access ramp on the flood side would remain in place for future maintenance of the mitigation feature. The other two ramps would be removed after the end of the initial construction period. The material would be removed with a track hoe and placed in trucks to be hauled and placed in the adjacent borrow pits. The affected levee areas would then be regraded and fertilized and seeded.

The initial construction phase to establish feature JL7 would require an estimated 8.5 to 9.5 months. There would then be an idle period of roughly 9 to 12 months to allow the fill to settle to desired final target elevation of approximately 1.0 feet. Once settled, the restoration feature would be planted native swamp canopy and midstory species in accordance with the swamp planting guidelines contained in appendix L. The three Millaudon Canal gaps would not be re-planted. The degraded spoil berm on the north side of JL7 would also not be planted. Instead, this area would be allowed to re-vegetate naturally in the current plan. However, this approach may be modified in the future to include some planting of the degraded berm with native swamp canopy species. This would be determined during the PED phase of the project.

The proposed restoration features JL8 and JL9 would encompass existing open water areas including two isolated “keyhole” canals. These canals would be filled and planted to restore native swamp habitat. Two construction access corridors would be required to build features JL8 and JL9; one extending from the east end of JL8 to the GIWW and one extending from the east end of JL9 to the GIWW. These access corridors would each be 100 feet wide, as measured parallel to the GIWW. Clearing of vegetation and debris with dozers and/or chainsaws from within the canals and construction access corridors, as well as trimming of overhanging trees along the edges of the mitigation features would be required prior to placement of fill. All material removed during clearing and grubbing would be placed in the canals prior to fill.

There are existing spoil berms on the north and south sides of both restoration features. Segments of these berms would be cleared of vegetation and debris and then “gapped” (degraded) with bulldozers/track equipment to improve surface flow and exchange. Two gaps on the north side and 3 gaps on south side of JL8 would be created. Two gaps on north side and 2 gaps on south side of JL9 would be created. Each gap would be degraded to approximately elevation 1.0 feet to match the existing grades typically found in nearby swamp habitats. Each gap would have a bottom width of approximately 100 feet, as measured parallel to the proposed swamp features, and would have 1:3 side slopes.

Vegetation debris cleared during construction of the gaps would be placed within the footprints of the proposed swamp features, as would be the soil excavated during the process of construction the gaps.

The assumed existing bottom elevation of features JL8 and JL9 is -8.0 feet. Features JL8 and JL9 would be filled with approximately 10.5 feet material mechanically placed to an initial target elevation of 2.5 feet in order to form a platform for the restored swamp habitats. It is estimated that approximately 3,600 cys of fill would be obtained through construction of the spoil berm gaps. However, it is estimated that an additional 135,000 cys of fill would be required to establish the earthen platforms for the restored swamp features. This material (borrow) would be bucket dredged from the GIWW.

The GIWW is currently a federally authorized navigation channel. Current maintenance uses a 125 feet bottom width at an approximate elevation of -12.0 feet. The GIWW project is authorized to a full 150 feet bottom width at an approximate bottom elevation of -16.0 feet. The designers used a mean bottom elevation of -16.0 feet. Borrow would be obtained between approximate Mile 13.0 to Mile 15.0. Grain size distribution of borrow materials was assumed to be 10 percent silty sand and 90 percent silty clay. The proposed borrow area (see appendix A) would be approximately 70 ft wide and 5,000 ft long (17.2 acres) and would be dug to 4 feet below existing grade with an allowable 1 foot of overdepth. The material would be mechanically dredged with a barge mounted dragline. The dredge material would be placed on a barge and towed over to the feature locations. The material would be off-loaded with a dragline and hauled from the GIWW shoreline to the features with trucks and pushed into place with dozers. All activities within the GIWW would be coordinated with the US Coast Guard as to not impede navigation.

There is reportedly an abandoned oil/gas well within feature JL8 that has previously been cased and capped. It is possible that this well may need to be re-cased/capped and it may be necessary to lower the height of the well such that it would not interfere with planting the proposed feature. The need for such actions will be evaluated further in the PED phase and will be addressed further in the TIER covering proposed mitigation of Park/404c impacts.

The initial construction of JL8 and JL9 would require about 3 to 4 months. There would then be an idle period of roughly 9 to 12 months to allow the fill to settle to desired final target elevation of approximately 1.0 feet. Once settled, features JL8 and JL9 would be planted with native swamp canopy and midstory species in accordance with the swamp planting guidelines contained in appendix L. The spoil berm gaps constructed and the two cleared construction access corridors would not be re-planted. Instead, these areas would be allowed to re-vegetate naturally. The final construction phase (e.g. initial planting of features JL8 and JL9) would require roughly 2 to 3 weeks.

It is anticipated that several trees and shrubs installed at the time of initial planting of all the restoration features would not survive for a year; thus, it was estimated that about 20%

of the total number of plants initially installed in each feature would need to be planted roughly one year after completion of initial plantings. Activities that would occur during the overall project construction phase would include periodic eradication of invasive/nuisance plant species within the restoration features, and possibly within the degraded spoil berm area adjacent to JL7 and/or within the cleared construction access corridors adjacent to the eastern ends of features JL8 and JL9. Other activities during the project construction phase would include mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of the project to the NFS).

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation features and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L). Large trees and shrubs as well as accumulated sediments may occasionally need to be removed from the Millaudon Canal gaps and from the spoil berm gaps established adjacent to features JL8 and JL9 in order to restore the desired bottom elevation and cross-sectional flow area of these gaps.

PARK/404(C) MARSH IMPACTS

Jean Lafitte Marsh Restoration – PIER Design

This mitigation project would involve restoring fresh marsh habitat from open water. The single proposed marsh restoration feature, JL1B4, would encompass approximately 20.4 acres, located in Jefferson Parish within the Park (see appendix A). Restoration work would involve establishing a land platform for the new marsh habitat proposed.

The first step would be to construct an earthen retention dike along the perimeter of feature JL1B4. It was assumed that total perimeter retention would be required to retain dredge material and allow for vertical accretion. Approximately 3,780 linear feet of retention dike would be required. Of the total 3,780 linear feet of dikes, approximately 1,780 linear feet would be armored/capped with stone (well graded riprap with a proposed top size stone of 650 pounds) during the second project construction phase. This armored dike segment would be located along the eastern boundary of feature of JL1B4 adjacent to the remaining open water portion of Yankee Pond (see appendix A).

Retention dikes would be constructed to maintain a minimum of one foot of freeboard during dredging operations. The retention dikes would be constructed to elevation +5.0 feet, with a 5-foot crown to assure dike integrity. Borrow for these retention dikes would be excavated with a marsh buggy from within the marsh creation footprint. The borrow ditch would be offset a minimum of 40 feet from the dike to assure dike stability. For initial quantity estimates, the dikes were assumed to have 1V:4H side slopes. A low level weir would be constructed in the southwest corner of the restoration feature to allow for effluent water release from within the marsh restoration area and potentially nourish the existing marsh adjacent to the west side of JL1B4. If deemed necessary by the construction contractor, a low level interior weir could be constructed to assist in vertical stacking of dredged material.

Marsh restoration would require approximately 150,000 cubic yards of material hydraulically dredged from Lake Cataouatche. It is anticipated that the borrow source proposed would contain approximately 10 percent sand. The borrow site would be situated a minimum 2,000 feet from the lake shoreline and borrow would be removed by a hydraulic cutter-head dredge. The borrow site would be approximately 1,500 ft X 300ft (roughly 10.3 acres) with a maximum cut of 10 feet. The material would be pumped from the borrow site to feature JL1B4 via pipeline routed adjacent to the western bank of Bayou Segnette. Floating pipeline would be used which is a dredge discharge pipe positioned on pontoons. The pipeline corridor would be 100 feet wide. This corridor would be marked on 150 foot centers to prevent boat hazards in the lake and along the bayou. Markers would include lighted and reflective buoys. As the pipeline would need to cross a portion of Lake Cataouatche, a small segment of submerged pipeline would be installed at the crossing with appropriate signage to ensure safe passage of vessels over the line.

The main navigation channel in the Bayou Segnette Waterway (BSSW) ranges from 300 to 450 feet wide. As noted, that portion of the slurry pipeline routed adjacent to the west bank of the BSSW would have a pipeline corridor width of 100 feet. The eastern boundary of this corridor would not extend into the limits of the main BSSW navigation channel. Since proposed marsh JL1B4 would be located on the western side of Bayou Segnette, the sediment pipeline would not need to cross the BSSW navigation channel. Throughout the initial construction phase, project construction would be coordinated with the US Coast Guard.

The initial target marsh elevation (elevation of slurry fill) would be +3.5 feet. It is estimated that the initial project construction activities discussed above would require approximately 3 to 4 months. Once these activities are completed there would be an idle period of approximately 1 year to allow the marsh feature to settle to the desired final target elevation of approximately +1.0 to +1.5 feet. The final construction phase would begin following settlement and dewatering of the created marsh platform.

The south and west perimeter retention dikes (e.g. dikes adjacent to existing marsh habitats) would be degraded with a marsh buggy such that the crest of the dikes would be the same as the final target elevation of the marsh platform. Approximately 2-feet of dike degrading is anticipated after the initial year of settlement to revert the dike footprint to desired marsh elevation. The dike segment along the eastern edge of feature JL1B4 would first be degraded to elevation +3.0 feet. Armoring would then be placed along the eastern face of this dike, constructed with a 2-foot stone cap to elevation +3.0 feet. During this process, fish dips" (essentially armored gaps) would be constructed in the armored dike segment. The fish dips would allow water exchange and provide aquatic organisms access to the marsh feature. Each fish dip would have a bottom width of approximately 100 feet, a bottom elevation no greater than 0 feet, and 1V:3H side slopes. At this phase of design, it was assumed that there would be one fish dip established for every 500 feet of armored dike (i.e. 500-foot spacing). Sediment generated during the dike degrading process would be placed back into the depression left from the original borrow ditch within the restoration feature.

In conjunction with this dike degrading effort, trenasses would be constructed as necessary to serve as tidal creeks to facilitate water exchange and create shallow water interspersion features within JL1B4. The trenasses would be rutted to a lower than marsh elevation by performing two passes of a marsh buggy along the desired alignment. The acceptable trenasse width, if constructed in this fashion, would be the width of marsh buggy. If the resulting depression is not adequate for minimal water flow, the marsh equipment can excavate material along the proposed alignment, not to exceed a 5-foot bottom width by 1-foot deep channel. It is anticipated that the final phase of construction activities (degrading dikes, constructing trenasses and fish dips, installation of dike armoring) would require approximately 3 to 4 months.

Additional activities that would occur during the project construction phase would include periodic eradication of invasive/nuisance plant species within the mitigation feature as well as mitigation monitoring and reporting conducted in accordance with the applicable guidelines contained in appendix L (i.e. monitoring and reporting necessary prior to transfer of monitoring responsibilities to the NFS). It was assumed that appropriate fresh marsh plant species would naturally colonize the marsh restoration feature; hence, no planting of the feature is proposed.

Various activities would be necessary during the OMRR&R phase of the project. At a minimum, these would include periodic eradication of invasive/nuisance plants in the mitigation feature and mitigation monitoring and reporting as prescribed in appendix L. Additional activities may need to be performed to ensure compliance with applicable mitigation success criteria (see appendix L). The armored perimeter dike would likely need to be maintained once every 15 years through the addition of armoring (stone/rip-rap). Approximately 2,000 tons of stone may be required each 15-year maintenance cycle.

One should note that another marsh restoration feature, feature JL1B5, is proposed in Yankee Pond immediately adjacent to the subject marsh feature JL1B4. If this other marsh restoration project is authorized, the design of feature JL1B4 would change dramatically. Essentially, feature JL1B4 would merge with feature JL1B5 to create one overall marsh restoration feature occupying approximately 109.5 acres (see appendix A). Under this scenario, there would be no armored dike constructed along the eastern edge of JL1B4 since this area would become part of the overall marsh platform. The earthen perimeter retention dikes along the western and southern boundaries of feature JL1B4 would remain and would tie into the earthen retention dikes required to construct feature JL1B5. An armored perimeter dike would be built along the eastern boundary of marsh feature JL1B5 to help protect the overall marsh feature from erosion, thereby cancelling the need for an armored dike along the east boundary of feature JL1B4.

APPENDIX F

SCREENING CRITERIA RATIONALE

The Project Delivery Team (PDT) evaluated approximately 636 alternative measures for Lake Pontchartrain and Vicinity (LPV) HSDRRS Mitigation and approximately 400 alternative measures for West Bank and Vicinity (WBV) HSDRRS Mitigation during screening. Measures included proposed USACE-constructed mitigation projects on public and private lands, as well as alternatives to purchase credits from mitigation banks. Screening criteria were developed by the PDT and are described in detail below. Screening criteria respond to Congressional authority and other laws, policies and guidance, and the CEMVN Commander's Intent, and include, but are not limited to, constraints. Alternatives that did not meet any one of the screening criteria were discarded without further investigation.

Screening Criteria Common to LPV and WBV Mitigation Basins

No conversion of existing wetlands to uplands.

- Definition/Application

This criterion specifies that no existing wetlands would be converted to create an upland project such as a BLH-ridge. The application of this criterion eliminated any projects converting marsh, swamp or BLH-wet to BLH-dry.

- Justification/Legal and Policy References

    - No net loss of wetlands. WRDA 1990, Section 307.

    - Avoid and minimize impacts to wetlands. E.O. 11990.

    - Mitigation Planning Objectives. Mitigation planning objectives are clearly written statements that prescribe specific actions to be taken… and identifies specific amounts (units of measurement, e.g., habitat units) of compensation required to replace or substitute for remaining, significant unavoidable losses.ER 1105-2-100 C-3 b(13).

  - (c) Fundamental to the Guidelines is the precept that dredged or fill material should not be discharged into the aquatic ecosystem, unless it can be demonstrated that such a discharge will not have an unacceptable adverse impact either individually or in combination with known and/or probable impacts of other activities affecting the ecosystems of concern. (d) From a national perspective, the degradation or destruction of special aquatic sites, such as filling operations in wetlands, is considered to be among the most severe environmental impacts covered by these Guidelines. The guiding principle should be that degradation or destruction of special sites may represent an irreversible loss of valuable aquatic resources. Federal Water Pollution Control Act, 33 U.S.C. 1344 (b)(1); 40 CFR 230.1

- (a) Except as provided under section 404(b)(2), no discharge of dredge or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences. (Section 404(b)(2) established the National Pollutant Discharge Elimination System (NPDES) to control water pollution by regulating point sources that discharge pollutants into waters of the United States.) 33 U.S.C. 1344 (b)(1); 40 CFR 230.10

Additionally, conversion of wetlands to uplands would require mitigation, decreasing the cost effectiveness of such a project.

Compliant with applicable laws and policies

- Definition/Application

A given mitigation alternative must be compliant with all federal laws and policies. In application, laws such as WRDA 2007 ("Mitigation plans should comply with the mitigation standards and policies established pursuant to the regulatory programs administered by the Secretary of the Army." §2036(a)) served as a framework from which to develop additional screening criteria, rather than a screening criteria in and of itself. Other laws were applied directly as screening criteria. One example is the application of 31 U.S.C. 1301, under which projects authorized under other authorities were screened out.

- Justification/Legal and Policy References

The following Engineering Regulations require that project alternatives comply with applicable laws and policies:

- The objectives and requirements of applicable laws and executive orders are considered throughout the planning process in order to meet the federal objective. USACE ER 1105-2-100, 2-2.

- Each alternative shall be formulated in consideration of four criteria described in the [Principles & Guidelines]: completeness, efficiency, effectiveness, and acceptability… Acceptability is the extent to which the alternatives are acceptable in terms of applicable laws, regulations and public policies. USACE ER 1105-2-100, 2-3.

- Civil Works studies and projects should be in compliance with all applicable Federal environmental statutes and regulations and with applicable State laws and regulations where the Federal government has clearly waived sovereign immunity. USACE ER 1105-2-100, 2-7.

Additionally, two principles of fiscal law prohibit the use of funds appropriated under one authority from being expended on actions pursuant to a different authority. First, 31 USC

1301(a) posits that appropriations may be used only for their intended purposes. Second, as a general principle, when both specific and general authorizations/ appropriations exist, the specific always rules over the general such that agencies do not have an option. For example, if a specific appropriation exists for a particular item, then that appropriation must be used and it is improper to "charge" the more general appropriation or any other appropriation. These principles were used to screen out projects that were authorized under authorities other than the HSDRRS authority.

Within Mitigation Basin

- Definition/Application

For purposes of this screening criterion, mitigation basins may be viewed as watersheds or drainage basins. Mitigation measures for impacts to habitats within the LPV mitigation basin would need to be provided within the LPV mitigation basin and that mitigation measures for impacts to habitats within the WBV mitigation basin would need to be provided within the WBV mitigation basin (i.e. provide mitigation in the same watershed/basin as where the impact occurred).

The boundaries of the LPV mitigation basin can be generally described as follows: North boundary = Interstate 12 (I-12); South boundary = east bank of the Mississippi River; East boundary = from the I-12 intersection with the western boundary of the Pearl River Basin, then southward along this boundary, then southward through Breton Sound and Chandeluer Sound inside the barrier islands; West boundary = the east bank of the Mississippi River to the intersection of Interstate 10 with the river.

The boundaries of the WBV mitigation basin can be generally described as follows: North boundary = west bank of the Mississippi River; South boundary = Bayou Lafourche; East boundary = a line following the approximate boundary separating fresh marsh vegetation from intermediate marsh vegetation (i.e. the fresh marsh/intermediate marsh interface or boundary of these two types of marsh habitats), as determined by USGS (Sasser et al., 2008); West boundary = Bayou Lafourche northward to its intersection with the Mississippi River. The basis for the east boundary was that WBV HSDRRS improvements only impacted fresh marsh habitats and mitigation for these impacts would need to be provided as enhancement or restoration of fresh marsh habitats (e.g. “in kind” mitigation). Thus, it would have been inappropriate to consider mitigation sites situated in areas dominated by existing intermediate marsh habitats.

During the screening process, potential mitigation sites were excluded from further consideration in cases where the mitigation site was located outside of the applicable mitigation basin. In cases where the applicable mitigation basin boundary ran through a potential mitigation site, such a mitigation site was also excluded from further consideration.

- Justification/Legal and Policy References

    - Mitigation plans shall comply with the standards and policies of the regulatory program. WRDA 2007, Section 2036.

- The mitigation plans are to set forth the mitigation activities that are to be undertaken within the watershed in which the losses occur or in any case in which the mitigation will occur outside the watershed, the mitigation plan shall set forth a detailed explanation for undertaking the mitigation outside the watershed. WRDA 2007, Section 2036.

- In general, the required compensatory mitigation should be located within the same watershed as the impact site, and should be located where it is most likely to successfully replace lost functions and services, taking into account such watershed scale features as aquatic habitat diversity, habitat connectivity, relationships to hydrologic sources (including the availability of water rights), trends in land use, ecological benefits, and compatibility with adjacent land uses. 33 CFR Part 332, Section 332.3(b)(1), and; 40 CFR Part 230, Section 230.93(b)(1).

- Where permitted impacts are not in the service area of an approved mitigation bank or in-lieu fee program that has the appropriate number and resource type of credits available, permittee-responsible mitigation is the only option. Where practicable and likely to be successful and sustainable, the resource type and location for the required permittee-responsible compensatory mitigation should be determined using the principles of a watershed approach as outlined in paragraph (c) of this section. 33 CFR Part 332, Section 332.3(b)(4), and; 40 CFR Part 230, Section 230.93(b)(4).

- The district engineer must use a watershed approach to establish compensatory mitigation requirements in DA permits to the extent appropriate and practicable. Where a watershed plan is available, the district engineer will determine whether the plan is appropriate for use in the watershed approach for compensatory mitigation. In cases where the district engineer determines that an appropriate watershed plan is available, the watershed approach should be based on that plan. Where no such plan is available, the watershed approach should be based on information provided by the project sponsor or available from other sources. The ultimate goal of a watershed approach is to maintain and improve the quality and quantity of aquatic resources within watersheds through strategic selection of compensatory mitigation sites. 33 CFR Part 332, Section 332.3(c)(1), and; 40 CFR Part 230, Section 230.93(c)(1)

- The size of watershed addressed using a watershed approach should not be larger than is appropriate to ensure that the aquatic resources provided through compensation activities will effectively compensate for adverse environmental impacts resulting from activities authorized by DA permits. The district engineer should consider relevant environmental factors and appropriate locally developed standards and criteria when determining the appropriate watershed scale in guiding compensation activities. 33 CFR Part 332, Section 332.3(c)(4), and; 40 CFR Part 230, Section 230.93(c)(4).

No known HTRW risk

- Definition/Application

Hazardous, toxic, and radioactive waste (HTRW) includes various materials defined in Section 4.a.(1) of ER 1165-2-132 (USACE, 1992). Examples of such materials include, but are not limited to any material listed as a "hazardous substance" under the Comprehensive Environmental Response, Compensation and Liability Act (42 U.S.C. 9601 et seq.).

In screening potential mitigation sites, CEMVN reviewed various information sources to determine if there could be Recognized Environmental Conditions (REC) present within a particular site. The term "REC" is defined in Section 1.1.1 of ASTM Standard Practice E 1527-05 (ASTM, 2005). This term basically refers to the presence or likely presence of HTRW on a property under conditions which indicate an existing or past release, or a material threat of a release of HTRW into structures on the property or into the ground, ground water, or surface water of the property. It does not include *de minimis* conditions that commonly do not present a threat to human health or the environment.

The following information sources (databases) were consulted and searched as part of the review process: (a) Federal records - United States Environmental Protection Agency's (USEPA) National Priorities List; USEPA Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS); USEPA No Further Remedial Action Planned Sites (NFRAP); USEPA Resource Conservation and Recovery Information System (RCRIS-LG); USEPA Emergency Response Notification System (ERNS); USEPA Corrective Action Report (CORRACTS); USEPA Biennial Reporting System (BRS); USEPA Superfund (CERCLA) Consent Decrees (CONSENT); USEPA Facility Index System/Facility Identification Initiative Program Summary Report (FINDS); USDOT Hazardous Materials Information Reporting System (HMIRS); USNRC Material Licensing Tracking System (MLTS); USEPA Federal Superfund Liens (NPL LIENS); USEPA PCB Activity Database System (PADS); USEPA RECRA Administrative Action Tracking System (RAATS); USNTIS Records of Decision (ROD); USEPA Toxic Chemical Release Inventory System (TRIS); USEPA Toxic Substances Control Act (TSCA); (b) State and local records - Solid and Hazardous Waste Sites (SHWS); Solid Waste Facilities/Landfill Sites (SWF/LF); LDEQ Approved Debris Sites (DEBRIS); Recycling Sites (SWRCY); Leaking Underground Storage Tanks (LUST); Historic Leaking Underground Storage Tanks (HIST LUST); Louisiana Underground Storage Tank Database (UST); Environmental Liens (LIENS); Spills and Releases (SPILLS); Listing of institutional and/or engineering controls (AUL); Voluntary Remediation Program Sites (VCP); Drycleaner Facility Listing (DRYCLEANERS); LPDES Permits Database (NPDES).

If a potential mitigation site was determined to have the risk for REC (risk for HTRW), then the site was further evaluated to determine whether the boundaries of the site could be adjusted to exclude the area(s) posing a risk for REC. If the boundaries could be adjusted to exclude the problem area(s) and still satisfy other applicable screening criteria, then the boundaries were adjusted accordingly and the resultant site was retained as a potential location for mitigation measures. If the boundaries could not be adjusted in this manner, then the site was excluded from further consideration.

- Justification/Legal and Policy References

    - Construction of Civil Works projects in HTRW-contaminated areas should be avoided where practicable. USACE ER 1165-2-132, 6.b.

    - Alternative project plans may consider avoidance of HTRW as well as possible responses. At least one alternative should be formulated to avoid HTRW sites to the maximum extent possible, consistent with project objectives. USACE ER 1165-2-132, 8.a.

    - Civil Works plan formulation and plan selection may be substantially influenced by the presence of HTRW in the project area. HTRW sites will be avoided whenever practicable. USACE ER 1165-2-132, 8.d.

    - The development of a response plan for dealing with HTRW, as well as response measures to relocate HTRW or to treat the HTRW in place is 100% Non-Federal cost. USACE ER 1165-2-132, Table 1.

In kind replacement of impact AAHUs by habitat type (exception: BLH-Dry can be mitigated as BLH-Wet)

- Definition/Application

This criterion specifies that impacts must be mitigated by replacing the same habitat type as was originally impacted. In kind is defined as a resource of a similar structural and functional type to the impacted resource (40 CFR 230.92). Functions mean the physical, chemical and biological processes that occur in ecosystems (40 CFR 230.92). The application of this criterion eliminated projects that attempted to mitigate fresh/intermediate marsh impacts with anything other than a fresh/intermediate project, brackish/saline marsh impacts with anything other than a brackish/saline marsh project, swamp impacts with anything other than a swamp project, BLH-dry impacts with anything other than a BLH project, and BLH-wet impacts with anything other than a BLH-wet project. In addition, protected side projects for flood side impacts were eliminated since a loss of functions and values inherent in flood side habitats would occur resulting in out of kind mitigation. These definitions of in-kind for the pursposes of HSDRRS mitigation were developed in coordination with Federal and state resource agencies.

- Justification/Legal and Policy References

    - Comply with the Fish and Wildlife Coordination Act by giving full consideration to reports and recommendations furnished by the Secretary of the Interior (U. S. Fish and Wildlife Service), the Secretary of Commerce (National Marine Fisheries Service), and the appropriate head of the State agency exercising administration over the fish and wildlife resources. ER 1105-2-100, Section d(3)(b).
    - Mitigation plans shall ensure that impacts to bottomland hardwood forests are mitigated in kind, to the extent possible. WRDA 1986, 33 U.S.C 2283(a).

- Other habitat types are mitigated to not less than in kind condition to the extent possible. WRDA 2007, Section 2036(a).

- (1) In general, in-kind mitigation is preferable to out-of-kind mitigation because it is most likely to compensate for the functions and services lost at the impact site. For example, tidal wetland compensatory mitigation projects are most likely to compensate for unavoidable impacts to tidal wetlands, while perennial stream compensatory mitigation projects are most likely to compensate for unavoidable impacts to perennial streams. Thus, except as provided in paragraph (e)(2) of this section, the required compensatory mitigation shall be of a similar type to the affected aquatic resource. (2) If the district engineer determines, using the watershed approach in accordance with paragraph (c) of this section that out-of-kind compensatory mitigation will serve the aquatic resource needs of the watershed, the district engineer may authorize the use of such out-of-kind compensatory mitigation. The basis for authorization of out-of-kind compensatory mitigation must be documented in the administrative record for the permit action. 40 CFR Part 230.93(e)

- (5) Permittee-responsible mitigation through on-site and in-kind mitigation. In cases where a watershed approach is not practicable, the district engineer should consider opportunities to offset anticipated aquatic resource impacts by requiring on-site and in-kind compensatory mitigation. The district engineer must also consider the practicability of on-site compensatory mitigation and its compatibility with the proposed project. (6) Permittee-responsible mitigation through off-site and/or out-of-kind mitigation. If, after considering opportunities for on-site, in-kind compensatory mitigation as provided in paragraph (b)(5) of this section, the district engineer determines that these compensatory mitigation opportunities are not practicable, are unlikely to compensate for the permitted impacts, or will be incompatible with the proposed project, and an alternative, practicable off-site and/or out-of-kind mitigation opportunity is identified that has a greater likelihood of offsetting the permitted impacts or is environmentally preferable to on-site or in-kind mitigation, the district engineer should require that this alternative compensatory mitigation be provided. 33 CFR Part 332.3(b).

- The Secretary of Commerce is required to obtain the views of Federal agencies affected by the program, including the Department of the Interior, and to ensure that these views have been given adequate consideration before approval of Coastal Zone Management Plans. 16 U.S.C. 1451-1464.

- It is preferable, in most cases, to recommend ways to replace such habitat value losses in-kind. FR Vol 46. No. 15. 23 Jan 1981.

- Mitigation plans shall ensure that adverse impacts to bottomland hardwood forests are mitigated in-kind, to the extent possible. The intent is that the bottomland hardwood forest as an ecological system be mitigated rather than mitigating for faunal species in an upland hardwood forest habitat type. In this instance "to the extent possible" shall take into consideration the availability of manageable units of existing or restorable bottomland hardwood forests and the practicability and feasibility of implementing management measures to accomplish in-kind mitigation. In-kind does not necessarily mean acre-for-acre, but may be restoration or the increased management of bottomland hardwood forests to compensate for the loss of biological productivity (habitat quality). Consultation with appropriate Federal and non-Federal agencies is required in complying with this requirement. ER 1105-2-100, C-3 e(6).

Under the above provision of WRDA 1986, the PDT considered that BLH-D habitat could be mitigated with BLH-W habitat in cases where it is not possible to mitigate BLH-D. The PDT sees this habitat exchange as providing equal habitat value to that which was lost through BLH-BLH-W habitat is a more diverse habitat while still supporting the species found in BLH-D habitat. BLH-W also has wetland functions and values not found in BLH-D habitat. BLH-W is thus seen as more valuable habitat because it can support both BLH-W and BLH-D species and has added habitat functions and values. It is not acceptable to mitigate BLH-W impacts with BLH-D habitat because the wetland functions and values as well as some diversity would be lost. The justification for eliminating the use of protected side projects for flood-side impacts stems from the notion that aquatic ecosystems lose habitat value when the natural hydrology of the ecosystem is altered by impoundment. This notion is supported by the metrics used in the Wetland Value Assessment Methodology Community Models used to quantify impacts and benefits for the HSDRRS system.

- Coastal Wetlands Planning, Protection and Restoration Act, Wetland Value Assessment Methodology, Bottomland Hardwood Community Model - Variable V4, Hydrology: Bottomland hardwood stands in the Louisiana Coastal Zone generally occur in one of four basic hydrology classes or water regimes: 1) efficient forced drainage system, 2) irregular periods of inundation due to an artificially lowered water table, 3) extended inundation or impoundment because of artificially raised water table, and 4) essentially unaltered. The optimum bottomland hardwood hydrology (SI= 1.0) is one that is essentially unaltered, allowing natural wetting and drying cycles which are beneficial to vegetation and associated fish and wildlife species. When a bottomland hardwood stand is part of an efficient forced drainage system, the vegetative component provides some habitat value, but wildlife species which are dependent on water would essentially be excluded year round, and the area would not in any way serve to promote fish production (SI = 0.1). With a moderately lowered water table, the vegetative component of the site could provide excellent habitat for many wildlife species and temporary habitat for wildlife species which are dependent on water, but fish would generally be excluded (SI = 0.5). With a raised water table, fish habitat and habitat for water-dependent wildlife could be equivalent to an unaltered system; however, other wildlife species could be adversely affected because of water-related impacts to the vegetative components of the stand (SI = 0.5).

- Coastal Wetlands Planning, Protection and Restoration Act, Wetland Value Assessment Methodology, Swamp Community Model - Variable V3, Water regime: This variable considers the duration and amount of water flow/exchange. Four flow/exchange and four flooding duration categories are described to characterize the water regime. The optimal water regime is assumed to be seasonal flooding with abundant and consistent riverine/tidal input and water flow-through (SI=1.0). Seasonal flooding with periodic drying cycles is assumed to contribute to increased nutrient cycling (primarily through oxidation and decomposition of accumulated detritus), increased vertical structure complexity (due to growth of other plants on the swamp floor), and increased recruitment of dominant overstory trees. In addition, abundant and consistent input and water flow-through is optimal, because under that regime the full functions and values of a swamp in providing fish and wildlife habitat are assumed to be maximized. Temporary flooding is also assumed to be desirable. Habitat suitability is assumed to decrease as water exchange between the swamp and adjacent systems is reduced. The combination of permanently flooded conditions and no water exchange (e.g., an impounded swamp where the only water input is through rainfall and the only water loss is through evapotranspiration and ground seepage) is assumed to be the least desirable (SI=0.1).

- Coastal Wetlands Planning, Protection and Restoration Act, Wetland Value Assessment Methodology, Coastal Marsh Community Models for Brackish and Intermediate Marsh - Variable V6, Aquatic Organism Access: Access by estuarine aquatic organisms (i.e., transient and resident species), is considered to be a critical component in assessing the quality of a given marsh system. Additionally, a marsh with a relatively high degree of access by default also exhibits a relatively high degree of hydrologic connectivity with adjacent systems, and therefore may be considered to contribute more to nutrient exchange than would a marsh exhibiting a lesser degree of access. Optimal conditions are assumed to exist when all of the study area is accessible and the access points are entirely open and unobstructed.

Technically viable (e.g. salinity suitable for target habitat type)

- Definition/ Application

As applied to HSDRRS Mitigation, technically viable means capable of achieving ecological functionality from a scientific or engineering standpoint. As specifically applied during screening, alternatives were only screened under this criterion if the conditions in the vicinity of the proposed alternative were not supportive of a target habitat type. In addition, projects that did not produce positive mitigation benefits were not considered further.

- Justification/Legal and Policy References

WRDA 2007 requires that mitigation for water resources projects achieve ecological success. Additionally, USACE regulations specify that civil works projects must be implementable, feasible, constructible, reliable, and functional. Specific excerpts of WRDA 2007 and these regulations are provided below:

- MITIGATION REQUIREMENTS…INCLUSIONS.—A specific mitigation plan for a water resources project … shall include, at a minimum—(i) a plan for monitoring the implementation and ecological success of each mitigation measure, including the cost and duration of any monitoring, and, to the extent practicable, a designation of the entities that will be responsible for the monitoring; (ii) the criteria for ecological success by which the mitigation will be evaluated and determined to be successful based on replacement of lost functions and values of the habitat, including hydrologic and vegetative characteristics; … and (v) a contingency plan for taking corrective actions in cases in which monitoring demonstrates that mitigation measures are not achieving ecological success in accordance with criteria under clause (ii)… DETERMINATION OF SUCCESS…CONSULTATION.—In determining whether a mitigation plan is successful under subparagraph (A), the Secretary shall consult annually with appropriate Federal agencies and each State in which the applicable project is located on at least the following: (i) The ecological success of the mitigation as of the date on which the report is submitted. (ii) The likelihood that the mitigation will achieve ecological success, as defined in the mitigation plan. (iii) The projected timeline for achieving that success. (iv) Any recommendations for improving the likelihood of success. WRDA 2007, Section 2036 (a) (3) (a).

- [Principles and Guidelines] Evaluation Criteria: (1)… Two primary dimensions to acceptability are implementability and satisfaction. Implementability means that the alternative is feasible from technical, environmental, economic, financial, political, legal, institutional, and social perspectives. If it is not feasible due to any of these factors, then it cannot be implemented, and therefore is not acceptable. An infeasible plan should not be carried forward for further consideration. USACE ER 1105-2-100, E-3. General Policies a. The Planning Process, (4) Step 4- Evaluate alternative plans.

- Evaluation of Alternatives. Engineering staff shall assist in the evaluation of alternatives to identify those that are constructible and the degree to which safety, reliability, and functional requirements and objectives are met including operations and maintenance. The type and extent of HTRW contamination shall be determined and alternatives and costs for remedial action developed. Proposed alternatives that do not satisfy the constructability, reliability, safety, or functional requirements shall be recommended for withdraw[al] from further consideration. This recommendation shall be discussed and agreed upon by the full PDT. USACE ER 1110-2-1150, Section 13.4.

- …habitat-based evaluation methodologies, supplemented with production, user-day, population census, and/or other appropriate information, shall be used to the extent possible to describe and evaluate ecological resources and impacts associated with alternative plans. ER 1105-2-100, Section C-3 d(5).

- Mitigation plan components include documentation of the functions and values that will result from the mitigation. WRDA 2007, Section 2036(a).

Screen out measures that are in the Future Without Project Condition

- Definition/Application

The Future Without Project Condition for HSDRRS Mitigation is defined in part by the measures (projects) that would likely exist in the absence of the implementation of the HSDRRS Mitigation. Projects included in the Future Without Project Condition are displayed in Attachment 1. Projects included in the Future Without Project Condition were screened out as potential HSDRRS Mitigation projects.

- Justification/Legal and Policy References

Establishment of the Future Without Project Condition is required for alternative plan evaluation in USACE civil works planning, as described in the below bullets. The impacts of alternatives, including benefits, are qualitatively or quantitatively described as the different between the Future Without and Future With Project Condition. Specific excerpts of these regulations are provided below:

- The second step of the planning process is to develop an inventory and forecast of critical resources (physical, demographic, economic, social, etc.) relevant to the problems and opportunities under consideration in the planning area. This information is used to further define and characterize the problems and opportunities. A quantitative and qualitative description of these resources is made, for both current and future conditions, and is used to define existing and future without-project conditions. Existing conditions are those at the time the study is conducted. The forecast of the future without-project condition reflects the conditions expected during the period of analysis…The future without-project condition provides the basis from which alternative plans are formulated and impacts are assessed. Since impact assessment is the basis for plan evaluation, comparison and selection, clear definition and full documentation of the without-project condition are essential. Gathering information about historic and existing conditions requires an inventory. Gathering information about potential future conditions requires forecasts, which should be made for selected years over the period of analysis to indicate how changes in economic and other conditions are likely to have an impact on problems and opportunities. Information gathering and forecasts will most likely continue throughout the planning process. USACE ER 1105-2-100, Section 2-3 b.

- The without-project condition is the most likely condition expected to exist in the future in the absence of a proposed water resources project. Proper definition and forecast of the future without-project condition are critical to the success of the planning process. The future without-project condition constitutes the benchmark against which plans are evaluated. Forecasts of future without-project conditions shall consider all other actions, plans and programs that would be implemented in the future to address the problems and opportunities in the study area in the absence of a Corps project. Forecasts should extend from the base year (the year when the proposed project is expected to be operational) to the end of the period of analysis. ER 1105-2-100, Section 2-4 b (1).

Must have independent utility (not dependent on implementation of or modification to other projects)

- Definition/ Application

The project would not be dependent on implementation of or modification to other projects for ecological success and fulfillment of Average Annual Habitat Unit (AAHU) requirement. If the sustainability or technical viability would be reliant upon another project, the net benefits of the project could not be guaranteed such that mitigation credit could be secured.

- Justification/Legal and Policy References
  - Evaluation of management features shall be based upon the features' completeness, effectiveness, efficiency and acceptability in fulfilling established management (mitigation or enhancement) objectives. ER 1105-2-100, Section C-3 d(1)(b).

A project without independent utility may not meet the P&G “completeness” criteria. Completeness is the extent to which a given alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of the planned effects. If the success of a project depends upon factors beyond the control of the planning team that are required to make the plan’s effects (benefits) a reality, it would not meet the completeness criteria.

- …mitigation, including acquisition of the lands or interests – (A) shall be undertaken or acquired before any construction of the project …,or (B) shall be undertaken or acquired concurrently with lands and interests in lands for project purposes (other than mitigation of fish and wildlife losses)… WRDA 1986, 33 U.S.C. 2283(a).

If a project's ecological success relies upon the implementation or modification of another project, there is increased risk in delay of mitigation implementation.

- Temporal loss is the time lag between the loss of aquatic resource functions caused by the permitted impacts and the replacement of aquatic resource functions at the compensatory mitigation site. Higher compensation ratios may be required to compensate for temporal loss. When the compensatory mitigation project is initiated prior to, or concurrent with, the permitted impacts, the district engineer may determine that compensation for temporal loss is not necessary, unless the resource has a long development time. 33 CFR Part 332.2.

The potential time lag in implementation of mitigation for such projects could reduce their cost effectiveness due to higher compensation ratios and thus increased required acreage.

Can be easily scaled to meet changing mitigation acreage requirements.

- Definition/Application

The size of a given alternative must have the ability to increase or decrease the number of AAHUs it would provide over the 50 year project life in a practical, logical and technically feasible manner. For example, the PDT used aerial photography and GIS capabilities to determine whether adequate acreage was available to increase a particular project polygon in case mitigation requirements were increased.

- Justification/Legal and Policy References

Under the premise laid forth in the Antideficiency Act, 31 USC 1341 et seq., the Corps' ability to expend funds to produce AAHUs is limited to the mitigation requirement for HSDRRS impacts. Funds expended for AAHUs above those required for HSDRRS mitigation could be viewed as a violation of this fiscal law.

The exact HSDRRS mitigation requirement will not be determined until all as-builts become available for HSDRRS Projects and final AAHUs of impact are determined. Early estimates of acreages needed are based on HSDRRS designs rather than as-builts, as well as previous WVAs conducted for similar projects. The number of acres needed to mitigate for HSDRRS unavoidable losses will continue to evolve throughout the planning and design phases, as impact acreage are revised. The selected projects must be scalable such that the mitigation designs can be adjusted to produce only the required AAHUs.

No stand alone BLH-Dry measures (BLH-Dry requirements will be mitigated contiguous with mitigation for other habitat types and can be mitigated on flood side or protected side of levee)

- Definition/Application:

This criterion specifies that the requirement for non-wet bottomland hardwood impacts will be mitigated adjacent to mitigation measures that are designed to address other LPV/WBV HSDRRS mitigation requirements. All other mitigation measures have hydrologic components. Flood side versus protected side does not affect BLH-Dry because BLH-Dry has no hydrologic component. The application of this criterion results in optimized mitigation plan element outputs (as described in the Justification paragraph below) and addresses multiple mitigation requirements in one geographic area.

- Justification/Legal and Policy References*:*

By limiting stand alone BLH-dry mitigation measures, this criterion limits alternative combinations and increases ecological functions and values. The resulting combination requires less land to yield the needed AAHUs when the BLH-Dry component is combined with other wet mitigation features. Without this limitation, the BLH-Dry mitigation requirement could be mitigated on virtually any upland (which yields lower AAHUS outputs) in the Barataria or Pontchartrain Basin (with the exception of portions of the north shore of Lake Pontchartrain which are more suitable for pine and mixed pine habitats) and in areas suitable for BLH-wet habitat (which yield higher AAHU outputs). Forcing BLH-Dry to be mitigated with one of the other mitigation requirements: 1) increases the contiguous habitat area included in the resulting mitigation plan which increases efficiency, i.e. cost effectiveness, (by increasing ecological outputs and taking advantages of cost efficiencies), 2) increases habitat functions and values by adding hydrologic functions adjacent to, and in some cases instead of, an upland system. The BLH WVA assigns increasing benefits as the acres of contiguous forested land increase (V5), and assesses benefits for surrounding land use with other forested areas and marsh receiving the greatest credit (V6). As such, preference is given to large contiguous tracts of forested land over smaller. Without this criterion, the lower outputs from stand alone BLH-D WVAs would show these measures to be less cost effective [i.e. less efficient].

No stand alone unconfined marsh nourishment measures

- Definition/Application:

A given alternative cannot propose to produce all of its AAHUs through unconfined marsh nourishment. Unconfined refers to a design in which no dikes or containment structures are constructed to contain or otherwise restrict the movement of sediment introduced into the project area.

- Justification/Legal and Policy References:

Projects with greater risk and uncertainty are less effective at meeting planning objectives. There is a higher probability that projects with greater risk will incur higher costs over the period of analysis. Reduction of risk and uncertainty is more important for mitigation than for ecosystem restoration because a mitigation project must legally produce a specific number of benefits. However, ecosystem restoration projects are not legally bound to produce their projected benefits. The importance of reducing risk and uncertainty is reflected in the 30% weight for risk and reliability criterion in AEP selection. Because of the weight, projects with high risk and uncertainty (e.g. unconfined marsh nourishment) would not perform well in the plan selection process.
Regarding the implementation limitations of unconfined marsh nourishment, the amount of benefits (marsh enhanced) and detriments (marsh potentially converted to upland) associated with these projects are uncertain until after the initial consolidation and dewatering of fill material is complete. Because sediment is uncontained, target marsh elevations cannot be assured, making calculation and tracking of benefits after initial consolidation and dewatering of fill material difficult and uncertain, and the need for adaptive management activities more likely.

The following are legal and policy requirements for the mitigation of civil works projects:

- Design of mitigation projects. The Secretary shall design mitigation projects to reflect contemporary understanding of the science of mitigating the adverse environmental impacts of water resources projects. WRDA 1986, 33 USC 2283(d)(2).
- Formulate specific ecological resources mitigation and restoration plans using generally known and established techniques to address specific, clearly defined management objectives. ER 1105-2-100, Section C-3 d(3)(i).

Although unconfined marsh nourishment is a valuable ecosystem restoration technique, the Interagency Team, CEMVN Regulatory Branch, and the LPV HSDRRS PDT believe such a technique has limited utility as a mitigation design. Thus, stand alone unconfined marsh nourishment was screened out as a mitigation technique because 1) the use of confined marsh creation was deemed a more cost-effective approach (reduced cost for dredged material and LERRDs) because sediment would be contained on a smaller project area footprint, and 2) because it is less effective at meeting planning objectives due to risk and uncertainty concerns.

No preservation measures

- Definition/Application

Preservation is defined as the removal of a threat to, or preventing the decline of, aquatic resources by an action in or near those aquatic resources typically through the implementation of appropriate legal mechanisms. Preservation does not produce a gain in aquatic resource area or functions.

- Justification/Legal and Policy References

Preservation was not chosen as a mitigation type for HSDRRS mitigation projects because:

1. There are proven methodologies for restoration of the aquatic resource types impacted by HSDRRS such that utilization of preservation as justified in 33 CFR Part 332.3(e)(3) for difficult to replace resources is not justifiable;
2. There are multiple restoration mitigation projects available, which is the preferred mitigation type as stated in 33 CFR Part 332.3(a)(2); and
3. The use of preservation as a mitigation type does not provide an increase in aquatic resource area or functions.

  - Compensatory mitigation may be performed using the methods of restoration, enhancement, establishment, and in certain circumstances preservation. Restoration should generally be the first option considered because the likelihood of success is greater and the impacts to potentially ecologically important uplands are reduced compared to establishment, and the potential gains in terms of aquatic resource functions are greater, compared to enhancement and preservation. 33 CFR Part 332.

  - Preservation may be used to provide compensatory mitigation…when all the following criteria are met:

1. The resources to be preserved provide important physical, chemical, or biological functions for the watershed;
2. The resources to be preserved contribute significantly to the ecological sustainability of the watershed. In determining the contribution of those resources to the ecological sustainability of the watershed, the district engineer must use appropriate quantitative assessment tools, where available;
3. Preservation is determined by the district engineer to be appropriate and practicable;
4. The resources are under threat of destruction or adverse modifications; and
5. The preserved site will be permanently protected through an appropriate real estate or other legal instrument

In addition, when preservation is used as compensatory mitigation, to the extent appropriate and practicable the preservation should be done in conjunction with aquatic resource restoration, establishment, and/or enhancement activities. 33 CFR Part 332.3(h).

<u>WBV- Specific Screening Criteria</u>

- **The portions of measures which address mitigation requirements for impacts to Jean Lafitte National Historical Park and Preserve (JLNHPP) and 404(c) area must be located wholly within the boundary or acquisition boundary of the JLNHPP. (An exception could be made for uneconomic remnants of tracts that are located partially within the boundary or acquisition boundary of the JLNHPP).**

- Definition/Application

  Impacts to JLNHPP were considered to be those impacts to habitats located within the boundaries of lands owned by the National Park Service (NPS) in the Barataria Preserve unit of JLNHPP. These boundaries were determined based on information provided by the NPS. The "404(c) area" refers to the Bayou aux Carpes Clean Water Act (CWA) 404(c) site, as established by the US Environmental Protection Agency (EPA, 1985). The boundaries of lands contained in the 404(c) area were based on the boundaries of this area as set forth by EPA (EPA, 1985). Impacts to the 404(c) area were determined based on these boundaries. Generally speaking, the 404(c) area or site is bounded on the north by the east-west Old Estelle Pumping Station Outfall Canal, on the east by Bayou Barataria (Gulf Intracoastal Waterway), on the south by Bayou Barataria and Bayou des Familles, and on the west by State Highway 3134 and the "V Levee". It is noted that in 2009, the federally owned portions of the 404(c) site were added to the Barataria Preserve unit of JLNHPP (e.g. became part of the park).

  In locating proposed mitigation measures for impacts to habitats in JLNHPP, the boundaries for lands where mitigation could be provided were considered to encompass: (1) Lands presently owned by the NPS (aka Department of the Interior) in the Barataria Preserve unit of JLNHPP, and; (2) Lands within the boundaries of areas authorized by Congress for future acquisition by the NPS for incorporation into the Barataria Preserve unit of JLNHPP (e.g. the "acquisition boundary"). The approximate limits of the "acquisition boundary" were based on information provided by the NPS. In locating proposed mitigation measures for impacts to habitats in the 404(c) area, the boundaries for lands where mitigation could be provided were considered to encompass: (1) Lands within the boundaries of the 404(c) area, and; (2) Lands presently owned by the NPS in the Barataria Preserve unit of JLNHPP.

  One should note that mitigation measures proposed for compensating impacts to habitats in the JLNHPP/404(c) area (e.g. "Park/404(c)" impacts) were not considered as being mitigation "alternatives" that could be compared to other mitigation measures generated to compensate for impacts to habitats situated outside the boundaries of JLNHPP and the 404(c) area, since these other mitigation measures were not located within the appropriate boundaries described above. These other mitigation measures were designated as mitigation for "non-Park/404(c)" or as "non-Park" impacts. Also, in determining the amount of mitigation required for Park/404(c) impacts, CEMVN strived to ensure that the mitigation measures not only fully replaced lost habitat functions and values (as determined through WVA evaluations), but also provided at least a 1:1 mitigation ratio based on the acreage of the habitats impacted (i.e. minimum 1 acre mitigation for each acre of impact).

- Justification/Legal and Policy References

  - The Service will manage wetlands in compliance with NPS mandates and the requirements of Executive Order 11990 (Protection of Wetlands), the Clean Water

Act, the Rivers and Harbors Appropriation Act of 1899, and the procedures described in Director's Order 77-1 (Wetland Protection). NPS, 2006; Section 4.6.5.

- For proposed new development or other activities, plans, or programs that are either located in or otherwise could have adverse impacts on wetlands, the Service will employ the following sequence: avoid adverse wetland impacts to the extent practicable; minimize impacts that cannot be avoided; compensate for remaining unavoidable adverse wetland impacts by restoring wetlands that have been previously destroyed or degraded. Compensation for wetland impacts or losses will require that at least 1 acre of wetlands be restored for each acre destroyed or degraded. NPS, 2006; Section 4.6.5.

- For the purpose of wetland compensation, wetland restoration proposals must, at a minimum, provide one-for-one (1:1) wetland function replacement (i.e., focus on no net loss of wetland functions, not just wetland acreage). Section 5.3.3 of these procedures discusses evaluation of wetland functions for this purpose. In the absence of definitive information needed to specifically address 1:1 wetland function replacement, a minimum of 1:1 wetland acreage replacement may be used as a surrogate. In the latter case, the focus should be on replacing wetlands of equivalent type and function, to the extent practicable. Wetland compensation sites must be on lands managed by the NPS, with the following recommended priority order: 1) within the same wetland system as the impacted wetland; 2) within the same watershed; or 3) in another watershed within the same NPS unit. If no practicable restoration sites can be found within this location sequence, then sites in other NPS units within the Region may be considered. Practicability factors such as those discussed in Section 5.3.1.2 should be considered in determining appropriate compensation sites. For example, lack of opportunities may make local restoration impossible in some cases, and the decision to expand the area of consideration for compensation sites is clear. However, there may be other cases where local restoration sites exist, but factors such as the opportunity to restore a rare or critical wetland type in another watershed may outweigh the value of restoring a more local wetland. NPS, 2011; Section 5.2.3.

- Although a final mitigation plan has yet to be finalized, the District Commander for the New Orleans District in a letter to the Regional Administrator for EPA Region 6 dated November 4, 2008, (Appendix 1) committed to mitigate for all unavoidable adverse impacts to the Bayou aux Carpes CWA Section 404(c) area within the Bayou aux Carpes CWA Section 404(c) area and/or Jean Lafitte National Historical Park and Preserve, as per an agreement with EPA and the resource agencies. EPA, 2009; Section V.

- The Corps agrees that mitigation for all unavoidable adverse impacts to the Bayou aux Carpes 404(c) area would occur within the Bayou aux Carpes 404(c) area and/or Jean Lafitte National and Historical Park. EPA, 2009; Appendix 1.

- Permittee-responsible mitigation through on-site and in-kind mitigation. In cases where a watershed approach is not practicable, the district engineer should consider opportunities to offset anticipated aquatic resource impacts by requiring on-site and in-kind compensatory mitigation. The district engineer must also consider the practicability of on-site compensatory mitigation and its compatibility with the proposed project. 33 CFR Part 332.3(b)(5).

Note: The following five criteria share a common "Justification/Legal and Policy References" section found after the fifth criterion's definition.

- **The project area of protected side BLH-Wet measures must be contiguous with or within an existing resource-managed area (BLH-Wet protected side impacts may be mitigated protected side or flood side).**

  - Definition /Application

    This criterion specifies that the requirement for WBV HSDRRS protected side BLH-Wet impacts can be mitigated for with a WBV BLH-Wet project on either side of the levee, but if that project is on the protected side of the levee its boundary must be contiguous with or within the boundary of another resource managed area within the WBV watershed. Resource-managed area is defined for these purposes as a Federal or state area that is managed in part for fish or wildlife resources (including habitat), or a mitigation bank that has a perpetual conservation easement/servitude. The application of this criterion eliminated any BLH-Wet WBV project mitigating for protected side impacts on the protected side of the levee that was not contiguous with or within an existing resource managed area in the WBV watershed. It also allowed protected side impacts to BLH-wet to be mitigated on the flood side with a BLH-Wet project in the WBV watershed and resulted in larger mitigation plan elements that address multiple mitigation requirements in larger project footprints.

- **The project area of flood side BLH-Wet measures must be contiguous with (or within) an existing resource-managed area or with the project area of another proposed mitigation measure.**

  - Definition /Application

    This criterion specifies that WBV HSDRRS BLH-Wet flood side projects must have a boundary contiguous with or within the boundary of another resource managed area within the WBV watershed; or contiguous with the boundary of mitigation measures designed to address other WBV HSDRRS mitigation requirements. Resource-managed area is defined for these purposes as a Federal or state area that is managed in part for fish or wildlife resources (including habitat), or a mitigation bank that has a perpetual conservation easement/servitude. The application of this criterion eliminated any BLH-Wet WBV flood side projects that were not contiguous with or within an existing resource managed area in the WBV watershed or other WBV HSDRRS mitigation feature and resulted in larger mitigation plan elements that address multiple mitigation requirements in larger project footprints.

- **The project area of swamp measures must be contiguous with (or within) an existing resource-managed area or with another proposed mitigation measure.**

  - Definition /Application

    This criterion specifies that the WBV HSDRRS requirement for Swamp must be mitigated with a project which has a boundary: contiguous with or within the boundary of another resource managed area within the WBV watershed; or contiguous with the boundary of mitigation measures designed to address other WBV HSDRRS mitigation requirements. Resource-managed area is defined for these purposes as a Federal or state area that is managed in part for fish or wildlife resources (including habitat), or a mitigation bank that has a perpetual conservation easement/servitude. The application of this criterion eliminated any Swamp WBV projects that were not contiguous with or within an existing resource managed area in the WBV watershed or contiguous with other WBV HSDRRS mitigation features and resulted in larger mitigation plan elements that address multiple mitigation requirements in larger project footprints

- **Flood Side mitigation measures must be part of proposed mitigation projects that consist of multiple habitat types unless contiguous with or within another resource-managed area.**

  - Definition /Application

    This criterion specifies that the boundary of any WBV flood side mitigation measure must be contiguous with the boundary of mitigation measures designed to address other WBV HSDRRS mitigation requirements or contiguous with or within the boundary of another resource managed area within the WBV watershed. Resource-managed area is defined for these purposes as a Federal or state area that is managed in part for fish or wildlife resources (including habitat), or a mitigation bank that has a perpetual conservation easement/servitude. The application of this criterion eliminated any flood side stand alone projects that were not contiguous with another WBV HSDRRS mitigation project or with or within the boundary of Resource-managed area within the WBV watershed.

- **Measures must meet 100% of the mitigation requirement by habitat type according to the following groupings (FS=flood side; PS=protected side):**

    - 100% non-park/404(c) BLH-Wet PS (mitigate PS or FS)
    - 100% non-park/404(c) BLH-Wet FS (mitigate FS)
    - 100% non-park/404(c) Swamp FS (mitigate FS)
    - 100% non-park/404(c) Fresh Marsh FS (mitigate FS)
    - 100% park/404(c) BLH-Wet FS (mitigate FS)
    - 100% park/404(c) Swamp FS (mitigate FS)
    - 100% park/404(c) Fresh Marsh FS (mitigate FS)

- Definition/Application

This criterion specifies that the WBV HSDRRS mitigation projects must address the entire mitigation requirement for the habitat type being restored at that site. Specifically: All WBV flood side or protected side BLH-Wet projects mitigating for WBV HSDRRS BLH-Wet non- park/404(c) protected side impacts must be able to address all of the requirements for WBV HSDRRS BLH-Wet non- park/404(c) protected side impacts. All WBV flood side BLH-Wet projects mitigating for WBV HSDRRS BLH-Wet non-park/404(c) flood side impacts must be able to address all the WBV requirements for non- park/404(c) flood side BLH-Wet impacts. All WBV flood side Swamp projects mitigating for WBV HSDRRS Swamp non- park/404(c) flood side impacts must be able to address all the WBV requirements for non- park/404(c) flood side swamp impacts. All WBV flood side fresh marsh projects mitigating for WBV HSDRRS fresh marsh non-park/404(c) flood side impacts must be able to address all the WBV requirements for non- park/404(c) flood side fresh marsh impacts. All WBV flood side BLH-Wet projects mitigating for WBV HSDRRS BLH-Wet park/404(c) flood side impacts must be able to address all the WBV requirements for park/404(c) flood side BLH-Wet impacts. All WBV flood side swamp projects mitigating for WBV HSDRRS swamp park/404(c) flood side impacts must be able to address all the WBV requirements for park/404(c) flood side swamp impacts. All WBV flood side fresh marsh projects mitigating for WBV HSDRRS fresh marsh park/404(c) flood side impacts must be able to address all the WBV requirements for park/404(c) flood side fresh marsh impacts. The application of this criterion eliminated any projects that did not meet the above specifications based on the following table.

WBV Basin		**BLH-Dry Acres**	**Fresh Marsh Acres**	**Swamp Acres**	**BLH- Wet Acres**
Impacts (not including park & 404(c))	**Protected Side (PS)**				
	Restore	19.5			1083.0
	Enhance	62.5			3440.5
	Floodside (FS)				
	Restore		276.0	166.0	890.0
	Enhance		N/A	339.0	2827.0
Park & 404(c) Impacts	**Floodside (FS)**				
	Restore			94.0	72.5
	Enhance			192.0	230.5
TOTALS		**19.5-62.5**	**276.0**	**260.0–531.0**	**2045.5–6498.0**

- Justification/Legal and Policy References
    - Mitigation, to the extent practicable, shall be developed and implemented on project lands. If project lands cannot fulfill the mitigation requirements, then separable public lands adjacent to project lands, to the extent possible, should be considered next. EP 1165-2-1, superseded by ER1105-2-100 in 2000.
    - …we are committed to identifying large-scale projects that will mitigate for the impacts caused by the HSDRRS program and provide the most cost effective benefits to coastal and ecosystem restoration. ASA(CW) letter to Governor Jindal, 19 March 2010.

These criteria limit alternative plan combinations and work toward identifying projects that will result in large contiguous tracts of land for the purposes of greater ecological output within the watershed. In addition, the consolidation of mitigation projects produces cost efficiencies experienced during construction and O&M phases. The BLH WVA assigns increasing benefits as the acres of contiguous forested land are increased (V5), and assesses benefits for surrounding land use with contiguity with other forested areas and marsh receiving the greatest credit (V6). As such, preference is given to large contiguous tracts of forested land over smaller.

- Variable V5 – Size of Contiguous Forested Area.

Although edge and diversity, which are dominant features of small forested tracts, are important for certain wildlife species, it is important to understand four concepts: 1) species which thrive in edge habitat are highly mobile and presently occur in substantial numbers, 2) because of forest fragmentation and ongoing timber harvesting by man, edge and diversity are quite available, 3) most species found in "edge" habitat are "generalists" in habitat use and are quite capable of existing in larger tracts, and 4) those species in greatest need of conservation are "specialists" in habitat use and require large forested tracts. Therefore, the basic assumption for this variable is that larger forested tracts are less common and offer higher quality habitat than smaller tracts. For this model, tracts greater than 500 acres in size are considered large enough to warrant being considered optimal and receive a suitability index of 1. Tracts up to 5 acres receive a SI of 0.2, tracts from 5.1 to 20 acres receive a SI of .4, tracts from 21.1 to 100 receive a SI of .4, and tracts from 100.1 to 500 acres receive a SI of .8.

- Variable V6– Suitability and Traversability of Surrounding Land Uses.

Many wildlife species commonly associated with bottomland hardwoods will often use adjacent areas as temporary escape or resting cover and seasonal or diurnal food sources. Surrounding land uses which meet specific needs can render a given area of bottomland hardwoods more valuable to a cadre of wildlife species. Additionally, the type of surrounding land use may encourage, allow, or discourage wildlife movement between two or more desirable habitats. Land uses which allow such movement essentially increase the amount of habitat available to wildlife populations. The weighting factor assigned to various land uses reflects their estimated potential to meet specific needs and allow movement between more desirable habitats. For this model, contiguity with other forested areas and marsh receive the greatest suitability (1.0) because of the ability for contiguous habitats to allow wildlife movement.

Potential Relief from Law, Policy, Regulation or Guidance Requirements

CEMVN has been asked to provide applicable legal and policy justification for the HSDRRS Mitigation screening criteria, and the process by which the screening criteria could be changed. Changes to some screening criteria would require legal and policy changes or waivers. The following table provides a list of the applicable laws and policies, which are cited in the above screening criteria justification, and the process by which these requirements could be changed or waived.

Law, Policy, Regulation or Guidance	Who can change and how?
Coastal Zone Management Act, 16 USC 1451	Act of Congress
Appropriations, General, 31 USC 1301	Act of Congress
Compensatory Mitigation for Losses of Aquatic Resources, 33 CFR 332	Engage new rulemaking under Administrative Procedures Act
Final Policy on the National Wildlife Refuge System and Compensatory Mitigation under the Section 10/404 Program FR 64, 10 Sep 1999: 49229-49234	Waiver sought through USFWS
WRDA 1986, 1990 and 2007	Act of Congress
Hazardous Substances Releases, Liability, Compensation , 42 USC 9601	Act of Congress
Limitations on Expending and Obligating Amounts, 31 USC 1341	Act of Congress
National Park Service Management Policies	Waiver sought through NPS
National Park Service Procedural Manual #77-1	Waiver sought through NPS
404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material, 40 CFR 230	Engage new rulemaking under Administrative Procedures Act
Hazardous, toxic and radioactive waste (HTRW) guidance for civil works projects, ER 1165-2-132	Waiver sought through USACE HQ
Engineering and Design -Engineering and Design for Civil Works Projects, ER 1110-2-1150	Waiver sought through USACE HQ
Planning - Planning Guidance Notebook , ER 1105-2-100	Waiver sought through USACE HQ
EPA Final Determination concerning Bayou aux Carps	Recoordination with EPA
EPA Modification to 404(c) final	Recoordination with EPA, possible new

determination for Bayou aux Carpes	rulemaking under Administrative Procedures Act
U.S. Fish and Wildlife Service Mitigation Policy, FR 46 (23 Jan 1981)	Waiver sought through USFWS

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WRDA 1990. Water Resources Development Act of 1990. Public Law 101-640.

WRDA 2007. Water Resources Development Act of 2007. Public Law 110-114.

APPENDIX G

AEP PLAN SELECTION CRITERIA

In brief, plan selection criteria reflect project goals. For instance, if the mission is to buy a car, goals may be to have a low start-up and operating cost. This scenario would have the criteria of retail cost and gas mileage. Note that constraints are not considered criteria (i.e. the retail cost of the car must be under $20K) because alternatives cannot be compared based on this information. Selection criteria vary widely depending on the problem, and can even vary within the umbrella of Civil Works. But for the purposes of HSDRRS Environmental Mitigation, the Project Delivery Team has identified the following plan selection criteria:

- Risk & Reliability
- Environmental
- Time
- Cost Effectiveness
- Other Cost Considerations
- Watershed & Ecological Site Considerations

Risk & Reliability: One of the Chief's 4 priorities is to "employ risk-based concepts in planning, design, construction, operations, and major maintenance." Analysis of alternatives with regard to their risk and reliability is a paradigm shift from deterministic methodologies (e.g. National Economic Development, Benefit/Cost ratios, etc.) to more statistical, probabilistic terms. Though the policy and even the science is still in its nascent stages, enough is usually known to begin making risk-informed decisions, at least qualitatively

AEPs conducted to determine the type of hurricane and storm damage risk reduction features that would be built in a given polder defined risk and reliability primarily in terms of flood risk. The environmental mitigation AEP process has adapted this definition to better capture the risk-based decisions to be made for mitigation projects, such as project sustainability.

Risk is defined as probability multiplied by consequences. An example of risk would be a calculation of the relative chance of saltwater intrusion during the 50-year period of analysis multiplied by magnitude of anticipated plant mortality. Actions can be implemented to reduce risk, but because risk can never be completely eliminated, *residual risk* will remain.

Reliability refers to the chance that a component of the system will fail to perform its intended purpose as a function of the forces placed upon it. Reliability is often displayed using a fragility curve which describes the probability of failure as a function of an applied force. Many separate system components can be combined in an event tree to represent the reliability of a system.

Since these two factors are similar, it is best to consider them as one criterion: Risk & Reliability. Moreover, PDTs are only expected to perform Risk & Reliability analysis qualitatively. It is unlikely that PDTs will have fragility curves or event trees when analyzing alternatives. Instead, PDTs should analyze alternatives comparatively. For example, "Alternative 1 is *much more* reliable than Alternative 2, but only *slightly more* reliable than Alternative 3."

The below risk and reliability subcriteria (see Table C-1) were applied to each mitigation alternative, and qualitative and quantitive data for each alternative under each of the subcriteria are provided in Appendix B, table 2.

Table C-1: Risk and Reliability

Issue	**Explanation**
Uncertainty Relative to Achieving Ecological Success/Potential Need for Adaptive Management (Contingency) Actions	Sources of *uncertainty relative to achieving ecological success* include: (1) incomplete understanding of the system (environmental or engineering) to be managed or restored (e.g. hydroperiod, water depth, water supply, substrate, nutrient levels, toxic compounds) (2) imprecise estimates of the outcomes of alternative management actions (e.g. proven methodology, project complexity). *Evaluation of Potential Need for Adaptive Management (Contingency) Actions:* (1) Is there sufficient flexibility within project design and operation to permit adjustments to management actions? (2) Is the system (or components) to be restored or managed well understood (e.g. hydrology and ecology) and are management outcomes accurately predictable? (3) Do participants generally agree on the most effective design and operation to achieve project goals and objectives? (4) Are the goals and objectives for restoration understood and agreed upon by all parties?
Uncertainty Relative to Implementability	Includes implementability issues that are not captured under other selection criteria. Implementability means that the alternative is feasible from technical, environmental, economic, financial, political, legal, institutional, and social perspectives. If it is not feasible due to any of these factors, then it cannot be implemented, and therefore is not acceptable. An infeasible plan should not be carried forward for further consideration. However, just because a plan is not the preferred plan of a non-Federal sponsor does not make it infeasible or unacceptable *ipso facto*.
Adaptability	Ability to expand (or otherwise adapt) the measure to achieve/maintain ecological success

Issue	Explanation
Long-Term Sustainability of Project Benefits	For marsh: Measured by % emergent marsh remaining in TY50, as calculated for Variable 1 in the Marsh WVA model. For Forested Habitat: Measured by the Habitat Suitability Index Value at TY50, which incorporates the suitability index of all WVA variables in the WVA model.
Self-Sustainability of Project Once Ecological Success Criteria Linked to NCC are Achieved	(1) Does the project utilize active engineering features (e.g., pumps)? (2) Anticipated OMRR&R Activities (3) Relative difficulty of OMRR&R
Risk of Exposure to Stressors/ Reliability & Resiliency of Design	(1) To what stressors will a given alternative be exposed (e.g. sea level rise, subsidence, saltwater intrusion during storm or drought, long-term salinity shift, herbivory, invasive species, inundation from storm surge, damage from storm-induced wave action, runoff from adjacent property which could alter chemical or nutrient balance of soils, altered hydrologic regime which could change habitat type or stress vegetation, non-storm wave energy)? (2) How is the project, as designed, likely to perform relative to stressors and/or how well is the project expected to return to functionality after exposure to stressors?

Environmental: The National Environmental Policy Act (NEPA) and other environmental laws require federal agencies to consider the environmental impacts in their decision-making, identify unavoidable environmental impacts and make this information available to the public. All evaluated alternatives should be investigated with respect to environmental consequences. The IER records this investigation. However, since a recommended alternative needs to be selected prior to the IER being released for public review and comment, the PDT must attempt to analyze the impacts qualitatively using preliminary information, for those resources which could be impacted to differing degrees by each of the alternatives, focusing only on noteworthy differences between the alternatives. Environmental metrics are displayed in a data matrix in the Environmental Appendix of this EAR.

Time: The PDT must analyze the likely implementation schedules for mitigation alternatives. Time metrics account for engineering and design, real estate acquisition, construction, and period to project turn-over. Time metrics include:

- Estimated time to construction contract award (measured from TSP milestone in September 2011).

- Estimated time to NCC milestone (measured from TSP milestone in September 2011).

Cost Effectiveness: Cost effectiveness analysis seeks to answer the question: given an adequately described objective, what is the least-costly way of attaining the objective?

Other Cost Considerations: In most cases, a contract's Current Working Estimate (CWE) is based on the Programmatic Cost Estimate (PCE), which includes the additional request for funds received in the FY09 President's Budget. PDTs should not expect additional appropriations. Therefore, alternatives' costs, excluding escalation and contingency, should not exceed the HSDRRS Current Working Estimate. Life cycle costs are a consideration when evaluating alternatives, but should not drive plan selection. Cost calculations for HSDRRS projects should include construction, engineering and design, construction supervision and administration, Lands, Easements, Rights-of-way, Relocations, & Disposal Areas (LERRDs), and Operation Maintenance Repair Replacement & Rehabilitation (OMRR&R). Monitoring and adaptive management costs should be added for mitigation projects. Cost containment is an important consideration and PDTs should not only analyze an alternative's ability to stay within CWE, but also determine the least-cost alternative. Cost metrics include Total Project Cost and Average Annual Cost (and components thereof).

For alternative comparison purposes, minimal OMRR&R activities are assumed for both the WVA modeling and for cost development. These are limited to: monitoring, invasive/nuisance plant eradication, maintenance/replacement of weirs and culverts, and channel maintenance. Once the TSP is identified, assumptions may be changed for the TSP elements to include adaptive management, additional OMRR&R activities, major rehabilitation, etc. in order to sustain ecological success or to address uncertainty. These new assumptions would be reflected in the advanced project design, revised WVA modeling for the TSP, and revised TSP cost estimates,

Watershed & Ecological Site Considerations: The PDT has added this selection criterion to address unique factors that apply to environmental mitigation projects that were not addressed in the previously listed selection criteria. Guidance from 40 CFR Part 230 discusses consideration of a mitigation site's role in the larger landscape and other ecological conditions. The first two bullets below aim to capture this guidance. These subcriteria are considered for each alternative, and the outcome of this consideration is shown in the Watershed & Ecological Site Considerations data matrix in Appendix B, table 3.

Watershed Considerations/Significance within the Watershed:

- Consistency with watershed plans (e.g. Coast 2050, LCA, LaCPR, State Master Plan 2007). 40 CFR Part 230 Compensatory Mitigation for Losses of Aquatic Resources includes guidance regarding the siting of mitigation projects. This guidance directs that mitigation should consider existing watershed plans within the project area. Therefore, the selection criteria considers how a given alternative relates to existing watershed plans within the project area. The four watershed plans considered are Coast 2050, LCA, LaCPR and the 2007 State Master Plan. Coast 2050 is a strategic plan for coastal Louisiana, sponsored by the Louisiana State Wetlands Conservation and Restoration Authority and the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) Task Force. It was adopted in 1999 . The Coast 2050 report evolved into the Louisiana Coastal Area (LCA) Ecosystem Restoration Plan of

2004. In 2007, the Corps of Engineers, in partnership with the State of Louisiana, developed a preliminary report entitled The Louisiana Coastal Protection and Restoration (LaCPR) Preliminary Technical Report, which identified a range of coastal restoration and flood control measures for South Louisiana. Also in 2007, the state officially adopted Louisiana's Comprehensive Master Plan for a Sustainable Coast, which complements the LaCPR report.

- Contiguous with or within resource managed area (i.e. Federal, state, private mitigation bank or other restoration projects considered under Future Without Project condition)
- Located in parish of impact by habitat-type
- Critical features
  - critical geomorphic structures for ecosystem stability (critical geomorphic structures in the coastal ecosystem are those above sea level that protect lower elevation features and in many instances represent the first line of defense against marine influences and tropical storm events (i.e. restoration or preservation of natural ridges, lake rims, land bridges, gulf shoreline barrier islands, barrier headlands, and Chenier ridges)
  - LaCPR critical landscape features for storm damage risk reduction identified in Figure 7-17, Louisiana Coastal Protection and Restoration Final Technical Report and Comment Addendum, August 2009
- Habitat Linkages (e.g. wildlife corridors)

Ecological Site Considerations not captured in WVA:

- Fragmentation within site boundary (swamp and marsh alternatives only)
- Site habitat connectivity to larger surrounding project area considering future land use trends (swamp and marsh alternatives only)

APPENDIX H

REFORMULATION WITH NFS

TABLE OF CONTENTS

DEPARTMENT OF THE ARMY
MISSISSIPPI VALLEY DIVISION, CORPS OF ENGINEERS
P.O. BOX 80
VICKSBURG, MISSISSIPPI 39181-0080

REPLY TO
ATTENTION OF:

CEMVD-PD-N

3 August, 2012

MEMORANDUM FOR HQUSACE (CECW-ZB/Mr. Stockton), WASH DC 20314-1000

SUBJECT: New Orleans District West Bank and Vicinity (WBV) Hurricane and Storm Damage Risk Reduction System (HSDRRS) Mitigation Reformulation Efforts with the State of Louisiana Coastal Protection and Restoration Authority (CPRA)

1. Reference memorandum, CEMVN-PD, 18 July 2012, SAB (encl).

2. The enclosed memorandum referenced above is provided to inform HQUSACE and the Assistant Secretary of the Army for Civil Works (ASA(CW)) of the WBV HSDRRS Mitigation proposed Tentatively Selected Plans (TSP) and current State of Louisiana concerns with the TSP to mitigate for WBV HSDRRS unavoidable impacts being non-compliant with the 19 March 2010 letter from ASA(CW) to Governor Bobby Jindal.

3. The Mississippi Valley Division (MVD) concurs with the assessment of the New Orleans District Engineers of the current proposed TSP being consistent with law, policy, and meeting the intent of the commitments expressed by the ASA(CW) in the aforementioned letter. Furthermore, MVD supports continuing efforts to finalize NEPA compliance requirements and subsequent documentation for MVD approval.

4. Request the enclosed information be processed to the ASA(CW) for awareness and in preparation, should the State of Louisiana choose to elevate these issues to HQUSACE and ASA(CW). Any questions should be directed to Mr. Rayford Wilbanks, CEMVD-PD-N, at (601) 634-5847.

Building Strong!

Encl

JOHN W. PEABODY
Major General, USA
Commanding

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO
ATTENTION OF:

CEMVN-PD

18 JUL 2012

8/1/2012

MEMORANDUM FOR Commander, Mississippi Valley Division

SUBJECT: New Orleans District West Bank and Vicinity (WBV) Hurricane and Storm Damage Risk Reduction System (HSDRRS) Mitigation Reformulation Efforts with the State of Louisiana Coastal Protection and Restoration Authority (CPRA)

1. CEMVN is seeking to inform the Assistant Secretary of the Army (Civil Works) (ASA-CW) of the decision discussed in this memorandum so that the ASA-CW can be prepared for any future engagement with the State of Louisiana concerning this decision.

2. Reference:

a. Water Resource Development Act of 1986, Title 33 U.S.C 2283(a): Bottomland hardwood forests are mitigated in kind, to the extent possible.

b. Implementation Guidance 2036(a) for the Water Resource Development Act of 2007: Other habitat types are mitigated to not less than in-kind conditions to the extent possible.

c. Resource Development Act of 1986, Title 33 U.S.C 2283(a): Mitigation and the lands required for mitigation, to be undertaken and acquired before construction begins or concurrent with construction.

d. Implementation Guidance 2036(a) for the Water Resource Development Act of 2007: Mitigation plans comply with the mitigation standards and policies of the regulatory programs administered by the Secretary.

e. Titles 40 C.F.R Part 230.93(e)(1) and 33 C.F.R 332.3(e)(1): In-kind mitigation is preferable to out-of-kind mitigation.

f. Titles 40 C.F.R Part 230.93(c)(1) and 33 C.F.R Part 332.3(c)(1): Use of the watershed approach to establish compensatory mitigation; the district engineer's consideration of watershed plans.

g. Titles 40 C.F.R Part 230.93(e)(2) and 33 C.F.R 332.3(e)(2): Out-of- kind mitigation using the watershed approach.

Encl

3. The WBV HSDRRS work incurred unavoidable impacts to four habitat types (fresh marsh, bottomland hardwoods wet (BLH-Wet), bottomland hardwoods dry (BLH-Dry), and swamp) that require mitigation. The project delivery team (PDT), identified the tentatively selected plan (TSP) for the WBV HSDRRS mitigation on October 26, 2011. The non-Federal sponsor (NFS), CPRA, has objected to most portions of the TSP except that portion to mitigate for impacts to Jean Lafitte National Historical Park & Preserve and the EPA designated 404c area (Bayou aux Carpes). NFS objections center around none of the identified TSP projects overlapping with projects identified in the 2012 Louisiana Coastal Master Plan. The NFS has referred to the letter dated March 19, 2010, from the ASA to Governor Jindal (Encl 1) as a commitment from the Corps that WBV HSDRRS mitigation projects will specifically coincide with restoration projects identified in the Master Plan. We believe the TSP projects are consistent with the commitments made by the ASA in the referenced letter, even though these projects do not directly overlap restoration projects presently identified in the 2012 Master Plan.

4. CEMVN has worked closely with NFS's team since November 2011, to identify potential projects in the 2012 Louisiana Coastal Master Plan that could mitigate for the HSDRRS general impacts with some modifications. The CEMVN/NFS team originally identified four alternatives in three locations that coincided with Master Plan projects. However, two locations were subsequently deleted from the Master Plan leaving only two mitigation alternatives at one location. The results for the original four alternatives are as follows:

a. Mitigation for BLH-Dry and BLH-Wet, Protected Side Impacts: The non-Federal sponsor's Alternatives were 5 to 9 times the cost of the original TSP with moderate to high concern for sustainability due to potential impacts from excessively high salinity.

b. Mitigation for BLH-Wet, Flood Side Impacts: NFS Alternatives were 5 to 12 times the cost of the original TSP with moderate to high concern for sustainability due to potential impacts from excessively high salinity.

c. Mitigation for Fresh Marsh Impacts: NFS Alternatives were 2 to 7 times the cost of the original TSP.

d. Mitigation for Swamp Impacts: NFS Alternatives were 3 to 8 times the cost of the original TSP with moderate to high concern for sustainability due to potential impacts from excessively high salinity.

5. Following the above analysis, the NFS expressed interest in pursuing mitigation for swamp impacts via implementation of a marsh restoration project using the watershed approach. To suffice for swamp mitigation, quantification of the marsh project's protection to/enhancement of the functions and values of existing swamp habitats in the basin would be necessary; in this case,

the upper Barataria basin. The marsh project would then have to be sized to achieve the stated benefits to swamp.

a. CEMVN used data developed in other studies, such as Louisiana Coastal Protection and Restoration Act, to assess the potential for accomplishing the required swamp mitigation through a proposed marsh restoration project. Our assessment indicated that the area of influence from the marsh project identified in the 2012 Master Plan would be limited to east of Barataria Waterway. Analysis indicated that the acreage of swamp habitat found in this area is minimal and that, even if we prevented all swamp losses in the area, the prevention of such losses would not produce enough credit to suffice for the WBV HSDRRS swamp mitigation requirements.

b. The CEMVN/NFS technical team met on April 30, 2012, to determine whether the NFS could provide sufficient data to support a marsh restoration project in the lower basin that could provide protection to, or enhance of the functions and values of existing swamp habitats in the basin. The state presented data prepared through their previous analyses that supported preservation of some 20,000 acres of swamp habitat throughout the whole Barataria basin during the period of analysis. However, closer inspection indicated that the preservation would only occur if the entirety of State Master Plan were constructed.

Therefore, it was impossible to determine what the marsh restoration project contributed towards those preservation acreages. The teams collectively determined that additional time and funding would be necessary to conduct more detailed modeling in order to determine whether the marsh project alone could mitigate for the swamp impacts and where those swamp benefits would be located.

6. To date, the NFS has expressed an unwillingness to incur the additional expense over and above the costs of the currently identified WBV HSDRRS TSP in pursuit of a locally preferred alternative.

7. In consideration of the above and in an effort to complete the WBV HSDRRS Mitigation concurrent with construction of the WBV HSDRRS as required by law, CEMVN has decided to move forward with the identified WBV HSDRRS Mitigation TSP. As previously mentioned, we believe the TSP projects are consistent with the intent of commitments expressed by the ASA-CW in the March 19, 2010, letter from the ASA-CW to Governor Bobby Jindal.

CEMVN-PD
SUBJECT: New Orleans District West Bank and Vicinity (WBV) Hurricane and Storm Damage Risk Reduction System (HSDRRS) Mitigation Reformulation Efforts with the State of Louisiana Coastal Protection and Restoration Authority (CPRA)

8. If I can be of further assistance, please do not hesitate to call me or have a member of your staff contact Mr. Troy Constance, Chief, Regional Planning & Environment Division, South at 504-862-1971. Mr. Constance can also be contacted via e-mail at Troy.G.Constance@usace.army.mil.

EDWARD R. FLEMING
Colonel, EN
Commanding

2 Encls
1. as
2. Supporting background information

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
CIVIL WORKS
108 ARMY PENTAGON
WASHINGTON DC 20310-0108

MAR 19 2010

Honorable Bobby Jindal
Governor,
State of Louisiana
Post Office Box 94004
Baton Rouge, Louisiana 70804-9004

Dear Governor Jindal:

Thank you for your letter of February 22, 2010, concerning possible use of the Greater New Orleans area Hurricane and Storm Damage Risk Reduction System (HSDRRS) mitigation funds to mitigate for broader environmental impacts and to advance coastal sustainability goals. Specifically, you requested that the Army Corps of Engineers cease efforts to perform traditional mitigation measures and work closely with the Louisiana Coastal Protection and Restoration Authority on mitigation efforts. This response has been coordinated with the Council on Environmental Quality (CEQ) and the Office of Management and Budget.

I want to emphasize that the Army welcomes your interest and assistance in implementing the HSDRRS and your continued engagement in broader Louisiana coastal protection and restoration planning. Moreover, the Army will continue to work closely with the Louisiana Coastal Protection and Restoration Authority on all aspects of the HSDRRS to advance coastal sustainability goals. However, for the reasons described below, the Corps will continue its ongoing mitigation activities. We share the mutual goal of completing the HSDRRS to provide hurricane risk reduction that is consistent with coastal and ecosystem restoration goals and that takes advantage of opportunities for efficiencies and economies of scale by including large mitigation projects to improve their ecological performance and long-term viability for the treasured resources of Louisiana.

As part of the ongoing HSDRRS design and construction program to provide 100-year level of storm damage risk reduction for the Greater New Orleans area, the Army Corps of Engineers has been engaged in a rigorous and very public process to comply with the National Environmental Policy Act, the Fish and Wildlife Coordination Act, and other applicable environmental laws and regulations. This effort includes determining compensatory mitigation for unavoidable environmental impacts to fish and wildlife habitats including wetlands and bottomland hardwood forests. The Corps is conducting a proactive process that involves a continual dialog with our Federal, State and non-governmental organization partners to ensure that all voices are heard in developing a comprehensive HSDRRS plan.

Our collective planning efforts of sequentially avoiding, minimizing, rectifying, reducing and eliminating environmental impacts has succeeded in reducing the remaining balance of unavoidable environmental impact to be mitigated from an initial estimate of 15,000 acres to a current estimate of 5,650 acres of unavoidable impacts. About half of these acres are bottomland hardwood forests, which are required to be mitigated in kind to the extent possible under the Water Resources Development Act (WRDA) of 1986. The estimated cost to mitigate for these unavoidable impacts associated with the HSDRRS is approximately $250 million. This amount is budgeted within the HSDRRS program and fully funded along with the other program work. Mitigation projects are planned to be carried out within the adversely affected watersheds in line with the Federal laws and regulations that establish mitigation requirements for water resources projects.

Under the provisions of WRDA 1986, as amended in WRDA 2007, the Corps is required to develop and implement mitigation features concurrently with other construction and to provide in-kind mitigation for adversely affected habitats. While your specific request to use HSDRRS mitigation funds to implement Louisiana Coastal Area (LCA) projects would require new legislation, we share your desire to improve the effectiveness of the mitigation actions.

The Administration's Gulf Coast Ecosystem Restoration Roadmap identifies Federal actions to work with the states to seek more efficient implementation of ecosystem projects and effective use of mitigation funds, including review of mitigation policies and potentially proposing alternatives. We are committed to collaboration with other Federal agencies and the States of Louisiana and Mississippi through the Gulf Coast Ecosystem Restoration Working Group, and will continue to seek and encourage input on restoration and mitigation planning, as well as for project implementation. As noted earlier, we are committed to identifying large-scale projects that will mitigate for the impacts caused by the HSDRRS program and provide the most effective benefits to coastal and ecosystem restoration. Moreover, the Corps will develop HSDRRS mitigation plans in those high priority areas that also are identified within the state master plan, specifically the West Bank and Lake Pontchartrain areas.

The Administration is committed to moving the LCA Program forward. The President's Fiscal Year 2011 Budget for the Army Civil Works program includes $19 million to begin construction on authorized LCA projects that have successfully completed Administration review. This is one of only two new starts in the Civil Works Construction account.

Thank you for your engagement in implementing the HSDRRS program and in coastal protection and restoration planning. If you have further questions, please don't hesitate to contact me.

Very truly yours,

Jo-Ellen Darcy

Jo-Ellen Darcy
Assistant Secretary of the Army
(Civil Works)

CF: Chair Sutley
Ms. Ericsson

WBV HSDRRS MITIGATION FOR GENERAL IMPACTS: NFS MITIGATION ALTERNATIVES AND ORIGINAL TSP MITIGATION PROJECTS

BACKGROUND

The WBV HSDRRS work incurred impacts to four habitat types; fresh marsh, wet bottomland hardwoods (BLH-Wet), dry bottomland hardwoods (BLH-Dry), and swamp. These impacts occurred in two main categories; (1) habitats located within Jean Lafitte National Historical Park & Preserve (the Park) and the Bayou aux Carpes Clean Water Act Section 404c area (referred to as "Park/404c" impacts) and, (2) habitats located outside the Park/404c area (referred to as "general" impacts).

The PDT, which included NFS (i.e. Louisiana Coastal Protection and Restoration Authority or CPRA) staff, developed mitigation alternatives for each of the habitat types included in each of the 2 main categories. CPRA staff agreed to all the proposed alternatives at that time. TSP mitigation projects were then selected in late October 2011 using the AEP process. The TSP projects originally selected for mitigating WBV HSDRRS general impacts (the original TSP projects) were:

(A) Mitigation for impacts to BLH-Dry and BLH-Wet habitats on protected side of levee:
The original TSP was use of a mitigation bank (i.e. purchase of mitigation bank credits).

(B) Mitigation for impacts to BLH-Wet habitats on floodside of levee:
The original TSP was the Lake Boeuf swamp restoration alternative. This project involves restoring BLH-Wet habitats from existing agricultural crop fields and pastures.

(C) Mitigation for impacts to fresh marsh habitats on floodside of levee:
The original TSP was the Jean Lafitte non-Park/404c marsh restoration alternative. This project involves restoring fresh marsh habitats from existing open water areas within the Park.

(D) Mitigation for impacts to swamp habitats on floodside of levee:
The original TSP was the Lake Boeuf swamp restoration alternative. This project involves restoring swamp habitats from existing agricultural crop fields and pastures. Most of the restored areas would be directly adjacent to the BLH-Wet habitats restored at the Lake Boeuf site (see item "(B)" above).

Subsequent to the selection of the original TSP projects, the NFS provided consensus on those TSP projects identified for mitigating Park/404c impacts. The TSP projects for mitigating Park/404c impacts consisted of a TSP for mitigating impacts to swamp habitats (restoration of swamp habitats within existing open water areas), a TSP for mitigating impacts to fresh marsh habitats (restoration of marsh habitat within an existing open water area), and a TSP for mitigating impacts to BLH-Wet floodside habitats (restoration of BLH-Wet habitat within existing open water areas). WBV HSDRRS improvements did not impact any BLH-Dry habitats in the Park/404c area, thus no mitigation was necessary for such impacts. All these TSP projects are located within the Park or in lands slated for acquisition and incorporation into the Park.

The NFS objected to all the original TSP projects identified for mitigating general impacts. The basis of this objection was that none of the original TSP projects coincided with projects identified in the Louisiana Coastal Master Plan (the Master Plan). At the time the NFS lodged this objection, the 2007 Master Plan was being revised and a list of candidate projects was under consideration for the 2012 Master Plan. Although none of the original TSP projects for mitigating Park/404c impacts coincided with the Master Plan candidate projects, the NFS did not object to these since it was recognized that these TSP projects must be conducted within the boundaries of the Park due to National Park Service policies and conditions set forth in the modification to the 1985 404c designation that allowed WBV HSDRRS impacts in the EPA-designated 404c area.

Since early November 2011, CEMVN has worked closely with CPRA's team to identify potential projects slated for inclusion in the 2012 Master Plan that could mitigate for the general impacts with some modifications.

The CEMVN/CPRA team first identified 3 potential mitigation project areas (Delta Farms, Lake Salvador, and Naomi) that coincided with restoration projects under consideration for the 2012 Master Plan, as selected from various potential project areas. Four alternative mitigation plans were developed with each alternative capable of fully mitigating for all the affected habitat types. One alternative mitigation plan was developed for the Delta Farms site, one was developed for the Lake Salvador site, and two alternative plans were developed for the Naomi site (Naomi Alt. 1 and Naomi Alt. 2), thereby resulting in a total of 4 mitigation alternatives for each of the affected habitat types. All of the alternative mitigation plans (i.e. the reformulated NFS mitigation alternatives) involved restoration of the target habitat types from existing open water areas. The potential mitigation project areas were approved by CPRA on 12 December 2011. Conceptual designs for the four alternative mitigation plans, as documented in a report prepared by CEMVN, were approved by CPRA on 27 January 2012.

After the draft 2012 Master Plan was released to the public, the team found that the number of projects included in the plan had been significantly reduced and that only one the 3 potential mitigation project areas (the Naomi project area) area and two of the alternative mitigation plans discussed above (Naomi Alt. 1 and Naomi Alt. 2) still overlapped projects remaining in the Master Plan.

A comparison of the reformulated NFS mitigation alternatives coinciding with the Master Plan and the original WBV HSDRRS TSP projects for mitigating general impacts is provided in the subsections below. All of the NFS alternatives significantly exceed the estimated costs for the comparable original TSP projects (ranging from 2 times to 12 times the cost) and all NFS alternatives have a significantly higher risk of failure compared to the original TSP projects, with the exception of the Naomi Alt. 1 marsh mitigation alternative.

1. Mitigation for BLH-Dry and BLH-Wet, Protected Side Impacts

A. Naomi Alternative 2

- NFS Alternative (Naomi Alt 2) is greater than 5 times the cost of the original TSP (mitigation bank), with a difference of $47,158,486.
- This NFS alternative has a substantial risk of failure due to excessively high salinity, whereas the original TSP involves minimal to no risk (the bank assumes risk).

B. Naomi Alternative 1

- NFS Alternative (Naomi Alt 1) is greater than 10 times the cost of the original TSP (mitigation bank), with a difference of $116,006,994.
- This NFS alternative has the lowest risk of failure (due to excessively high salinity) compared to Naomi Alt. 2, since this alternative includes making improvements to the freshwater Naomi Siphon and the NFS would assume control and operation of the siphon whereas Naomi Alt. 2 is based on making no improvements to the siphon and the siphon remaining in control of Plaquemines Parish. However, the risk is still greater than the risk associated with the original TSP.

2. Mitigation for BLH-Wet, Flood Side Impacts

A. Naomi Alternative 2

- NFS Alternative (Naomi Alt 2) is greater than 4.6 times the cost for the original TSP (Lake Boeuf), with a difference of $41,314,653.
- This NFS alternative has a substantial risk of failure due to excessively high salinity, whereas the original TSP has a minimal risk of failure.

B. Naomi Alternative 1

- NFS Alternative (Naomi Alt 1) is greater than 12 times the cost of the original TSP (Lake Boeuf), with a difference of $126,781,028.
- This NFS alternative has the lowest risk of failure (due to excessively high salinity) compared to Naomi Alt. 2, since this alternative includes the previously mentioned freshwater siphon improvements and control. However, the risk is still greater than the risk associated with the original TSP.

3. Mitigation for Fresh Marsh Impacts

A. Naomi Alternative 2

- NFS Alternative (Naomi Alt 2) is greater than 5.3 times the cost for the original TSP (Jean Lafitte), with a difference of $43,709,209.
- This NFS alternative has a slightly higher risk of failure compared to the original TSP.

B. Naomi Alternative 1

- NFS Alternative (Naomi Alt 1) is greater than 2 times the cost for the original TSP (Jean Lafitte), with a difference of $10,374,770.

- This NFS alternative has roughly the same or slightly lower risk of failure compared to the original TSP and has a higher risk of failure when compared to Naomi Alt. 1.
- Note: A mitigation bank that could satisfy the marsh mitigation needs may soon be approved. This could pose additional problems if this NFS alternative is used as the locally-preferred plan since the cost of a mitigation bank alternative would likely be much lower than the cost of Naomi Alt. 1.

4. Mitigation for Swamp Impacts

A. Naomi Alternative 2

- NFS Alternative (Naomi Alt 2) is greater than 3 times the cost for the original TSP (Lake Boeuf), with a difference of $26,853,009.
- This NFS alternative has a significant risk of failure due to excessively high salinity, whereas the original TSP has a minimal risk of failure.

B. Naomi Alternative 1

- NFS Alternative (Naomi Alt 1) is greater than 8 times the cost of the original TSP (Lake Boeuf), with a difference of $100,559,615.
- This NFS alternative has the lowest risk of failure (due to excessively high salinity) compared to Naomi Alt. 1, since this alternative includes the previously mentioned freshwater siphon improvements and control. However, the risk is still greater than the risk associated with the original TSP.

After development of the reformulated NFS alternatives, CEMVN advised CPRA that the only viable NFS alternative appeared to be the Naomi Alt. 1 marsh mitigation since the NFS alternatives for mitigating swamp and BLH impacts were excessively expensive and risky. CEMVN advised CPRA that this NFS marsh mitigation alternative could be pursued as the LPP but the NFS would need to bear the incremental cost of the betterment. CPRA supported the NFS marsh alternative as the LPP for marsh mitigation but refused to bear the incremental cost.

CPRA later indicated they wished to pursue mitigation for swamp impacts with a marsh restoration project using the "watershed approach" to compensatory mitigation (refer to 33 CFR §332.3(b)(6)(c)). CEMVN advised CPRA that this approach would require:

(1) Data demonstrating how the marsh mitigation would provide protection to, or enhance the functions and values of, existing swamp habitats in the upper Barataria Basin. The benefits to the swamp habitats would have to be quantified and meet the swamp mitigation requirement.
(2) Data demonstrating that the marsh project was adequately sized to achieve the stated benefits to swamp and meet the marsh mitigation requirement as well.
(3) An agreement with the USFWS as regards the project's ability to replace the lost swamp functions and values.

CEMVN also advised CPRA that if they seek to mitigate swamp impacts out-of-kind (instead of replacing the lost functions and values of the swamp impacts), then the NFS would have to:

(1) Demonstrate that in-kind swamp mitigation is not possible, or;
(2) If in-kind mitigation is possible, petition Congress to change WRDA 2007, §2036(a).

On 30 April 2012, CPRA convened a meeting with CEMVN to discuss a potential Master Plan marsh restoration project that would have swamp benefits and thereby possibly suffice for mitigating WBV HSDRRS general impacts to swamp habitats. CPRA presented data from their Master Plan vegetation model that predicted the preservation of roughly 20,000 acres of swamp over a 50-year period as a direct result of implementing all of the projects in the Barataria Basin called for in the draft (not final) 2012 Master Plan. CPRA offered one of the Master Plan marsh projects (roughly 8,070 acres) as a possible means of mitigating both marsh and swamp WBV HSDRRS impacts. However, CPRA was unable to identify the potential benefits that construction this marsh restoration project, or a portion thereof, would have to swamp habitats in the upper basin and advised that additional modeling would be necessary to conduct such an evaluation.

CONCLUSIONS (RECOMMENDED PATH FORWARD)

Further Evaluation of NFS Watershed Approach to Mitigating Swamp Impacts

While all projects in the 2012 Master Plan could collectively benefit swamp habitats in the upper Barataria Basin, the marsh mitigation CPRA proposed during the 30 April 2012 meeting is only one minor component of all restoration types and scales (i.e. diversions, marsh creation, barrier islands) the Master Plan considers. CEMVN staff does not believe that construction of any Master Plan marsh restoration project in isolation would yield sufficient swamp benefits to meet the WBV HSDRRS mitigation requirement. This professional opinion is supported by preliminary analyses conducted by USGS staff who also participated in developing models used in the Master Plan.

Other CEMVN concerns with pursuing further modeling to determine whether an NFS marsh restoration project could produce enough swamp mitigation benefits include: (1) This exercise would be lengthy, expensive, and would further delay mitigation implementation; (2) The Wetland Value Assessment (WVA) models necessary to quantify mitigation adequacy would partially rely on inputs generated from CPRA's models, but CEMVN hasn't validated these models; (3) If it could be demonstrated that the NFS marsh project would actually compensate for both swamp and marsh impacts, the cost of this project would no doubt substantially exceed the cost of the original TSP marsh and swamp mitigation projects (at least 3 to 5 times the cost, if not much more); however CPRA has indicated they are unwilling to pay the incremental cost.

Given these points, CEMVN concludes that further evaluation of CPRA's proposed watershed approach to mitigating swamp impacts would not be productive and therefore should be abandoned as a potential mitigation alternative.

Potential NFS Watershed Approach to Mitigating BLH Impacts

The NFS has not yet proposed consideration of a "watershed approach" to mitigating BLH impacts, whereby a marsh restoration project would be used to produce benefits to BLH habitats that would satisfy WBV HSDRRS mitigation requirements for general impacts to BLH habitats. However, one could anticipate that the NFS might propose such an alternative in the future. CPRA's vegetation models used to develop and analyze projects in the Master Plan are not capable of identifying existing BLH habitats or predicting the effects of Master Plan projects on such habitats, according to CPRA. Because of this, CPRA would not have the tools required to determine whether implementing one or more Master Plan marsh restoration projects could result in benefits to BLH habitats that would satisfy BLH mitigation requirements. Thus, CEMVN concludes that CPRA cannot take a watershed approach to mitigating BLH impacts similar to the approach they wished to pursue for mitigating swamp impacts.

Selection of Naomi Alt. 1 Marsh Project as the LPP vs. the Original TSP Marsh Mitigation Project

While the Naomi Alt. 1 marsh restoration project proposed by the NFS appears adequate to satisfy marsh mitigation needs and is roughly equivalent to the original TSP for marsh mitigation as regards risk, the Naomi Alt. 1 marsh mitigation alternative is twice the cost of the original TSP. Since CPRA refuses to pay the incremental cost if the Naomi Alt. 1 marsh alternative becomes the LPP, there is no reason to consider this alternative further. CEMVN thus concludes that the original TSP marsh mitigation project (Jean Lafitte marsh restoration) should remain as the TSP for mitigating WBV HSDRRS general impacts to fresh marsh habitats.

Selection of Reformulated NFS Alternatives for Mitigating Swamp and BLH Impacts vs. the Original TSP Projects Identified for Mitigating Swamp and BLH Impacts

The reformulated NFS alternatives for mitigating swamp impacts and BLH impacts that coincide with Master Plan projects (e.g. the Naomi Alt. 1 and Naomi Alt. 2 alternatives) are substantially more expensive than the original TSP projects selected for mitigating these impacts. The cited NFS alternatives also have a risk of failure that is significantly greater than the risk associated with the original TSP projects. . Given this high risk of failure and CPRA's refusal to pay incremental costs, there is no reason to consider the reformulated NFS swamp and BLH mitigation alternatives further. CEMVN therefore concludes that the original TSP project for mitigating WBV HSDRRS general impacts to swamp habitats (Lake Boeuf swamp restoration), the original TSP project for mitigating WBV HSDRRS general impacts to BLH-Wet and BLH-Dry habitats on the protected side of the levee (mitigation bank), and the original TSP project for mitigating general impacts to swamp habitats (Lake Boeuf swamp restoration) should remain as the TSP projects for compensating the cited impacts.

Original TSP Projects in Relation to the 2012 Master Plan

In a letter dated 19 March 2010 from Assistant Secretary of the Army Jo-Ellen Darcy to Governor Bobby Jindal concerning HSDRRS mitigation, the ASA emphasized the Corps' commitment to identifying large-scale projects that will mitigate for the impacts caused by the HSDRRS program and provide the most effective benefits to coastal and ecosystem restoration. The ASA further stated the Corps would develop HSDRRS mitigation plans "…in those high priority areas that also are identified within the state master plan, specifically the West Bank and Lake Pontchartrain areas."

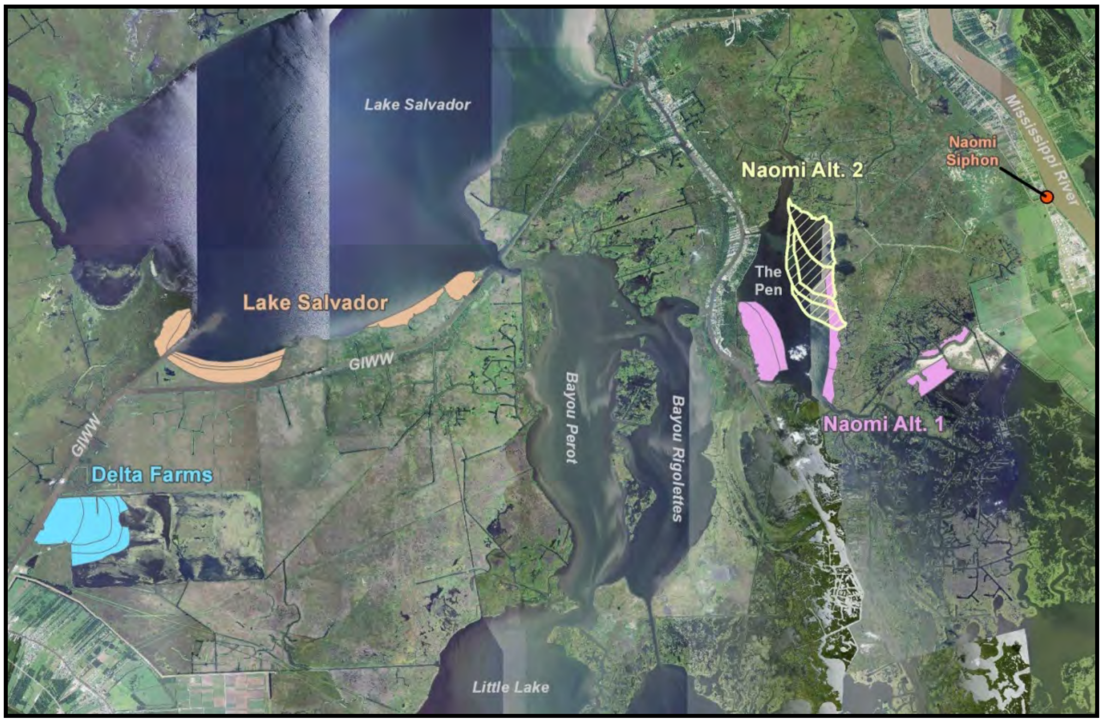
The original TSP mitigation projects identified for compensating WBV HSDRRS general impacts are all located within the West Bank area. These projects have been sized to meet mitigation requirements and their selection was largely based on identifying mitigation projects that would provide the most effective benefits to coastal/ecosystem restoration. While none of the original TSP projects actually "overlap" specific restoration projects presently identified in the Master Plan, CEMVN has expended great effort in attempting to develop mitigation projects that would overlap Master Plan projects. However, as discussed herein, potential mitigation projects developed to coincide with Master Plan projects do not appear to be viable.

It is noted that the majority of WBV HSDRRS general impacts affected swamp and BLH habitats, whereas impacts to fresh marsh habitats were much less extensive. The 2012 Master Plan does not identify any potential swamp or BLH restoration projects in the Barataria Basin. Only marsh restoration projects are specifically identified in this basin. This situation makes it practically impossible to develop swamp and BLH mitigation projects that coincide with swamp and BLH restoration or enhancement projects in the Master Plan since none exist. While the Naomi Alt. 1 marsh restoration project proposed by the NFS does overlap a specific marsh restoration project identified in the Master Plan and this alternative seems viable, the NFS has refused to bear the incremental cost difference between this alternative and the cost associated with the original TSP project for mitigating marsh impacts.

One of the overall goals stated in the 2012 Master Plan is habitat restoration using "…an integrated and synergistic approach to ensure a sustainable and resilient coastal landscape." CEMVN believes all the original TSP mitigation projects are consistent with this goal. One of the restoration goals in the 2012 Master Plan specific to the Southeast Coast is to "…sustain a diversity of coastal habitats including cypress swamps, marshes, ridges, and barrier islands." CEMVN believes the original TSP mitigation projects are also consistent with this goal.

WEST BANK AND VICINITY, NEW ORLEANS, LA
HURRICANE & STORM DAMAGE RISK REDUCTION SYSTEM
WBV MITIGATION PROJECT

ADDITIONAL MITIGATION ALTERNATIVES



Preliminary Design
January 2012
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US Army Corps
of Engineers®

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1.0 INTRODUCTION

The US Army Corps of Engineers, Mississippi Valley Division, New Orleans District (CEMVN) must mitigate, to the extent possible, for West Bank and Vicinity (WBV) Hurricane and Storm Damage Risk Reduction System (HSDRRS) impacts to four specific types of habitat; swamp, fresh marsh, bottomland hardwoods dry (BLH-Dry), and bottomland hardwoods wet (BLH-Wet). The proposed mitigation would replace the lost functions and values of the impacted areas through restoration or enhancement activities that increase/improve the habitat functions and values within a particular mitigation feature.

One should note that WBV HSDRRS mitigation requirements were separated into two main groups or categories. The first group involves mitigation needs specific to WBV HSDRRS impacts to habitats within Jean Lafitte National Historical Park and Preserve (JLNHPP or "the Park"), including impacts to habitats within lands designated as the "Bayou aux Carpes 404(c)" area (the 404c area), that are now part of the Park. Since the proposed mitigation features are specifically for the Park/404(c) habitat impacts and mitigation for these impacts must be provided within Park boundaries, these mitigation components are not alternatives that can be evaluated in relation to mitigation alternatives for WBV HSDRRS impacts to habitats outside the Park/404(c) area. Thus, this mitigation requirement category is referred to as mitigation for Park/404(c) impacts.

The other category of mitigation requirements is referred to as mitigation for non-Park/404(c) impacts or as mitigation for "general" impacts. This category includes mitigation for WBV HSDRRS impacts to habitats located outside the Park/404(c) area. Mitigation features proposed as compensation for general impacts could be provided at a variety of suitable locations. Numerous mitigation alternatives can be developed and compared to one another when dealing with the general impacts since there are a variety of potential mitigation locations, including use of authorized mitigation banks.

Engineering approaches and alternatives to achieve mitigation requirements were previously developed in cooperation with the Project Delivery Team (PDT), including the CEMVN Environmental Branch, CEMVN Plan Formulation Branch, the Non-Federal Sponsor (NFS), and resource agencies. Close coordination with these groups has occurred through their ongoing participation in the HSDRRS Interagency Mitigation Team.

As documented in the Engineering Alternatives Report (EAR) prepared for the WBV mitigation project (USACE, 2011), a final array of alternatives for mitigating general impacts was selected and evaluated plus a few design alternatives were developed and evaluated for mitigating Park/404(c) impacts. Through the Alternatives Evaluation Process (AEP), the general mitigation alternatives were ranked and the preferred alternatives were selected by CEMVN PDT members (recommended as the Tentatively Selected Plan or TSP for mitigating general impacts). The CEMVN PDT members also recommended the preferred design option (recommended TSP) for mitigating Park/404(c) impacts.

Shortly after completion of the original AEP discussed above, the NFS advised CEMVN that the NFS did not concur with the final array of general mitigation alternatives addressed in the EAR, and requested CEMVN to develop additional potential alternatives for mitigating general impacts. The main reason for this was that none of the original final array of alternatives involved mitigation sites that coincided with areas designated in the State's Master Plan (CPRA, 2011). Overlap with potential restoration projects in the State Master Plan did not occur because the master plan projects in the Barataria Basin are located in areas that typically support intermediate to saline marsh vegetation. Since upgrades to the WBV HSDRRS incurred marsh impacts to fresh marsh only and because opportunities were available to replace these impacts with fresh marsh projects, the HSDRRS mitigation southern basin boundary was initially established at the fresh/intermediate marsh interface as documented in the 2007 USGS habitat mapping. However, due to the flexibility that exists within the MVN Regulatory Program to mitigate fresh marsh impacts with either fresh or intermediate projects, CEMVN has since agreed to evaluate intermediate marsh projects to mitigate for HSDRRS impacts. The NFS did concur with CEMVN's recommended plan for mitigating Park/404(c) impacts, recognizing that such mitigation could not be conducted anywhere except within Park lands.

Pursuant to the NFS's request, the PDT, including the NFS and resource agencies, reconvened to select and develop conceptual designs for additional alternatives that could serve as compensation for WBV HSDRRS general impacts. This document provides information concerning the additional alternatives generated, also referred to as the "WBV additional mitigation alternatives". These additional mitigation alternatives were situated in four project groups referred to as Delta Farms, Lake Salvador, Naomi Alternative 1, and Naomi Alternative 2.

All tables cited in this document are provided in Appendix 1 while all figures cited are provided in Appendix 2. Unless otherwise indicated, all elevations cited are expressed in feet NAVD 88.

2.0 MITIGATION REQUIREMENTS

WBV HSDRRS impacts to non-Park/404(c) habitats have affected all four of the habitat types previously mentioned (i.e. fresh marsh, BLH-Wet, BLH-Dry, and swamp). At the present time, in which HSDRRS improvements are still under construction, CEMVN estimates that approximately 120 acres of fresh marsh, 344 acres of BLH-Wet, 395 acres of BLH-Dry, and 223 acres of swamp were, or will be, directly impacted through construction of WBV HSDRRS improvements outside the Park/404(c) lands. The net loss of AAHUs (Average Annual Habitat Units) associated with these impacts are presently estimated to be approximately 83 AAHUs from marsh impacts, 216 AAHUs from BLH-Wet impacts, 199 AAHUs from BLH-Dry impacts, and 124 AAHUs from swamp impacts. The cited impact acreages for each of the habitat types, along with the associated net loss of AAHUs, will be refined once as-built drawings are available for the WBV HSDRRS projects.

In the case of the additional WBV mitigation alternatives, the mitigation features would typically involve restoring habitat types equivalent to the habitat types impacted (e.g. "type for type" or "in-kind" mitigation). In the case of impacts to BLH-Dry habitats, however, the proposed mitigation would involve restoring BLH-Wet habitat in place of BLH-Dry habitat. BLH-Wet habitats are scarcer in the general region than are BLH-Dry habitats, and these wetter hardwood forests are being lost at a greater rate than are the drier hardwood forests. BLH-Wet habitats tend to be more diverse than BLH-Dry habitats, and the BLH-Wet habitats provide wetland functions and values not afforded by BLH-Dry habitats. Thus, it was deemed more desirable to restore BLH-Wet habitats. It is noted that these two habitat types are often comprised of similar plant species and that many

BLH-Dry habitats affected by WBV projects were likely once BLH-Wet habitats whose hydrologic regimes were altered by a variety of factors.

Also in the case of impacts to fresh marsh habitats, it was assumed that the proposed mitigation would involve restoring intermediate marsh habitat instead of fresh marsh habitat. The PDT determined that, given the relatively high salinity levels anticipated in the areas where the additional alternatives are proposed and the predominance of existing intermediate marshes in these areas, it would be more appropriate to restore intermediate marsh habitats rather than fresh marsh habitats. It is noted that intermediate and fresh marsh habitats are quite similar to one another. These two marsh types are often dominated by similar plant species, although species diversity tends to be greater in fresh marshes. One should also note that CEMVN's Regulatory Division allows impacts to fresh marsh habitats to be mitigated via restoration or enhancement of either fresh marsh or intermediate marsh habitats. The reader is further advised that, should any of the proposed marsh restoration alternatives be carried forward, the classification of the marsh habitat to be restored would be further evaluated to determine if restoration of fresh marsh habitat rather than intermediate marsh habitat is viable.

Mitigation for impacts to habitats located on the flood side (FS) of the levee system must be conducted on the FS of existing levees while mitigation for impacts to habitats located on the protected side (PS) of the levee system can be conducted either on the PS or FS of existing levees. The four additional WBV mitigation alternative project groups would all be located on the FS of existing levees. The allowance for mitigating protected side impacts using flood side mitigation was based on the concept that flood side habitat has inherently higher ecological value than protected side habitat. In addition, mitigation conducted on the protected side of the levee system could potentially be affected by regional activities that are beyond the control of CEMVN or the NFS (ex. change in pumping regime employed by a levee district could alter hydrologic conditions; presently undeveloped lands adjacent to proposed mitigation features could be developed, etc.).

The total acreage necessary to compensate for each habitat impact category was estimated based on: (1) Wetland Value Assessment (WVA) models run for the WBV HSDRRS impacts, thereby yielding the total number of AAHUs lost as a result of these impacts, or the "impact AAHUs"; (2) WVA models run for similar types of mitigation, as analyzed for the initial array of alternatives for the WBV HSDRRS mitigation alternatives and for the Lake Pontchartrain and Vicinity (LPV) HSDRRS mitigation alternatives. The WVA models run for similar types of mitigation, i.e. restoration of habitats from existing open water areas, generated the anticipated "mitigation potential" for the various types of habitats proposed. The mitigation potential is the net AAHUs per acre produced by the mitigation activity. By knowing the AAHUs lost via impacts, the anticipated mitigation acreage required was determined through the following formula; Acres required = (AAHUs lost via impacts) / (mitigation potential in AAHUs per acre).

Table 1 provides data used in determining the mitigation acreage requirements for each habitat impact category. These acreage requirements were: 441.5 acres for impacts to BLH-Dry, PS habitats; 64.6 acres for impacts to BLH-Wet, PS habitats; 415.0 acres for impacts to BLH-Wet, FS habitats; 288.6 acres for impacts to swamp, FS habitats (all swamp impacts were FS impacts), and; 238.5 acres for impacts to fresh marsh, FS habitats (all fresh marsh impacts were FS impacts) when the restored habitat would be intermediate marsh rather than fresh marsh.

It is worth noting that, should any of the additional mitigation alternatives be carried forward for further analysis and comparison to the initial array of mitigation alternatives, WVA models would need to be run for the proposed mitigation features. The results of these models could reveal that the size (acreage) of one or more mitigation features would need to be increased to yield the AAHUs required. All four of the additional mitigation alternative project groups are such that increasing the size of one or more of the proposed mitigation features within a particular group could be readily achieved if necessary. Similarly, the WVA models could indicate that the size of one or more mitigation features currently proposed could be reduced and still yield the AAHUs necessary.

3.0 ADDITIONAL MITIGATION ALTERNATIVES

The PDT evaluated various areas where additional mitigation alternatives could be established. During this evaluation, the initial screening criteria for the WBV HSDRRS mitigation projects were utilized to formulate the alternatives. The results of this evaluation yielded four project area groups. These groups, which may also be considered as "mitigation sites," are; Delta Farms, Lake Salvador, Naomi Alternative 1, and Naomi Alternative 2 (see Figure 1 for location of these groups). Each group contains proposed features (mitigation features) that mitigate all of the impacted habitat types and meet 100 percent of the mitigation need for the habitat type(s) involved, based on the means of determining acreage requirements discussed in Section 2. One should note that the Naomi Alternative 1 and the Naomi Alternative 2 project groups are really just two different design approaches (design alternatives) to achieving mitigation requirements at essentially the same mitigation site. However, these two design alternatives are herein considered as being two different project groups.

All of the proposed mitigation features in each of the four project groups would involve habitat restoration to achieve mitigation goals. These are referred to as restoration features. The term "restoration", when used in the context of mitigation, typically implies that mitigation activities seek to restore habitats that previously existed but have been eliminated due to various factors. While this is true for some of the proposed restoration features, others involve establishing native habitats at locations where the proposed habitat type may not have been present historically. These mitigation features are still referred to as restoration features herein, despite the typical terminology for such mitigation being habitat "creation" or "establishment."

The mitigation activities involved in the proposed restoration features (mitigation features) would involve altering existing surface elevations to attain the desired hydrologic platform. Mitigation activities in restoration features would also include planting native trees and shrubs in proposed BLH-Wet and swamp features, while features slated for intermediate marsh restoration would be planted with native herbaceous species. The eradication and control of invasive and nuisance plant species would be a component of all restoration features.

It is important to remember that mitigation alternatives can only be compared based on the habitat type impacted and the location of the impact (i.e. PS or FS). Because of this, the four additional mitigation project groups are really not alternatives that can be compared to one another as regards comparing all the proposed mitigation features contained in one project group to all the proposed mitigation features contained in another project group. Each of the project groups contains four mitigation alternatives that correspond to the four habitat impact categories. Alternatives that provide mitigation for the same habitat impact category can be compared to each other, not project groups as a whole.

The four mitigation alternative categories are summarized below. Refer to Figures 2 through 5 for illustrations of the mitigation features cited.

Alternatives for Mitigating BLH-Dry and BLH-Wet, Protected Side Impacts. Four alternative project groups (mitigation sites) have features that could provide mitigation for these impacts include:

- Delta Farms – mitigation feature DF1 (BLH-Wet restoration feature).
- Lake Salvador – mitigation features LS3, LS4, and LS5, considered as a group (all are BLH-Wet restoration features).
- Naomi Alternative 1 – mitigation feature N2 (BLH-Wet restoration feature).
- Naomi Alternative 2 – mitigation feature N8 (BLH-Wet restoration feature).

Alternatives for Mitigating BLH-Wet, Flood Side Impacts. Four alternative project groups (mitigation sites) have features that could provide mitigation for these impacts include:

- Delta Farms – mitigation feature DF2 (BLH-Wet restoration feature).
- Lake Salvador – mitigation feature LS2 (BLH-Wet restoration feature).
- Naomi Alternative 1 – mitigation features N3, N4, N5, and N6, considered as a group (all are BLH-Wet restoration features).
- Naomi Alternative 2 – mitigation feature N9 (BLH-Wet restoration feature).

Alternatives for Mitigating Swamp, Flood Side Impacts. Four alternative project groups (mitigation sites) have features that could provide mitigation for these impacts include:

- Delta Farms – mitigation feature DF3 (swamp restoration feature).
- Lake Salvador – mitigation features LS6 and LS7, considered as a group (both are swamp restoration features).
- Naomi Alternative 1 – mitigation feature N7 (swamp restoration feature).
- Naomi Alternative 2 – mitigation feature N10 (swamp restoration feature).

Alternatives for Mitigating Fresh Marsh, Flood Side Impacts. Four alternative project groups (mitigation sites) have features that could provide mitigation for these impacts include:

- Delta Farms – mitigation features DF4 and DF5, considered as a group (both are intermediate marsh restoration features).
- Lake Salvador – mitigation features LS1 (intermediate marsh restoration feature).
- Naomi Alternative 1 – mitigation feature N1 (intermediate marsh restoration feature).
- Naomi Alternative 2 – mitigation feature N11 (intermediate marsh restoration feature).

As an example of how mitigation alternatives may be evaluated, the four alternatives for mitigating impacts to swamp habitats that can be compared to one another include; the swamp feature in the Delta Farms project group (feature DF3), the swamp features in the Lake Salvador project group (features LS6 & LS7; considered as a group rather than individually), the swamp feature in the

Naomi Alternative 1 project group (feature N7), and the swamp feature in the Naomi Alternative 2 project group (feature N10). During the Alternatives Evaluation Process (AEP), these swamp mitigation alternatives would be ranked relative to one another based on the five plan selection criteria; risk & reliability, environmental, watershed & ecological site considerations, time, cost effectiveness, and other cost considerations, as addressed in the EAR generated for the initial final array of WBV mitigation alternatives (USACE, 2011). Alternatives for mitigating impacts to the each of the other habitat impact categories (BLH-Dry & BLH-Wet protected side impacts, BLH-Wet flood side impacts, and fresh marsh flood side impacts) would also be ranked relative to one another during the AEP.

Assuming the additional WBV mitigation alternatives were the only ones being compared against one another, one could theoretically determine through the AEP that the recommended mitigation plan would include separate features from each of the four project groups. Similarly, such a recommended plan could potentially include mitigation features located in only two of the four project groups. This is only an example of how the alternatives ranking and selection process works and should not be construed as a recommended course of action.

4.0 COMMON PROJECT DESIGN FEATURES & CONCEPTS

The four additional project groups share several common design components and concepts. The following sub-sections address these rather than reiterating them in the project descriptions (Section 5). The reader is advised that the level of design addressed in this report is preliminary (pre-35% design level). This report does not include engineering data. Quantities are based on various assumptions and research, without the aid of site visits. The designers used assumptions to determine stability and settlement.

4.1. General Project Components & Activities

All four of the project groups (mitigation sites or projects) would include restoration of native habitats from existing open water areas. All four would include restoration of BLH-Wet habitats (as mitigation for impacts to BLH-Wet PS habitats, BLH-Dry PS habitats, and BLH-Wet FS habitats), swamp habitats (as mitigation for impacts to swamp FS habitats), and intermediate marsh (as mitigation for impacts to fresh marsh FS habitats). The process involved in constructing all these habitats or mitigation features would be as follows:

- The initial construction period would be to construct retention dikes and subsequently fill the mitigation feature to establish the platform (base) for proposed habitat. Fill for the platforms would be excavated by hydraulic cutter-head dredge and transported to the proposed feature in suspension via pipeline. For some of the mitigation features, foreshore rock dikes would be constructed at this stage rather than earthen retention dikes. Some earthen retention dikes would also be armored with a stone cap, with this armoring also installed at this stage of the project. One should note that the ability to include armoring would, to a degree, depend on the bearing capacity of the underlying substrate. This would be determined during the PED phase should an alternative calling for inclusion of an armored earthen retention dike be carried forward.

- Following placement of fill, each mitigation feature would remain idle for a period of approximately 1 year to allow the fill to dewater and settle to the desired target grade elevation.
- A second construction period would occur at the end of the idle period. During this second construction phase, certain dikes would be degraded and, where called for, trenasses would be constructed within certain mitigation features. Each mitigation feature would then be planted with appropriate native species; canopy and midstory woody species in the proposed BLH-Wet and swamp features, and herbaceous species in the proposed intermediate marsh features.

Mitigation monitoring and reporting activities would commence soon after the mitigation features are planted. Appendix 3 contains preliminary mitigation monitoring and reporting guidelines. One should note that the Appendix 3 guidelines are the same as the mitigation planting, monitoring, reporting guidelines / mitigation success criteria guidelines contained in the EAR prepared for the initial area of WBV mitigation alternatives. It is anticipated that efforts necessary to eradicate and control invasive and nuisance plant species (see Appendix 3) would also begin after completion of the initial plantings, although the time between when plants are first installed and the first invasive/nuisance plant eradication event could vary considerably depending on the level of invasive/nuisance plant infestation found in a particular mitigation feature.

It was assumed that additional plantings would be required in the proposed BLH-Wet and swamp features approximately 1 year after completion of the initial plantings (refer to Section 4.6) in order to achieve applicable mitigation success criteria (refer to Appendix 3). Mitigation monitoring and reporting activities as well as management and maintenance activities would continue throughout the life of the project. Appendix 3 provides general guidelines concerning such activities.

4.2. <u>Hydrologic Platforms</u>

The design components of all the proposed mitigation features include restoration of different hydrologic platforms, which are herein also referred to as earthen platforms or simply platforms. Successful design and construction of the proposed mitigation features must consider the appropriate hydroperiod, the behavior of the water table over time in relation to the soil surface, necessary for the habitat type proposed. Design measures employed to achieve the desired hydroperiod included actions such as adding fill to existing open water areas and other physical alterations. Such measures were used to establish the necessary “hydrologic platform” for the mitigation features (e.g. the base topography following mitigation construction).

All of the proposed restoration features are currently open water areas. The method of achieving the desired hydrologic platform in such areas would involve hydraulic placement of earthen fill by cutter-head dredge to the desired elevations within each feature. Material would be excavated at the borrow site and transported to the mitigation feature in suspension via pipeline in a slurry. Retention dikes or other types of dikes (see Section 4.3) would be included to confine the slurry within the targeted area. Initial fill elevations within the restoration features would be higher than the proposed target grade elevations (desired final grades) due to expected dewatering and foundation settlement. Settlement curves would be developed during the Preconstruction, Engineering, and Design (PED) phase to finalize the amount of overbuild needed. Project features would take approximately one year to dewater and settle to the target grades.

The following subsections address the proposed platforms for each of the three habitat types that would be restored.

Intermediate Marsh

Proposed intermediate marsh features would be intertidal. The target platforms for the marshes should exist between the mean high water (MHW) elevation and the mean low water (MLW) elevation. These are the lowest hydrologic platforms addressed in this report. If the constructed elevations are too high, an inappropriate scrub-shrub habitat may develop. If the constructed elevations are too low, the proposed marsh features would not achieve target elevations and would be shallow open water.

Based on examination of LiDAR topographic data in existing marsh habitats found in the vicinity of the mitigation alternatives, it was determined that the target grade elevation (the desired final platform elevation) for all proposed intermediate marsh features would be 1.5 feet. This elevation may be reexamined should any of the marsh mitigation alternatives be carried forward for further evaluation.

It was assumed that no future lifts (i.e. no future additions of fill) would be necessary for the marsh platforms after the target elevation is initially achieved in order for proposed marsh features to yield, over the course of the 50-year project life, the net gain in AAHUs necessary to satisfy mitigation requirements. This assumption was based on the results of WVA models run for similar marsh restoration features proposed in the initial final array of WBV HSDRRS mitigation alternatives, and is consistent with assumptions used for this initial final array of alternatives. If one of the additional marsh mitigation alternatives discussed herein becomes the Tentatively Selected Plan for mitigating fresh marsh impacts, the potential need for future lifts would be further examined during the PED phase.

Swamp

The swamp hydrologic platforms were designed to be 0.5 feet higher than the marsh platforms. Based on examination of LiDAR topographic data in existing swamp habitats found in the vicinity of the mitigation alternatives, it was determined that the target grade elevation (final platform elevation) for all proposed swamp features would be 2.0 feet. This elevation may be reexamined should any of the mitigation alternatives be carried forward for further evaluation.

After the platforms have settled to the desired target grade, it was assumed that no further additions of fill would be required in order for proposed swamp features to yield, over the course of the 50-year project life, the net gain in AAHUs necessary to satisfy mitigation requirements. This assumption was based on the results of WVA models run for similar swamp restoration features proposed in the initial final array of WBV HSDRRS mitigation alternatives, and is consistent with assumptions used for this initial final array of alternatives. If one of the additional swamp mitigation alternatives discussed herein becomes the Tentatively Selected Plan for mitigating swamp impacts, the potential need for future lifts would be further examined during the PED phase.

Wet Bottomland Hardwoods
The hydrologic platforms for the wet bottomland hardwood (BLH-Wet) mitigation features are the highest platforms included in this report. The BLH-Wet hydrologic platforms were designed to be 0.5 feet higher than the swamp platforms. Based on examination of LiDAR topographic data in existing BLH-Wet habitats found in the vicinity of the mitigation alternatives, it was determined that the target grade elevation (final platform elevation) for all proposed BLH-Wet features would be 2.5 feet. This elevation may be reexamined should any of the mitigation alternatives be carried forward for further evaluation.

After the platforms have settled to the desired target grade, it was assumed that no further additions of fill would be required in order for proposed BLH-Wet features to yield, over the course of the 50-year project life, the net gain in AAHUs necessary to satisfy mitigation requirements. This assumption was based on the results of WVA models run for similar BLH-Wet restoration features proposed in the initial final array of WBV HSDRRS mitigation alternatives, and is consistent with assumptions used for this initial final array of alternatives. If one of the additional BLH-Wet mitigation alternatives discussed herein becomes the Tentatively Selected Plan for mitigating BLH impacts, the potential need for future lifts would be further examined during the PED phase.

Table 2 provides various data for the proposed earthen platforms that would be established for the various mitigation features at each alternative site. These data include: the assumed average existing grade elevation where platforms would be constructed; the initial platform fill elevation (i.e. the approximate elevation of the top of the slurry fill when it is first placed in the feature); the final target grade elevation of the platform (i.e. the desired final surface elevation of the platform following dewatering and settlement); the acreage encompassed by the mitigation feature, and; the estimated total quantity of fill (borrow) required to construct the platform.

4.3. Dikes

In the majority of cases, earthen retention dikes would be built along the perimeter of the proposed features to retain fill needed to construct the hydrologic platform necessary for each feature. Certain earthen retention dike segments would also be armored, i.e. provided with a stone cap along one face of the dike (see Section 4.3.2); however, most of the dikes would not be armored. In limited locations, foreshore rock dikes would be built along certain perimeter segments of proposed features rather than earthen retention dikes (see Section 4.3.3).

4.3.1. Earthen Retention Dikes

The earthen retention dikes would be built to an elevation that allows storage of both the borrow material and water needed to transport the material. In addition, the crest of the dikes would include a minimum one foot of freeboard to prevent overflow of effluent over the freshly constructed earthen dikes. Effluent discharge points (effluent returns, constructed as spill boxes or weirs) would be established at one or more locations along the course of the retention dikes at the time of construction to allow for effluent water release from within the mitigation feature. The freeboard of the dikes would act as a training dike to direct effluent waters over the effluent return locations. These locations would be determined during the PED phase. If practicable, the effluent returns would be positioned such that the effluent would flow into existing adjacent marsh habitats and thereby help nourish the adjacent marshes.

The earthen retention dikes would have a crown (top or crest) width of 5 feet and would have 1V:4H side slopes. Borrow necessary to construct the retention dikes would be obtained from within the boundaries of the mitigation feature being established. The borrow ditch would be offset a minimum of 40 feet from the interior toe of the dike to ensure dike stability. Figure 6A provides a typical cross-section for the earthen retention dikes. If deemed necessary by the construction contractor, a low level interior weir could be constructed within a particular mitigation feature to assist in vertical stacking of the dredged material used to establish the feature platform.

The initial crest (top or crown) elevation of the retention dikes would be set to account for the lift (elevation difference) between the proposed final target elevation of the feature platform and the existing elevation. In addition, the retention dikes would require additional lift to hold water used to transport fill material to the proposed feature via pipeline in slurry. The amount of lift needed to hold slurry water varies based on the type of borrow material involved. The more granular the borrow material type, the faster the fill settles out of suspension. For finer borrow material, the fill material stays in suspension longer and additional retention lift is needed. The bulking factor due to suspension of fill materials commonly varies between 40 and 60 percent, with the finer borrow material having the higher bulking factor.

Once the process of placing borrow material within a mitigation feature is completed, it would take approximately one year for the material to dewater and settle to the desired final target grade elevation. The earthen retention dikes would be degraded once this occurs, with the degraded material placed into the original borrow ditch used to construct the dikes. Retention dikes along the perimeter of intermediate marsh and BLH-Wet mitigation features would be degraded to equal the final target elevations of these adjacent features to allow for drainage and water interchange. Degrading the dikes in this manner would also allow those portions of the dikes having an elevation equal to the elevation of the adjacent marsh and BLH-Wet mitigation features to be included in the total acreage of the adjacent mitigation feature. If the retention dikes were to remain at their initial crest elevations, they would be too high to be considered as a component of the adjacent mitigation feature and thus would have to be excluded from the total acreage of the adjacent mitigation feature.

Earthen retention dikes along the perimeter of swamp mitigation features would be degraded to an elevation that is approximately 1 foot higher than the final target elevation for the restored swamp, to allow the swamp to be inundated by standing water and achieve the desired swamp hydroperiod. The final crest elevation (degraded elevation) of the retention dikes containing swamp features would be determined during the PED phase. This design phase could also determine that surface water control structures (ex. V-notch weir) may need to be incorporated into the certain dikes to better achieve the desired swamp hydroperiod.

Table 3 provides various data for the proposed earthen retention dikes, excluding those that will be armored. These data include: the assumed average existing grade elevation where dikes would be constructed; the initial dike crest elevation (crest elevation when dike is first constructed); the final dike crest elevation (crest elevation once dike has been degraded), and; the total linear feet of dike to be built.

4.3.2. Armored Earthen Retention Dikes

In the case of the Delta Farms alternative, certain earthen retention dike segments would be armored with a stone cap in order to protect adjacent proposed mitigation features from erosion and scouring that would likely arise from boat traffic and natural wave action. The proposed armored dikes would be established along the northern boundary of mitigation features DF1, DF2, DF3, and DF4 (see Figure 2).

The armored earthen retention dikes would be constructed exactly the same as the non-armored earthen retention dikes (see Section 4.3.1), with the exception of the armoring itself. The northern side slopes (waterward side) of the armored dike segments would be armored with a 2-foot thick stone cap. The stone would be well-graded riprap and utilizing a top sized stone of 650 pounds. Figure 6B provides a typical cross-section for the armored dike segments. The initial and final crest elevation of the stone cap would be equal to the final (degraded) crest elevation of the earthen dike in cases where the armored dike is adjacent to BLH-Wet features (features DF1 and DF2). Where the armored dike is adjacent to the swamp feature (feature DF3) and the intermediate marsh feature (DF4), the crest elevation of the stone cap would be 0.5 feet lower than the final crest elevation of the earthen dike.

Table 4 provides various data for the proposed armored earthen retention dikes. These data include: the assumed average existing grade elevation where dikes would be constructed; the initial dike crest elevation (crest elevation of earthen dike when dike is first constructed); the final dike crest elevation (crest elevation of earthen dike once dike has been degraded); the crest elevation of the stone cap; the total linear feet of dike to be built, and; the estimated quantity of stone required for the stone cap/armoring.

Once fill used to establish the platforms for the adjacent mitigation features has settled to the desired final target grade elevation, the top of the earthen portion of the armored retention dikes would be degraded, with the degraded material placed into the original borrow ditch used to construct the dikes. The stone caps (armoring) adjacent to the earthen portion of the dikes would not be degraded since the armoring installed would be initially built such that the crest elevation of the stone cap equals the desired final crest elevation of the stone cap.

4.3.3. Foreshore Rock Dikes

Foreshore rock dikes would be built along specific perimeter segments of certain proposed mitigation features instead of earthen retention dikes or armored earthen retention dikes. These foreshore rock dikes would be utilized to help prevent erosion of the adjacent mitigation features in settings where the erosion potential is substantial. They would also serve to retain the borrow material used to create the platforms for the mitigation features.

The locations of the proposed foreshore rock dikes would be as follows:

- Delta Farms – Along western perimeter of BLH-Wet feature DF1, adjacent to the Gulf Intracoastal Waterway (GIWW). Refer to Figure 2.
- Lake Salvador – Along southern perimeter of BLH-Wet feature LS3, segment adjacent to Lake Salvador; along eastern perimeter of swamp feature LS7, segment adjacent to Lake Salvador; along northern and western perimeters of swamp feature LS6, segments adjacent to Lake Salvador; along western perimeters of BLH-Wet features LS2 and LS4, segments adjacent to Lake Salvador; along northern perimeter of intermediate marsh feature LS1, segment adjacent to Lake Salvador; along northern perimeter of BLH-wet feature LS5, segment adjacent to Lake Salvador, and along the eastern perimeter of this feature, segment adjacent to the GIWW. Refer to Figure 3.
- Naomi Alternative 1 – Along the northern and southern perimeters of BLH-Wet feature N2, segments adjacent to open water; along the northern, southern, and eastern perimeters of BLH-Wet feature N3, segments adjacent to open water; along the western and southern perimeters of BLH-Wet feature N4, segments adjacent to open water; along the western and northern perimeters of swamp feature N7, segments adjacent to open water. Refer to Figure 4.
- Naomi Alternative 2 – Along the western perimeters of BLH-Wet feature N8, swamp feature N10, and intermediate marsh feature N11, only those segments that will be adjacent to open water of the Pen. Refer to Figure 5.

Figure 6B provides a typical cross-section for the proposed foreshore rock dikes. The foreshore rock dikes would be constructed with 650-pound stone. These dikes would have 1V:2H side slopes and a crown (crest) width of 4 feet to assure dike integrity. The crest elevation of the foreshore rock dikes would vary depending on the target final grade elevation of the mitigation feature(s) immediately adjacent to the dikes. In addition to the main dike component, each of the foreshore rock dikes would include a rock berm constructed along the waterward face of each dike. The proposed berms are necessary to help ensure the stability of the foreshore rock dikes given their height and the substantial quantity of fill the dikes must retain. The berms would have a crest width of 25 feet and a crest elevation of -1.0 feet. Table 5 provides various data for the foreshore rock dikes. These data include: the assumed average existing grade elevation where dikes would be constructed; the final dike crest elevation; the total linear feet of dike to be built, and; the estimated quantity of stone required for the dike.

Barges would be used to transport stone to the project site. In some locations, it may be necessary to dredge temporary access channels (flotation channels) near the foreshore rock dikes where the existing bottom elevation of the waterbody is too high to accommodate barge access. In such cases, the flotation channel would be dredged a minimum of 50 feet from the toe-of-slope of the waterward side of the foreshore rock dike. The dredged material would be side-cast and this side-cast material would be use to backfill the flotation channel once the foreshore rock dike is constructed. The determination of whether flotation channels are needed, their width, and their depth would be made during the PED phase.

Once the dikes are constructed, the fill has been installed for the mitigation feature platforms, and the platforms have settled to the desired target grade elevation, "fish dips" (essentially armored gaps) would be constructed in foreshore rock dike segments adjacent to proposed intermediate marsh features. The fish dips would allow water exchange and provide aquatic organisms access to the marsh features. Figure 7 provides typical details for the proposed fish dips. Each fish dip would be approximately 50 feet wide and the bottom elevation would be no greater than 0 feet. At this phase of design, it was assumed that there would be one fish dip established for every 1,000 feet of foreshore rock dike adjacent to proposed intermediate marsh features (i.e. 1,000-foot spacing).

Fish dips would also be installed at locations where proposed primary trenasses (see Section 4.4) intersect foreshore rock dikes adjacent to proposed intermediate marsh features and those adjacent to other proposed habitat type features.

The fish dips to be installed in foreshore rock dikes would occur as follows (refer to Figures 2 through 5):

- Delta Farms – One fish dip constructed in the foreshore rock dike along BLH-Wet feature DF1 (at proposed primary trenasse location).
- Lake Salvador – Total of 10 fish dips constructed in the foreshore rock dike along feature LS1 (marsh feature), two constructed in the foreshore rock dike along swamp feature LS6 (at proposed primary trenasse locations), and two constructed in the foreshore rock dike along swamp feature LS7 (at proposed primary trenasse locations).
- Naomi Alternative 1 – One fish dip constructed in the foreshore rock dike along BLH-Wet feature N3 (at proposed primary trenasse location), one constructed in the foreshore rock dike along BLH-Wet feature N4 (at proposed primary trenasse location), and three constructed in the foreshore rock dike along swamp feature N7 (at proposed primary trenasse locations).
- Naomi Alternative 2 – Two fish dips constructed in the foreshore rock dike along swamp feature N10 (at proposed primary trenasse locations), plus 8 fish dips constructed in the foreshore rock dike along feature N11 (marsh feature).

The provision of one fish dip per 1,000 linear feet of foreshore rock dike adjacent to proposed intermediate marsh features is in keeping with guidelines provided by the National Marine Fisheries Service (NMFS). As discussed, these fish dips are necessary to allow aquatic organisms access to the marsh features and to aid water exchange with adjacent open water habitats. The foreshore rock dikes adjacent to proposed swamp and BLH-Wet features would be provided with fish dips only where proposed primary trenasses intersect these dikes. BLH-Wet habitats would typically be inundated by very shallow standing water for brief, sporadic periods; hence, structures that impede aquatic organism access to these habitats would not significantly affect habitat functions and values. Aquatic organism access to proposed swamp habitats is desirable, considering these habitats would typically be inundated for several months during a year of normal rainfall. However, it was assumed that dikes adjacent to proposed swamp habitats (foreshore rock dikes, earthen retention dikes, armored earthen retention dikes) would need to remain approximately 1 foot higher than the surface grade elevation of the swamps in order to achieve the desired hydroperiod. Thus, provision of fish dips in foreshore rock dikes adjacent to swamp habitats at locations other than where primary trenasses are proposed would reduce the chances of obtaining the desired hydroperiod.

4.4. <u>Trenasses</u>

Each of the four project groups (mitigation sites) would include mitigation features that could potentially block water exchange between adjacent existing marsh habitats and waterbodies, and could also reduce the ability of aquatic organisms to access these marsh habitats. To help reduce such effects, trenasses (tidal creeks, shallow flowways/channels) would be constructed through certain proposed mitigation features.

These primary trenasses would be constructed in conjunction with the degrading of retention dikes. The trenasses would have a bottom width of approximately 25 feet and a bottom elevation of approximately 0.5 feet (i.e. approximately 1 foot deep in relation to the target grade for proposed intermediate marsh features). As mentioned, the intended function of the proposed trenasses is to provide a direct and constant hydrologic connection between existing marsh habitats flanked by the mitigation features and the existing open water habitat at the terminus of each trenasse. The adjacent existing marshes typically have an elevation of approximately 1.5 feet based on review of LiDAR topography. It was therefore assumed that the proposed trenasse bottom elevation of 0.5 feet would provide the desired hydrologic connection. This bottom elevation may be reexamined during the PED phase of the project, as may be additional design components needed to help insure the stability of trenasse side slopes.

Figures 2 through 5 illustrate the conceptual locations and alignments of proposed primary trenasses. Marsh hoes would be used to construct (excavate) these trenasses. It is anticipated that the material excavated during the construction process would be side cast into the surrounding mitigation features. The side cast material would subsequently be spread out in a thin layer, thereby resulting in minimal changes to the desired grades in the mitigation features.

Primary trenasses would penetrate proposed foreshore rock dikes along certain mitigation features. These features would include: Delta Farms, BLH-Wet feature DF1 (see Figure 2); Lake Salvador, swamp features LS6 and LS7 (see Figure 3); Naomi Alternative 1, BLH-Wet features N3 and N4, plus swamp feature N7 (see Figure 4); Naomi Alternative 2, swamp feature N10 and intermediate marsh feature N11 (see Figure 5). As previously discussed, fish dips would be constructed in the foreshore rock dikes where the trenasses intersect these dikes.

In addition to the primary trenasses described above, additional smaller trenasses would be constructed within proposed intermediate marsh features to serve as tidal creeks to facilitate water exchange and create shallow water interspersion features. In conjunction with the dike degrading efforts, the trenasses would be rutted to a lower than marsh elevation by performing two passes of a marsh buggy along the desired alignment. The acceptable trenasse width, if constructed in this fashion, would be the width of the marsh buggy. If the resulting depression is not adequate for minimal water flow, the marsh equipment could excavate material along the proposed alignment, not to exceed a 5-foot bottom width by 1-foot to 1.5-feet deep channel.

4.5. <u>Borrow Sites</u>

As mentioned, the fill necessary to construct the hydrologic platforms for proposed mitigation features would be dredged from various waterbodies. The design of the borrow sites assumed a 2:1 cut to fill ratio to allow for unknown utilities, anomalies, and cultural sites. If potential long-term environmental impacts are anticipated at a particular borrow site, dissolved oxygen and rate of infilling would be monitored at the sites following construction. To establish the earthen platforms for any of the proposed mitigation features, a given borrow site would be hydraulically dredged and the excavated material would be transported to the contained disposal sites (the mitigation features) via pumping through pipelines.

A total of five borrow sites were identified as potential sources of borrow material for feature platform construction. Section 5 contains information regarding the specific borrow sites proposed for use in constructing mitigation features at each of the four alternative project groups. The following subsections address basic design assumptions for the various borrow sites.

Lake Salvador

Borrow sites within the southern portion of Lake Salvador would be dredged to obtain fill for the mitigation feature platforms proposed in the Delta Farms project group (see Figure 9) and those proposed in the Lake Salvador project group (see Figure 10). The lake could also serve as a secondary option for obtaining borrow to create some or all of the mitigation feature platforms proposed in the Naomi Alternative 1 project group and those proposed in the Naomi Alternative 2 project group (see Figure 11). Lake Salvador borrow would be obtained a minimum distance of 2,000 feet from the lake's shoreline to help avoid exacerbating lake shoreline erosion. The exact positioning of borrow sites would be determined in the PED phase in an effort to avoid impacts to existing beds of submerged aquatic vegetation (SAV) to the maximum degree practicable. Existing lake bottom elevations vary. Until surveys are taken during the PED phase, the designers assumed an existing lake bottom elevation of -6.0 feet. Maximum excavation in the borrow site would be to elevation -20 feet. Construction cost estimates were based on cut quantities. Grain size distribution of borrow materials was assumed to be 10 percent silty sand and 90 percent silty clay. Due to high clay content in the borrow site, a bulking factor of 60 percent is used in the design of the retention dikes.

The Pen

Borrow sites within the Pen could serve as the primary option for obtaining borrow needed to build some or all of the mitigation feature platforms proposed in the Naomi Alternative 1 project group (see Figure 11) and those proposed in the Naomi Alternative 2 project group (see Figure 14) . The Pen was once under pump for agricultural use. The dikes failed and the area is now open water. There are two ongoing marsh creation projects along the south shore of the Pen. Both of these projects will utilize borrow obtained from within The Pen. Surveys and borings were taken for these projects at the south portion on the Pen. The existing bottom elevation is approximately -5.0 feet. Borings are available for review. The Pen is much smaller than Lake Salvador and, due to the reduced fetch associated with the Pen, the separation distance between the proposed borrow areas and the Pen's shoreline would be a minimum of 200 feet. Maximum excavation in the proposed borrow sites would be to elevation -20.0 feet. Construction cost estimates were based on cut quantities. Grain size distribution of borrow materials was assumed to be 10 percent silty sand and 90 percent silty clay. Due to high clay content in the borrow sites, a bulking factor of 50 percent is used in the design of the retention dikes.

Mississippi River Sites
Borrow sites within the Mississippi River (see Figure 12) could serve to construct some of the mitigation feature platforms proposed in the Naomi Alternative 1 project group and could potentially serve as a supplementary source of borrow for mitigation feature platforms proposed in the Naomi Alternative 2 project group. The preferred borrow site is the Alliance South Borrow Area located along the Right Descending Bank (RDB) of the river (approx. River Mile 60.5). This borrow site is closest to the proposed mitigation features. A secondary potential borrow site is the Alliance Anchorage area. It is located on the RDB of the river (approx River Mile 64.5) and would likely have sufficient potential borrow quantity; however it is also designated for other projects (ex. Corps Salt Water Sill and the Bayou Dupont Project). The least preferred alternative borrow site, the USACE #2 and Will's Point Anchorage South Borrow Area, is located along the Left Descending Bank (LDB) of the river (approx. River Mile 67). This alternative site is the longest pump distance and the design would need to include barge haul across the river or careful pipeline crossing criteria. Borrow dimensions for all sites would be determined during the PED phase. Analysis would include stability for both the river bank and adjacent MRL levee. Grain size distribution of borrow materials was assumed to be 70 percent fine sand and 30 percent silty clay. Due to moderate clay content in the borrow site, a bulking factor of 30 percent was used in the design of the retention dikes.

4.6. <u>Plantings</u>

Once the fill used to construct earthen platforms has settled to the desired target grade elevations (assumed to be approximately one year after initial placement of fill is completed), all the proposed mitigation features would be planted with suitable native species. The following subsections provide further information regarding proposed plantings in each of the three habitat types to be restored. It is noted that in settings where herbivory may threaten the survival of the plantings, seedling protection devices (ex. plastic seedling protectors, wire-mesh fencing) would be installed around each planted seedling, as addressed in Appendix 3.

BLH-Wet Mitigation Features
The initial planting of BLH-Wet mitigation features would be in general accordance with the BLH-Wet planting guidelines contained in Appendix 3. Canopy species (oaks, elms, etc.) would be planted on 9-foot centers (538 seedlings/acre) and midstory species (persimmon, wax myrtle, etc.) would be planted on 20-foot centers (109 seedlings/acre). It is anticipated that several trees and shrubs installed at the time of initial planting would not survive; thus, it was estimated that about 20% of the total number of plants initially installed would need to be re-planted one year after completion of initial plantings.

Swamp Mitigation Features
The initial planting of swamp mitigation features would be in general accordance with the swamp planting guidelines contained in Appendix 3. Canopy species (bald cypress, tupelogum, etc.) would be planted on 9-foot centers (538 seedlings/acre) and midstory species (buttonbush, swamp privet, etc.) would be planted on 20-foot centers (109 seedlings/acre). It is anticipated that several trees and shrubs installed at the time of initial planting would not

survive; thus, it was estimated that about 20% of the total number of plants initially installed would need to be re-planted one year after completion of initial plantings.

Intermediate Marsh Mitigation Features
The initial planting of intermediate marsh mitigation features would be in general accordance with the intermediate marsh planting guidelines contained in Appendix 3. Herbaceous species (mash-hay cordgrass, seashore paspalum, etc.) would be planted on 7-foot centers (889 plants/acre). It is anticipated that these initial plantings, combined with natural colonization by marsh plants, would be sufficient to rapidly establish acceptable vegetative cover within the intermediate marsh features; thus, it was assumed that no additional plantings would be required. One should note that additional plants would be installed if applicable vegetative cover success criteria are not achieved (refer to Appendix 3 for success criteria).

5.0 PROJECT DESCRIPTIONS

The following sections provide brief descriptions for each of the four additional project groups (i.e. Delta Farms, Lake Salvador, Naomi Alternative 1, and Naomi Alternative 2). Table 6 provides the approximate acreage for each of the proposed mitigation features within each of the project groups. This table also indicates the identification code for each feature (as labeled in Figures 2 through 5), the proposed habitat type for each feature, and the impact category that each features serves to mitigate.

5.1. Delta Farms

The Delta Farms project group is located in Lafourche Parish, about two miles northeast of the town of Larose, Louisiana, and immediately east of the Gulf Intracoastal Waterway (GIWW). The proposed mitigation features at this site are illustrated in Figure 2. Five separate mitigation features, totaling approximately 1,450 acres, are proposed:

- Feature DF1, 507.5 acres, proposed BLH-Wet habitat – provided as mitigation for impacts to BLH-Dry PS habitats and impacts to BLH-Wet PS habitats.
- Feature DF2, 414.3 acres, proposed BLH-Wet habitat – provided as mitigation for impacts to BLH-Wet FS habitats.
- Feature DF3, 289.6 acres, proposed swamp habitat – provided as mitigation for impacts to swamp FS habitats.
- Feature DF4, 38.0 acres, and feature DF5, 200.6 acres, both are proposed intermediate marsh habitats – provided as mitigation for impacts to fresh marsh FS habitats.

The open water area referred to as Delta Farms, where the project features are located, was reportedly drained and leveed for agricultural purposes around 1910. This area subsequently subsided, and was flooded in the mid-1970's via a breach in the adjacent GIWW. This area has also been heavily used by the oil and gas industries. According to the Louisiana Department of Natural Resources GIS database concerning oil and gas wells (LDNR, 2011), numerous oil and/or gas wells are present within and near the proposed mitigation features. The proposed mitigation features were laid out such that oil/gas wells designated as "active-producing" or as "shut-in productive, future utility" would not be contained within feature boundaries.

However, several oil/gas wells designated as “plugged and abandoned” or as “dry and plugged” are situated within the limits of the mitigation features.

Figure 8 shows the location of the “active-producing” and “shut-in productive, future utility” wells in the immediate vicinity of the project. The original design concept for this project group was to have one contiguous intermediate marsh feature along the eastern boundary of feature DF3. However, the design was modified to split the intermediate marsh feature into two separate features (i.e. DF4 and DF5) in order to avoid conflicts with the two wells located between the two marsh features now proposed. The project design would leave an open water canal or channel between the northern edges of features DF1, DF2, DF3, and DF4 and the existing marsh habitats just north of these features. This channel would serve two purposes; it would allow water exchange between the GIWW and the remainder of waterbody situated east of the mitigation features, hopefully providing a source of lower salinity water to the mitigation features, and it would provide an access channel from the GIWW to remaining active oil and gas wells. Note also that the project design would include an open water channel extending southward from the previously described channel to the active well located near the center of feature DF2 (see Figures 2 and 8).

All retention dikes constructed for this project would be earthen dikes, with the exception of the dike segment along the western boundary of feature DF1. This would be a foreshore rock dike. In addition, the earthen dikes constructed along the northern boundary of features DF1, DF2, DF3, and DF4 would be armored with a stone cap on the northern face of the dikes. If all the mitigation features proposed were to be constructed, there would be a total of approximately 86,455 linear feet of earthen dikes (see Table 3), 7,200 linear feet of armored earthen dikes (see Table 4), and 6,150 linear feet of foreshore rock dikes (see Table 5).

The borrow required to construct the earthen platforms for the proposed mitigation features would be obtained from Lake Salvador (see Figure 9). It is estimated that the total amount of borrow required to construct all the features would be approximately 19,500,000 cubic yards (see Table 2). The proposed borrow area would encompass approximately 1,117 acres and would be hydraulically dredged to elevation -20.0 feet (an estimated 14-foot cut). The dredged material would be transported to the Delta Farms site via pipeline routed down the GIWW.

One primary trenasse would be constructed through portions of features DF1, DF2, DF3, and DF5 once the fill placed in the features has settled to the final target grade elevation (see Figure 2). One fish dip would be constructed in the proposed foreshore rock dike where the primary trenasse intersects the GIWW. As previously discussed, smaller trenasses would be established within intermediate marsh features DF4 and DF5.

Existing canals extend from the southern end of the open water area of Delta Farms to Little Lake, located southeast of Delta Farms. It appears that water from Little Lake may flow through these canals and into the Delta Farms waterbody on occasions. Salinity concentrations in Little Lake tend to be significantly higher than the salinity concentrations typically present in the GIWW near the project site. In an effort to restrict the flow of higher salinity water into the project site waters, earthen dikes (canal blocks) would be constructed where a three-pronged extension from one of the aforementioned canals intersects the Delta Farms waterbody (see Figure 2). Each of the three proposed canal blocks would be earthen dikes having a crown width of 10 feet and 1V:4H side slopes. The crest elevation of these dikes would be 6.0 feet.

Borrow needed to construct the canal block dikes would be obtained from the existing open water area immediately north of the proposed dikes.

5.2. Lake Salvador

The Lake Salvador project group is located in Lafourche Parish in the southwestern corner of Lake Salvador within a portion of the lake referred to as Catahoula Bay. A segment of the GIWW is located immediately south of the project. The proposed mitigation features at this site are illustrated in Figure 3. Seven separate mitigation features, totaling approximately 1,461 acres, are proposed:

- Feature LS1, 244.0 acres, proposed intermediate marsh habitat – provided as mitigation for impacts to fresh marsh FS habitats.
- Feature LS2, 417.8 acres, proposed BLH-Wet habitat – provided as mitigation for impacts to BLH-Wet FS habitats.
- Feature LS3, 202.7 acres, feature LS4, 101.5 acres, and feature LS5, 205.0 acres, all are proposed BLH-Wet habitats – provided as mitigation for impacts to BLH-Dry PS habitats and impacts to BLH-Wet PS habitats.
- Feature LS6, 189.2 acres, and feature LS7, 100.8 acres, both are proposed swamp habitats – provided as mitigation for impacts to swamp FS habitats.

All retention dikes constructed for this project would be earthen dikes, with the exception of dike segments that would remain adjacent to existing open water areas. These dike segments would be built as foreshore rock dikes and would include:

- Northern boundary of feature LS1 (proposed intermediate marsh).
- Western boundary of feature LS2 (proposed BLH-Wet).
- Southern boundary of feature LS3 (proposed BLH-Wet).
- Western boundary of feature LS4 (proposed BLH-Wet).
- The boundary of feature LS5 (proposed BLH-Wet) adjacent to Lake Salvador and the boundary of this feature adjacent to the GIWW.
- Northern and western boundaries of feature LS6 (proposed swamp).

If all the mitigation features proposed were to be constructed, there would be a total of approximately 110,775 linear feet of earthen dikes (see Table 3) and 39,480 linear feet of foreshore rock dikes (see Table 5).

The borrow required to construct the earthen platforms for the proposed mitigation features would be obtained from Lake Salvador (see Figure 10). It is estimated that the total amount of borrow required to construct all the features would be approximately 17,400,000 cubic yards (see Table 2). The proposed borrow pit would encompass approximately 1,153 acres and would be hydraulically dredged to elevation -20.0 feet (an estimated 14-foot cut). The dredged material would be transported to the nearby mitigation features via pipeline.

Two primary trenasses would be constructed through portions of features LS2, LS4, and LS6. Two primary trenasses would also be constructed through portions of features LS3 and LS7, with one of these trenasses having two additional branches where it passes through feature LS3. All these trenasses would be established once sediment placed in the features has settled to the applicable final target grade elevations. Smaller trenasses would also be built within feature LS1 (proposed intermediate marsh) at the same time.

One fish dip would be constructed in the proposed foreshore rock dikes where each of the primary trenasses intersect these dikes (i.e. two fish dips in foreshore rock dike along feature LS6 and two in foreshore rock dike along feature LS7). A total of 10 fish dips would be constructed in the foreshore rock dike along feature LS1.

5.3. Naomi Alternative 1

The Naomi Alternative 1 project group is located in Jefferson Parish. Four of the proposed mitigation features are located in a waterbody known as the Pen, which is just east of the town of Lafitte, Louisiana. Three of the proposed mitigation features are situated east of the Pen near the Cheniere Traverse Bayou. The proposed mitigation features at this site are illustrated in Figure 4. Seven separate mitigation features, totaling approximately 1,467 acres, are included in the project group:

- Feature N1, 249.6 acres, proposed intermediate marsh habitat – provided as mitigation for impacts to fresh marsh FS habitats.
- Feature N2, 510.6 acres, proposed BLH-Wet habitat – provided as mitigation for impacts to BLH-Dry PS habitats and impacts to BLH-Wet PS habitats.
- Feature N3, 230.0 acres, feature N4, 93.7 acres, feature N5, 32.3 acres, and feature N6, 59.9 acres, all are proposed BLH-Wet habitats– provided as mitigation for impacts to BLH-Wet FS habitats.
- Feature N7, 291.0 acres, proposed swamp habitat – provided as mitigation for impacts to swamp FS habitats.

All retention dikes constructed for this project would be earthen dikes, with the exception of dike segments adjacent to existing open water portions of the Pen. These dike segments would be built as foreshore rock dikes and would include:

- Northern and southern boundaries of feature N2 (proposed BLH-Wet).
- Northern, southern, and eastern boundaries of feature N3 (proposed BLH-Wet).
- Western and southern boundaries of feature N4 (proposed BLH-Wet).
- Western boundary of feature N7 (proposed swamp).

If all the mitigation features proposed were to be constructed, there would be a total of approximately 87,430 linear feet of earthen dikes (see Table 3) and 30,361 linear feet of foreshore rock dikes (see Table 5).

It is estimated that the total amount of borrow required to construct all the proposed mitigation features would be approximately 16,300,000 cubic yards (see Table 2). There are various options as to potential borrow sites that could provide the material needed for feature platform construction. The preferred or primary option would be to obtain most of the borrow from the Pen, in conjunction with an option to obtain some of the borrow from the Mississippi River. Two borrow sites would be located in the Pen, with the northern area encompassing approximately 241 acres and the southern area encompassing approximately 754 acres (see

Figure 11). These two sites would be dredged to elevation -20.0 feet (a 15-foot cut) and would be capable of yielding sufficient borrow for all of the proposed mitigation features.

Rather than obtaining all necessary borrow from the Pen, it would be preferable to obtain the borrow required to construct features N1, N5, and N6 (i.e. the mitigation features located east of the Pen) from the Mississippi River. Figure 12 shows the locations of four possible borrow areas in the river, including:

- USACE #2 Borrow Area (left descending bank; approx. river mile 67).
- Will's Point / Anchorage South Borrow Area (left descending bank; approx. river mile 67).
- USACE #1, Alliance Anchorage, BA-39 Borrow Areas (right descending bank; approx. river mile 64.5). These are considered as one borrow area herein since these areas essentially overlap one another.
- Alliance South Borrow Area (right descending bank; approx. river mile 60.5).

It is not anticipated that use of one or all of these river borrow sites would yield enough material to meet the fill requirements of all the proposed mitigation features, but it is possible that one or more could be adequate to construct the earthen platforms for features N1, N5, and N6. Unfortunately, there is a substantial demand for these sites by other projects seeking river borrow and the refill rates for these sites is estimated to be approximately four years (e.g. the time required between a site is dredged for borrow to the time when sediment deposition has "refilled" the sites). Given this, should other projects dredge borrow from these areas at a time near when construction of the proposed mitigation features would preferably begin, then feature construction would be substantially delayed. Such a time lag in implementing mitigation is very undesirable and would likely increase the acreage of mitigation required due to increased temporal losses (e.g. the loss of AAHUs resulting from HSDRRS general impacts would increase due to the delay in implementation of mitigation). This is why the two borrow sites in the Pen were sized to provide enough borrow for all the proposed mitigation features. During the PED phase, the likelihood of obtaining a sufficient quantity of borrow from the river within the desired timeframe would be further explored. If it appears a sufficient quantity of river borrow is available to establish the platforms for mitigation features N1, N5, and N6, then the size of one of the borrow sites in the Pen could be reduced accordingly.

The secondary option for acquiring borrow would be to obtain it from Lake Salvador (see Figure 11). Under this option, one borrow site encompassing approximately 1,069 acres would be dredged in Lake Salvador to elevation -20.0 feet (approximately a 14-foot cut). This area is estimated to be sufficient to construct the earthen platforms for all the proposed mitigation features.

It is possible that certain problems could arise that would reduce the total quantity of borrow available from the proposed borrow sites in the Pen. Examples include real estate issues (inability to acquire adequate real estate needed to encompass the borrow acreage needed) and conflicts with other projects (ex. other projects slated for construction using borrow from the Pen could obtain borrow from one or more of the proposed borrow sites in advance of the Naomi Alternative 1 project, thereby reducing the quantity of borrow available). Under the secondary borrow option, some portions of one or both of the two Pen borrow sites would be used in combination with some of the Lake Salvador borrow site if there is borrow available in the Pen but not enough to meet all the needs for the Naomi Alternative 1 project. If, due to conflicts, there was no borrow available in the Pen, then the Lake Salvador site would be used as the sole borrow source. The determination of which avenue to pursue would be made during the PED phase. It is also possible that some borrow for features N1, N5, and N6 could be obtained from one of the Mississippi River sites under the secondary option scenario. This would also be determined during the PED phase.

One primary trenasse would be constructed through portions of features N2 and N3. One primary trenasse would be constructed through feature N4, and three primary trenasses would be built through portions of feature N7. All these trenasses would be established once sediment placed in the features has settled to the applicable final target grade elevations. Smaller trenasses would also be built within feature N1 (proposed intermediate marsh) at the same time. One fish dip would be constructed in the proposed foreshore rock dikes where each of the primary trenasses intersect these dikes (i.e. one fish dip in foreshore rock dike along feature N3, one in foreshore rock dike along feature N4, and three in foreshore rock dike along feature N7).

The Naomi Alternative 1 project group is located within the boundaries of what is herein referred to as the Naomi Outfall Management Area (NOMA). The NOMA encompasses several thousand acres and essentially combines the project areas of three separate but interrelated projects; the Naomi Freshwater Diversion Project (BA-03), the Naomi Siphon Outfall Management Project (BA-03c), and the Barataria Bay Waterway East Side Shoreline Protection Project (BA-26) (Boshart, 2003a). The NOMA boundaries are shown in Figure 13.

The Naomi Freshwater Diversion Project (project BA-03, aka LaReussite) was a cost-shared project by the state of Louisiana and Plaquemines Parish. This project involved the construction of the Naomi Siphon, a freshwater diversion structure located at river mile 64 of the Mississippi River (see Figure 1). The structure consists of eight 6-foot diameter siphon tubes with a combined maximum discharge of 2,144 cfs. These siphons empty river water and sediments into an armored ponding area on the flood side of the river levee. From this ponding area, flows are distributed through a single channel that outfalls into existing marsh habitats (Boshart, 1998). The siphon is now owned and operated by Plaquemines Parish Government (PPG). The intended function of this project was to protect the project area from continued saltwater intrusion and reduce wetland loss by restoring riverine inputs of freshwater and sediments into the project area.

The Naomi Siphon Outfall Management Project (project BA-03C) is a CWPPRA (Coastal Wetlands Planning, Protection, and Restoration Act) project. The objective of this project is to manage the diverted freshwater from the Naomi Siphon in the project area via the installation of two water control structures designed to reduce freshwater loss and saltwater intrusion, and to protect the project area from continued degradation by introducing freshwater from the Mississippi River (via the Naomi Siphon). The water control structures installed consisted of a fixed crest weir with a boat bay located in Goose Bayou Canal at its intersection with the Pen and a second fixed crest weir with a boat bay located in Bayou Dupont Canal(aka Bayou Dupont Channel) near the canal's intersection with the Barataria BayWaterway (Boshart, 2003b).

The Barataria Bay Waterway East Side Shoreline Protection Project (project BA-26) is also a CWPPRA project. The purpose of this project was to rebuild the east bank of the Barataria Bay

Waterway (BBW) to protect adjacent marsh habitats from erosion due to boat wakes and saltwater intrusion. Roughly 17,600 linear feet of foreshore rock dike was installed along the east bank of the BBW as a result of this project (Boshart, 2003b).

Salinity monitoring data recorded at various monitoring stations located near the proposed mitigation features demonstrate that the Naomi Siphon does help reduce salinity in the area when the siphon produces substantial freshwater discharge (flow). This can be seen in the data presented below (Boshart, 2003a), although some of the difference in salinity values between times the siphon is flowing and times it is not is also attributable to natural seasonal variations.

Monitoring Station # and Location	Mean Salinity 1993 to 2002 (ppt)	
	Major Siphon Flow (>1,072 cfs)	No Siphon Flow
60, far north end of the Pen	0.5	3.6
62, northern third of the Pen	0.5	4.7
8, marsh by central part of the Pen	0.7	3.5
63, southern third of the Pen	1.2	5.8
5, far south end of the Pen	1.0	4.6
7, near mitigation features east of the Pen	1.2	4.0

PPG's operation of the siphon has been inconsistent and often not in keeping with the operational plan (Raynie and Visser, 2002; Boshart & Richard, 2008). Some of the factors contributing to this include the inability to run siphons due to low river stages and/or loss of prime, maintenance problems, staffing limitations, tropical storms, and responses to marine fisheries complaints (Raynie and Visser, 2002). Note that flow from the siphons depends on the head differential between the Mississippi River and the outfall ponding area, and the siphons cannot function when the river stage is lower than the water elevation in the ponding area (typically around elevation 2.0 feet).

Mitigation features comprising the Naomi Alternative 1 project group were designed based on the assumption that the Naomi Siphon would be able to provide an adequate and reliable source of freshwater input to the region containing the mitigation features. Salinity concentrations in the region are of great concern, particularly as regards the ability to sustain the proposed forested habitat types. To ensure the survival and health of the proposed forested habitats, especially the BLH-Wet habitats, it was determined that salinity concentrations should be maintained at less than 1.0 ppt and preferably less than 0.5 ppt if feasible.

It is recognized that the proposed LCA modifications to the operation of the Davis Pond freshwater diversion structure, if authorized, would likely help decrease salinity in the region containing the Naomi Alternative 1 mitigation features. A review of available models run based on the proposed operational modifications indicated, however, that these modifications alone would likely not be adequate to reduce salinity concentrations to the desired levels. It was therefore assumed that adequate and reliable freshwater inputs from the Naomi Siphon would be necessary to achieve a sufficient reduction in salinity concentrations in the area containing the proposed mitigation features.

CEMVN examined salinity data from monitoring stations near the proposed mitigation features and siphon output (flow) data for the period from January 1, 2007 through December 31, 2011. The Naomi Siphon only achieved flows between 1,000 and 2,000 cfs for a total of 8 percent of this five-year period. No salinity concentrations exceeding 1 ppt were recorded on days when the siphon flow was greater than 1,100 cfs. There were a few occasions when salinity readings of 1 ppt or less were recorded during the same time siphon flow was less than 1,100 cfs, but these rare instances occurred only during the rainy season months of July and August. These findings are in keeping with monitoring data for the 1993 to 2002 period, which indicated mean salinity concentrations recorded at six monitoring stations near the proposed mitigation features (stations BA03-5, 7, 8, 60, 62, and 63) ranged from 0.5 to 1.2 ppt during times when siphon flow exceeded 1,072 cfs, but increased to a range of 2.0 to 4.8 ppt during times when the siphon was running but flow was less than 1,072 cfs (Boshart, 2003a). It is noted that the highest salinity concentrations (4.8 ppt) occurred during a significant drought. Given these findings, it was concluded that the minimum siphon flow necessary to maintain salinity concentrations less than 1.0 ppt in the region containing the proposed mitigation features would be at least 1,100 cfs.

The Naomi Alternative 1 project would include several improvements to the Naomi Siphon in order to help achieve the desired salinity goals. These improvements would include:

- Install a series of electric-powered pumps totaling a minimum of 1,100 cfs in capacity. The designers assumed these would consist of three 300 cfs pumps and one 200 cfs pump. The new pumps would allow the siphon to flow even when the river elevation is low, providing a minimum discharge rate of 1,100 cfs even when the siphon would typically not be able to flow under present circumstances. These pumps would also be used to help keep the siphon primed and eliminate the need for the vacuum system currently being used to prime the siphon. Note that the invert elevation of the siphon intake tubes is -4.0 feet (Perrin & Carter, 2003). This is low enough to allow pumping of the siphon even during the lowest of river stages, without the necessity of extending the siphon tubes to a lower elevation. It is not anticipated that siphon withdrawals when the river is low would adversely affect river flow. During times of low river stages, river flow is typically at least 400,000 cfs. With the siphon pumps withdrawing river water at a rate of 1,100 cfs during such conditions, the siphon withdrawal would represent less than one-half percent of the total river flow.
- Install a flow meter on the outfall end of each of the siphon tubes to allow accurate daily recording of siphon flow rates.
- Install a salinity meter at the intake end of the siphon. This would allow monitoring of salinity in the river. During low river stages, a salt water wedge tends to move upstream in the river. By monitoring salinity, one would have the ability to temporarily shut down the new pumps should salinity levels become adversely high during low river stages.
- Install a 20 horse power electric vacuum pump producing an average of approximately 25 cfm. This stationary pump would be connected to the existing vacuum storage tank. Dissolved gases are released from the diversion water and collect in the high point of each siphon pipe. The gases are removed from the pipes through a float-operated air vent valve connected to the storage tank that collects the gases. This lets the siphon operate at full flow until the vacuum storage tank is full of collected gases. Once this

happens, the siphon can no longer produce optimal flow until the storage tank is recharged with vacuum so the dissolved gases can be drawn off (Perrin & Carter, 2003). The proposed vacuum pump would serve this function.

- Install a Data Collection Platform (DCP) to allow remote and local monitoring of siphon flow, salinity, siphon pumps, and vacuum storage tank pressure, plus remote and local operation of the new siphon pumps and vacuum storage tank. The remote monitoring and operational control would be Supervisory Control and Data Acquisition (SCADA) based. The DCP/SCADA system would allow remote monitoring and control of the siphon (pumps, vacuum storage tank/pump) by the NFS. Read-out instruments would also be installed on-site, which would show the same information being transmitted.
- Construct a small building on the floodside of the river levee next to the siphon to house the new siphon pumps, the new electronic data processing and transmitting equipment, and the new read-out instruments.

The reader is advised that the proposed siphon improvements described above may not necessarily be all the changes/improvements required to help ensure a reliable, efficient, and effective siphon system and remote monitoring/operating system. The need for additional changes/improvements would be evaluated during the PED phase.

The proposed project would also require the NFS to obtain ownership of the Naomi Siphon and to assume all siphon operation, monitoring, maintenance, and repair responsibilities. This would be critical in order to ensure the siphon, including the pumping system, would be operated appropriately at all times. It is assumed that the new pumps would be used to run the siphon at the maximum pumping capacity of 1,100 cfs during times when the siphon would otherwise not be able to generate flow. Once the river is sufficiently high thereby allowing the siphon to flow without pumping, the pumps would be turned off once the flow is at least 1,100 cfs. During periods when the siphon is flowing without the aid of pumps, the siphon would be allowed to discharge up to its maximum capacity.

One should note that there could potentially be times during a given year that there would be no need to run the Naomi Siphon at all, or at least flow may be reduced below the 1,100 cfs minimum threshold, assuming salinity concentrations in the project area are sufficiently low (around ≤0.5 ppt) and monitoring data indicate these low salinity levels will likely remain stable for at least a few consecutive weeks. As mentioned previously, past monitoring data do indicate this is a possibility when inputs from rainfall and freshwater runoff are adequate. During the PED phase, available salinity and siphon discharge monitoring data would be examined more thoroughly in an attempt to better define the recommended siphon operation protocols. Additional analysis of these data would also be warranted during the PED phase to better determine the appropriate capacity of the proposed pumps.

It is also noted that accurate and continuous monitoring of salinity concentrations within and near the proposed mitigation features would be another critical component of the Naomi Alternative 1 project. This would likely require installation of additional automatic monitoring stations. The need for additional monitoring stations and their proposed locations, if any, would be evaluated during the PED phase.

The Pen is hydraulically connected to the Barataria Bay Waterway (BBW) west of the Pen via canals or channels that run from the BBW to the Pen. During periods of high tide, reverse flow occurs and high-salinity water flows from the BBW into the Pen via these canals (Boshart et. al, 2004). As previously mentioned, weirs were built in the two main canals connecting the BBW to the Pen as part of CWPPRA project BA-03C, with one weir built in the Bayou Dupont Canal and one in the Goose Bayou Canal to reduce the intrusion of high-salinity water into the Pen and adjacent marsh habitats.

In an effort to maximize benefits of the Naomi Siphon by further reducing the exchange between the Pen and the BBW, the subject project would include construction of an earthen dike (canal block) near the eastern end of another canal herein referred to as the Kerner Canal (see Figure 4). This canal also serves as a hydraulic connection between the BBW and the Pen. The proposed dike would be approximately 50 feet long, have a crown width of 10 feet, and would have 1V:4H side slopes, while its crest elevation would be 3.0 feet. It would be constructed using borrow obtained from locally available Government or commercial pits with the borrow trucked to the site and mechanically placed.

The positioning of the proposed canal block would be such that water access (navigation access) to properties along the Kerner Canal would not be eliminated. Vessels seeking to use the canal would be able to access it via the BBW, which is located at the canal's western end. The canal block would prohibit vessels traversing the canal to reach the Pen via the canal as they can today. Instead, vessels would have to travel northward along the BBW to the Goose Bayou Canal or travel southward along the BBW to the Bayou Dupont Canal to access the Pen.

5.4. <u>Naomi Alternative 2</u>

The Naomi Alternative 2 project group is located in Jefferson Parish. All of the proposed mitigation features are located in a waterbody known as the Pen, which is just east of the town of Lafitte, Louisiana. The proposed mitigation features at this site are illustrated in Figure 5. Four separate mitigation features, totaling approximately 1,449 acres, are proposed:

- Feature N8, 503.1 acres, proposed BLH-Wet habitat – provided as mitigation for impacts to BLH-Dry PS habitats and impacts to BLH-Wet PS habitats.
- Feature N9, 418.0 acres, proposed BLH-Wet habitat – provided as mitigation for impacts to BLH-Wet FS habitats.
- Feature N10, 288.8 acres, proposed swamp habitat – provided as mitigation for impacts to swamp FS habitats.
- Feature N11, 239.5 acres, proposed intermediate marsh habitat – provided as mitigation for impacts to fresh marsh FS habitats.

All retention dikes constructed for this project would be earthen dikes, with the exception of those dike segments that would remain adjacent to the existing open water portions of the Pen. These dike segments would be built as foreshore rock dikes and would include:

- Small portion of western boundary of feature N8 (proposed BLH-Wet).
- Substantial portion of western boundary of feature N10 (proposed swamp).
- Majority of southern boundary of feature N11 (proposed intermediate marsh).

If all the mitigation features proposed were to be constructed, there would be a total of approximately 73,095 linear feet of earthen dikes (see Table 3) and 18,580 linear feet of foreshore rock dikes (see Table 5).

It is estimated that the total amount of borrow required to construct all the proposed mitigation features would be approximately 17,300,000 cubic yards (see Table 2). There are two options as to potential borrow sites that could provide the material needed for feature platform construction. The preferred or primary option would be to obtain all of the borrow from the Pen. Two borrow sites would be located in this waterbody, with the northern area encompassing approximately 225 acres and the southern area encompassing approximately 761 acres (see Figure 14). These two sites would be dredged to elevation -20.0 feet (a 15-foot cut) and would be capable of yielding sufficient borrow for all of the proposed mitigation features.

The secondary option for acquiring borrow would be to obtain it from Lake Salvador (see Figure 11). Under this option, a single borrow site encompassing approximately 1,069 acres would be dredged in Lake Salvador to elevation -20.0 feet (approximately a 14-foot cut). This area is also estimated to be sufficient to construct the earthen platforms for all the proposed mitigation features.

As discussed in Section 5.3, it is possible that certain problems could arise that would reduce the total quantity of borrow available from the proposed borrow sites in the Pen. Under the secondary borrow option, some portions of one or both of the two Pen borrow sites would be used in combination with some of the Lake Salvador borrow site if there is borrow available in the Pen but not enough to meet all the needs for Naomi Alternative 1 project. If, due to conflicts, there was no borrow available in the Pen, then the Lake Salvador site would be used as the sole borrow source. The determination of which avenue to pursue would be made during the PED phase.

As part of both the primary borrow option and the secondary borrow option, borrow may also obtained from one of the Mississippi River borrow sites (see Figure 12) discussed in Section 5.3. If any of the Naomi Alternative 2 mitigation features are carried forward, the determination of whether obtaining borrow from the river represents a viable proposition would be made during the PED phase. It is noted that if borrow is obtained from the river, this would be in conjunction with borrow obtained from the Pen and/or Lake Salvador since it is anticipated that it would not be possible to obtain all the borrow required from the river alone.

Two primary trenasses would be constructed through portions of features N8, N9, and N10. Another primary would be constructed through portions of features N10 and N11, while one more primary trenasse would be built through another portion of feature N11. All these trenasses would be established once sediment placed in the features has settled to the applicable final target grade elevations. Smaller trenasses would also be built within feature N11 (proposed intermediate marsh) at the same time.

One fish dip would be constructed in the proposed foreshore rock dikes where each of the primary trenasses intersect these dikes (i.e. two fish dips in foreshore rock dike along feature N10 and two fish dips in foreshore rock dike along feature N11). In the case of proposed feature N11, eight more fish dips would be built in this feature’s foreshore rock dike in addition to the two fish dips that would be established where proposed primary trenasses would be constructed.

The Naomi Alternative 2 project group is also located within the boundaries of the NOMA (see Section 5.3). Unlike Naomi Alternative 1, the mitigation features comprising the Naomi Alternative 2 project group were designed based on the assumption that Plaquemines Parish Government would remain the owner and operator of the Naomi Siphon and that no substantial improvements would be made to this siphon. Given these assumptions, one would anticipate higher salinity concentrations in the project region and greater variability in these concentrations compared to the conditions anticipated under the Naomi Alternative 1 scenario.

Past monitoring of salinity levels in the NOMA (Boshart, 2003a) indicated salinity reduction occurred in the NOMA during times when the Naomi Siphon is in either major operation (average discharge ≥ 1,072 cu. ft. per sec. per month) or minor operation (average discharge >0 to <1,072 cu. ft. per sec. per month). These data further indicated that salinity is influenced by factors other than siphon operation, especially seasonal variability, during periods when the Naomi Siphon is not operational or is in low levels of minor operation. The cited monitoring data also indicated that salinity tends to increase in the Pen as one moves from north to south across this waterbody. This gradient in salinity is particularly pronounced when discharge from the Naomi Siphon is low (minor flow) or nonexistent. In consideration of these factors, the PDT consolidated all proposed mitigation features for the Naomi Alternative 2 project group in the northern end of the Pen.

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APPENDIX 1

TABLES

Table 1. WBV HSDRRS impacts to non-Park/404(c) habitats; acres impacted, AAHUs lost through these impacts, anticipated mitigation potentials for mitigation features used to compensate these impacts, and estimated acres of mitigation required.

Impact Category	Impact Acres	Impact AAHUs	Mitigation Potential (AAHUs/acre)	Mitigation Acres Required
BLH-Dry, PS	394.75	198.66	0.45	441.5
BLH-Wet, PS	54.45	29.08	0.45	64.6
BLH-Wet, FS	289.62	186.75	0.45	415.0
Swamp, FS	222.56	124.10	0.43	288.6
Fresh Marsh, FS	119.99	83.49	0.35	238.5

Notes:
BLH-Dry = Dry bottomland hardwoods.
BLH-Wet = Wet bottomland hardwoods.
FS = Impacts affected habitats on the flood side of the levee.
PS = Impacts affected habitats on the protected side of the levee.
AAHUs = Average Annual Habitat Units.
Mitigation Potential = Estimated net gain in AAHUs that would be generated by the proposed mitigation features, expressed as the number of AAHUs per acre of mitigation feature.
Mitigation Acres Required = (Impact AAHUs) / (Mitigation Potential).

Table 2. Data for earthen platforms (hydrologic platforms) established for proposed mitigation features.

Mitigation Feature ID & Proposed Habitat	Existing Grade Elev.	Initial Fill Elev.	Final Target Grade Elev.	Mitigation Feature Acres	Fill Quantity Required (cu. yds.)
Delta Farms					
DF1: BLH-Wet	- 6.0	7.0	2.5	507.5	7,000,000
DF2: BLH-Wet	- 6.0	7.0	2.5	414.3	5,700,000
DF3: Swamp	- 6.0	6.0	2.0	289.6	3,800,000
DF4: Int. Marsh	- 6.0	5.5	1.5	38.0	500,000
DF5: Int. Marsh	- 6.0	5.5	1.5	200.6	2,500,000
Lake Salvador					
LS1: Int. Marsh	- 5.0	5.5	1.5	244.0	2,600,000
LS2: BLH-Wet	- 5.0	7.0	2.5	417.8	5,100,000
LS3: BLH-Wet	- 5.0	7.0	2.5	202.7	2,500,000
LS4: BLH-Wet	- 5.0	7.0	2.5	101.5	1,300,000
LS5: BLH-Wet	- 5.0	7.0	2.5	205.0	2,500,000
LS6: Swamp	- 5.0	6.0	2.0	189.2	2,200,000
LS7: Swamp	- 5.0	6.0	2.0	100.8	1,200,000
Naomi, Alternative 1					
N1: Int. Marsh	- 3.0	5.5	1.5	249.6	1,900,000
N2: BLH-Wet	- 5.0	7.0	2.5	510.6	6,200,000
N3: BLH-Wet	- 5.0	7.0	2.5	230.0	2,800,000
N4: BLH-Wet	- 5.0	7.0	2.5	93.7	1,200,000
N5: BLH-Wet	- 3.0	7.0	2.5	32.3	300,000
N6: BLH-Wet	- 3.0	7.0	2.5	59.9	600,000
N7: Swamp	- 5.0	7.0	2.0	291.0	3,300,000
Naomi, Alternative 2					
N8: BLH-Wet	- 5.0	7.0	2.5	503.1	6,100,000
N9: BLH-Wet	- 5.0	7.0	2.5	418.0	5,100,000
N10: Swamp	- 5.0	6.0	2.0	288.8	3,300,000
N11: Int. Marsh	- 5.0	5.5	1.5	239.5	2,800,000

Notes:
All elevations are expressed in feet NAVD 88.
BLH-Wet = Wet bottomland hardwoods.
Int. Marsh = Intermediate marsh.
Initial Fill Elevation = Approximate elevation of fill (sediments) when it is first placed in the mitigation feature.
Final Target Grade Elevation = Desired elevation of the earthen platform surface after fill used to construct the platform has dewatered and settled.

Table 3. Data for earthen retention dikes, excluding earthen retention dikes armored with a stone cap.

Mitigation Feature ID & Proposed Habitat	Existing Grade Elev.	Initial Dike Crest Elev.	Final Dike Crest Elev.	Linear Feet of Dike
Delta Farms				
DF1: BLH-Wet	- 6.0	8.0	2.5	14,000
DF2: BLH-Wet	- 6.0	8.0	2.5	22,280
DF3: Swamp	- 6.0	7.0	3.0	24,375
DF4: Int. Marsh	- 6.0	6.5	1.5	6,015
DF5: Int. Marsh	- 6.0	6.5	1.5	19,785
Lake Salvador				
LS1: Int. Marsh	- 5.0	6.5	1.5	12,400
LS2: BLH-Wet	- 5.0	8.0	2.5	29,285
LS3: BLH-Wet	- 5.0	8.0	2.5	14,215
LS4: BLH-Wet	- 5.0	8.0	2.5	27,585
LS5: BLH-Wet	- 5.0	8.0	2.5	7,170
LS6: Swamp	- 5.0	7.0	3.0	14,445
LS7: Swamp	- 5.0	7.0	3.0	5,675
Naomi, Alternative 1				
N1: Int. Marsh	- 3.0	6.5	1.5	19,460
N2: BLH-Wet	- 5.0	8.0	2.5	21,260
N3: BLH-Wet	- 5.0	8.0	2.5	9,580
N4: BLH-Wet	- 5.0	8.0	2.5	5,190
N5: BLH-Wet	- 3.0	8.0	2.5	6,320
N6: BLH-Wet	- 3.0	8.0	2.5	10,620
N7: Swamp	- 5.0	8.0	3.0	15,000
Naomi, Alternative 2				
N8: BLH-Wet	- 5.0	8.0	2.5	20,650
N9: BLH-Wet	- 5.0	8.0	2.5	21,585
N10: Swamp	- 5.0	7.0	3.0	20,465
N11: Int. Marsh	- 5.0	6.5	1.5	10,395

Notes:
All elevations are expressed in feet NAVD 88.
BLH-Wet = Wet bottomland hardwoods.
Int. Marsh = Intermediate marsh.
Initial dike elevation includes 1 foot freeboard, bulking factor of 1.5.
Final dike crest elevation = elevation after dike has been degraded.

Table 4. Data for earthen retention dikes with stone caps (armored earthen retention dikes) utilized at the Delta Farms mitigation site.

Mitigation Feature ID & Proposed Habitat	Existing Grade Elev.	Initial Dike Crest Elev.	Final Dike Crest Elev.	Stone Cap Crest Elev.	Linear Feet of Dike	Stone Quantity (tons)
DF1: BLH-Wet	- 6.0	4.5	2.5	2.5	2,500	3,900
DF2: BLH-Wet	- 6.0	4.5	2.5	2.5	2,315	3,600
DF3: Swamp	- 6.0	4.0	3.0	2.5	1,735	2,700
DF4: Int. Marsh	- 6.0	3.5	2.5	2.0	650	1,050

Notes:
All elevations are expressed in feet NAVD 88.
BLH-Wet = Wet bottomland hardwoods.
Int. Marsh = Intermediate marsh.
Initial and final dike crest elevations indicated are for the earthen portion of the dikes.
The stone cap crest elevations indicated represent both the initial and final crest elevations for the armoring.
Armor (stone cap) thickness is 2 feet.
Armoring would not extend to final dike crest elevation in some cases.

Table 5. Data for foreshore rock dikes.

Mitigation Feature ID & Proposed Habitat	Existing Grade Elev.	Dike Crest Elev.	Linear Feet of Dike	Stone Quantity (tons)
Delta Farms				
DF1: BLH-Wet	- 6.0	5.5	6,150	205,000
Lake Salvador				
LS1: Int. Marsh	- 5.0	4.5	10,170	300,000
LS2: BLH-Wet	- 5.0	5.5	740	22,000
LS3: BLH-Wet	- 5.0	5.5	1,325	40,000
LS4: BLH-Wet	- 5.0	5.5	280	8,500
LS5: BLH-Wet	- 5.0	5.5	7,370	216,000
LS6: Swamp	- 5.0	5.0	13,735	405,000
LS7: Swamp	- 5.0	5.0	5,860	172,000
Naomi, Alternative 1				
N2: BLH-Wet	- 5.0	5.5	3,215	95,000
N3: BLH-Wet	- 5.0	5.5	11,646	342,000
N4: BLH-Wet	- 5.0	5.5	3,400	100,000
N7: Swamp	- 5.0	5.0	12,100	355,000
Naomi, Alternative 2				
N8: BLH-Wet	- 5.0	5.5	2,100	62,000
N10: Swamp	- 5.0	5.0	8,290	243,000
N11: Int. Marsh	- 5.0	4.5	8,190	240,000

Notes:
All elevations are expressed in feet NAVD 88.
BLH-Wet = Wet bottomland hardwoods.
Int. Marsh = Intermediate marsh.
Initial settlement assumed to be 50% (all cases).
Foreshore rock dikes include 25-foot rock berm with crest elevation of -1.0.

Table 6. Data for proposed mitigation features within each of the four additional WBV mitigation alternatives project groups.

Feature ID Code	Proposed Habitat Within Feature	Impact Category for Which Mitigation is Provided	Feature Acres
Delta Farms			
DF1	BLH-Wet	BLH-Wet & BLH-Dry, PS	507.5
DF2	BLH-Wet	BLH-Wet, FS	414.3
DF3	Swamp	Swamp, FS	289.6
DF4	Intermediate Marsh	Fresh Marsh, FS	38.0
DF5	Intermediate Marsh	Fresh Marsh, FS	200.6
Sub-Total (DF4 & DF5)	*Intermediate Marsh*	*Fresh Marsh, FS*	*238.6*
		Total Acres	**1,450.0**
Lake Salvador			
LS1	Intermediate Marsh	Fresh Marsh, FS	244.0
LS2	BLH-Wet	BLH-Wet, FS	417.8
LS3	BLH-Wet	BLH-Wet & BLH-Dry, PS	202.7
LS4	BLH-Wet	BLH-Wet & BLH-Dry, PS	101.5
LS5	BLH-Wet	BLH-Wet & BLH-Dry, PS	205.0
Sub-Total (LS3-LS5)	*BLH-Wet*	*BLH-Wet & BLH-Dry, PS*	*509.2*
LS6	Swamp	Swamp, FS	189.2
LS7	Swamp	Swamp, FS	100.8
Sub-Total (LS6 & LS7)	*Swamp*	*Swamp, FS*	*290.0*
		Total Acres	**1,461.0**
Naomi, Alternative 1			
N1	Intermediate Marsh	Fresh Marsh, FS	249.6
N2	BLH-Wet	BLH-Wet & BLH-Dry, PS	510.6
N3	BLH-Wet	BLH-Wet, FS	230.0
N4	BLH-Wet	BLH-Wet, FS	93.7
N5	BLH-Wet	BLH-Wet, FS	32.3
N6	BLH-Wet	BLH-Wet, FS	59.9
Sub-Total (N3-N6)	*BLH-Wet*	*BLH-Wet, FS*	*415.9*
N7	Swamp	Swamp, FS	291.0
		Total Acres	**1,467.1**
Naomi, Alternative 2			
N8	BLH-Wet	BLH-Wet & BLH-Dry, PS	503.1
N9	BLH-Wet	BLH-Wet, FS	418.0
N10	Swamp	Swamp, FS	288.8
N11	Intermediate Marsh	Fresh Marsh, FS	239.5
		Total Acres	**1,449.4**

FS = Mitigation is for impacts to habitats on the flood side of the levee.
PS = Mitigation is for impacts to habitats on the protected side of the levee.
All mitigation features involve restoration of habitats in existing open water areas.

APPENDIX 2

FIGURES

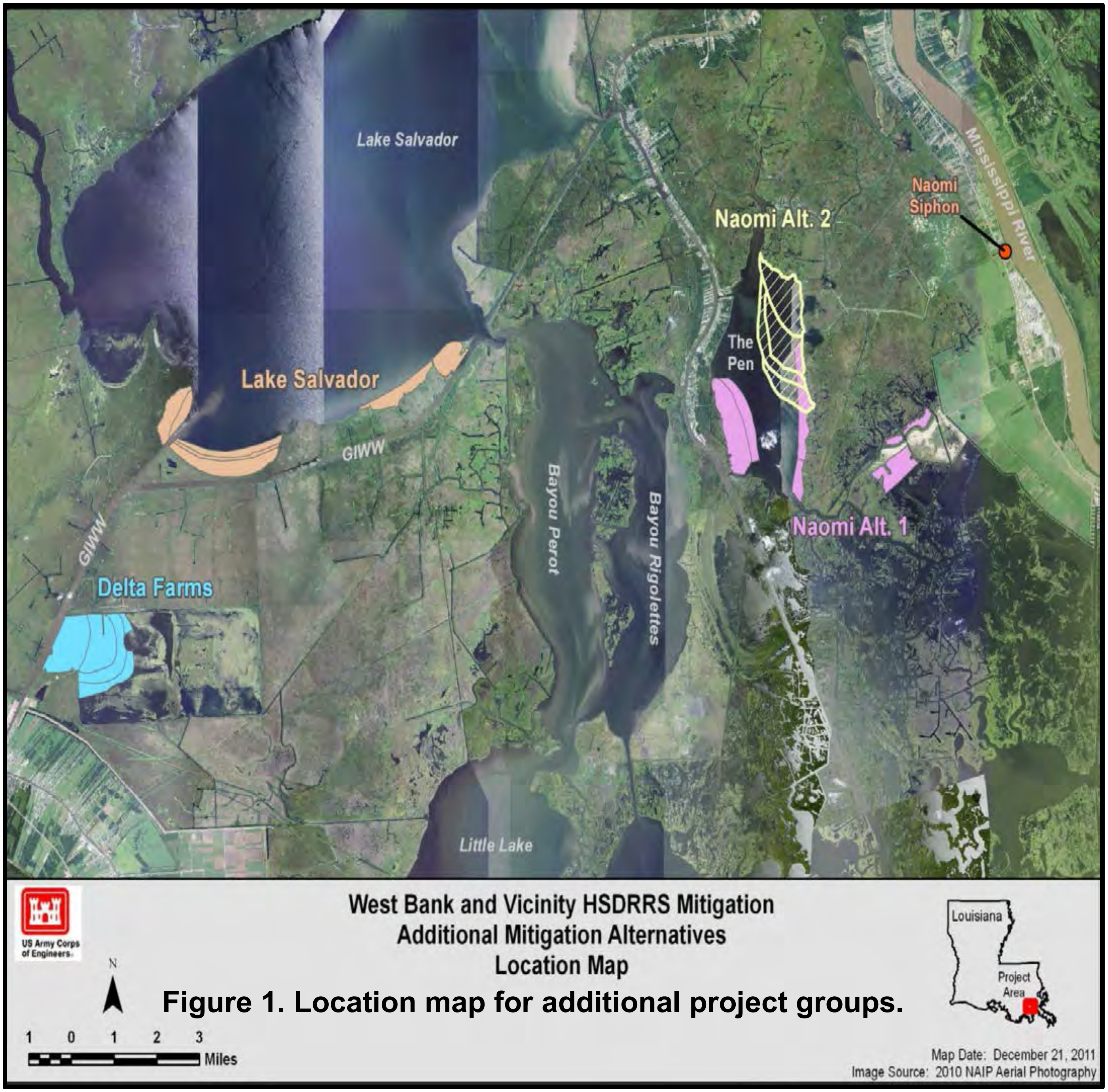
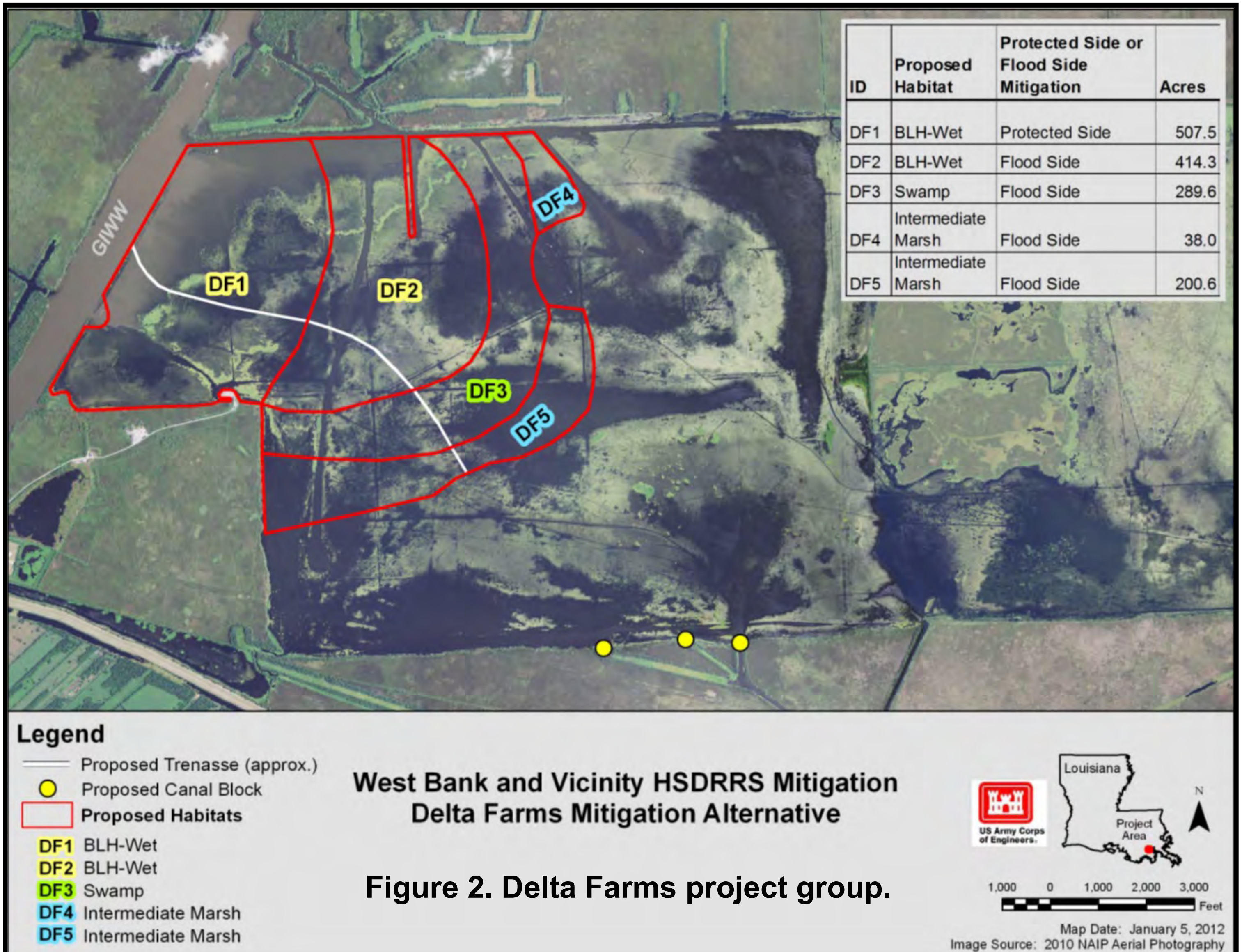
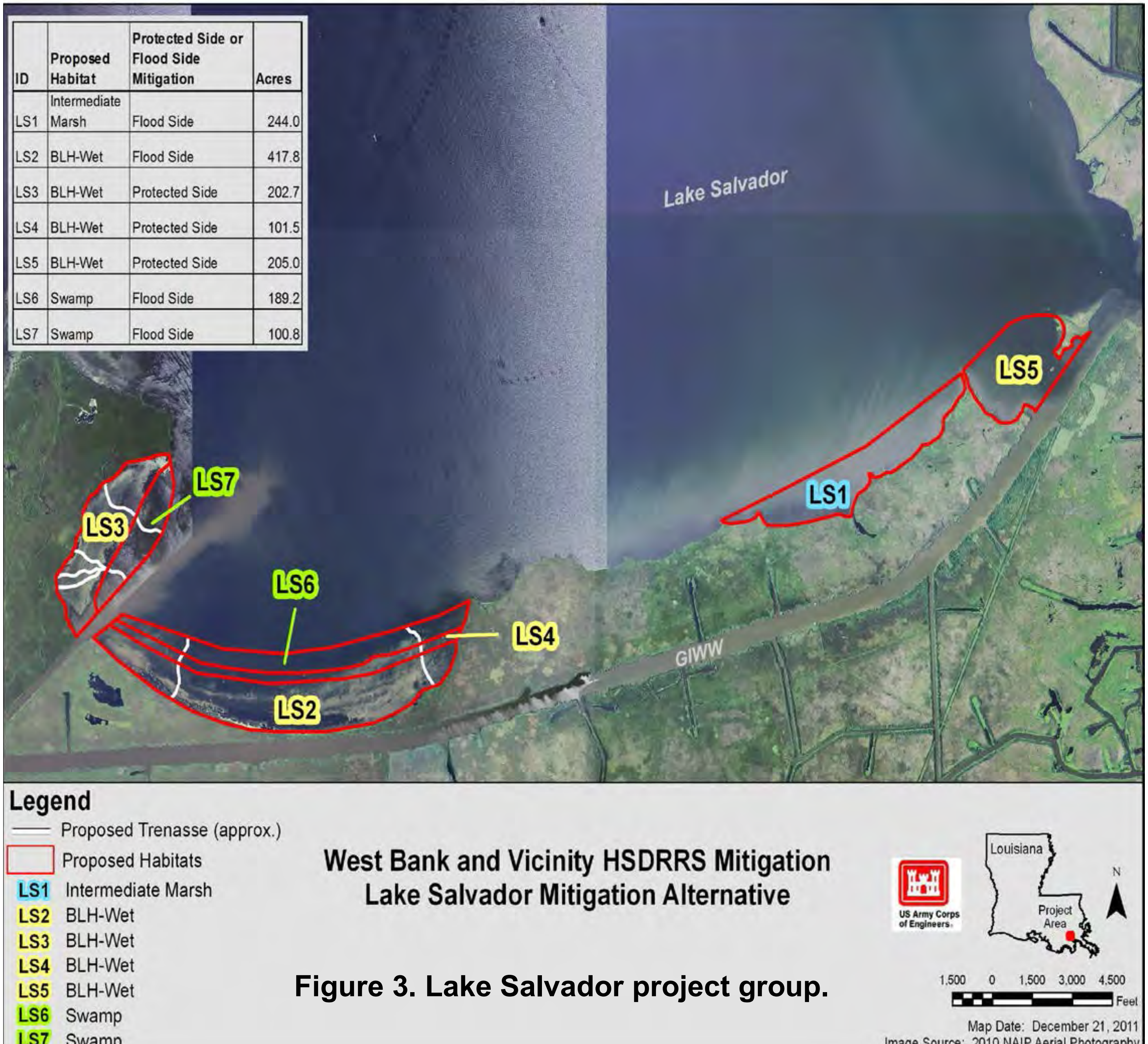


Figure 1. Location map for additional project groups.



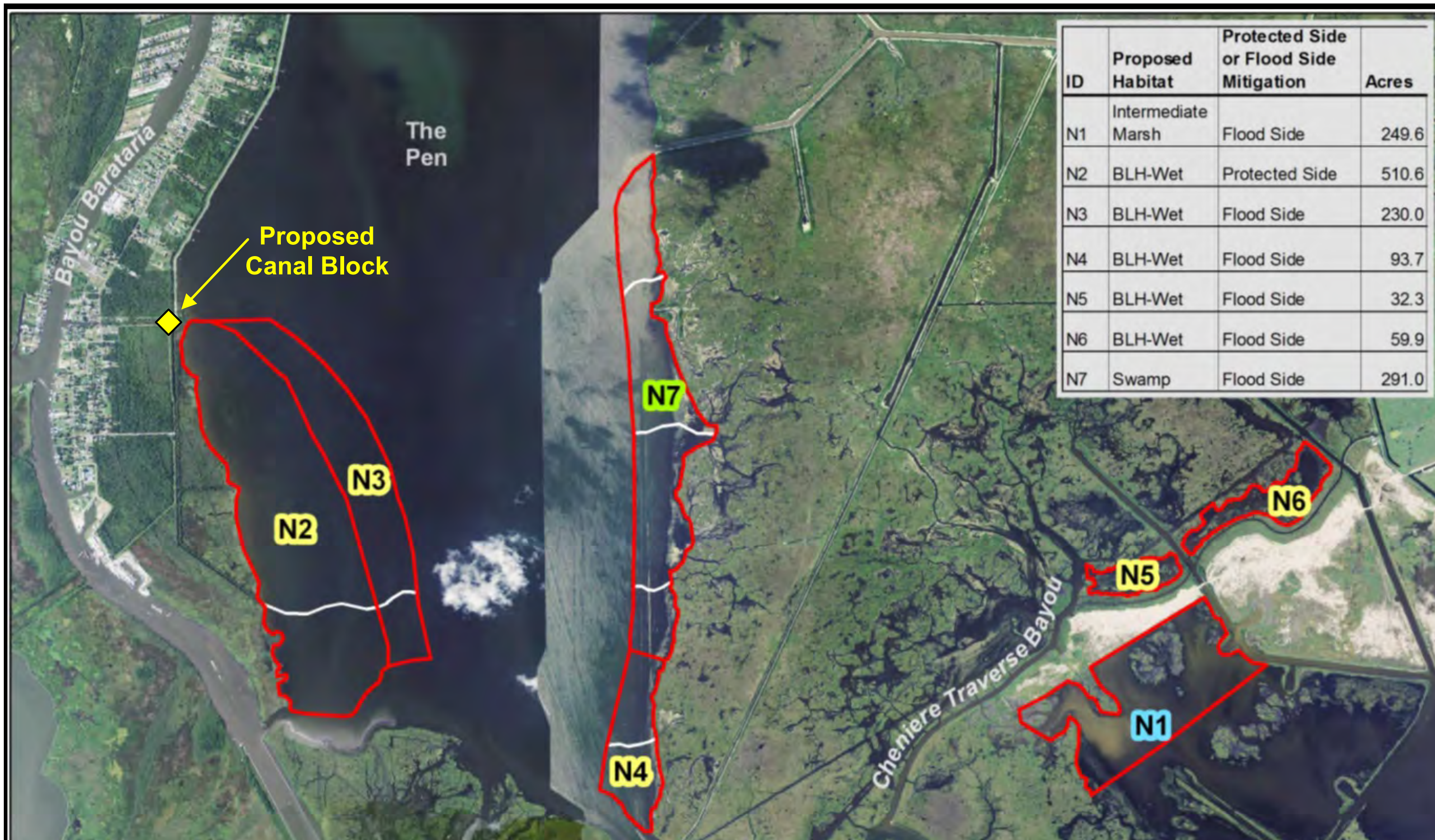
ID	Proposed Habitat	Protected Side or Flood Side Mitigation	Acres
DF1	BLH-Wet	Protected Side	507.5
DF2	BLH-Wet	Flood Side	414.3
DF3	Swamp	Flood Side	289.6
DF4	Intermediate Marsh	Flood Side	38.0
DF5	Intermediate Marsh	Flood Side	200.6

Figure 2. Delta Farms project group.



ID	Proposed Habitat	Protected Side or Flood Side Mitigation	Acres
LS1	Intermediate Marsh	Flood Side	244.0
LS2	BLH-Wet	Flood Side	417.8
LS3	BLH-Wet	Protected Side	202.7
LS4	BLH-Wet	Protected Side	101.5
LS5	BLH-Wet	Protected Side	205.0
LS6	Swamp	Flood Side	189.2
LS7	Swamp	Flood Side	100.8

Figure 3. Lake Salvador project group.



ID	Proposed Habitat	Protected Side or Flood Side Mitigation	Acres
N1	Intermediate Marsh	Flood Side	249.6
N2	BLH-Wet	Protected Side	510.6
N3	BLH-Wet	Flood Side	230.0
N4	BLH-Wet	Flood Side	93.7
N5	BLH-Wet	Flood Side	32.3
N6	BLH-Wet	Flood Side	59.9
N7	Swamp	Flood Side	291.0

Legend

Proposed Trenasse (approx.)
Proposed Habitats
N1 Intermediate Marsh
N2 BLH-Wet
N3 BLH-Wet
N4 BLH-Wet
N5 BLH-Wet
N6 BLH-Wet
N7 Swamp

West Bank and Vicinity HSDRRS Mitigation
Naomi Alternative 1 Mitigation Alternative

US Army Corps of Engineers

Louisiana
Project Area
N

1,000 0 1,000 2,000 3,000 Feet

Map Date: January 5, 2012
Image Source: 2010 NAIP Aerial Photography

Figure 4. Naomi Alternative 1 project group.

ID	Proposed Habitat	Protected Side or Flood Side Mitigation	Acres
N8	BLH-Wet	Protected Side	503.1
N9	BLH-Wet	Flood Side	418.0
N10	Swamp	Flood Side	288.8
N11	Intermediate Marsh	Flood Side	239.5

Legend

Proposed Trenasse (approx.)
Proposed Habitats

N8 BLH-Wet
N9 BLH-Wet
N10 Swamp
N11 Intermediate Marsh

West Bank and Vicinity HSDRRS Mitigation
Naomi Alternative 2 Mitigation Alternative

US Army Corps of Engineers

Louisiana
Project Area
N

1,000 0 1,000 2,000 3,000 Feet

Map Date: December 21, 2011
Image Source: 2010 NAIP Aerial Photography

Figure 5. Naomi Alternative 2 project group.

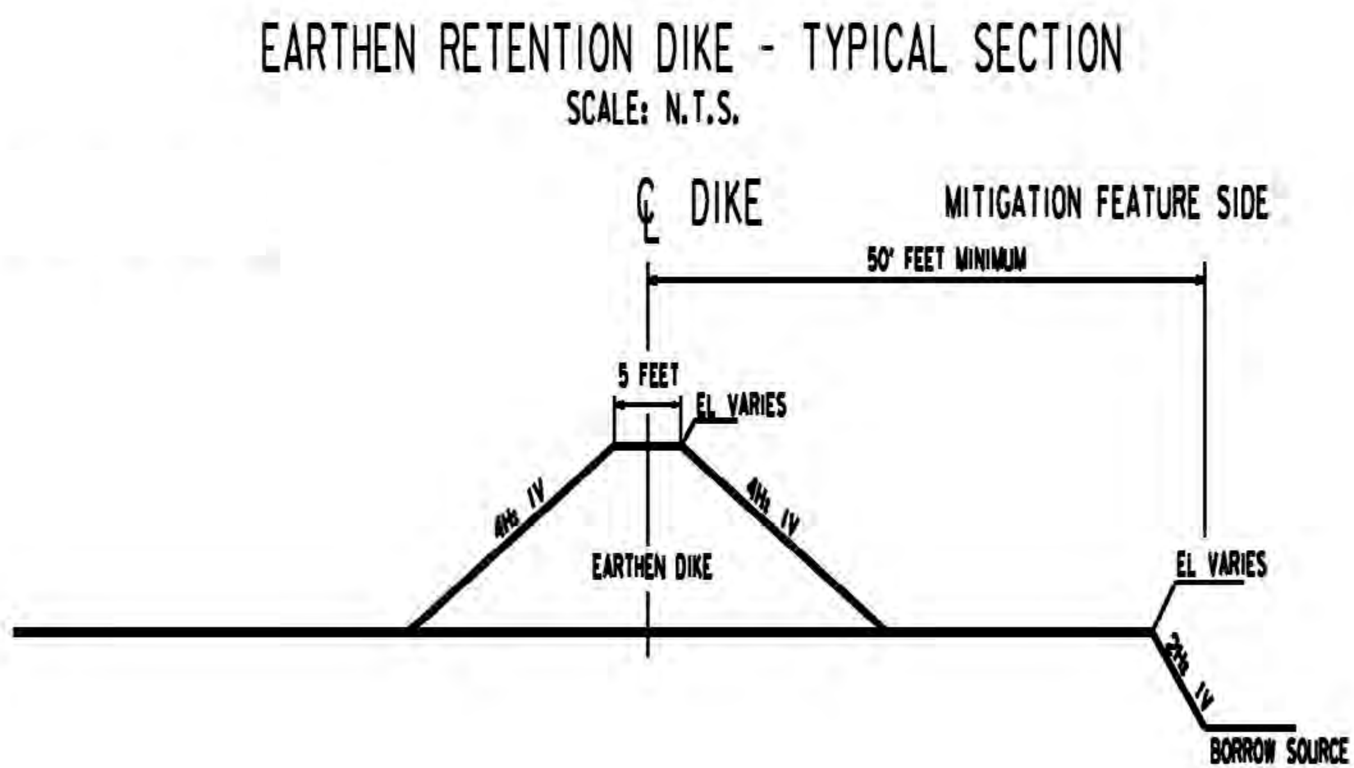


Figure 6A. Typical section for proposed earthen retention dikes.

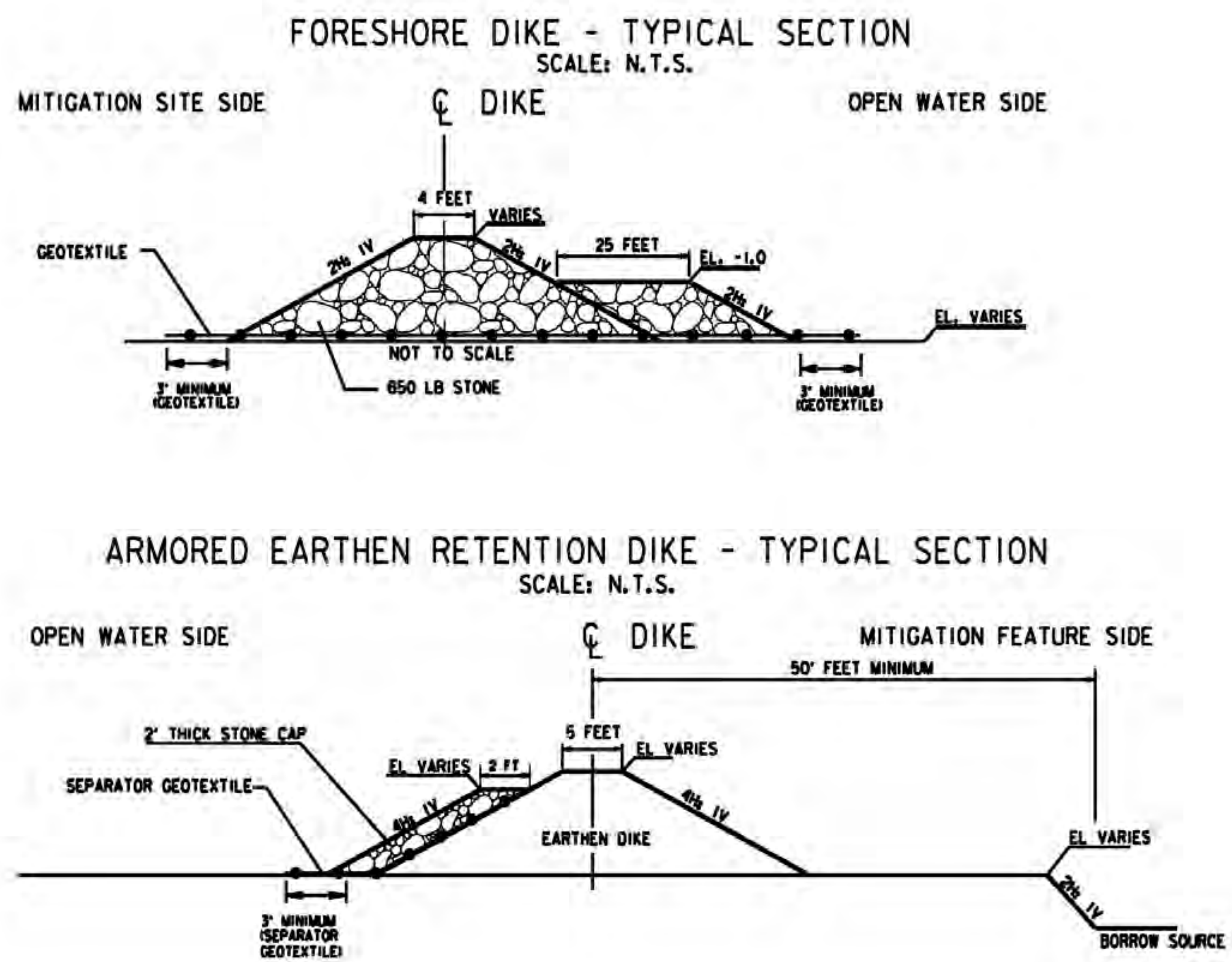


Figure 6B. Typical sections for proposed foreshore rock dikes and proposed armored earthen retention dikes.

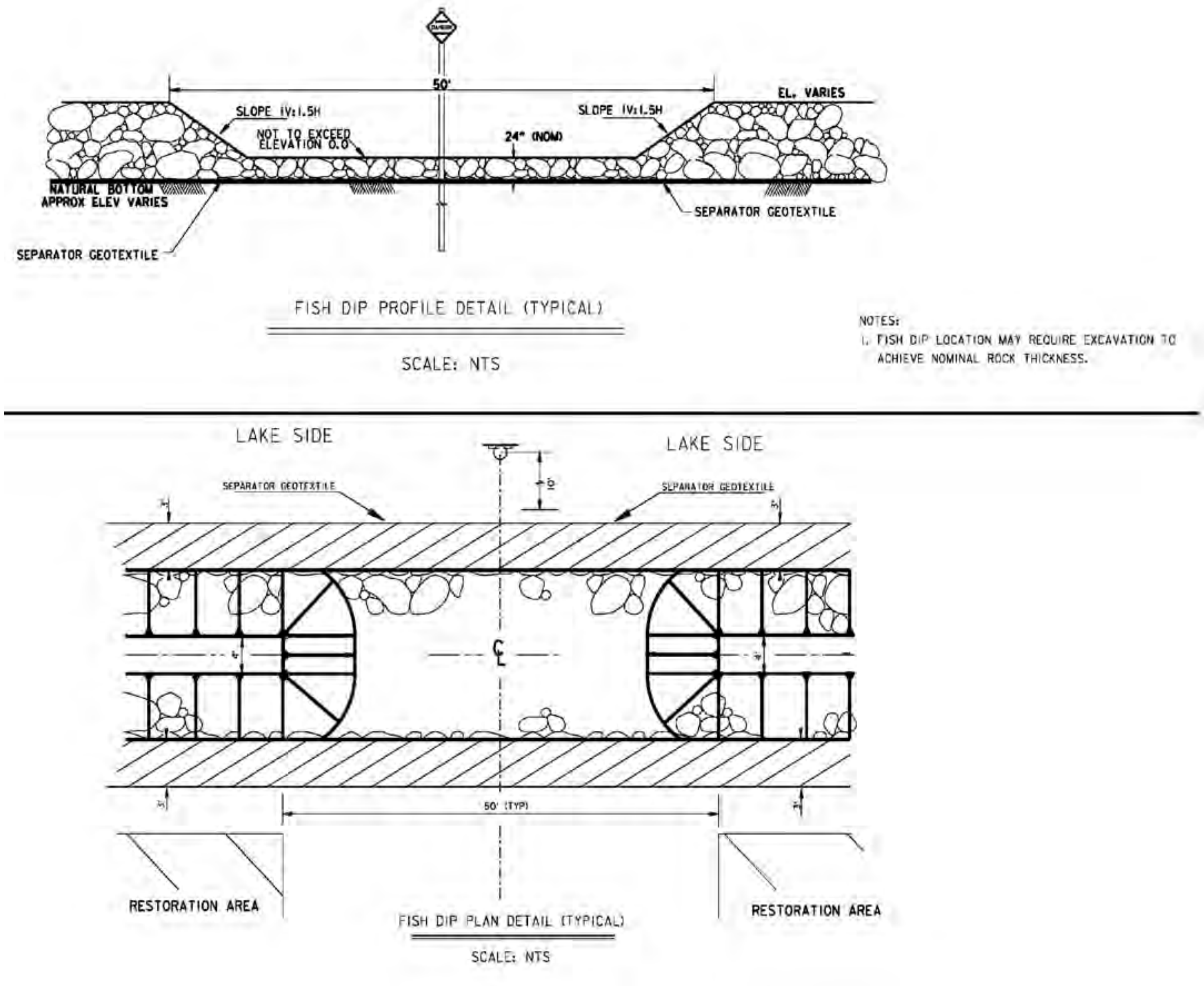


Figure 7. Typical plan and profile details for proposed fish dips.

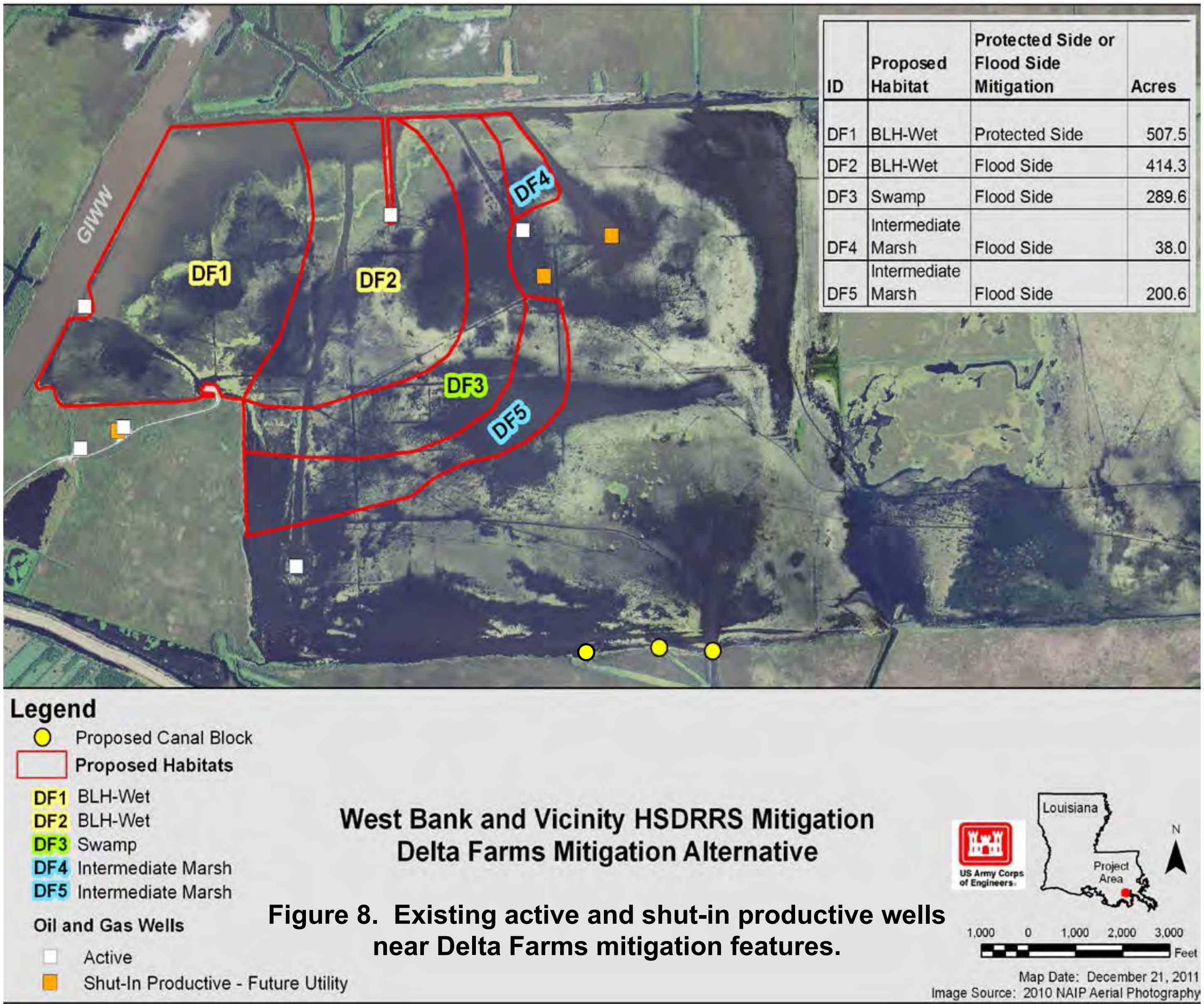


Figure 8. Existing active and shut-in productive wells near Delta Farms mitigation features.

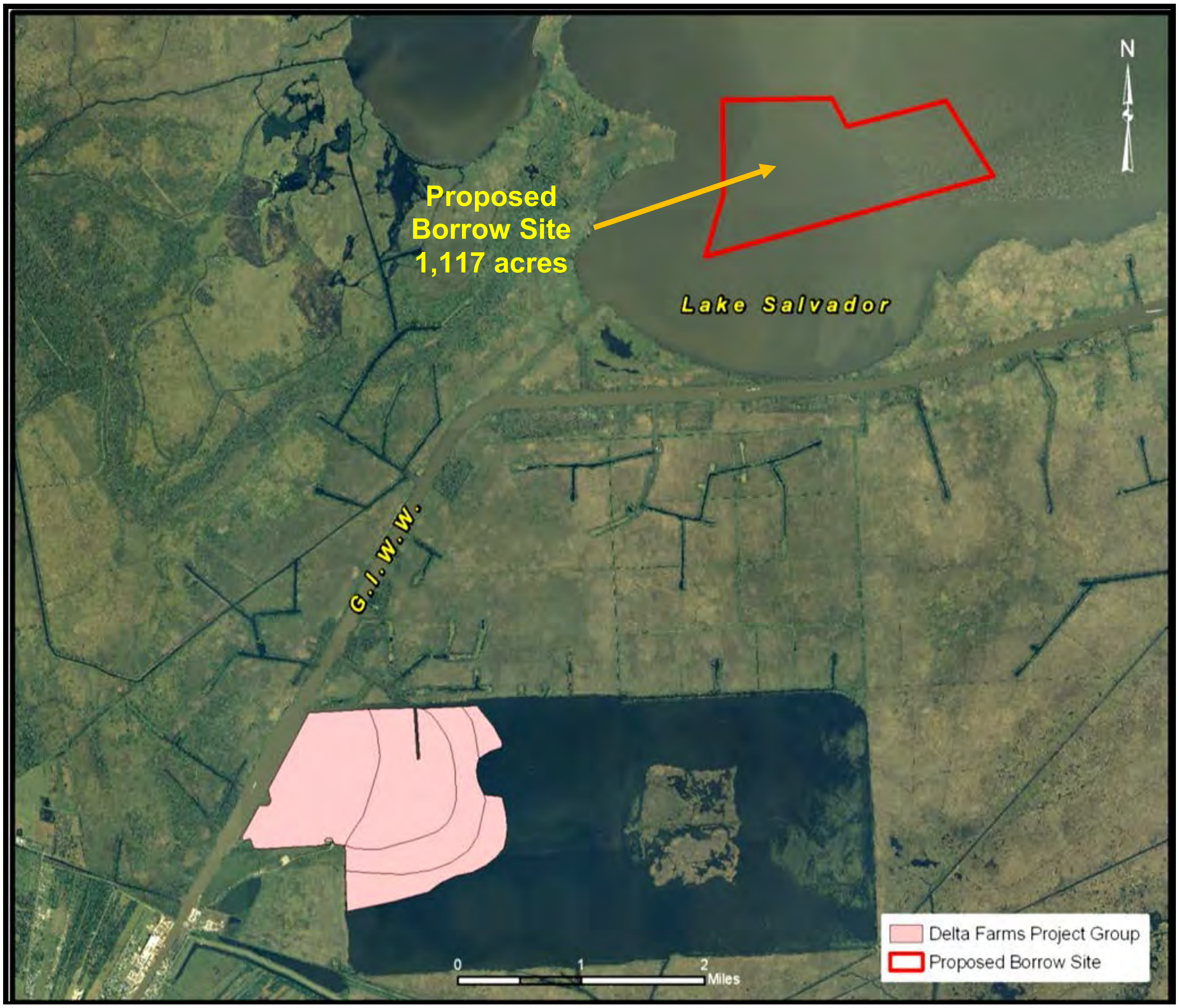


Figure 9. Proposed borrow site for the Delta Farms project group.

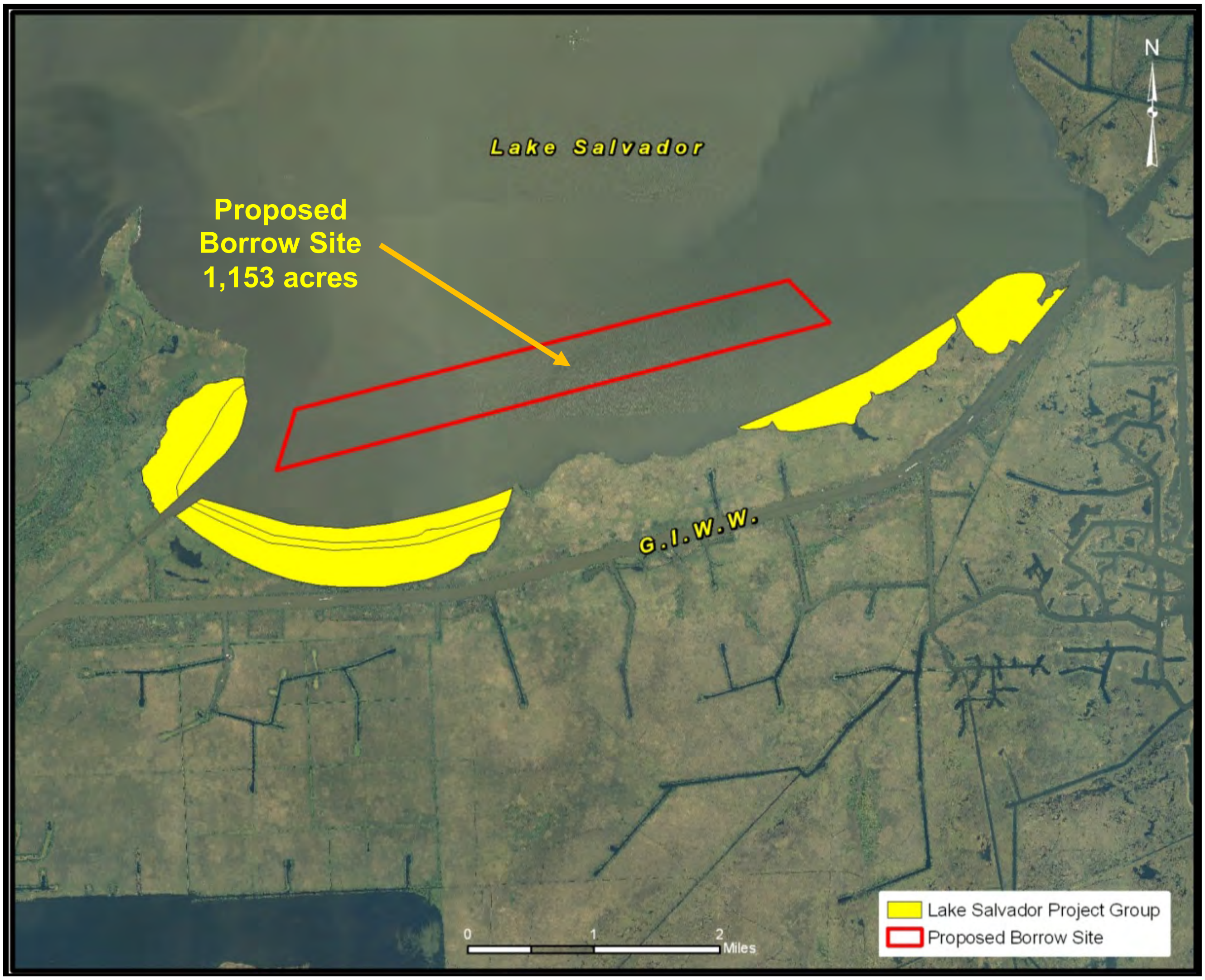


Figure 10. Proposed borrow site for the Lake Salvador project group.

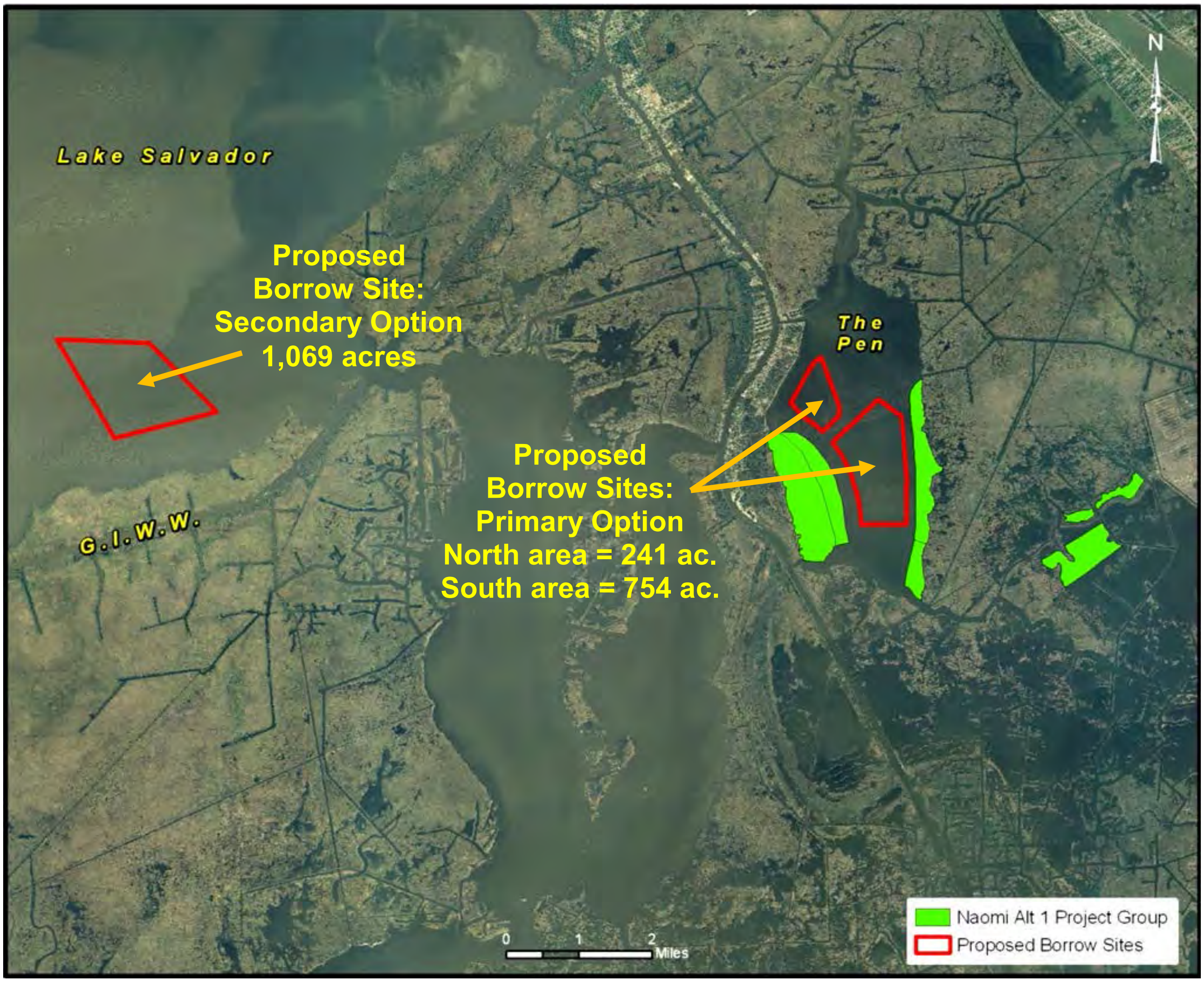


Figure 11. Proposed borrow sites for the Naomi Alternative 1 project group (excluding potential Mississippi River borrow sites).

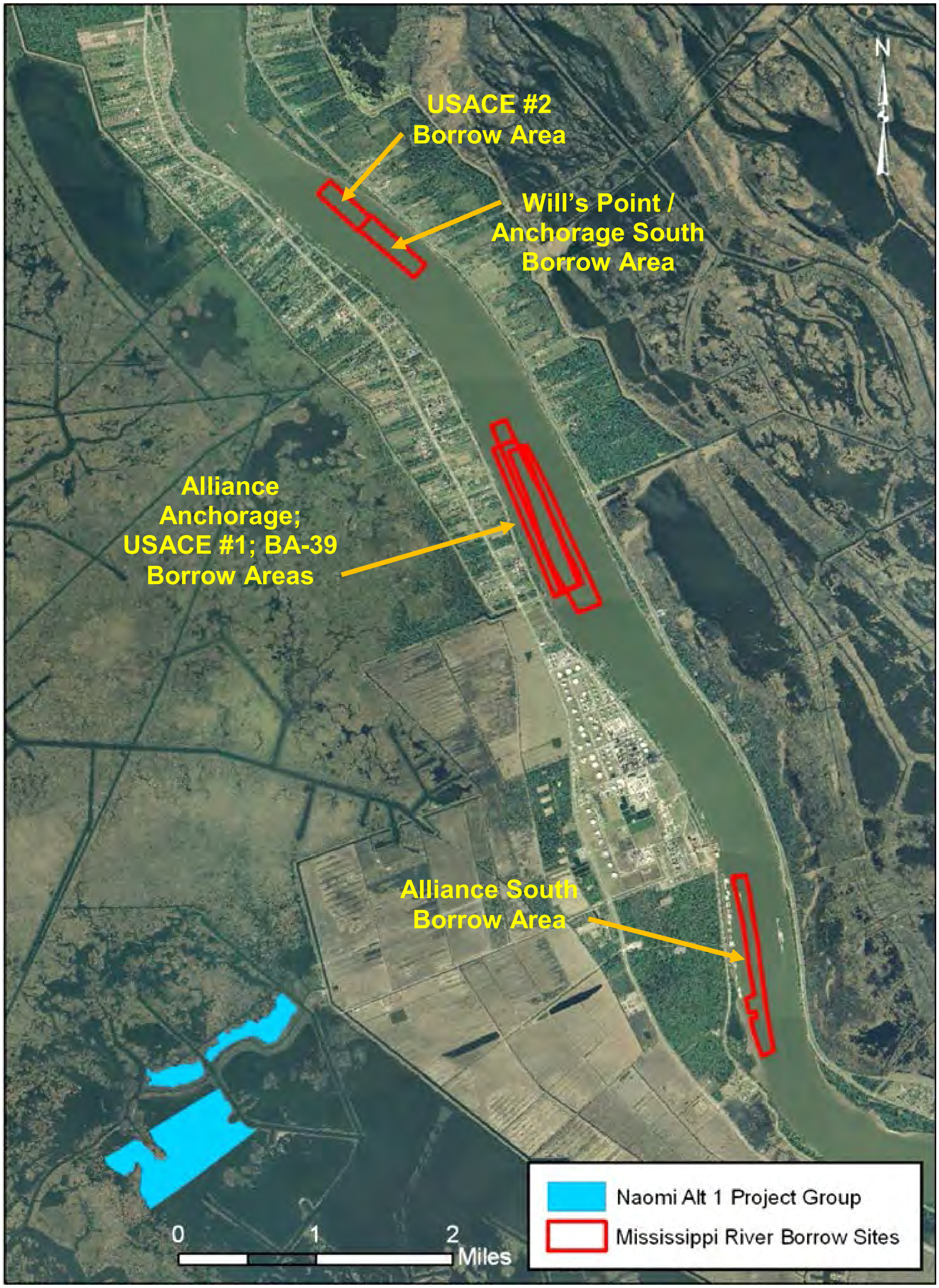


Figure 12. Potential Mississippi River borrow sites for the Naomi Alternative 1 project group and the Naomi Alternative 2 project group.

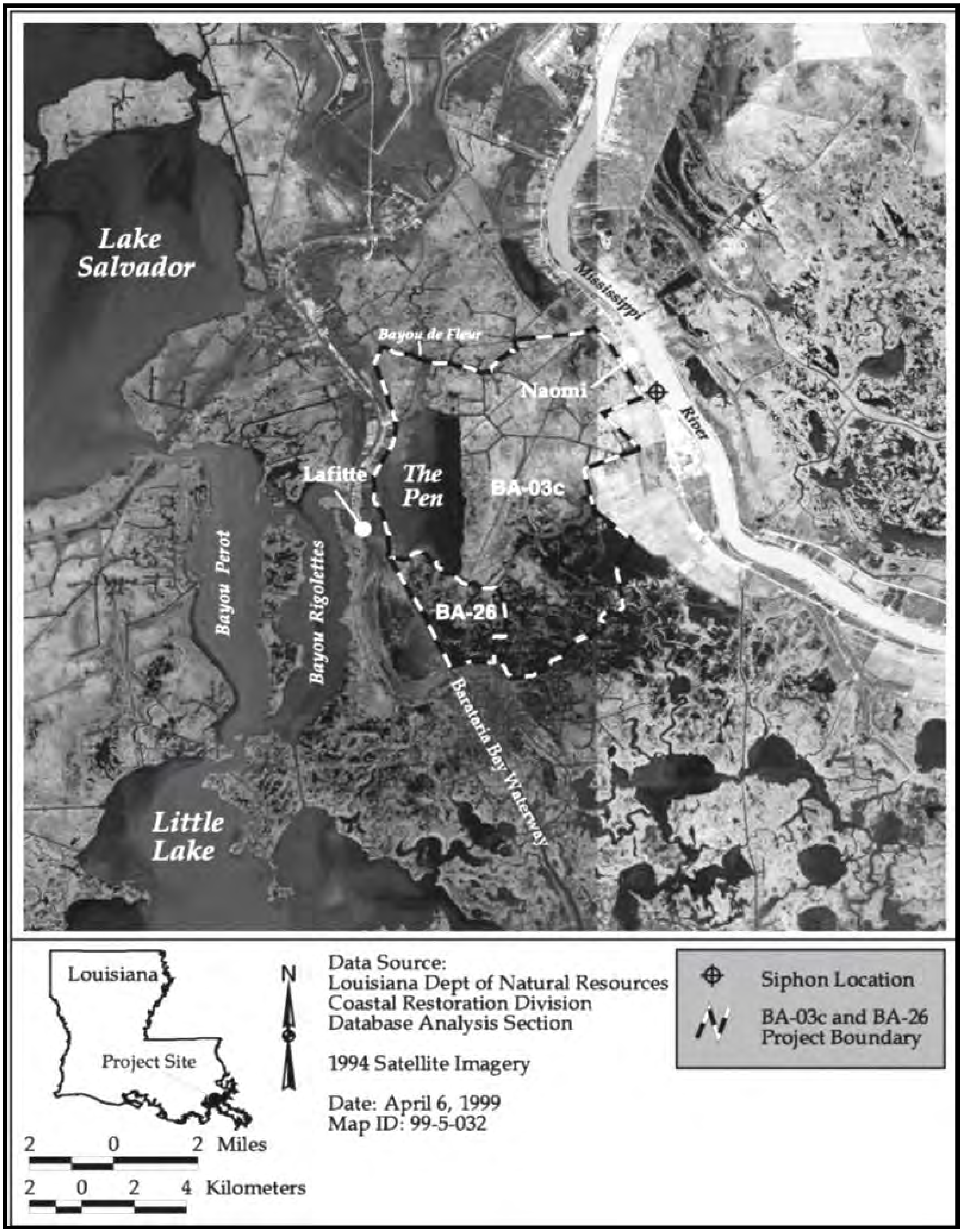


Figure 13. Naomi Outfall Management Area (NOMA) boundaries (i.e. project boundary shown for BA-03c and BA-26).

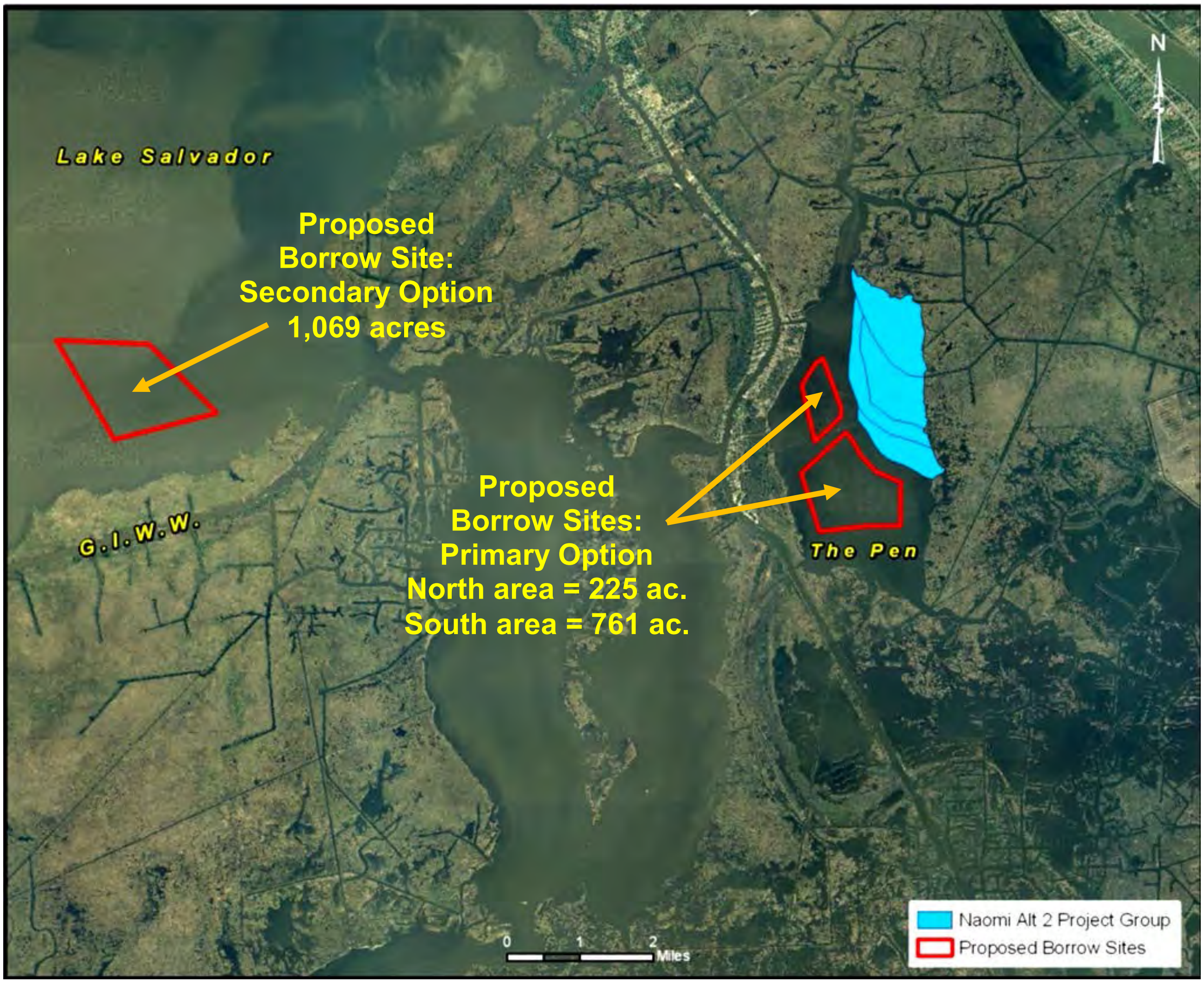


Figure 14. Proposed borrow sites for the Naomi Alternative 2 project group(excluding potential Mississippi River borrow sites).

APPENDIX 3

MITIGATION PLANTING, MONITORING, & RELATED GUIDELINES / MITIGATION SUCCESS CRITERIA

MITIGATION PLANTING GUIDELINES, OTHER GENERAL MITIGATION GUIDELINES, MITIGATION SUCCESS CRITERIA, MITIGATION MONITORING GUIDELINES, AND MITIGATION MONITORING SCHEDULES AND RESPONSIBILITIES

MITIGATION PLANTING GUIDELINES

PLANTING GUIDELINES FOR BOTTOMLAND HARDWOOD (BLH) HABITATS

Canopy species will be planted on 9-foot centers (average) to achieve a minimum initial stand density of 538 seedlings (trees) per acre. Midstory species will be planted on 20-foot centers (average) to achieve a minimum initial stand density of 109 seedlings per acre. Stock will be at least 1 year old, at least 1.5 feet in height, have a minimum root collar diameter of 0.5 inch, and must be obtained from a registered licensed regional nursery/grower and of a regional eco-type species properly stored and handled to ensure viability. The plants will typically be installed during the period from December through March 15 (planting season/dormant season); however, unanticipated events such as spring flooding may delay plantings until late spring or early summer. The seedlings will be installed in a manner that avoids monotypic rows of canopy and midstory species (i.e. goal is to have spatial diversity and mixture of planted species). If herbivory may threaten seedling survival, then seedling protection devices such as wire-mesh fencing or plastic seedling protectors will be installed around each planted seedling.

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

The canopy species installed will be in general accordance with the species lists provided in Tables 1A and 1B. Plantings will be conducted such that the total number of plants installed in a given area consists of approximately 60% hard mast-producing species (Table 1A) and approximately 40% soft mast-producing species (Table 1B). The species composition of the plantings for each of the two groups of canopy species (e.g. hard mast species and soft mast species) should mimic the percent composition guidelines indicated in Tables 1A and 1B. However, site conditions (factors such as hydrologic regime, soils, composition of existing native canopy species, etc.) and planting stock availability may necessitate deviations from the species lists and/or the percent composition guidelines indicated in these tables. In general, a minimum of 3 hard mast species and a minimum of 3 soft mast species should be utilized.

The midstory species installed will be selected from the species list provided in Table 1C. Plantings will consist of at least 3 different species. The species used and the proportion of the total midstory plantings represented by each species (percent composition) will be dependent on various factors including site conditions (composition and frequency of existing native midstory species, hydrologic regime, soils, etc.) and planting stock availability.

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

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

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

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

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

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

TBD = To Be Determined

<u>Species for Dry Bottomland Hardwood Habitats (BLH-Dry Habitats)</u>

The canopy species installed will be in general accordance with the species lists provided in Tables 2A and 2B. Plantings will be conducted such that the total number of plants installed in a given area consists of approximately 50% hard mast-producing species (Table 2A) and approximately 50% soft mast-producing species (Table 2B). The species composition of the plantings for each of the two groups of canopy species (e.g. hard mast species and soft mast species) should mimic the percent composition guidelines indicated in Tables 2A and 2B. However, site conditions (factors such as hydrologic regime, soils, composition of existing native canopy species, etc.) and planting stock availability may necessitate deviations from the species lists and/or the percent composition guidelines indicated in these tables. In general, a minimum of 3 hard mast species and a minimum of 3 soft mast species should be utilized.

The midstory species installed will be selected from the species list provided in Table 2C. Plantings will consist of at least 3 different species. The species used and the proportion of the total midstory plantings represented by each species (percent composition) will be dependent on various factors including site conditions (composition and frequency of existing native midstory species, hydrologic regime, soils, etc.) and planting stock availability.

Table 2A: Preliminary Planting List for Dry Bottomland Hardwood Habitat, Hard Mast-Producing Canopy Species (50% of Total Canopy Species)

Common Name	Scientific name	Percent Composition
Nuttall oak	*Quercus nuttalli* or *Q. texana*	10%
Willow oak	*Quercus phellos*	10%
Water oak	*Quercus nigra*	20%
Live oak	*Quercus virginiana*	20%
Cherrybark oak	*Quercus pagoda*	5%
Sweet Pecan	*Carya illinoensis*	20%
Southern red oak	*Quercus falcata*	5%
Cow oak	*Quercus michauxii*	10%

Table 2B: Preliminary Planting List for Dry Bottomland Hardwood Habitat, Soft Mast-Producing Canopy Species (50% of Total Canopy Species)

Common Name	Scientific name	Percent Composition
Drummond red maple	*Acer rubrum* var. *drummondii*	10%
Sugarberry	*Celtis laevigata*	15%
Green ash	*Fraxinus pennsylvanica*	15%
Sweetgum	*Liquidambar styraciflua*	20%
American elm	*Ulmus americana*	10% - 20%
Common persimmon	*Diospyros virginiana*	15%
Red mulberry	*Morus rubra*	5 - 10%
American sycamore	*Platanus occidentalis*	0 - 5%
River birch	*Salix nigra*	0 - 5%
Honey locust	*Gleditsia triacanthos*	0 – 5%

Table 2C: Preliminary Planting List for Dry Bottomland Hardwood Habitat, Midstory Species

Common Name	Scientific name	Percent Composition
Roughleaf dogwood	*Cornus drummondii*	TBD
Mayhaw	*Crataegus opaca*	TBD
Green hawthorn	*Crataegus viridis*	TBD
Deciduous holly	*Ilex decidua*	TBD
Yaupon	*Ilex vomitoria*	TBD
Palmetto	*Sabal minor*	TBD
Southern wax myrtle	*Morella cerifera*	TBD
Southern magnolia	*Magnolia grandiflora*	TBD
Southern crabapple	*Malus angustifolia*	TBD
Eastern red cedar	*Juniperus virginiana* var. *virginiana*	TBD
Elderberry	*Sambucus canadensis*	TBD

TBD = To Be Determined

Deviations from Typical Planting Guidelines

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

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

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

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

PLANTING GUIDELINES FOR SWAMP HABITATS

Canopy species will be planted on 9-foot centers (average) to achieve a minimum initial stand density of 538 seedlings (trees) per acre. Midstory species will be planted on 20-foot centers (average) to achieve a minimum initial stand density of 109 seedlings per acre. Stock used for canopy species will be at least 1 year old, at least 3 feet tall, and have a root collar diameter that exceeds 0.5 inch. Stock used for midstory species will be at least 1 year old and will be at least 3 feet tall. All stock must be obtained from a registered licensed regional nursery/grower and of a regional eco-type species properly stored and handled to ensure viability. The plants will typically be installed during the period from December through March 15 (planting season/dormant season); however, unanticipated events may delay plantings until late spring or early summer. The seedlings will be installed in a manner that that avoids monotypic rows of canopy and midstory species (i.e. goal is to have spatial diversity and mixture of planted species). If herbivory may threaten seedling survival, then seedling protection devices such as wire-mesh fencing or plastic seedling protectors will be installed around each planted seedling.

The canopy species installed will be in general accordance with the species lists provided in Table 3A. The species composition of the plantings should mimic the percent composition guidelines indicated in this table. However, site conditions (factors such as hydrologic regime, soils, composition of existing native canopy species, etc.) and planting stock availability may necessitate deviations from the species lists and/or the percent composition guidelines indicated. In general, a minimum of 3 canopy species should be utilized, the plantings must include baldcypress and tupelogum (water tupelo), and baldcypress should typically comprise at least 50% of the total number of seedlings installed.

The midstory species installed will be selected from the species list provided in Table 3B. Plantings will consist of at least 2 different species. The species used and the proportion of the total midstory plantings represented by each species (percent composition) will be dependent on various factors including site conditions (composition and frequency of existing native midstory species, hydrologic regime, soils, etc.) and planting stock availability.

Table 3A: Preliminary Planting List for Swamp Habitat, Canopy Species

Common Name	Scientific name	Percent Composition
Bald cypress	*Taxodium distichum*	60% - 75%
Tupelogum	*Nyssa aquatic*	20% - 25%
Green ash	*Fraxinus pennsylvanica*	10% - 15%
Drummond red maple	*Acer rubrum* var. *drummondii*	5%
Water hickory	*Carya aquatica*	5% - 10%

Table 3B: Preliminary Planting List for Swamp Habitat, Midstory Species

Common Name	Scientific name	Percent Composition
Buttonbush	*Cephalanthus occidentalis*	TBD
Roughleaf dogwood	*Cornus drummondii*	TBD
Swamp privet	*Forestiera acuminata*	TBD
Possumhaw	*Ilex decidua*	TBD
Virginia willow	*Itea virginica*	TBD
Wax myrtle	*Myrica cerifera*	TBD
Swamp rose	*Rosa palustris*	TBD
American snowbell	*Styrax americanus*	TBD

TBD = To Be Determined

<u>Deviations from Typical Planting Guidelines</u>

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

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

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

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

PLANTING GUIDELINES FOR MARSH HABITATS

Planting Guidelines for Intermediate and Brackish Marsh Habitats

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

Species installed in proposed intermediate marsh habitats will be selected from the species list provided in Table 4. Plantings will consist of at least 2 different species. The species used and the proportion of the total plantings represented by each species will be dependent on various factors including site conditions and planting stock availability.

Table 4: Preliminary Planting List for Intermediate Marsh Habitats

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

Species installed in proposed brackish marsh habitats will be selected from the species list provided in Table 5. Plantings will consist of at least 2 different species. The species used and the proportion of the total plantings represented by each species will be dependent on various factors including site conditions and planting stock availability.

Table 5: Preliminary Planting List for Brackish Marsh Habitats

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

Planting Guidelines for Fresh Marsh Habitats

Planting of fresh marsh habitats is not proposed since it is anticipated that desirable fresh marsh vegetation would rapidly colonize such habitats through natural recruitment. Should the initial vegetation success criteria for such features not be achieved however, supplemental planting of herbaceous species would be conducted to help insure the establishment of sufficient vegetative cover. Stock will typically be either 4-inch container size or bare-root or liner stock, depending on the species involved. The required stock size for each plant species proposed for installation must be specified in the Mitigation Work Plan. Plants must be obtained from a registered licensed regional nursery/grower and of a regional eco-type species properly stored and handled to ensure viability. Plant installation should be conducted during the period from March 15 through June 15. Planting should not be undertaken later than approximately July 15, although planting during the early fall may be deemed acceptable on a case-by-case basis.

The plant species to be installed would be determined based on field inspections of the mitigation site as would the planting plan (e.g. location of supplemental plantings and density of such plantings). Potential species to be installed could include such plants as maidencane, giant cutgrass, arrowheads (*Sagittaria* spp.), pickerelweed (*Pontederia cordata*), arrow arum (*Peltandra virginica*), smartweed (*Polygonum* spp.), common rush (*Juncus effusus*), pennyworts (*Hydrocotyle* spp.), and spikerush (*Eleocharis* spp.), although other species could be utilized. Typically at least two different species would be utilized.

Deviations from Typical Planting Guidelines

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

It may be determined that the initial planting of brackish marsh features would best be conducted in phases. Using this approach, a certain percentage of the total number of plants required would be installed in the year that final marsh construction activities are completed while the remainder would be installed in the following year. The determination of whether to use phased planting or to install all the necessary plants upon completion of construction activities will be made during the final design phase of the mitigation project. The proposed planting scheme would be subject to review and approval by the Interagency Team.

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

ADDITIONAL MITIGATION GUIDELINES

GUIDELINES FOR THE ERADICATION AND CONTROL OF INVASIVE AND NUISANCE PLANT SPECIES

The eradication of invasive and nuisance plant species may incorporate a variety of eradication methods including mechanized removal (ex. hydroaxes, gyro-tracs, heavy machinery used in areas slated for topographic alterations), non-mechanized removal (use of hand implements such as chain saws and machetes, direct uprooting by hand), aerial herbicide applications (applications using aircraft), and ground herbicide applications (on-the-ground applications using backpack sprayers, wick applicators, etc.). Only ground herbicide applications would be used in marsh habitats. Regardless of the methods involved, care will be exercised to avoid damage to desirable native species to the greatest extent practicable.

During the initial eradication process in forested habitats, larger quantities of felled materials may be removed from the mitigation site and disposed in a duly-licensed facility. Some felled woody plants may be chipped on-site with the chips spread in a layer not exceeding approximately 3 to 4 inches thick. Felled woody plants may also be gathered and stacked "teepee" style in scattered locations. In certain cases, larger invasive trees may be killed and allowed to remain standing if it is determined this would not interfere with mitigation goals. The Mitigation Work Plan must address the specific measures proposed to conduct initial eradication efforts, including handling of vegetative debris, and the recommended measures for the subsequent control of invasive and nuisance plant species.

The USACE will be responsible for the initial eradication of invasive and nuisance plants as well as for any subsequent eradication efforts until such time that the mitigation project is transferred to the Sponsor. Thereafter, the Sponsor will be responsible for the successful control and eradication of invasive and nuisance plant species. The management objectives will be to maintain the mitigation site such that it is essentially free from invasive and nuisance plant species immediately following a given maintenance event and such that the total vegetative cover accounted for by invasive and nuisance species each constitute less than 5% of the total plant cover during periods between maintenance events.

GUIDELINES FOR CLEARING, GRADING, AND OTHER EARTHWORK ACTIVITIES

Enhancement or restoration activities in certain mitigation areas where the proposed habitat is BLH or swamp may include alterations to existing topography. This includes an array of potential actions such as lowering grades over relatively large areas, breaching or removal of existing berms and spoil banks, filling of drainage canals and ditches, construction of containment berms, etc. The construction process could involve mechanized clearing and grubbing of the areas to be graded followed by the actual grading work.

Prior to the clearing, grubbing, grading, and related earthwork activities, the exact limits of zones requiring clearing and grading/earthwork will be determined in the field and will be marked with protective barriers such as flagging, ropes, stakes, silt fence, enviro-fence, or a combination of such items. These marker barriers will remain in place until grading activities are completed. Prior to initiation of the clearing and grading/earthwork activities, silt fences will also be installed at appropriate locations adjacent to existing wetlands to control erosion and sediment transport. These erosion/sediment control devices will remain in place until earthwork activities are completed and the disturbed areas are stabilized. Machinery/vehicle ingress and egress routes to the areas requiring earthwork will be restricted to avoid unnecessary damage to nearby upland and wetland areas.

Cleared vegetation will be removed from the mitigation site for disposal either within a duly licensed off-site disposal facility, or will be burned on-site if practicable. Soil removed during the grading/earthwork process will either be disposed off-site in a licensed facility or used within the mitigation site as fill if the material is suitable and fill is needed. All other debris generated during the clearing and grading process will be disposed in a duly-licensed off-site facility.

If grading or other earthwork activities are necessary, the Mitigation Work Plan must include detailed plans depicting the required activities (ex. grading contours, cross-sections, stormwater pollution prevention plans, etc.). These plans will be developed by the USACE in coordination with the Interagency Team. The USACE will be responsible for the successful completion of all initial earthwork activities. The Sponsor will be responsible for any subsequent earthwork activities necessary for the proper maintenance of the mitigation site. However if the primary purpose of the initial grading/earthwork activities is to enhance site hydrology, then the USACE will be responsible for conducting any additional grading/earthwork activities necessary to ensure the hydrologic enhancement objectives (success criteria) are achieved. Once it is demonstrated that these objectives have been satisfied, the Sponsor will then be responsible for any further earthwork activities needed to ensure proper maintenance.

The construction of all proposed marsh habitats (fresh, intermediate, and brackish marshes) and the construction of some BLH restoration and swamp restoration features will be achieved by adding fill to existing open water areas. The Mitigation Work Plan for such construction must include a detailed Stormwater Pollution Prevention Plan that minimizes potential impacts to adjacent natural habitats and minimizes degradation of water quality in off-site areas. The USACE will be responsible for preparation of this plan and for the successful completion of all initial construction activities. Once the applicable topographic success criteria have been achieved, the Sponsor will thereafter be responsible for any topographic alterations necessary to achieve mitigation success.

GUIDELINES FOR SURFACE WATER MANAGEMENT FEATURES AND STRUCTURES

Enhancement or restoration efforts in some mitigation areas may include construction of surface water management systems and/or installation of water conveyance or water control structures (ex. drainage culverts, flap gates, weirs). If such actions are necessary, the Mitigation Work Plan must include detailed plans for these activities as well as operational specifications if applicable. These plans and specifications will be developed by the USACE in coordination with the Interagency Team. The USACE will be responsible for the successful construction of any surface water management features, drainage structures, and water control structures. The Sponsor will be responsible for the subsequent maintenance and operation activities required.

It is noted that there is a strong preference for mitigation sites that are self-sustaining from a hydrologic perspective. While active water management might be needed in the short-term for establishment of plantings or other reasons, sites that require active hydrologic management to achieve long-term success should generally be avoided.

SWAMP HYDROLOGY GUIDELINES

The optimal hydrologic regime for baldcypress/tupelogum swamps involves both seasonal flooding and good surface water exchange between a particular swamp and adjacent systems. The typical hydroperiod should include several periods of flooding (inundation) and drawdown, or a “pulsing” hydrology. Surface water should be present for extended periods, especially during portions of the growing season, but should be absent (water table at or below the soil surface) by the end of the growing season in most years. At a minimum, standing surface water should be absent for approximately 2 months during the growing season once every 5 years. Abundant and consistent freshwater input from riverine systems is most desirable, as is relatively consistent surface water flow through the swamp during flooded periods. However, other sources of sheetflow into the swamp can be similarly beneficial. The main objective is to have sufficient surface water exchange between the swamp and adjacent habitats. Situations involving permanent flooding and/or no surface water exchange should be avoided when possible.

The following provides some general hydrologic guidelines for mitigation projects involving swamp restoration and for those mitigation projects involving swamp enhancement where enhancement of the existing hydrologic regime is a component of the mitigation work program. It is emphasized that these are merely guidelines and the attainment of one or more of these guidelines may not be possible in some situations.

- Strive for a minimum of about 200 consecutive days but no more than roughly 300 consecutive days of inundation (flooding). This period of inundation should overlap a portion of the growing season (preferably the early portion or late portion).
- Strive for a minimum of roughly 40 to 60 consecutive days during the growing season where the water table is at or below the soil surface (i.e. non-inundated period). This non-inundated period should preferably occur during the middle portion of the growing season. The non-inundated period should not exceed approximately 90 to 120 days.
- Strive to achieve an average maximum (peak) water table elevation that ranges between approximately 1.0 feet to 2.0 feet above the soil surface (i.e. depth of average peak inundation is 1.0 to 2.0 feet). Water table elevations greater than 2 feet above the soil surface may occur, however such occurrences should be of relatively short duration (i.e. brief “spikes” in the depth of inundation).

- Locate the mitigation area such that it naturally receives freshwater inputs via surface flow from adjacent lands and such that, during periods of inundation, there is good sheet flow through the mitigation area including a means for surface water discharge from the mitigation area. If the mitigation area cannot be located to attain these goals naturally, then mitigation activities should include actions to achieve these goals to the greatest degree practicable (e.g. include measures to provide for good surface water exchange between the swamp and adjacent systems), while at the same time not jeopardizing hydrology objectives pertaining to the swamp's hydroperiod.

WET BOTTOMLAND HARDWOOD HYDROLOGY GUIDELINES

The optimal hydrologic regime for wet bottomland hardwood (BLH) forests also involves both brief seasonal flooding and sufficient surface water exchange between the forest and adjacent systems. Wet BLH forests (BLH-Wet habitats) are commonly flooded for some portion of the year, although the timing, extent, depth, duration, and source of floodwaters can be highly variable. The hydroperiod commonly includes temporary flooding for brief periods during the growing season; however the water table is typically below the soil surface for the majority of the growing season. When flooding (inundation) does occur, freshwater input from riverine systems is most desirable as is relatively consistent surface water flow through the forest. Having good surface water exchange between the BLH forest and adjacent habitats is the primary objective, thus other sources of sheetflow into the forest besides riverine sources can be similarly beneficial.

The following provides some general hydrologic guidelines for mitigation projects involving BLH-Wet habitat restoration and for those mitigation projects involving BLH-Wet habitat enhancement where enhancement of the existing hydrologic regime is a component of the mitigation work program. These are simply guidelines and the attainment of one or more of these guidelines may not be possible in some situations.

- Avoid extended periods of inundation, particularly during the early portion of the growing season. Brief periods of flooding typically should occur during the winter and early spring, but the water table should be greater than 1 foot below the soil surface for an extended period during the growing season.
- The hydroperiod should be such that the forest is irregularly inundated or soils are saturated to the soil surface for a period ranging from approximately 15 to 30 days during the growing season.
- Locate the mitigation area such that it naturally receives occasional freshwater inputs via surface flow from adjacent lands and such that, during periods of inundation, there is good sheet flow through the mitigation area including a means for surface water discharge from the mitigation area. If the mitigation area cannot be located to attain these goals naturally, then mitigation activities should include actions to achieve these goals to the greatest degree practicable (e.g. include measures to provide for good surface water exchange between the BLH forest and adjacent systems), while at the same time not jeopardizing hydrology objectives pertaining to the forest's hydroperiod.

MITIGATION SUCCESS CRITERIA AND MITIGATION MONITORING:
BOTTOMLAND HARDWOOD MITIGATION FEATURES (BLH-Wet and BLH-Dry)

MITIGATION SUCCESS CRITERIA

The success (performance) criteria described herein are applicable to both proposed BLH-Wet habitats and BLH-Dry habitats, unless otherwise indicated.

1. General Construction

A. As applicable, complete all necessary initial earthwork and related construction activities in Mitigation TY1 (2014). The necessary activities will vary with the mitigation site. Examples include, but are not limited to: clearing, grubbing, and grading activities; construction of new water management features (weirs, flap-gates, diversion ditches, etc.); modifications/alterations to existing water control structures and surface water management systems; construction of perimeter containment dikes and installation of fill (dredged sediments or other soil).

B. For mitigation features established in existing open water areas, complete all final construction activities in Mitigation TY2 (2015). The necessary activities will vary with the mitigation site. Examples include, but are not limited to: degrading or "gapping" of perimeter retention dikes; construction of water management structures (weirs, etc.).

2. Native Vegetation

A. Complete initial planting of canopy and midstory species.

B. 1 Year Following Completion of Initial Plantings (at end of first growing season following plantings) –

- Achieve a minimum average survival of 50% of planted canopy species (i.e. achieve a minimum average canopy species density of 269 seedlings/ac.). The surviving plants must approximate the species composition and the species percentages specified in the initial plantings component of the Mitigation Work Plan. These criteria will apply to the initial plantings as well as any subsequent replantings necessary to achieve this initial success requirement.
- Achieve a minimum average survival of 85% of planted midstory species (i.e. achieve a minimum average midstory species density of 93 seedlings/ac.). The surviving plants must approximate the species composition percentages specified in the initial plantings component of the Mitigation Work Plan. These criteria will apply to the initial plantings as well as any subsequent replantings necessary to achieve this initial success requirement.

C. 4 Years Following Completion of Initial Plantings –

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

D. Within 10 Years Following Completion of Initial Plantings –

- Attain a minimum average cover of 80% by planted canopy species and/or naturally recruited native canopy species. This criterion will thereafter remain in effect for the duration of the overall monitoring period.

E. 15 Years Following Completion of Initial Plantings –

- Achieve a minimum average density of 75 living native plants per acre in the midstory stratum (planted midstory and/or naturally recruited native midstory species).

F. 25 Years Following Completion of Initial Plantings –

- Average cover by native species in the midstory stratum must be greater than 20% but cannot exceed 50%. This criterion will thereafter remain in effect for the duration of the overall monitoring period.
- Average cover by native species in the understory stratum must be greater than 30% but cannot exceed 60%. This criterion will thereafter remain in effect for the duration of the overall monitoring period.

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

3. Invasive and Nuisance Vegetation

A. Complete the initial eradication of invasive and nuisance plant species.

B. Maintain all areas such that they are essentially free from invasive and nuisance plant species immediately following a given maintenance event and such that the total vegetative cover accounted for by invasive and nuisance species each constitute less than 5% of the total plant cover during periods between maintenance events. Note -These criteria must be satisfied throughout the duration of the overall monitoring period.

4. Topography

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

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

5. Thinning of Native Vegetation (Timber Management)

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

6. Hydrology (applicable to BLH-Wet habitats only)

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

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

MITIGATION MONITORING GUIDELINES

The following guidelines for mitigation monitoring and reporting are applicable to both BLH-Wet and BLH-Dry habitats unless otherwise indicated.

“Time Zero” Monitoring Report

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

- A detailed discussion of all mitigation activities completed.

- A description of the various features and habitats within the mitigation site.

- A plan view drawing of the mitigation site showing the approximate boundaries of different mitigation features (ex. planted areas, areas only involving eradication of invasive and nuisance plant species; surface water management features, etc.), monitoring transect locations, sampling plot locations, photo station locations, and, if applicable, piezometer and staff gage locations.

- An as-built survey of finished grades for any relatively large areas subject to topographic alterations and an as-built survey of any surface water drainage features, drainage culverts, and/or water control structures constructed. Detailed surveys of topographic alterations simply involving the removal of existing linear features such as berms/spoil banks, or involving the filling of existing linear ditches or canals, will not be required. However, the as-built survey will include spot cross-sections of such features sufficient to represent typical conditions. The as-built survey must include a survey of areas where existing berms, spoil banks, or levees have been breached in sporadic locations. For mitigation areas involving habitat restoration in existing open water areas, the as-built survey must include a topographic survey of the entire restoration feature.

- A detailed inventory of all canopy and midstory species planted, including the number of each species planted and the stock size planted. In addition, provide a breakdown itemization indicating the number of each species planted in a particular portion of the mitigation site and correlate this itemization to the various areas depicted on the plan view drawing of the mitigation site.

<u>Additional Monitoring Reports</u>

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

- A plan view drawing of the mitigation site showing the approximate boundaries of different mitigation features (ex. planted areas, areas only involving eradication of invasive and nuisance plant species; surface water management features, etc.), monitoring transect locations, sampling plot locations, photo station locations, and, if applicable, piezometer and staff gage locations.

- A brief description of maintenance and/or management and/or mitigation work performed since the previous monitoring report along with a discussion of any other significant occurrences.

- Photographs documenting conditions in the mitigation site at the time of monitoring. Photos will be taken at permanent photo stations within the mitigation site. At least two photos will be taken at each station with the view of each photo always oriented in the same general direction from one monitoring event to the next. The number of photo stations required as well as the locations of these stations will vary depending on the mitigation site. The USACE will make this determination in coordination with the Interagency Team and will specify the requirements in the Mitigation Monitoring Plan. For mitigation features involving habitat enhancement rather than restoration, the permanent photo stations will primarily be established in areas slated for planting of canopy and midstory species, but some may also be located in areas where plantings are not needed.

- Quantitative plant data collected from permanent monitoring plots measuring approximately 90 feet X 90 feet in size or from circular plots having a radius of approximately 53 feet. Data recorded in each plot will include: number of living planted canopy species present and the species composition; number of living planted midstory species present and the species composition; average density of all native species in the canopy stratum, the total number of each species present, and the wetland indicator status of each species; average cover by native species in the canopy stratum; average density of all native species in the midstory stratum, the total number of each species present, and the wetland indicator status of each species; average cover by native species in the midstory stratum; average percent cover accounted for by invasive plant species (all vegetative strata combined); average percent cover accounted for by nuisance plant species (all vegetative strata combined). The permanent monitoring plots will be located within mitigation areas where initial planting of canopy and midstory species is necessary. The number of plots required as well as the locations of these plots will vary depending on the mitigation site. The USACE will make this determination in coordination with the Interagency Team and will specify the requirements in the Mitigation Monitoring Plan. Typically there will be at least one monitoring plot for every 20 acres planted.

- Quantitative plant data collected from either: (1) permanent transects sampled using the point-centered quarter method with a minimum of 20 sampling points established along the course of each transect, or; (2) permanent belt transects approximately 50 feet wide. The number of transects necessary as well as the location and length of each transect will vary depending on the mitigation site. The USACE will make this determination in coordination with the Interagency Team and will specify the requirements in the Mitigation Monitoring Plan. Data recorded from the sampling transects will include: average density of living planted canopy species present and the species composition; average density of living planted midstory species present and the species composition; average density of all native species in the canopy stratum along with the species composition and the wetland indicator status of each species; average percent cover by all native species in the canopy stratum; average height of native species in the canopy stratum; average density of native species in the midstory stratum, the total number of each species present, and the wetland indicator status of each species; average percent cover by native species in the midstory stratum; average height of native species in the midstory stratum; if present, average percent cover accounted for by invasive and nuisance species present in the canopy and midstory strata (combined).

- Quantitative data concerning plants in the understory (ground cover) stratum and concerning invasive and nuisance plant species will be gathered from sampling quadrats. These sampling quadrats will be established either along the axis of the belt transects discussed above, or at sampling points established along point-centered quarter transects discussed above, depending on which sampling method is used. Each sampling quadrat will be approximately 2 meters X 2 meters in size. The total number of sampling quadrats needed along each sampling transect will be determined by the USACE with the Interagency Team and will be specified in the Mitigation Monitoring Plan. Data recorded from the sampling quadrats will include: average percent cover by native subcanopy species; composition of native subcanopy species and the wetland indicator status of each species; average percent cover by invasive plant species; average percent cover by nuisance plant species.

- For BLH-Wet habitats only -- A summary of rainfall data collected during the year preceding the monitoring report based on rainfall data recorded at a station located on or in close proximity to the mitigation site. Once all hydrology success criteria have been achieved, collection and reporting of rainfall data will no longer be required.

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

- Various qualitative observations will be made in the mitigation site to help assess the status and success of mitigation and maintenance activities. These observations will include: general estimates of the average percent cover by native plant species in the canopy, midstory, and understory strata; general estimate of the average percent cover by invasive and nuisance plant species; general estimates concerning the growth of planted canopy and midstory species; general observations concerning the colonization by volunteer native plant species. General observations made during the course of monitoring will also address potential problem zones, general condition of native vegetation, trends in the composition of the plant communities, wildlife utilization as observed during monitoring, and other pertinent factors.

- For mitigation features restored from existing open water areas, provide an as-built topographic survey of all such mitigation features in the year immediately following the “time zero” monitoring event. No additional topographic surveys will typically be required following this second survey. However if the second survey indicates topographic success criteria have not been achieved and supplemental topographic alterations are necessary, then another topographic survey may be required following completion of the supplemental alterations. This determination will be made by USACE in coordination with the Interagency Team.

- Rectified aerial photographs of all mitigation features. This aerial photography will only be provided in the following monitoring reports: (a) The monitoring report prepared for monitoring conducted in the year immediately preceding the year the mitigation project is transferred to the Sponsor; (b) The monitoring report prepared for monitoring conducted approximately 15 years following completion of initial plantings.

- A summary assessment of all data and observations along with recommendations as to actions necessary to help meet mitigation and management/maintenance goals and mitigation success criteria.

- A brief description of anticipated maintenance/management work to be conducted during the period from the current monitoring report to the next monitoring report.

Monitoring Reports Involving Timber Management Activities

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

Monitoring Reports Following Re-Planting Activities

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

MITIGATION MONITORING SCHEDULE AND RESPONSIBILITIES

Monitoring will typically take place in late summer of the year of monitoring, but may be delayed until later in the growing season due to site conditions or other unforeseen circumstances. Monitoring reports will be submitted by December 31 of each year of monitoring. Monitoring reports will be provided to the USACE, the Sponsor, and the agencies comprising the Interagency Team.

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

1. General Construction – 1.A or 1.B, as applicable.
2. Native Vegetation – A and B.
3. Invasive & Nuisance Vegetation – A, plus B until such time as project is transferred to the Sponsor.

4. Topography – A, as applicable, or B, as applicable.

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

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

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

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

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

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

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

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

MITIGATION SUCCESS CRITERIA AND MITIGATION MONITORING:
SWAMP MITIGATION FEATURES

MITIGATION SUCCESS CRITERIA

The success criteria specified herein apply to both swamp restoration projects and swamp enhancement projects unless otherwise indicated.

1. General Construction

A. As applicable, complete all necessary initial earthwork and related construction activities in Mitigation TY1 (2014). The necessary activities will vary with the mitigation site. Examples include, but are not limited to: clearing, grubbing, and grading activities; construction of new water management features (weirs, flap-gates, diversion ditches, etc.); modifications/alterations to existing water control structures and surface water management systems; construction of perimeter containment dikes and installation of fill (dredged sediments or other soil).

B. For mitigation features established in existing open water areas, complete all final construction activities in Mitigation TY2 (2015). The necessary activities will vary with the mitigation site. Examples include, but are not limited to: degrading or "gapping" of perimeter retention dikes; construction of water management structures (weirs, etc.).

2. Native Vegetation

A. Complete initial planting of canopy and midstory species.

B. 1 Year Following Completion of Initial Plantings (at end of first growing season following plantings) –
- Achieve a minimum average survival of 50% of planted canopy species (i.e. achieve a minimum average canopy species density of 269 seedlings/ac.). The surviving plants must approximate the species composition and the species percentages specified in the initial plantings component of the Mitigation Work Plan. These criteria will apply to the initial plantings as well as any subsequent replantings necessary to achieve this initial success requirement.
- Achieve a minimum average survival of 85% of planted midstory species (i.e. achieve a minimum average midstory species density of 93 seedlings/ac.). The surviving plants must approximate the species composition percentages specified in the initial plantings component of the Mitigation Work Plan. These criteria will apply to the initial plantings as well as any subsequent replantings necessary to achieve this initial success requirement.

C. 4 Years Following Completion of Initial Plantings –
- Achieve a minimum average density of 250 living native canopy species per acre (planted trees and/or naturally recruited native canopy species).
- Achieve a minimum average density of 125 living baldcypress trees (planted trees and/or naturally recruited native canopy species). The species composition of the additional native canopy species present must be generally consistent with the planted ratios for such species.
- Achieve a minimum average density of 85 living native midstory species per acre (planted midstory and/or naturally recruited native midstory species).
- Demonstrate that vegetation satisfies USACE hydrophytic vegetation criteria. This criterion will thereafter remain in effect for the duration of the overall monitoring period.

D. Within 15 Years Following Completion of Initial Plantings –
- Achieve one of the two following vegetative cover requirements:
  1. The average percent cover by native species in the canopy stratum is at least 50%, <u>and</u>; the average percent cover by native species in the midstory stratum exceeds 33%, <u>and</u>; the average percent cover by native species in the ground cover stratum (herbaceous cover) exceeds 33%.

2. The average percent cover by native species in the canopy stratum is at least 75%, and: (a) the average percent cover by native species in the midstory stratum exceeds 33%, or; (b) the average percent cover by native species in the ground cover stratum (herbaceous cover) exceeds 33%.

E. Within 45 Years Following Completion of Initial Plantings –

- Demonstrate that the average diameter at breast height (DBH) of living baldcypress trees exceeds 10 inches. This criterion will thereafter remain in effect for the duration of the overall monitoring period.
- Demonstrate that the average DBH of the other living native trees in the canopy stratum (trees other than baldcypress) exceeds 12 inches. This criterion will thereafter remain in effect for the duration of the overall monitoring period.
- Demonstrate that the average total basal area accounted for by all living native trees in the canopy stratum combined exceeds approximately 161 square feet per acre. This criterion will thereafter remain in effect for the duration of the overall monitoring period.

F. 45 Years Following Completion of Initial Plantings –

- Demonstrate that a minimum of 160 living native trees remain in the canopy stratum.
- Demonstrate that either success criteria D.1 or D.2 above have been maintained.

Note: The above requirements may need to be modified later due to factors such as the effects of sea level rise or salinity on vegetative cover. Proposed modifications must first be approved by the USACE in coordination with the Interagency Team.

3. Invasive and Nuisance Vegetation

A. Complete the initial eradication of invasive and nuisance plant species.

B. Maintain all areas such that they are essentially free from invasive and nuisance plant species immediately following a given maintenance event and such that the total vegetative cover accounted for by invasive and nuisance species each constitute less than 5% of the total plant cover during periods between maintenance events. These criteria must be satisfied throughout the duration of the overall monitoring period.

4. Topography

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

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

5. Thinning of Native Vegetation (Timber Management)

The USACE, in cooperation with the Interagency Team, may determine that thinning of the canopy and/or midstory strata is warranted to maintain or enhance the ecological value of the site. This determination will likely be made after it is demonstrated that the average total basal area accounted for by living native canopy species exceeds 170 square feet per acre. If it is decided that timber management efforts are necessary, the Sponsor will develop a Timber Stand Improvement/Timber Management Plan in coordination with the USACE and Interagency Team. Following approval of the plan, the Sponsor will perform the necessary thinning operations and will demonstrate the successful completion of these operations. Timber management activities will only be allowed for the purposes of ecological enhancement of the mitigation site.

6. Hydrology

The following applies to mitigation features involving swamp restoration and to those involving swamp enhancement where hydrologic enhancement is a component of the mitigation program.

A. In a year having essentially normal rainfall, demonstrate compliance with each of the following criteria:

- Achieve inundation of the majority of the mitigation area for a minimum of 200 consecutive days but for no more than approximately 300 consecutive days, preferably with periods of inundation overlapping a portion of the growing season.
- Achieve non-inundation of the majority of the mitigation (water table at or below the soil surface) for a minimum of approximately 60 consecutive days but for no more than approximately 90 consecutive days, preferably during the period from June through August.
- The average maximum (peak) water table elevation must range between approximately 1.0 feet to 2.0 feet above the soil surface.

Note: The specific mitigation work program generated for the mitigation area may include deviations from one or more of the above criteria to better reflect the desired wetland hydroperiod. Such deviations must be approved by the USACE in coordination with the Interagency Team, and would supersede the above criteria once approved.

The following applies to swamp enhancement mitigation areas where hydrologic enhancement is not a component of the mitigation program.

B. In a year having essentially normal rainfall, demonstrate that the water table is less than or equal to 12 inches below the soil surface for a period of at least 14 consecutive days.

MITIGATION MONITORING GUIDELINES

"Time Zero" Monitoring Report

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

- A detailed discussion of all mitigation activities completed.

- A description of the various features and habitats within the mitigation site.

- A plan view drawing of the mitigation site showing the approximate boundaries of different mitigation features (ex. planted areas, areas only involving eradication of invasive and nuisance plant species; surface water management features, etc.), monitoring transect locations, sampling plot locations, photo station locations, and piezometer and staff gage locations.

- An as-built survey of finished grades for any relatively large areas subject to topographic alterations and an as-built survey of any surface water drainage features, drainage culverts, and/or water control structures constructed. Detailed surveys of topographic alterations simply involving the removal of existing linear features such as berms/spoil banks, or involving the filling of existing linear ditches or canals, will not be required. However, the as-built survey will include spot cross-sections of such features sufficient to represent typical conditions. The as-built survey must include a survey of areas where existing berms, spoil banks, or levees have been breached in sporadic locations. For mitigation features involving habitat restoration in existing open water areas, the as-built survey must include a topographic survey of the entire restoration feature.

- A detailed inventory of all canopy and midstory species planted, including the number of each species planted and the stock size planted. In addition, provide a breakdown itemization indicating the number of each species planted in a particular portion of the mitigation site and correlate this itemization to the various areas depicted on the plan view drawing of the mitigation site.

Additional Monitoring Reports

All monitoring reports generated after the initial "time zero" report will provide the following information unless otherwise noted:

- A plan view drawing of the mitigation site showing the approximate boundaries of different mitigation features (ex. planted areas, areas only involving eradication of invasive and nuisance plant species; surface water management features, etc.), monitoring transect locations, sampling plot locations, photo station locations, and piezometer and staff gage locations.

- A brief description of maintenance and/or management and/or mitigation work performed since the previous monitoring report along with a discussion of any other significant occurrences.

- Photographs documenting conditions in the mitigation site at the time of monitoring. Photos will be taken at permanent photo stations within the mitigation site. At least two photos will be taken at each station with the view of each photo always oriented in the same general direction from one monitoring event to the next. The number of photo stations required as well as the locations of these stations will vary depending on the mitigation site. The USACE will make this determination in coordination with the Interagency Team and will specify the requirements in the Mitigation Monitoring Plan. Permanent photo stations will primarily be established in areas slated for planting of canopy and midstory species. For mitigation involving swamp enhancement, some photo stations may also be located in areas where plantings are not needed.

- Quantitative plant data collected from permanent monitoring plots measuring approximately 80 feet X 80 feet in size. Data recorded in each plot will include: number of living planted canopy species present and the species composition; number of living planted midstory species present and the species composition; average density of all native species in the canopy stratum, the total number of each species present, and the wetland indicator status of each species; average percent cover by native species in the canopy stratum; average density of all native species in the midstory stratum, the total number of each species present, and the wetland indicator status of each species; average percent cover by native species in the midstory stratum; average percent cover accounted for by invasive plant species (all vegetative strata combined); average percent cover accounted for by nuisance plant species (all vegetative strata combined). In addition to these data, the following information will be recorded for native tree species in the canopy stratum: the average diameter at breast height (DBH; expressed in inches) of baldcypress trees; average DBH of all other native tree species excluding baldcypress; the average total basal area of living native trees (expressed in square feet per acre). The DBH of planted canopy species will not need to be documented until the average DBH of these trees reaches approximately 2 inches. Total basal area data will also not need to be documented until such time that the average total basal area is estimated to exceed approximately 100 square feet per acre. The permanent monitoring plots will typically be located within mitigation areas where initial planting of canopy and midstory species is necessary. The number of plots required as well as the locations of these plots will vary depending on the mitigation site. The USACE will make this determination in coordination with the Interagency Team and will specify the requirements in the Mitigation Monitoring Plan.

- Quantitative data concerning plants in the understory (ground cover) stratum and concerning invasive and nuisance plant species will be gathered from permanent sampling quadrats nested within the permanent monitoring plots described above. There will be a total of 4 quadrats with each quadrat measuring approximately 2 meters X 2 meters in size. Data recorded from the sampling quadrats will include: average percent cover by native ground cover species; composition of native ground cover species and the wetland indicator status of each species; average percent cover by invasive plant species; average percent cover by nuisance plant species.

- Quantitative plant data collected from either: (1) permanent transects sampled using the point-centered quarter method with a minimum of 20 sampling points established along the course of each transect, or; (2) permanent belt transects approximately 50 feet wide. The number of transects necessary as well as the location and length of each transect will vary depending on the mitigation site. The USACE will make this determination in coordination with the Interagency Team and will specify the requirements in the Mitigation Monitoring Plan. Data recorded from the sampling transects will include: average density of living planted canopy species present and the species composition; average density of living planted midstory species present and the species composition; average density of all native species in the canopy stratum along with the species composition and the wetland indicator status of each species; average percent cover by all native species in the canopy stratum; average density of native species in the midstory stratum, the total number of each species present, and the wetland indicator status of each species; average percent cover by native species in the midstory stratum; if present, average percent cover accounted for by invasive and nuisance species present in the canopy and midstory strata (combined). In addition to these data, the following information will be recorded for native tree species in the canopy stratum: the average diameter at breast height (DBH; expressed in inches) of baldcypress trees; average DBH of all other native tree species excluding baldcypress; the average total basal area of living native trees (expressed in square feet per acre). The DBH of planted canopy species will not need to be documented until the average DBH of these trees reaches approximately 2 inches. Total basal area data will also not need to be documented until such time that the average total basal area is estimated to exceed approximately 100 square feet per acre.

- Quantitative data concerning plants in the understory (ground cover) stratum and concerning invasive and nuisance plant species will be gathered from sampling quadrats. These sampling quadrats will be established either along the axis of the belt transects discussed above, or at sampling points established along point-centered quarter transects discussed above, depending on which sampling method is used. Each sampling quadrat will be approximately 2 meters X 2 meters in size. The total number of sampling quadrats needed along each sampling transect will be determined by the USACE with the Interagency Team and will specify be specified in the Mitigation Monitoring Plan. Data recorded from the sampling quadrats will include: average percent cover by native ground cover species; composition of native ground cover species and the wetland indicator status of each species; average percent cover by invasive plant species; average percent cover by nuisance plant species.

- A summary of rainfall data collected during the year preceding the monitoring report based on rainfall data recorded at a station located on or in close proximity to the mitigation site. Once all hydrology success criteria have been achieved, collection and reporting of rainfall data will no longer be required.

- A summary of water table elevation data collected from piezometers coupled with staff gages installed within the mitigation site. The number of piezometers and staff gages required as well as the locations of these devices will vary depending on the mitigation site. The USACE will make this determination in coordination with the Interagency Team and will specify the requirements in the Mitigation Monitoring Plan. Data (water table elevations) will be collected at least bi-weekly throughout the year. For mitigation areas involving swamp enhancement where hydrologic enhancement is not a component of the mitigation program, it may also be necessary to collect water table elevations on a daily basis over the course of 3 to 4 weeks in order to demonstrate that the water table is less than or equal to 12 inches below the soil surface for a period of at least 14 consecutive days during the growing season. Once it is demonstrated that all applicable hydrology success criteria have been satisfied, water table monitoring will no longer be required. However, monitoring reports generated subsequent to the attainment of success criteria will include a general discussion of water levels and hydroperiod based on qualitative observations.

- Various qualitative observations will be made in the mitigation site to help assess the status and success of mitigation and maintenance activities. These observations will include: general estimates of the average percent cover by native plant species in the canopy, midstory, and ground cover strata; general estimate of the average percent cover by invasive and nuisance plant species; general estimates concerning the growth of planted canopy and midstory species; general observations concerning the colonization by volunteer native plant species; general observations regarding the growth of non-planted native species in the canopy and midstory strata. General observations made during the course of monitoring will also address potential problem zones, general condition of native vegetation, trends in the composition of the plant communities, wildlife utilization as observed during monitoring, and other pertinent factors.

- For mitigation features restored from existing open water areas, provide an as-built topographic survey of all such mitigation features in the year immediately following the “time zero” monitoring event. No additional topographic surveys will typically be required following this second survey. However if the second survey indicates topographic success criteria have not been achieved and supplemental topographic alterations are necessary, then another topographic survey may be required following completion of the supplemental alterations. This determination will be made by USACE in coordination with the Interagency Team.

- Rectified aerial photographs of all mitigation features. This aerial photography will only be provided in the following monitoring reports: (a) The monitoring report prepared for monitoring conducted in the year immediately preceding the year the mitigation project is transferred to the Sponsor; (b) The monitoring report prepared for monitoring conducted approximately 15 years following completion of initial plantings.

- A summary assessment of all data and observations along with recommendations as to actions necessary to help meet mitigation and management/maintenance goals and mitigation success criteria.

- A brief description of anticipated maintenance/management work to be conducted during the period from the current monitoring report to the next monitoring report.

Monitoring Reports Involving Timber Management Activities

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

Monitoring Reports Following Re-Planting Activities

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

MITIGATION MONITORING SCHEDULE AND RESPONSIBILITIES

Monitoring will typically take place in late summer of the year of monitoring, but may be delayed until later in the growing season due to site conditions or other unforeseen circumstances. Monitoring reports will be submitted by December 31 of each year of monitoring. Monitoring reports will be provided to the USACE, the Sponsor, and the agencies comprising the Interagency Team.

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

1. General Construction – 1.A or 1.B, as applicable.

2. Native Vegetation – A and B.
3. Invasive & Nuisance Vegetation – A, plus B until such time as project is transferred to the Sponsor.
4. Topography – A, as applicable, or B, as applicable.

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

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

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

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

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

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

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

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

MITIGATION SUCCESS CRITERIA AND MITIGATION MONITORING:
MARSH MITIGATION FEATURES (Fresh, Intermediate, and Brackish Marsh Habitats)

MITIGATION SUCCESS CRITERIA

The success (performance) criteria described herein are applicable to all proposed marsh habitats (fresh marsh, intermediate marsh, and brackish marsh restoration features), unless otherwise indicated.

1. General Construction

A. Within approximately 8 months following the start of mitigation construction, complete all initial mitigation construction activities (e.g. construction of temporary retention/perimeter dikes, placement of fill (borrow material/dredged material) into mitigation site, construction of permanent dikes if applicable, etc.).

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

2. Topography

A. Upon completion of final mitigation construction activities (approximate Target Year 2) –
- Demonstrate that at least 80% of each mitigation feature has a surface elevation that is within 0.5 feet of the desired target surface elevation.

B. 1 Year following completion of final mitigation construction activities (approximate Target Year 3) –
- Demonstrate that at least 80% of the mitigation site has a surface elevation that is within 0.5 feet of the desired target surface elevation.

C. 3 years following completion of final mitigation construction activities (approximate Target Year 5) –
- Demonstrate that at least 90% of the mitigation site has a surface elevation that is within the functional marsh elevation range.

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

3. Native Vegetation

A. For intermediate marsh and brackish marsh restoration features only –
- Complete initial marsh planting in accordance with applicable marsh planting guidelines.

B. For fresh marsh restoration features only; 1 year following completion of final mitigation construction activities:
- Achieve a minimum average cover of 50%, comprised of native herbaceous species.

- Demonstrate that vegetation satisfies USACE hydrophytic vegetation criteria. This criterion will thereafter remain in effect for the duration of the overall monitoring period.

C. For intermediate marsh and brackish marsh restoration features only; 1 year following completion of initial plantings–
- Attain at least 80% survival of planted species, or; Achieve a minimum average cover of 25%, comprised of native herbaceous species (includes planted species and volunteer species).
- Demonstrate that vegetation satisfies USACE hydrophytic vegetation criteria. This criterion will thereafter remain in effect for the duration of the overall monitoring period.

D. For fresh marsh restoration features only; 3 years following completion of final mitigation construction activities:
- Achieve a minimum average cover of 85%, comprised of native herbaceous species.

E. For intermediate marsh and brackish marsh restoration features only; 3 years following completion of initial plantings –
- Achieve a minimum average cover of 75%, comprised of native herbaceous species (includes planted species and volunteer species).

F. For all marsh restoration features (fresh, intermediate, and brackish) –
- For the period beginning 5 years following completion of final mitigation construction activities and continuing through 20 years following completion of final mitigation construction activities, maintain a minimum average cover of 80%, comprised of native herbaceous species.

4. Invasive and Nuisance Vegetation

A. Complete the initial eradication of invasive and nuisance plant species within 1 year of completion of final mitigation construction activities

B. Maintain all areas such that they are essentially free from invasive and nuisance plant species immediately following a given maintenance event and such that the total vegetative cover accounted for by invasive and nuisance species each constitute less than 5% of the total plant cover during periods between maintenance events. These criteria must be satisfied throughout the duration of the overall monitoring period.

MITIGATION MONITORING GUIDELINES

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

"Time Zero" Monitoring Report

The mitigation site will be monitored and a "time zero" or "baseline" monitoring report prepared. Information provided will include the following items:

- A detailed discussion of all mitigation activities completed.

- A plan view drawing of the mitigation site showing the approximate boundaries of the restored marsh features, significant interspersion features established within the marsh features (as applicable), monitoring transect locations, sampling plot locations, photo station locations, and staff gage locations.

- An as-built survey of surface elevations (topographic survey) within each marsh feature, along with an as-built survey of any permanent dikes constructed as part of the marsh restoration features including any "gaps" or "fish dips" established in such dikes. If a particular marsh feature is immediately adjacent to existing marsh habitat, the topographic survey will include spot elevations collected within the existing marsh habitat near the restored marsh feature. In addition to the survey data, an analysis of the data will be provided addressing attainment of topographic success criteria.

- Photographs documenting conditions in each restored marsh feature at the time of monitoring. Photos will be taken at permanent photo stations within the marsh features. At least two photos will be taken at each station with the view of each photo always oriented in the same general direction from one monitoring event to the next. The number of photo stations required as well as the locations of these stations will vary depending on the mitigation site. The USACE will make this determination in coordination with the Interagency Team and will specify the requirements in the Mitigation Monitoring Plan. At a minimum, there will be at least 4 photo stations established within each marsh feature.

- For restored intermediate marsh and brackish marsh features only -- A detailed inventory of all species planted, including the number of each species planted and the stock size planted. For mitigation sites that include more than one restored marsh feature, provide a breakdown itemization indicating the number of each species planted in each marsh and correlate this itemization to the marsh features depicted on the plan view drawing of the mitigation site.

- Water level elevation readings collected at the time of monitoring from a single staff gage installed within one of the restored marsh features. The location of the staff gage will be determined by the USACE in coordination with the Interagency Team during the final design phase of the mitigation project and will be specified in the Mitigation Monitoring Plan. The monitoring report will provide the staff gage data along with mean high and mean low water elevation data as gathered from a tidal elevation recording station in the general vicinity of the mitigation site. The report will further address estimated mean high and mean low water elevations at the mitigation site based on field indicators.

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

- A summary assessment of all data and observations along with recommendations as to actions necessary to help meet mitigation and management/maintenance goals and mitigation success criteria.

- A brief description of anticipated maintenance/management work to be conducted during the period from the current monitoring report to the next monitoring report.

Additional Monitoring Reports

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

- All items listed for the “time zero” (baseline) monitoring report with the exception of: (a) the topographic/as-built survey, although additional topographic/as-built surveys are required for specific monitoring reports (see below); (b) the inventory of planted species; although such an inventory must be provided in any monitoring report generated for a year in which a restored intermediate or brackish marsh feature is re-planted to meet applicable success criteria, and such an inventory must be provided in any monitoring report generated for a year in which a restored fresh marsh feature is planted to meet applicable success criteria.

- Quantitative data concerning plants in the ground cover stratum. Data will be collected from permanent sampling quadrats established at approximately equal intervals along permanent monitoring transects established within each marsh feature. Each sampling quadrat will be approximately 2 meters X 2 meters in size, although the dimensions of each quadrat may be increased if necessary to provide better data in planted marsh features. The number of monitoring transects and number of sampling quadrats per transect will vary depending on the mitigation site. This will be determined the USACE in coordination with the Interagency Team during the final design phase of the mitigation project and the resulting requirements, including quadrat dimensions, will be specified in the final Mitigation Monitoring Plan for the project. Data recorded from the sampling quadrats will include: average percent cover by native plant species; average percent cover by invasive plant species; average percent cover by nuisance plant species; composition of plant species and the wetland indicator status of each species. The average percent survival of planted species (i.e. number of living planted species as a percentage of total number of plants installed) will also be recorded in intermediate and brackish marsh features. However, data for percent survival of planted species will only be recorded until such time as it is demonstrated that success criteria for plant survivorship has been achieved.

- A brief description of maintenance and/or management work performed since the previous monitoring report along with a discussion of any other significant occurrences.

- Rectified aerial photographs of all mitigation features. This aerial photography will only be provided in the monitoring report prepared for monitoring conducted 3 years following completion of mitigation construction activities (estimated TY5).

- In addition to the above items, the monitoring report prepared for 1 year following completion of mitigation construction activities (estimated TY3) and the monitoring report prepared for 3 years following completion of mitigation construction activities (estimated TY5) will include a topographic survey of each marsh restoration feature. These surveys will cover the same components as described for the topographic survey conducted for the "time zero" monitoring report. In addition to the surveys themselves, each of the two monitoring reports involving topographic surveys will include an analysis of the data as regards attainment of applicable topographic success criteria. If the second survey indicates topographic success criteria have not been achieved and supplemental topographic alterations are necessary, then another topographic survey may be required following completion of the supplemental alterations. This determination will be made by USACE in coordination with the Interagency Team.

Monitoring Reports Following Re-Planting Activities in Intermediate or Brackish Marsh Features & Monitoring Reports Following Planting Activities in Fresh Marsh Features

Re-planting of certain areas within restored intermediate and/or brackish marsh habitats may be necessary to ensure attainment of applicable native vegetation success criteria. Planting of herbaceous species within restored fresh marsh features may also be necessary to attain applicable native vegetation success criteria. Any monitoring report submitted following completion of a re-planting event (for intermediate and brackish marshes) and any monitoring report submitted following completion of initial plantings (for fresh marshes) must include an inventory of the number of each species planted and the stock size used. It must also include a depiction of the areas re-planted or those planted, as applicable, cross-referenced to a listing of the species and number of each species planted in each area.

MITIGATION MONITORING SCHEDULE AND RESPONSIBILITIES

Monitoring will typically take place in mid to late summer of the year of monitoring, but may be delayed until later in the growing season due to site conditions or other unforeseen circumstances. Monitoring reports will be submitted by December 31 of each year of monitoring. Monitoring reports will be provided to the USACE, the Sponsor, and the agencies comprising the Interagency Team.

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

1. General Construction – A and B.
2. Topography – A and B.
3. Native Vegetation – For intermediate marsh and brackish marsh features, criteria 3.A and 3.C; for fresh marsh features, criteria 3.B.
4. Invasive & Nuisance Vegetation – A, plus B until such time as project is transferred to the Sponsor.

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

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

In certain cases it is possible that the marsh mitigation features may be established along with other mitigation features, like swamp or bottomland hardwood habitats, at the same mitigation site. This scenario could require some adjustments to the typical monitoring schedule described above in order to develop a reasonable and efficient monitoring schedule that covers all the mitigation features. Such adjustments, if necessary, would be made at the time final mitigation plans are generated. This schedule must be in general accordance with the guidance provided above and will be prepared by the USACE in coordination with the Interagency Team and the Sponsor.

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

(A) For intermediate and brackish marsh features –

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

(B) For fresh marsh features --

- If the initial vegetative cover criterion is not achieved (i.e. the requirement specified in success criteria 3.B), a monitoring report will be required for each consecutive year until two sequential annual reports indicate that the applicable vegetative cover criteria have been satisfied (i.e. that corrective actions were successful). Since failure to meet the success criterion would mandate planting the subject marsh, the USACE would also be responsible for the purchase and installation of the required plants.

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

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

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

(A) For intermediate and brackish marsh features –

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

(B) For fresh marsh features --

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

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

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

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

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

DEFINITION OF TERMS

Certain terms used herein shall have the meaning discussed in the following section.

Interagency Team
The "Interagency Team" consists of representatives from the following resource agencies; US Fish and Wildlife Service, National Marine Fisheries Service, US Environmental Protection Agency, Louisiana Department of Wildlife and Fisheries, State of Louisiana Office of Coastal Protection and Restoration, Louisiana Department of Natural Resources. In cases where proposed mitigation features will be established within Jean Lafitte National Historical Park and Preserve, representatives from the National Park Service would also comprise the Interagency Team.

Sponsor
This term refers to the Non-Federal Sponsor for the mitigation projects.

Target Year
This document often refers to mitigation "target years" or a particular mitigation "target year" (abbreviated "TY"). Target Year 0 (TY0) is the year in which mitigation construction activities are anticipated to commence, which is presently estimated to occur in calendar year 2013. Target years increase from this time forward. Hence, based on construction beginning in 2013, target year 1 (TY1) would be calendar year 2014, target year 2 (TY2) would be calendar year 2015, etc.

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

> Louisiana Aquatic Invasive Species Task Force. 2005. State Management Plan for Aquatic Invasive Species in Louisiana, Appendix B. Invasive Species in Louisiana (plants). Center for Bioenvironmental Research, Tulane & Xavier Universities, New Orleans, LA.
> (Website - http://is.cbr.tulane.edu/docs_IS/LAISMP7.pdf)
>
> U.S. Geological Survey. 2011. NAS – Nonindigenous Aquatic Species, Louisiana.
> Website - http://nas.er.usgs.gov/queries/SpeciesList.aspx?group=Plants&state=LA&Sortby=2

In addition, invasive plant species include; Japanese climbing fern (*Lygodium japonicum*), tall fescue (*Festuca arundinacea*), chinaberry (*Miscanthus sinensis*), Brazil vervain (*Verbena litoralis* var. *brevibrateata*), and rescuegrass (*Bromus catharticus*).

Nuisance Plant Species
Nuisance plant species will include native species deemed detrimental due to their potential adverse competition with desirable native species. Examples of potential nuisance plant species include; dog-fennel (*Eupatorium* spp.), ragweed (*Ambrosia* spp.), cattail (*Typha* spp.), grapevine (*Vitis* spp.), wild balsam apple (*Momordica charantia*), climbing hempvine (*Mikania scandens, M. micrantha*), pepper vine (*Ampelopsis arborea*), common reed (*Phragmites australis*), catbrier (*Smilax* spp.), black willow (*Salix nigra*), and boxelder (*Acer negundo*). The determination of whether a particular plant species should be considered as a nuisance species and therefore eradicated or controlled will be determined by the USACE in coordination with the Interagency Team, based on conditions present within a particular mitigation area.

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

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

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

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

Reed, P. B., Jr. 1988. National List of Plant Species that Occur in Wetlands: 1988 National Summary. Biological Report 88(24). Washington, DC: U.S. Fish and Wildlife Service.
(website - http://www.usace.army.mil/CECW/Documents/cecwo/reg/plants/list88.pdf)

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

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

Point-Centered Quarter Method
A plot-less method of forest sampling. Use of this method will be in general compliance with the applicable methodology described in the following reference:

Cottam, Grant and J. T. Curtis. 1956. The use of distance measures in phytosociological sampling. Ecology, 37(3):451-460.

Piezometer
Typically a small-diameter observation well employed as a means of measuring water elevations in the surficial aquifer (water table elevations). Piezometers used for monitoring purposes should be constructed in general accordance with the following reference, unless otherwise approved by the USACE:

U. S. Army Corps of Engineers. 2005. Technical standard for water-table monitoring of potential wetland sites. ERDC TN-WRAP-05-02. Vicksburg, MS: U.S. Army Engineer Research and Development Center.
(website - http://el.erdc.usace.army.mil/wrap/pdf/tnwrap05-2.pdf)

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

APPENDIX I

COASTAL MARSH MODULE 1.0

APPROVAL FOR USE

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
441 G STREET, NW
WASHINGTON, DC 20314-1000

REPLY TO
ATTENTION OF

CECW-P

28 February 2012

MEMORANDUM FOR Director, National Ecosystem Restoration Planning Center of Expertise (ECO-PCX)

SUBJECT: Wetland Value Assessment Models – Coastal Marsh Module Version 1.0 – Approval for Use

1. The Coastal Marsh Community model is one of seven WVA community models that were developed by the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) Environmental Work Group. Based on information provided by the ECO-PCX, it is the understanding of the HQUSACE Model Certification Panel that this model will be used on the following projects over the next five years:

a. MRGO Ecosystem Restoration
b. Barataria Basin Barrier Shoreline
c. Lake Pontchatrain and Vicinity Hurricane Storm Damage Risk Reduction System (HSDRRS) Mitigation
d. West Bank and Vicinity HSDRRS Mitigation
e. HSDRRS IERS –total number unknown
f. Louisiana Coastal Area (LCA) 4 Davis Pond Modification
g. LCA4 Modification to Caernarvon
h. LCA4 Point Au Fer Island
i. LCA4 Caillou Lake Land Bridge
j. LCA Myrtle Grove
k. LCA White Ditch PED
l. LCA Mississippi River Hydrodynamic and Delta Management
m. LCA Caernarvon
n. Larose to Golden Meadow (LGM) Post-Authorization Change (PAC) Study
o. Larose to Golden Meadow Intracoastal Floodwall Reach 2b (LGM-022C).
p. Larose to Golden Meadow Intracoastal Floodwall Reach 2a (LGM-022B).
q. Larose to Golden Meadow C-North Highway 24 Relocation (LGM-001C).
r. Baptiste Collette Bayou Deepening study
s. Barataria Bay Waterway (CAP 204)
t. Buras Marina (CAP 206)
u. Calcasieu River and Pass (CAP 204)
v. Calcasieu Lock Replacement
w. Morganza to the Gulf PAC
x. Morganza to the Gulf Supplemental NEPA documents –total number unknown
y. Southwest Coastal
z. Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) – West Bay Closure
aa. Houma Navigation Canal Deepening
bb. West Shore Lake Pontchartrain Hurricane & Flood Risk Reduction
cc. LCA Terrebonne Basin Barrier Shoreline Restoration
dd. LCA Demonstration Projects Grand Isle and Vicinity Project
ee. CAP 103 Grand Isle Highway 1 Shoreline Stabilization
ff. Donalsonville to the Gulf
gg. NOV Plaquemines Parish
hh. NFL Plaquemines Parish

2. Version 1.0 of the Coastal Marsh Community model is approved for use for the above projects. This approval for use is based on the decision of the HQUSACE Model Certification Panel which considered the ECO-PCX assessment of the model. Adequate technical reviews have been accomplished and the model meets the certification criteria contained in EC 1105-2-412. As indicated by the ECO-PCX, there are a number of unresolved issues related to the form of suitability graphs for Variables 1, 2 and 3 and the aggregation methods used to combine the marsh habitat units and open water habitat units for each sub-model. To increase the understanding of the sensitivity of the model to the unresolved issues and the impact the model differences may have on decision-making, the ECO-PCX is to work with the project delivery teams to conduct sensitivity analyses for each application of the marsh models. A summary of the sensitivity analyses must be presented in the project documentation and Agency Technical Review teams must be charged with reviewing the adequacy and findings of the sensitivity analyses.

3. It is expected that compiliation of the findings of the multiple sensitivity analyses will lead to updates and improvements of the model. As such, version control is imperative. The PCX must ensure that project delivery teams are are utilizing the most appropriate version of the model for their analyses and that they are properly identifiying the version of the model being used.

APPLICABILITY: This approval for use expires 28 February 2017 and is limited to the above studies with the caveat that updated versions of the model be used if appropriate.

Harry E. Kitch

HARRY E. KITCH, P.E.
Deputy Chief, Planning and Policy Division
Directorate of Civil Works

APPENDIX J

WVA SENSITIVITY ANALYSIS

Reviewers of Version 1.0 of the Coastal Marsh Community WVA model suggested an alternative treatment for the HSIs for three model variables involved in WVA marsh models: Suitability Index Value (SIV)1 - Percent of wetland area covered by emergent vegetation, SIV2 - Percent of open water area covered by aquatic vegetation, and SIV3 - Marsh edge and interspersion. The Ecosystem Restoration Planning Center of Expertise (ECO-PCX) and Mississippi Valley Division (MVD) subsequently contacted the Engineering and Research Development Center (ERDC) Environmental Laboratory (EL) for assistance in resolving several comments relating to the review. The ERDC-EL assessed the sensitivity of the WVA model outputs for the LPV and WBV marsh mitigation projects to the suggested changes in SIV1, SIV2 and SIV3. This assessment is provided in Attachment J-1. New models for each of the proposed marsh mitigation features were run with the alternative suitability curves for SIV1 and SIV2. Values for SIV3 are based on a suitability graph rather that a suitability curve, with a unique suitability index value assigned to each of 5 possible interspersion classes. The assignment of SIVs to a particular marsh mitigation feature under the future with project scenario is a matter of opinion as to how interspersion features within the marsh will develop over time. CWPPRA guidelines provide general directives concerning this issue; directives that were followed in the WVA marsh models run by CEMVN for LPV marsh alternatives. However, different assumptions were used by CEMVN in running the marsh models for WBV marsh alternatives. Given this, ERDC-EL did not assess the sensitivity of the original LPV models as regards SIV3 but did include a sensitivity analysis for SIV3 for the WBV marsh features (i.e. the new models were run using a more typical CWPPRA approach to SIV3).

When ERDC-EL ran the new WVA models using their suggested changes, the resulting output in AAHUs decreased by about 25 percent, on average, for the mitigation features as compared to the output for the previous model runs by CEMVN. One should note, however, that had the approach used by ERDC-EL in running the new models also been used to determine the net loss of AAHUs due to HSDRRS impacts, it is likely that impact AAHUs would have also decreased. It is important that both impacts and corresponding mitigation requirements be calculated using the same methodology; thus, the mitigation outputs calculated using the ERDC-EL approach should not be used unless impacts are re-calculated in the same manner.

ERDC-EL's WVA model sensitivity analysis focused on the net AAHUs generated by the mitigation alternatives (i.e. benefits or outputs). ERDC-EL recommended further comparison based on cost effectiveness (i.e. average annual cost per AAHU generated). This is accomplished in Tables J-1 and J-2.

Table J-1. Derivation of total AAHUs predicted by the new WVA fresh marsh models based on the current mitigation design plans.

Mitigation Alternative	Mitigation Feature ID In WVA	Mitigation Feature ID In Current Design	Acres Used In WVAs	Total AAHUs for New WVAs	Mitigation Potential for New WVAs (AAHUs/ac.)	Acres In Current Design	Total AAHUs per New WVA Mitigation Potentials
Non-Park/404c Fresh Marsh Alternatives							
Dufrene Ponds	M1 (DP5)	DP5	108.32	41.60	0.38	72.60	27.88
	M2 (DP3)	DP3	220.74	84.01	0.38	93.10	35.43
Totals for Dufrene Ponds			**329.06**	**125.61**		**165.70**	**63.31**
Jean Lafitte Marshes	M3 (JL4)	JL4B	376.00	77.06	0.20	129.00	26.44
	M4B (JL1B)	JL1B2	131.30	52.45	0.40	102.70	41.03
Totals for Jean Lafitte Marshes			**507.3**	**129.51**		**231.70**	**67.46**
Plaquemines Alt. 1	M1 (P2)	P2	312.18	95.67	0.31	205.20	62.89
Salvador-Timken	M1 (ST2)	ST2	324.89	84.58	0.26	189.90	49.44
Simoneaux Ponds	M1 (SP1)	SP2	312.52	101.07	0.32	177.90	57.53
Park - Fresh Marsh							
Jean Lafitte	M4B (JL1B)	JL1B1	131.30	52.45	0.40	14.50	5.79

Notes:

- New WVAs = WVA models run by ERDC-EL using CWPPRA approach to variables SIV1, SIV2, and SIV3.
- Mitigation potential for new WVAs = (Net AAHUs produced using new WVA models)/(acres used in WVA models)
- Total AAHUs per new WVA mitigation potentials = (mitigation potential for new WVAs) x (acres of mitigation feature in current design).
- The acreage of mitigation features used in both the original and new WVA models was based on the preliminary 35% design plans for the various mitigation alternatives. The size of the mitigation features used in these preliminary plans was based on an assumed mitigation potential. Once CEMVN ran WVA models based on these plans, the size of the mitigation features was adjusted (resized) based on the actual mitigation potential determined from the CEMVN WVA models. The adjusted mitigation features were those used in the current 35% design plans presented in the EAR.

The function of Table J-1 is to first calculate the total AAHUs generated by a particular mitigation feature based on the new WVA models (e.g. the models run by ERDC-EL) and the actual acreage of the mitigation feature as depicted in the 35% design plans addressed in the EAR. As discussed previously, the original WVA models run by CEMVN (e.g. the "old" or "original" models) were based on preliminary 35% plans. These plans were subsequently revised to be those addressed in the EAR, which resulted in changes to the mitigation feature acreages and to their identification codes (the mitigation feature ID). Since ERDC-EL used the data from the original WVA models to run their new models, the total AAHUS produced by these models were based on mitigation feature acreages that are no longer applicable.

One may note that the sensitivity analysis document (Attachment J-1) addresses three mitigation features contained in the mitigation plan for Jean Lafitte marshes (one of the Non-Park/404c fresh marsh alternatives), while Table J-1 only addresses two mitigation features for the Jean Lafitte marshes alternative. This is because two of the mitigation features contained in the preliminary design plan for this alternative, features M1 and M4A, were deleted in the process of generating the revised design plan addressed in the EAR. Feature M4B evaluated in the old and new WVA models was originally to be a single marsh feature of the Jean Lafitte marshes alternative. It was subsequently determined that there would be impacts to fresh marsh habitats within JLNHPP. Since impacts to habitats within JLNHPP must be mitigated within JLNHPP, it was necessary to develop a new marsh mitigation plan specifically for JLNHPP. A portion of original marsh mitigation feature M4B was used for this purpose while most of the remaining portion was used as one of the marsh features in the Jean Lafitte marshes alternative. The acreage indicated in Table J-1 for mitigation feature JL4B also warrants explanation. In both the preliminary plan and the current plan for the Jean Lafitte marshes alternative, the feature acreage used in the WVAs included the acreage of the feature itself as well as the acreage of the existing marsh habitats landward of the feature that would derive benefits through a reduction in erosion (e.g. proposed marsh feature protects landward area from erosion/land loss).

Table J-2 provides the actual cost effectiveness data for the marsh alternatives based on the new WVA models (models run by ERDC-EL) and original WVA models (models run by CEMVN) and the rankings of the alternatives based on the two WVA model approaches. This allows one to evaluate how changes to variables SIV1, SIV2, and SIV3 affect the ranking of the marsh alternatives based on cost effectiveness.

Table J-2. Comparison of cost effectiveness ranking order using new WVA models vs. original WVA models.

Mitigation Alternative	Average Annual Cost (AAC)	Data Using New WVA Models			Data Using Original WVA Models		
		AAHUs	Cost Effectiveness (AAC/AAHU)	Ranking	AAHUs	Cost Effectiveness (AAC/AAHU)	Ranking
Non-Park/404c Fresh Marsh Alternatives							
Dufrene Ponds (1)	~220% > least cost	63.31	~230% > least cost	7	84.71	~219% > least cost	7
Dufrene Ponds (2)	Least cost	63.31	~3% > least cost	2	84.71	Least cost	1
Jean Lafitte Marshes	~3% > least cost	67.46	Least cost	1	84.72	~3% > least cost	2
Plaquemines Alt. 1	~141% > least cost	62.89	~150% > least cost	5	86.18	~137% > least cost	5
Salvador-Timken	~15% > least cost	49.44	~52% > least cost	4	85.46	~14% > least cost	3
Simoneaux Ponds (3)	~152% > least cost	57.53	~186% > least cost	6	85.39	~150% > least cost	6
Simoneaux Ponds (4)	~30% > least cost	57.53	~48% > least cost	3	85.39	~29% > least cost	4
Park - Fresh Marsh							
Jean Lafitte	-	5.79	~33% > Original cost	N/A	7.69	Least cost	N/A

Notes:

- New WVA Models = WVA fresh marsh models run by ERDC-EL using CWPPRA approach to variables SIV1, SIV2, and SIV3.
- Original WVA Models = WVA fresh marsh models run by CEMVN.
- The marsh mitigation feature proposed as compensation for impacts to fresh marsh habitats in Jean Lafitte National Historical Park and Preserve (e.g. the Park-Fresh Marsh mitigation component listed in the table) cannot be compared to the Non-Park/404c Fresh Marsh Alternatives since this mitigation must be conducted in the park itself. Thus, the cost effectiveness of this mitigation component cannot be ranked.

(1) Dufrene Ponds alternative assuming borrow is obtained from Lake Salvador.

(2) Dufrene Ponds alternative assuming borrow is obtained from Bayou des Allemands.
(3) Simoneaux Ponds alternative assuming borrow is obtained from Lake Salvador.
(4) Simoneaux Ponds alternative assuming borrow is obtained from Bayou des Allemands.

There was no change in the ranking order for the alternatives ranked 5, 6, and 7 (e.g. the three lowest ranked alternatives). The ranking order of the top two alternatives was reversed based on the new WVA models. The ranking order of the third and fourth most cost effective alternatives was also reversed based on the new WVA models. One should note that cost effectiveness is only one of the weighted selection criteria that will be used in the selection of the preferred mitigation plan. Thus, the discrepancies in the cost effectiveness rankings may not significantly influence plan selection.

To assess whether adjustments to the WVA marsh models actually influence the overall selection of the Tentatively Selected Plan (TSP), the PDT will run a sensitivity analysis during the Alternative Evaluation Process using the cost effectiveness rankings based on the outputs of both the original and new WVA model runs. Essentially, the PDT will first determine the TSP using cost effectiveness rankings based on outputs from the original WVA models along with the other selection criteria. The PDT will then apply the cost effectiveness rankings based on outputs from the revised (new) models along with the other selection criteria to determine the TSP. If these two approaches arrive at the same TSP, then no further consideration will be necessary. If these two approaches arrive at two different TSPs, then the PDT will further evaluate the two TSPS to arrive at a single, final TSP.

<u>Update after AEP</u>

Following identification of the tentatively selected mitigation projects (TSMPs) through the AEP process, the revised impacts estimates (based on 95-100% design plans) were revisited and verified by the USFWS, which resulted in further adjustment to the estimated impacts. This revision drove resizing of the mitigation projects and made use of Bayou des Allemands as a borrow source impracticable since not all necessary borrow could be obtained from this site only; additional material would have to be obtained from Lake Salvador. Because of this and in an effort to avoid impacts to this scenic stream, the option to use Bayou des Allemands as a borrow source was dropped and only the use of Lake Salvador for borrow was pursued. A revision to table J-2 showing the loss of these options can be found below in table J-3. With the removal of the two options utilizing Bayou des Allemands as a borrow source, ranking of the projects based on cost effectiveness became the same whether the original or new WVA models were used and no sensitivity analysis was necessary.

Table J-3. Comparison of cost effectiveness ranking order for projects not utilizing Bayou des Allemands as a borrow source.

Mitigation Alternative	Average Annual Cost (AAC)	Data Using New WVA Models			Data Using Original WVA Models		
		AAHUs	Cost Effectivess (AAC/AAHU)	Ranking	AAHUs	Cost Effectiveness (AAC/AAHU)	Ranking
Non-Park/404c Fresh Marsh Alternatives							
Dufrene Ponds (1)	~220% > least cost	63.31	~230% > least cost	5	84.71	~219% > least cost	5
Jean Lafitte Marshes	~3% > least cost	67.46	Least cost	1	84.72	~3% > least cost	1
Plaquemines Alt. 1	~141% > least cost	62.89	~150% > least cost	3	86.18	~137% > least cost	3
Salvador-Timken	~15% > least cost	49.44	~52% > least cost	2	85.46	~14% > least cost	2
Simoneaux Ponds (3)	~152% > least cost	57.53	~186% > least cost	4	85.39	~150% > least cost	4
Park - Fresh Marsh							
Jean Lafitte	-	5.79	~33% > Original cost	N/A	7.69	Least cost	N/A

Notes:
- New WVA Models = WVA fresh marsh models run by ERDC-EL using CWPPRA approach to variables SIV1, SIV2, and SIV3.
- Original WVA Models = WVA fresh marsh models run by CEMVN.
- The marsh mitigation feature proposed as compensation for impacts to fresh marsh habitats in Jean Lafitte National Historical Park and Preserve (e.g. the Park-Fresh Marsh mitigation component listed in the table) cannot be compared to the Non-Park/404c Fresh Marsh Alternatives since this mitigation must be conducted in the park itself. Thus, the cost effectiveness of this mitigation component cannot be ranked.

(1) Dufrene Ponds alternative assuming borrow is obtained from Lake Salvador.
(3) Simoneaux Ponds alternative assuming borrow is obtained from Lake Salvador.

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ATTACHMENT J-1

Analysis of the WVA Model Outputs for the Mitigation of LPV and WBV Projects of the HSDRRS.

J. Kameron Jordan, Bobby McComas and J. Craig Fischenich[1]

Overview

The U.S. Army Corps of Engineers, New Orleans District (CEMVN) must mitigate for impacts associated with Hurricane and Storm Damage Risk Reduction System (HSDRRS) improvements in the Lake Pontchartrain and Vicinity (LPV) and West Bank and Vicinity (WBV) projects. Proposed mitigation to replace lost ecological functions include placement of dredged material to create marsh in areas currently occupied by open water. After screening an array of mitigation options using other criteria, outputs from the Wetlands Value Assessment models (WVA) are being used to select a plan from the final array of alternatives. The CEMVN applied the WVA to assess these alternatives using model input parameters considered appropriate at the time of the model application. Reviewers of the WVA have subsequently suggested an alternative treatment for the habitat suitability indices (HSIs) for three model variables (Suitability Index Value (SIV)1 - Percent of wetland area covered by emergent vegetation, SIV2 - Percent of open water area covered by aquatic vegetation, and SIV3 - Marsh edge and interspersion).

The Engineer Research and Development Center (ERDC) Environmental Laboratory (EL) assessed the sensitivity of the WVA model outputs for the LPV and WBV mitigation projects to the suggested changes in SIV1, SIV2 and SIV3. The treatment of the three variables in the sensitivity analysis for the new model runs was consistent with current application of the WVA to Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) projects. New models for each of the proposed mitigation sites were run with the alternative suitability curves for SIV1 and SIV2. A separate sensitivity analysis was run to assess the effects of SIV3 on the WBV sites (current CWPPRA guidelines were followed for SIV3 on the LPV sites).

The new models generally had lower average annual habitat unit (AAHU) outputs than the old runs conducted by MVN. Mean change in AAHU output was a 25 percent decrease, and ranged from a 3 percent increase to a 45 percent decrease. These new outputs cannot be directly compared to the required mitigation units because impacts were calculated using the “old” guidelines for the treatment of SIV1, SIV2 and (in the case of WBV) SIV3. The new SIV guidance had little effect on the ranking of the mitigation sites based on AAHU outputs; the maximum change in ranking for LPV sites was -2 and for WBV sites was +/- 1 position. Site prioritization could change when considering costs in addition to the revised AAHU outputs, and the sensitivity of the mitigation outputs to the treatment of the suitability curves in the models should be considered as part of the decision process.

Background

The CEMVN uses a suite of community-based ecosystem output models titled Wetlands Value Assessment (WVA) in Louisiana for assessing the functional impacts and benefits of actions affecting coastal habitats. These models were developed collaboratively by the US Fish and Wildlife Services (USFWS), Louisiana Department of Natural Resources (LA DNR), and other interagency groups (e.g. the CWPPRA Environmental Workgroup).

The WVA models were evaluated in accordance with EC 1105-2-407 and the Protocols for Certification of Planning Models (July 2007). Comments were furnished in a document titled “Wetlands Value Assessment (WVA) model, addressing model review comments on the application of WVA on the LCA Barataria Basin

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Barrier Shoreline Restoration Study," dated February 8, 2010. The memorandum identified several concerns regarding model parameters. The Ecosystem Restoration Planning Center of Expertise (ECO-PCX) and Mississippi Valley Division (MVD) subsequently contacted the Engineering and Research Development Center (ERDC) Environmental Laboratory (EL) for assistance resolving several comments relating to that review.

As a consequence of that review and subsequent discussions with the ECO-PCX, MVD, MVN and resource specialists familiar with the WVA and the ecosystems in question, it was determined that future applications of the WVA would employ adjustments to SIV1, SIV2 and SIV3. These adjustments would more closely reflect the original characterization of these model variables and would be consistent with their current treatment in CWRRPA. Figures 1 and 2 show how variables SIV1 and SIV2 were treated in the initial LPV and WBV mitigation models and how they are treated under the revised guidance. The treatment of SIV3 was consistent with current efforts under CWPPRA; carpet marsh was assigned to Class 3 (SI=0.4) instead of Class 1 (SI=1.0) (see Figure 3).

Analysis and Results

The affects of altering SIV1, SIV2, and SIV3 were determined by applying the above adjustments to the model equations to assess the difference in model outputs. To facilitate the analysis and to reduce opportunities for mistakes in data entry, we developed a set of spreadsheets that utilized the existing models as "input templates" for the new models. This allowed us to reference the data input cells of the existing models using the new model equations, and both the "old" and "new" models and results are contained on the same Excel workbook. The revised models are submitted separately with this report for MVN to review and consider. Summary results are presented herein; magnitude of change was quantified in terms of the percent change of the total average annual habitat units (AAHUs), as well as to the emergent marsh and open water habitats. We also assess the effects of the new model outputs on the ranking of alternatives.

Tables 1 through 4 summarize the results of the application of the new HSIs in terms of AAHUs and percent change in net AAHUs relative to the previous model runs by MVN. Percentage differences are as calculated by Equation 1 where the new model reflects the application of HSIs as currently used in CWPPRA, and the old model reflects the HSIs utilized the previous model runs by MVN.

$$\%_{AAHU-change} = \frac{AAHU_{NewModel} - AAHU_{OldModel}}{AAHU_{NewModel}} * 100 \qquad \text{Equation 1}$$

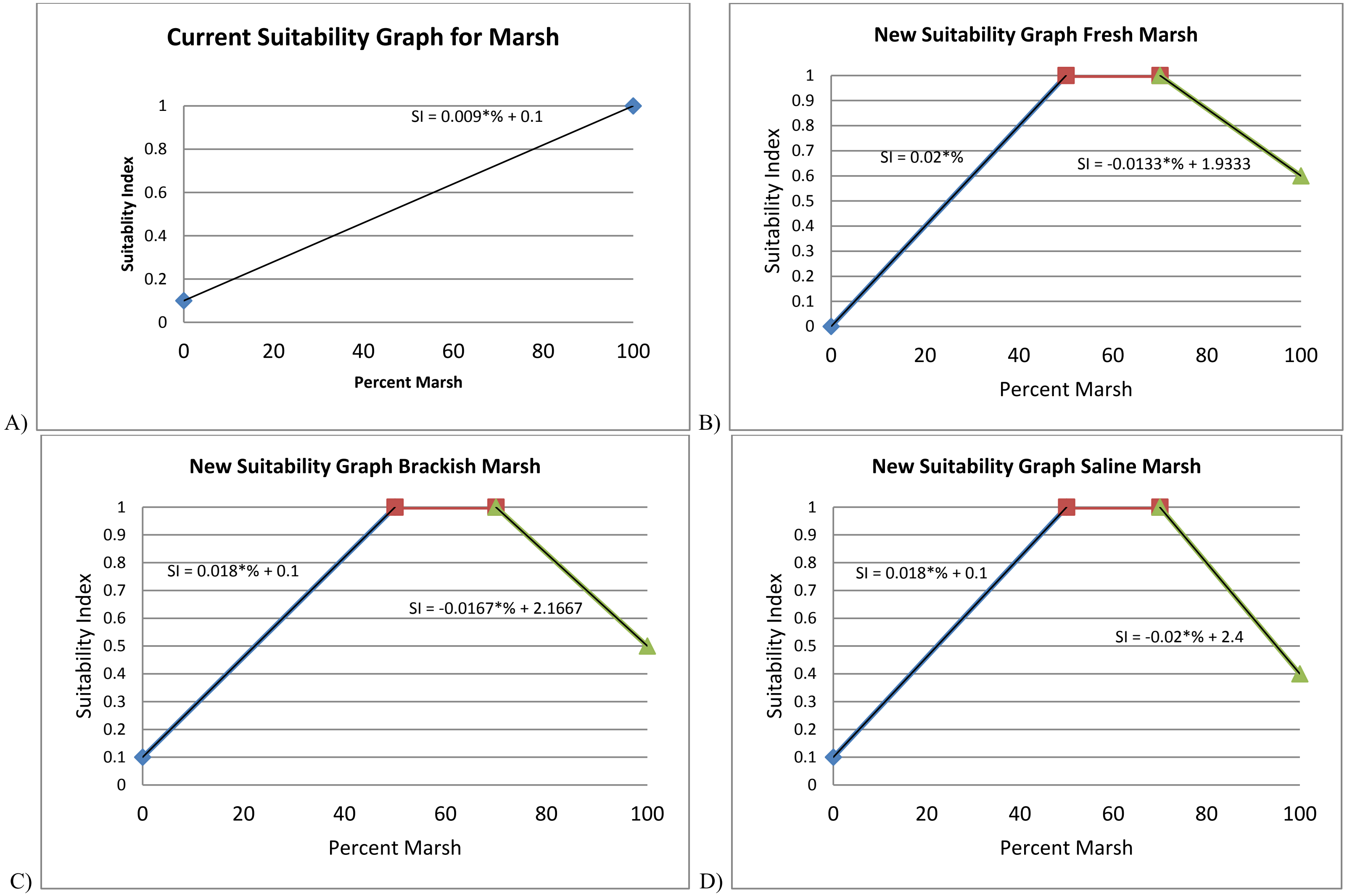

Figure 1. Suitability index curves for V1 showing the current treatment in LPV and WBV (A), and for the "new" guidance as applied to Fresh (B), Brackish (C) and Saline (D) Marsh.

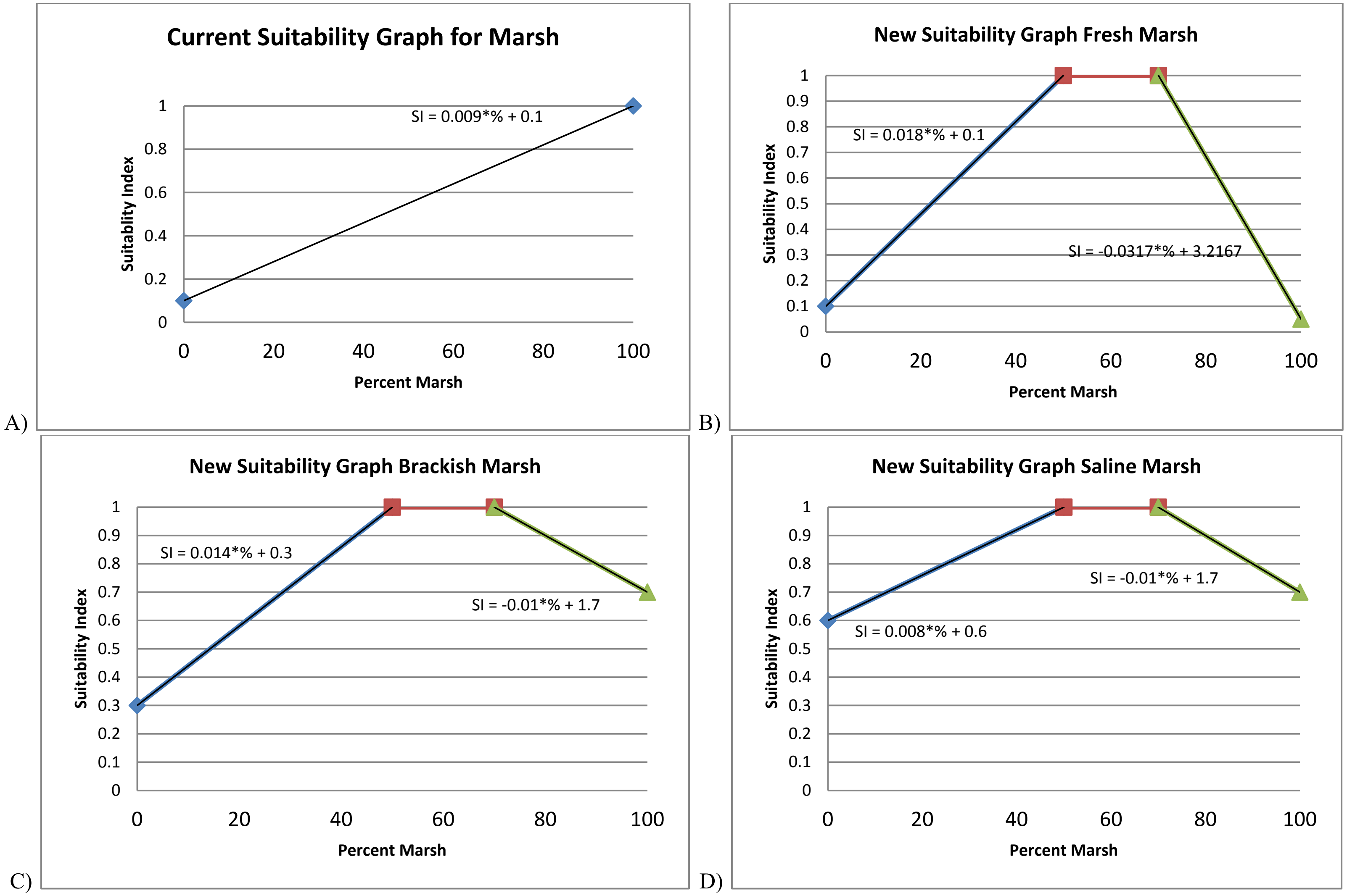

Figure 2. Suitability index curves for V2 showing the current treatment in LPV and WBV (A), and for the "new" guidance as applied to Fresh (B), Brackish (C) and Saline (D) Marsh.

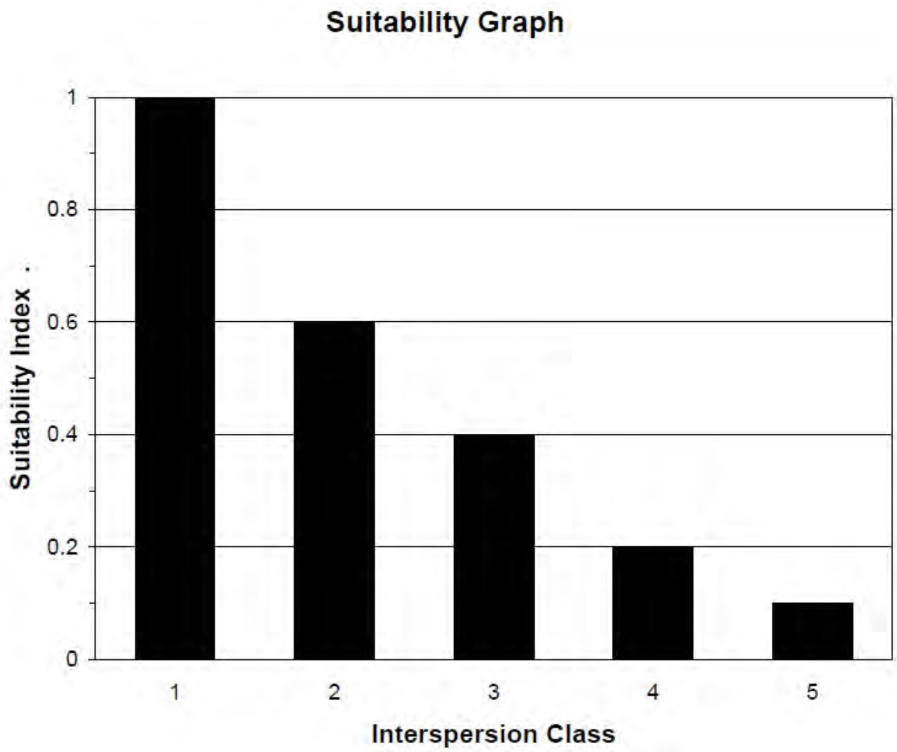

Figure 3. “Carpet Marsh” is treated as Class 3 for projects under CWPPRA.

Table 1: Percent change in model output for LPV sites

Model	Open Water % Change	Emergent Marsh % Change	Total Net Benefits % Change
Bayou Des Mats Intermediate Marsh	-42.42%	-14.30%	-35.08%
Big Branch-Brackish	-46.01%	-9.58%	-22.90%
Big Branch-Intermediate	-35.12%	-6.07%	-16.97%
Bayou Sauvage Floodside-Brackish	-20.32%	-19.65%	-36.00%
Bayou Sauvage Protected Intermediate	12.53%	1.93%	3.43%
Caernarvon Marsh	-34.16%	2.71%	-7.11%
Fritchie-Brackish Marsh	-41.79%	-8.79%	-22.63%
Fritchie-Fresh Marsh	-29.73%	-5.12%	-16.13%
Gold Triangle Brackish Marsh	-70.68%	-9.16%	-20.19%
La Branche Intermediate Marsh	-45.72%	-18.65%	-45.37%
Milton Island Intermediate Marsh	-40.57%	-18.30%	-39.73%
Maximum=	**12.53%**	**2.71%**	**3.43%**
Minimum=	**-70.68%**	**-19.65%**	**-45.37%**
Mean=	**-35.82%**	**-9.54%**	**-23.52%**
Standard Deviation=	**0.2034**	**0.0774**	**0.1461**

Table 2. Percent change in model output for WBV sites.

	Open Water	Emergent Marsh	Total Net Benefits
	% Change	**% Change**	**% Change**
Dufrene Pond M1	-10.46%	-20.50%	-25.31%
Dufrene Pond M2	-10.46%	-21.78%	-26.80%
Jean Lafitte M1	-40.29%	-8.10%	-20.93%
Jean Lafitte M2	-21.73%	-7.19%	-12.95%
Jean Lafitte M3	-20.31%	-7.64%	-12.91%
Jean Lafitte M4A	-25.75%	-22.80%	-33.11%
Jean Lafitte M4B	-10.84%	-21.20%	-25.17%
Plaquemines Alternative 1	14.65%	-23.61%	-27.47%
Salvador Timken	-40.69%	-21.77%	-42.38%
Simoneaux Ponds	-28.65%	-21.78%	-33.57%
Maximum=	**14.65%**	**-7.19%**	**-12.91%**
Minimum=	**-40.69%**	**-23.61%**	**-42.38%**
Mean=	**-19.45%**	**-17.64%**	**-26.06%**
Standard Deviation=	**0.1638**	**0.0695**	**0.0911**

Table 3: Side-by-side ranking of the LPV mitigation sites for the original total net benefits model runs and model runs using the CWPPRA suitability curves.

Model	Original Ranking	New Ranking	Difference	Original Net Benefits AAHUs	New Net Benefits AAHUs
Fritchie-Brackish Marsh	1	1	0	322.54	249.54
Fritchie-Fresh Marsh	2	2	0	290.02	243.25
Big Branch-Intermediate	4	3	+1	193.11	160.34
Gold Triangle Brackish Marsh	5	4	+1	183.90	146.77
Bayou Des Mats Intermediate Marsh	3	5	-2	206.70	134.18
Milton Island Intermediate Marsh	6	6	0	172.51	103.98
Bayou Sauvage Floodside-Brackish	7	7	0	156.91	100.42
Big Branch-Brackish	9	8	+1	119.24	91.93
Caernarvon Marsh	10	9	+1	82.04	76.20
La Branche Intermediate Marsh	8	10	-2	138.51	75.67
Bayou Sauvage Protected Side Intermediate Marsh	11	11	0	34.16	35.33

Table 4: Side-by-side ranking of the WBV mitigation alternative sites for the original total net benefits model runs and model runs using the CWPPRA suitability curves.

Model Run	Old Ranking	New Ranking	Difference	Original Total Benefits	New Suitability Graphs Total Benefits
Simoneaux Ponds	1	1	0	152.15	101.07
Plaquemines Alternative 1	3	2	+1	131.91	95.67
Salvador Timken	2	3	-1	146.78	84.58
Dufrene Pond M2	4	4	0	114.76	84.01
Jean Lafitte M3	5	5	0	88.48	77.06
Jean Lafitte M2	6	6	0	86.54	75.33
Jean Lafitte M1	8	7	+1	66.59	52.65
Jean Lafitte M4B	7	8	-1	70.09	52.45
Dufrene Pond M1	9	9	0	55.7	41.6
Jean Lafitte M4A	10	10	0	12.08	8.08

The results were generally similar for LPV and WBV in terms of the percentage change. The net effect of changing the HSI values to reflect current CWPPRA practice is a reduction in the total benefits on the order of about 25%. The mean change is virtually identical for the LPV and WBV sites, but there is greater variation among the LPV sites. The effects of the adjustments to SIV1 and SIV2 are especially significant and variable in terms of the open water habitat; changes in outputs range from +13% to -71% for the LPV sites and +15% to -41% for the WBV sites. Changes to emergent marsh habitat varied from +3% to -20% for LPV sites and from -7% to -24% for WBV sites.

Application of the new suitability curves had little effect on the ranking of the mitigation sites based on AAHU outputs. For LPV, Bayou Des Mats Intermediate Marsh and La Branche Intermediate Marsh each dropped two rankings while four sites increased one place and five sites remained unchanged. For WBV, two sites dropped a place, two increased one place and six remained unchanged. Note that these changes do not account for the costs for each site, and the changes to site prioritization could change when both costs and benefits are considered.

Under the “new” guidelines, carpet marsh should be regarded as Class 3 (SI=0.4) for SIV3 as opposed to Class 1 (SI=1.0) under the “old” approach. The new approach was applied to both the LPV and WBV sites by MVN in the existing models, but there are apparently some question regarding the assumptions applied to the WBV sites. Model input was treated as follows for the future with project condition on fresh marsh: 100% open water (Class 5) for years 0 and 1; 100% carpet marsh (Class 3) in year 3; 50% carpet marsh (Class 3) and 50% Class 1 in year 5; and 100% Class 1 in years 6 through 50. For other marsh types, SIV3 was set at 100% Class 1 for years 5-50. Given the relatively low loss rates for these sites, it seems unlikely that the carpet marsh would deteriorate in two years sufficiently to merit reclassification as Class 1.

The above approach is predicated on the assumption that marsh construction will include measures to optimize interspersion within each mitigation feature as part of the construction process. Meandering trenasses and scattered shallow depressions would be created within the marsh feature at or near the time that sediments pumped into the feature have settled to the desired grade and containment dikes are being degraded. These interspersion features could be established, for example, by tracking a marsh buggy or backhoe through the sediments and/or to excavate shallow depressions or trenasses.

We evaluated several alternatives to the above scenario to assess the sensitivity of the model output to assumptions regarding SIV3 using the models for Salvador Timken and Plaquemines. To bracket conditions, we made model runs assuming 100% Class 1 (SI=1.0) for the full 50 years, 100% Class 5 (SI=0) for the full 50 years, conversion of the carpet marsh to Class 1 in year 25 (as opposed to year 6), and a more gradual transition of carpet marsh to Class 1 ending with 50% each of Classes 1 and 3 at 50 years.

The results of the analyses, shown in Table 5, confirm previous sensitivity assessments. SIV3 has relatively little influence on the model results. Although it can influence model output by up to 14%, (all Class 1 versus all Class 5), the range of more probable conditions is considerably less than this. Our assessment shows that the conditions used in the "old" models may have overestimated the output by about 6 percent when compared to a more gradual conversion to Class 1, or by up to 9 percent if carpet marsh persist for the full 50 years.

Table 5. Sensitivity of model outputs (in net AAHUs) to various scenarios in the treatment of carpet marsh for two WBV sites.

	Salvador Timken	**Plaquemines**
Current "Old" Model	147	132
100% Class 5 for 50 yrs	126	114
100% Class 1 for 50 yrs	147	133
100% Class 3 for 50 yrs	134	120
Conversion 3 to 1 in 25 yrs	137	126
Gradual Conversion to 50/50	137	124

Discussion

Our assessment demonstrates that the LPV and WBV models are sensitive to assumptions regarding the treatment of SIV1 and SIV2. When applying the criteria used in the original WVA CWPPRA models for these parameters, the resulting output in AAHUs decreases by about 25 percent, on average, for the mitigation sites as compared to the output for the previous model runs by MVN. However, the same model assumptions would likely result in a decrease in overall impacts requiring mitigation when applied to the assessment of HSDRRS measures. The magnitude of the difference is uncertain and if these new model runs are to be used to directly assess mitigation credit, the impacts should be assessed using the same model assumptions.

Although the model assumptions had a significant impact on the magnitude of the outputs, it had relatively little effect on the ranking of mitigation sites based on the net AAHU output. This is especially true for the WBV sites. Costs for the mitigation sites weren't available for our assessment, and should be factored into the ranking of the alternatives. Finally, our assessment suggests that assumptions regarding the treatment of carpet marsh and SIV3 for sites in WBV might have resulted in a slight over prediction of benefits. A more realistic assumption regarding the eventual degradation of the marsh would yield about 6 percent reduction in AAHUs. This conclusion is based on an assessment of only two sites, but should hold for the remainder of the WBV sites.

The revised models and sensitivity analyses developed as part of this assessment are provided separately with this report. These "new" model results should be considered in addition to the old model assessments when making decisions regarding the mitigation of HSDRRS measures. If that assessment suggests a possible discrepancy between the mitigation benefits and likely impacts large enough to affect decisions, it may be necessary to run the impact assessment using the same model assumptions. We also recommend that future model assessments made with WVA apply ranges of likely future values for the model variables, and apply a more strict adherence to rules for significant digits.

APPENDIX K

WVA ASSUMPTIONS

LPV & WBV HSDRRS MITIGATION:
WETLAND VALUE ASSESSMENT (WVA) MODEL ASSUMPTIONS AND RELATED GUIDANCE

PREFACE

CEMVN works closely with the resource agencies on the Interagency Environmental Team (IET) to accurately assess the habitat impacts resulting from HSDRRS construction and the anticipated benefits to be expected from construction of the mitigation projects. In cooperation with CEMVN, the U.S. Fish and Wildlife Service (the Service) performs these habitat assessments. To quantify anticipated project impacts to fish and wildlife resources and benefits resulting from the proposed mitigation, the Service uses the WVA model approved by HQ USACE.

The WVA model quantifies the net change (improvement or destruction) in habitat by assessing a series of variables based on current and anticipated future site conditions. Habitat units fluctuate in response to changes in habitat quality, represented by the Habitat Suitability Index (HSI), and/or quantity (acres); those changes are predicted for various target years over the project life (i.e., 50 years), for future without-project and future with-project scenarios. Target years (TY) were selected for this analysis to capture the effects of important biological events. Values for model variables were obtained from site visits to the area, previous wetland assessments in similar habitats, communication with personnel knowledgeable about the study area and similar habitats, and review of aerial photographs and reports documenting fish and wildlife habitat conditions in the study area and similar habitats. In some instances where existing information regarding a particular variable is not available, the Service uses its professional judgment and experience to assess the expected conditions. For all the habitat assessments, the products of the resulting HSI values and acreage estimates are then summed and annualized for each habitat type to determine the AAHUs available. The net change (increase or decrease) in AAHUs under future with-project conditions, compared to future without-project conditions, provides a quantitative comparison of anticipated project impact/benefits in AAHUs. By dividing the AAHU by the proposed mitigation project acreage a mitigation potential per acre is determined. Impact assessments and mitigation benefit assessments considered sea-level rise, subsidence, accretion, and historic marsh loss trends and were coordinated with other State and Federal agencies.

Several of the assumptions set forth in this document are based on mitigation implementation schedules. Many sections include specified WVA model target years (TYs) and calendar years applicable to assumptions, and a few sections outline anticipated mitigation construction (i.e. mitigation implementation) schedules. It is critical for the WVA analyst to understand that this document has not been revised to account for changes to the mitigation implementation/construction schedules. It is therefore imperative for the analyst to obtain the most recent mitigation implementation/construction schedule for a particular mitigation project from CEMVN prior to running WVA models. The analyst may then need to modify some of the WVA model assumptions and guidelines presented herein to account for differences between the present mitigation implementation/construction schedule and the schedule(s) that were assumed in generating this document.

This document supersedes the WVA model assumptions/guidance document that was used when WVA models were first run for the final array of mitigation alternatives addressed in the LPV and WBV Engineering Alternatives Report. It should be applied when conducting WVA analyses for the Tentatively Selected Plans (TSPs) selected for meeting LPV and WBV mitigation needs. A separate document will be generated to address model assumptions applicable to evaluating impacts to open water habitats.

1.1 BOTTOMLAND HARDWOOD MODEL – GENERAL ASSUMPTIONS

V1 – Tree Species Association/Composition (in canopy stratum – percentage of trees that are hard mast or other edible-seed producing trees and percentage that are soft mast, non-mast/inedible seed producing trees)

BLH-Wet restore, FWP scenario:

- Of the total trees initially planted, 60% will be hard mast-producing species and 40% will be soft mast-producing species. Assume this species composition ratio (i.e. 60% of trees are hard mast-producing

and 40% are soft mast-producing) will remain static over the entire period of analysis (i.e. remains the same from time of planting throughout all subsequent model target years).
- Assume Class 5 is achieved once the planted trees are 10 years old. This class remains the same thereafter (i.e. Class 5 for all subsequent target years). Note that trees will be approximately 1 year old at the time they are initially planted. Thus, Class 5 is achieved 9 years after the time of initial planting.

General Notes:
- Do not classify Chinese tallow as a “mast or other edible-seed producing tree”. Consider it a non-mast producing tree. Although it is an invasive species, one must still include this species regarding its contribution to percent cover in the canopy, midstory, and ground cover strata when it is present on a site (applicable to FWP scenario at TY0 and applicable to FWOP scenario for all model target years).

V2 – Stand Maturity (average age or dbh of dominant and codominant canopy trees)

BLH-Wet and BLH-Dry restore and enhance, FWP scenario -----
- Guidance as to how factors like subsidence and sea level rise might affect this variable (especially if the mitigation site becomes flooded for long durations, since the growth of trees may be adversely affected and certain tree species could die) -----
  If the mitigation feature (polygon) is designed such that flooding at the end of the project life will not impact tree survival, i.e. flooding is <12% of the growing season (33 days) and is no more than 20% to 30% of the non-growing season, then trees should not be adversely affected. However, if the site design does not achieve this goal, then adjust the tree growth spreadsheet such that typical growth is reduced by at least 10% once flooding exceeds 20-30% of the non-growing season or is 12% or more of the growing season (Conner et al.; Francis 1983).

General Notes:
- Include the DBH of Chinese tallow when working with this variable (for FWOP scenario in all model target years and for FWP scenario at TY0). The same guidance would apply to other invasive species in the canopy stratum.
- For planted trees – You can use the age of the trees in lieu of their DBH when running the model (applies to all target years from time of planting throughout model run). Assume trees planted will be approximately 1 year old when they are first installed.

V3 – Understory/Midstory (percent cover)

BLH-Wet and BLH-Dry restore, FWP scenario --
Assumptions applicable to restoration features built in existing open water areas and for any restoration features that require deposition of fill to achieve target grades:

TY	Year	Assumption	
0	2013	Understory = 0% // Midstory = 0%	Refer to Note 1
1	2014	Understory = 0% // Midstory = 0%	
2	2015	Understory = 100% // Midstory = 0%	
20	2033	Understory = 25% // Midstory = 60%	
50	2063	Understory = 35% // Midstory = 30%	Refer to Note 2

Notes:
1. This assumption is applicable to restoration features built in existing open water areas. For restoration polygons built in other areas that are not open water or are only partially open water, values for cover in the understory and midstory strata must be based on site-specific conditions existing prior to the start of construction.
2. The specified values are based on the assumption that normal flooding conditions are present (i.e. desirable depth and duration of inundation). These values will need to be adjusted if sea-level rise is anticipated to increase flooding of the particular mitigation polygon to a degree whereby growth and/or survival of plant species in the understory and/or midstory strata are adversely impacted.
3. Keep in mind that canopy and midstory species will not be planted in restoration features built in open water areas until 1 year after the initial fill (borrow) has been placed in the mitigation feature. This allows 1 year of fill settlement prior to plantings.

BLH-Wet restore and BLH-Dry restore, FWP scenario --
Assumptions applicable to restoration features that do not require deposition of fill to achieve target grades:

TY	Year	Assumption
0	2013	Refer to Note 1
1	2014	Understory = 100% // Midstory = 0%
20	2033	Understory = 25% // Midstory = 60%
50	2063	Understory = 35% // Midstory = 30% Refer to Note 2

Notes:
1. Values for cover in the understory and midstory strata must be based on site-specific conditions existing prior to the start of construction.
2. The specified values are based on the assumption that normal flooding conditions are present (i.e. desirable depth and duration of inundation). These values will need to be adjusted if sea-level rise is anticipated to increase flooding of the particular mitigation polygon to a degree whereby growth and/or survival of plant species in the understory and/or midstory strata are adversely impacted.

General Notes:
- Cover accounted for by Chinese tallow and other invasive and nuisance plant species must be included in the percent cover data (applicable to FWOP scenario in all model target years and to FWP scenario at TY0).
- Changes in hydrology could result from factors such as sea-level rise and subsidence. An increase in the duration of flooding will typically decrease the understory cover and, to a lesser degree, decrease the midstory cover.

V4 – Hydrology (flooding duration and water flow/exchange)

BLH-Wet restore, FWP scenario -----
Assumptions applicable to restoration features built in existing open water areas and for restoration features that require deposition of fill to achieve target grades.

TY	Year	Assumption
0	2013	Baseline conditions (score based on existing hydrology)
1	2014	Duration = dewatered // Exchange = none
2	2015	Duration = temporary Refer to Note 1
20	2033	Duration = temporary Refer to Note 1
50	2063	Duration = temporary Refer to Notes 1 and 2

Notes:
1. Scoring of water flow/exchange component of hydrology must be based on site-specific conditions anticipated.
2. The specified value for flooding duration is based on the assumption that normal flooding conditions are present (i.e. desirable depth and duration of inundation). This value will need to be adjusted if sea-level rise is anticipated to significantly increase the duration of flooding in the particular mitigation polygon. In many cases, it is probable that the duration may shift from temporary to seasonal.

BLH-Wet restore & BLH-Wet enhance, FWP scenario -----
Assumptions applicable to restoration features that do not require deposition of fill to achieve target grades and to BLH-Wet enhancement features where hydrologic enhancement is a component of the mitigation design.

TY	Year	Assumption
0	2013	Baseline conditions (score based on existing hydrology)
1	2014	Duration = temporary Refer to Note 1
2	2015	Duration = temporary Refer to Note 1
20	2033	Duration = temporary Refer to Note 1
50	2063	Duration = temporary Refer to Notes 1 and 2

Notes:
1. Scoring of water flow/exchange component of hydrology must be based on site-specific conditions anticipated.

2. The specified value for flooding duration is based on the assumption that normal flooding conditions are present (i.e. desirable depth and duration of inundation). This value will need to be adjusted if sea-level rise is anticipated to significantly increase the duration of flooding in the particular mitigation polygon. In many cases, it is probable that the duration may shift from temporary to seasonal.
3. For BLH-Wet enhancement features that do not include measures to enhance existing hydrology as part of the mitigation design, the scoring of variable V4 must be based on site-specific conditions hence no general assumptions are applicable.

BLH-Dry restore or enhance, FWP scenario -----

- Score flooding duration as “dewatered” during all target years used in the model.

V5 – Size of Contiguous Forested Area

BLH-Wet & BLH-Dry restore, FWP scenario:

- Do not consider the mitigation polygon to classify as “forested” until the planted trees are 10 years old. Remember that trees will be 1 year old when they are first installed; hence, the mitigation polygon would classify as forested 9 years following the year of initial planting. Prior to this target year, the trees initially planted in the mitigation polygon will be considered as either understory or midstory cover. For the target year when the planted trees reach 10 years old and for all model target years thereafter, the planted trees will be considered large enough for the mitigation polygon to be considered a forest. Hence at the target year planted trees reach 10 years old and all target years thereafter, the mitigation polygon can be included in the calculation of forested acreages (along with contiguous forested areas outside the mitigation polygon).

BLH-Wet and BLH-Dry restoration or enhancement, FWP and FWOP scenarios:

- For areas outside the mitigation polygons, assume the conditions present at TY0 will remain unchanged throughout the life of the mitigation project. As used here, the term “mitigation polygons” refers to all proposed mitigation polygons regardless of the target habitat proposed. For example, a particular mitigation site could contain both a BLH-wet restoration polygon and a swamp restoration polygon. Under the FWP scenario, one would assume that the 2 restoration polygons would become forested over time but existing forested areas outside the limits of these polygons would remain forested throughout the period of analysis. Under the FWOP scenario, existing conditions would prevail in both the 2 restoration polygons and in the areas outside the limits of these polygons throughout the period of analysis.

General Notes:

- When scoring this variable for the FWP scenario, the area within the mitigation polygon itself as well as the adjacent “non-mitigation” areas are combined to generate the total forested acreage. However, remember the assumption that planted trees in restoration features will not be considered large enough for the feature to classify as a forest until the planted trees are 10 years old.
- When evaluating the size of contiguous forested areas, non-forested corridors <75 feet wide will not constitute a break in the forest area contiguity.

V6 – Suitability and Traversability of Surrounding Land Uses (within 0.5 mile of site perimeter)

BLH-Wet and BLH-Dry restoration or enhancement, FWP scenario:

- When scoring a given BLH mitigation polygon, include the nearby or adjacent mitigation polygons in your assessment of land use types by assuming their land use type is the habitat type proposed (i.e. the target habitat type). However, one must consider the TY that the nearby/adjacent mitigation polygon will actually shift from its existing habitat type to the target habitat type. For example, if the adjacent mitigation polygon is a marsh restoration feature then the change from the existing habitat type (open water typically) to the target marsh habitat would not occur until TY2 (2015).

BLH-Wet and BLH-Dry restoration or enhancement, FWP and FWOP scenarios:

- When evaluating this variable, typically assume that land uses in lands outside the mitigation polygons will score the same under the FWP and FWOP scenarios. In other words, typically assume that the existing conditions present in TY0 will remain unchanged over the life of the mitigation project. One

would typically not consider potential future land development rates when scoring this variable due to the uncertainty of long-term development trends. Exceptions to this general approach would include:
  - Situations where there is a high level of confidence that a particular area is slated for a significant change in land use (ex. construction of I-49 through the Dufrene Ponds mitigation site).
  - Situations where it is anticipated that the “land use” (habitat type) will significantly change over time due to the effects of sea-level rise and land loss (ex. existing adjacent marsh lands rated as highly suitable/traversable changing to open water, a much lower score, due to shoreline erosion or other land loss factors).

V7 – Disturbance (sources of disturbance vs. distance from site perimeter to disturbance source)

BLH-Wet and BLH-Dry restoration or enhancement, FWP and FWOP scenarios:

- For consistency purposes, assume baseline conditions affecting the scoring of this variable will not change over time. In other words, typically assume that the existing conditions present in TY0 will remain unchanged over the life of the mitigation project. For the WBV mitigation alternatives, there will be two exceptions to this general approach:
  - Bayou Signette – The variable score will need to change over time to account for building the nearby racetrack project.
  - Dufrene Ponds -- The variable score will need to change over time to account for the construction of the I-49 highway.

General Notes:

- When scoring this variable, all distances are measured from the perimeter of the BLH mitigation polygon itself.

1.2 NOTES REGARDING CONSTRUCTION & PLANTING OF BLH MITIGATION AREAS

Typical Estimated Project Construction Timelines -----

All projects – Begin construction around September 2013.

For BLH restoration areas built in existing open water features and for any other BLH restoration areas that require deposition of fill material as part of the construction process:

- Sept. 2013 – Begin construction.
- May 2014 – Complete construction.
- May 2015 – Initial grade settles to desired target grade (1 year after end of construction). If applicable, perimeter dikes constructed are degraded or gapped at this time.
- Dec. 2015 – Install plants (or could be installed in Jan. or Feb. of 2016).

For BLH restoration that do not require deposition of fill as part of the construction process:

- Sept. 2013 – Begin construction.
- Feb. 2014 – End construction (but could be as late as March or April of 2014 if much is earthwork required).
- March. 2014 – Install plants (earliest scenario for site requiring minimal earthwork).
- Dec. 2014 – Install plants (earliest scenario for site requiring substantial earthwork).

For BLH enhancement areas:

- Sept. 2013 – Begin construction (includes start of invasive plant eradication).
- Jan. 2014 – End construction (but could be as late as Feb. or March of 2014).
- March 2014 – Install plants.

Notes:

1. All of the above timelines are preliminary and are subject to refinement as plans are refined for a particular mitigation site.
2. Planting of canopy and midstory species in March should be avoided if possible since conditions could be adversely dry, thereby decreasing the survival of plantings.

3. Chemical eradication of invasive/nuisance hardwood species such as Chinese tallow should be done during the growing season. Greatest effectiveness may be realized if chemical treatment is applied from August through October when most energy is being used for root development.

Planting of BLH-Wet and BLH-Dry Restoration Areas -----

Initial plantings will be:

- Canopy species: plant on 9-foot centers (538 trees/acre); of total trees planted, 60% will be hard mast-producing species and 40% will be soft mast-producing species.
- Midstory species (shrubs and small trees): plant on 20-foot centers (109 seedlings per acre).
- Stock size (canopy and midstory species): 1 year old, 1.5 feet tall (minimum).

Planting of BLH-Wet and BLH-Dry Enhancement Areas -----

Initial plantings will follow the same guidelines as for BLH-Wet and BLH-Dry restoration areas regarding the general density of installed plants and the stock used. Where initial enhancement activities include the eradication of invasive and nuisance plant species, significant numbers of native canopy and/or midstory species may remain, but in a spatial distribution that leaves relatively large “gaps” in the canopy stratum and/or the midstory stratum. In such cases, areas measuring approximately 25 feet by 25 feet that are devoid of native canopy species should be planted and areas measuring approximately 45 feet by 45 feet that are devoid of native midstory species should be planted.

The typical guideline of having 60% of the canopy species planted be hard mast-producing and 40% of the canopy species planted be soft mast-producing may be altered in situations where several native trees remain after eradicating invasive/nuisance species. For example if the remaining native trees are predominantly soft mast-producing species, then a greater proportion of the planted trees would be hard-mast producing. The objective would be to have the ultimate canopy composition (planted trees after reaching canopy strata plus existing trees) be close to a 60%:40% ratio of hard mast to soft mast species.

1.3 BOTTOMLAND HARDWOOD WVA MODEL – TARGET YEARS FOR MODELS

Use the target years specified below when analyzing BLH restoration polygons built in existing open water features and for any other BLH restoration polygons that require deposition of fill material as part of the construction process:

TY	Year	
0	2013	Baseline conditions (assume construction starts in 2014 even though anticipated start is late 2013)
1	2014	Initial construction activities begin and are completed. No plants installed.
2	2015	Restoration feature settles to desired target grade. Any associated perimeter containment dikes are degraded or gapped. Plants installed. Temporary flooding duration (target flooding duration/target hydroperiod) achieved.
11	2024	Class 5 is achieved re V1. Planted areas class as forested re V5.
20	2033	For V3, Understory = 25% // Midstory = 60%
50	2063	End of project life for a HSDRRS mitigation feature.

Use the target years specified below when analyzing BLH restoration polygons that do not require deposition of fill material as part of the construction process, and when analyzing BLH enhancement polygons:

TY	Year	
0	2013	Baseline conditions (assume construction starts in 2014 even though anticipated start is late 2013)
1	2014	Initial construction activities begin and are completed. Initial eradication of invasive & nuisance plant species is started and completed.

		Plants are installed (either in March or in December depending on construction activities. Appropriate planting season extends from November through February). Temporary flooding duration (target flooding duration/target hydroperiod) achieved.
10	2023	Class 5 is achieved re V1. Planted areas class as forested re V5.
20	2033	For V3, Understory = 25% // Midstory = 60%
52	2065	End of project life for a HSDRRS mitigation feature (adjusted end to be consistent with final TY used in impact WVAs).

NOTE:
The user of these guidelines is cautioned that the construction schedule for proposed mitigation features may not follow the construction schedule assumed in the preceding sections. If this is the case, the model target years and their associated model assumptions may have to be adjusted accordingly.

2.1 SWAMP MODEL – GENERAL ASSUMPTIONS

V1 – Stand Structure (percent closure or Cover: overstory, midstory, herbaceous)

Swamp restore, FWP scenario --
Assumptions applicable to restoration features built in existing open water areas and for any restoration features that require deposition of fill to achieve target grades. If construction involves substantial excavation and grading rather than filling, use the next assumptions table rather than this one.

TY	Year	Assumption
0	2013	Baseline conditions (site-specific)
1	2014	Class 1
2	2015	Class 1
3	2016	Class 2
15	2028	Class 6
35	2048	Class 6
50	2063	Refer to Note 1

Notes:
1. Over time, sea-level rise and possibly subsidence could adversely affect the hydrologic regime (increased flooding duration, increased depth of inundation). Salinity could increase in some areas concurrent with sea-level rise. These factors are anticipated to adversely affect plant growth and survival. Thus, cover in the midstory and herbaceous (ground cover) strata are anticipated to decrease over time, as could percent cover in the canopy stratum to a lesser degree. This potential reduction must be evaluated on a site-specific basis, factoring in considerations such as the proposed grade of the mitigation polygon relative to the projected sea-level rise elevation, changes in salinity, etc. As a general "rule of thumb", one may anticipate the stand structure to decrease from Class 6 in TY35 to Class 4 by TY50. However, it is emphasized that the decrease in class score over time must be evaluated on a case-by-case basis.

Swamp restore, FWP scenario --
Assumptions applicable to restoration features involving substantial excavation and grading as part of the initial construction efforts. If fill is required via pumping of sediments into the feature, use the preceding assumptions table.

TY	Year	Assumption
0	2013	Baseline conditions (site-specific)
1	2014	Class 1
2	2015	Class 1
15	2028	Class 6
35	2048	Class 6
52	2065	Refer to Note 1 in preceding assumptions table

General Notes:

- Include the cover accounted for by Chinese tallow and other invasive plant species when working with this variable (for FWOP scenario in all model target years and for FWP scenario at TY0).
- For swamp enhancement features, FWP scenario --- The evaluation of existing canopy, midstory, and understory will be done via field data collection for this variable. The growth of planted species will be estimated from a growth calculator that is based on pertinent research. Assumptions will have to be made about the correlation between plant growth and observed coverage. The values will be averaged to get a single HSI for this variable. Planted canopy species should not be factored into the overstory coverage estimate until TY15. They will be considered either as part of understory cover (earlier) or midstory cover (later) prior to TY15.

V2 – Stand Maturity (average DBH of canopy trees; plus total basal area all trees)

Swamp restore, FWP scenario --
Assumptions applicable to restoration features built in existing open water areas and for any restoration features that require deposition of fill to achieve target grades. If construction involves substantial excavation and grading rather than filling, use the next assumptions table rather than this one.

TY	Year	Assumptions – Density of Trees	Assumptions – DBH of Planted Trees
0	2013	Baseline conditions.	N/A
1	2014	0 trees/ac.	N/A
2	2015	538 trees/ac. (trees installed, initial density)	Cypress = 0.2” // Tupelo = 0.3”
3	2016	269 trees/ac. (50% survival of planted trees)	Cypress = 0.2” // Tupelo = 0.5”
4	2017	258 trees/ac. (48% survival of planted trees)	
15	2028	215 trees/ac. (40% survival of planted trees)	Cypress = 3.5” // Tupelo = 4.1”
35	2048	161 trees/ac. (30% survival of planted trees)	Cypress = 8.2” // Tupelo = 9.6”
50	2063	161 trees/ac. (30% survival of planted trees)	Cypress = 11.9” // Tupelo = 14.0”

Swamp restore, FWP scenario --
Assumptions applicable to restoration features, or the portions thereof, involving substantial excavation and grading as part of the initial construction efforts. If fill is required via pumping of sediments into the feature, use the preceding assumptions table concerning tree densities.

TY	Year	Assumptions – Density of Trees	Assumptions – DBH of Planted Trees
0	2013	Baseline conditions.	N/A
1	2014	538 trees/ac. (trees installed; initial density)	Cypress = 0.2” // Tupelo = 0.3”
2	2015	269 trees/ac. (50% survival of planted trees)	Cypress = 0.2” // Tupelo = 0.5”
3	2016	258 trees/ac. (48% survival of planted trees)	
15	2028	215 trees/ac. (40% survival of planted trees)	Cypress = 3.5” // Tupelo = 4.1”
35	2048	161 trees/ac. (30% survival of planted trees)	Cypress = 8.2” // Tupelo = 9.6”
52	2065	161 trees/ac. (30% survival of planted trees)	Cypress = 11.9” // Tupelo = 14.0”

Swamp restore, FWP scenario ---
- Assume 70% of the trees planted will be cypress and that 30% of the trees planted will be tupelo or other non-cypress species. Assume that this ratio will remain constant over time once the trees are planted.

Swamp enhance, FWP scenario ---
- Do not factor planted trees into the site DBH calculations until TY15. Prior to TY15, the planted trees will be considered as being in the understory or midstory strata.

General Notes:
- Factors such as sea-level rise and increased salinity over time may adversely affect the growth and/or survival of planted trees and existing trees. These factors must be considered when assessing this variable and may require adjustments to the assumed density of planted trees (as regards survival of trees) and the assumed dbh of planted trees indicated in the preceding tables. The FWS spreadsheet used to predict tree growth (reference the “BLH Site Ingrowth” spreadsheet) includes correction factors

used to adjust typical growth rates to account for trees subject to stressors like excessive inundation or salinity. These correction factors should be used for target years in which one anticipates the stress factors may significant enough to affect tree growth. The stage in the project life that the effects become significant must be determined on a case-by-case basis.

V3 – Water Regime (flooding duration and water flow/exchange)

Swamp restore, FWP scenario --
Assumptions applicable to restoration features built in existing open water areas and for any restoration features that require deposition of fill to achieve target grades. If construction involves substantial excavation and grading rather than filling, use the next assumptions table rather than this one.

TY	Year	Assumption
0	2013	Baseline conditions (score based on existing hydrology)
1	2014	Duration = permanent // Exchange = none
2	2015	Duration = seasonal Refer to Note 1
15	2028	Duration = seasonal Refer to Note 1
35	2048	Duration = seasonal or semi-permanent Refer to Notes 1 and 2
50	2063	Duration = semi-permanent or permanent Refer to Notes 1 and 2

Notes:
1. Scoring of water flow/exchange component of hydrology must be based on site-specific conditions anticipated.
2. During the latter portions of the project life, flooding duration may be affected by sea-level rise. Swamp mitigation features are designed to have seasonal flooding once the features are constructed and have reached the desired target grade elevation. Sea-level rise will likely increase the duration of flooding. This effect will be site-specific and must be evaluated on a case-by-case basis. Sea-level rise will also likely affect the water flow/exchange. For a site that has limited exchange during early years, this may actually improve exchange for a period of years (ex. increase from low exchange in TY2 to moderate exchange in TY15). As the sea-level rise continues over time, however, the effect may be to reduce exchange (ex. decrease from moderate exchange in TY35 to low exchange in TY50). The degree to which sea-level rise affects flow/exchange over time must also be evaluated on a case-by-case basis.

Swamp restore, FWP scenario --
Assumptions applicable to restoration features, or the portions thereof, involving substantial excavation and grading as part of the initial construction efforts. If fill is required via pumping of sediments into the feature, use the preceding assumptions table.

TY	Year	Assumption
0	2013	Baseline conditions (score based on existing hydrology)
1	2014	Duration = seasonal Refer to Note 1
2	2015	Duration = seasonal Refer to Note 1
15	2028	Duration = seasonal Refer to Note 1
35	2048	Duration = seasonal or semi-permanent Refer to Notes 1 and 2
50	2063	Duration = semi-permanent or permanent Refer to Notes 1 and 2

Notes:
Notes 1 and 2 are the same as in the preceding table.

V4 – Mean High Salinity During the Growing Season (salinity re baldcypress & other trees)

General Notes:
- For current and near-term salinities, use the Coastwide Reference Monitoring System (CRMS) data (website http://www.lacoast.gov/crms%5Fviewer/) and USGS gage data (website http://waterdata.usgs.gov/la/nwis/rt) where available. Future salinities should be forecast using

reasonable estimates and best professional judgment (in the absence of hydrologic and hydrodynamic modeling).

Other WVA Swamp Model Guidance

The WVA procedural manual and Swamp Community Model text advises that habitat classification data and aerial photos should be used to determine a conversion rate of swamp to marsh. Based on this evaluation, the guidance states that areas of swamp converting to fresh marsh should be evaluated as open water habitat using the fresh marsh model. The determination of appropriate conversion rates would be quite complicated in the project area. Hence, this issue will not be addressed as part of the WVA analyses.

2.2 NOTES REGARDING CONSTRUCTION & PLANTING OF SWAMP MITIGATION AREAS

Typical Estimated Project Construction Timelines -----

All projects – Begin construction around September 2013.

For swamp restoration areas built in existing open water features and for any other swamp restoration areas that require deposition of fill material as part of the construction process:

- Sept. 2013 – Begin construction.
- May 2014 – Complete construction.
- May 2015 – Initial grade settles to desired target grade (1 year after end of construction). If applicable, perimeter dikes constructed are degraded or gapped at this time.
- Dec. 2015 – Install plants (or could be installed in Jan. or Feb. of 2016).

For swamp restoration areas involving extensive excavation and earthwork but that do not require deposition of fill as part of the construction process:

- Sept. 2013 – Begin construction.
- March 2014 – End construction (but could be as late as May of 2014; also, subsequent grading may be required in some areas after an as-built survey completed in order to correct any deficiencies).
- Dec. 2014 – Install plants.

For swamp enhancement areas:

- Sept. 2013 – Begin construction (includes start of invasive plant eradication).
- Jan. 2014 – End construction (but could be as late as Feb. or March of 2014).
- March 2014 – Install plants.

Note: All of the above timelines are preliminary and are subject to refinement as plans are refined for a particular mitigation site.

Planting of Swamp Restoration Areas -----

Initial plantings will be:

- Canopy species: plant on 9-foot centers (538 trees/acre); of total trees planted, approximately 70% will be cypress while the remaining trees will consist of tupelo and other non-cypress species.
- Midstory species (shrubs and small trees): plant on 20-foot centers (109 seedlings per acre).
- Stock size (minimums): Canopy species = 1 year old, 3 feet tall, 0.5” root collar; Midstory species = 1 year old, 3 feet tall.

Planting of Swamp Enhancement Areas -----

Initial plantings will follow the same guidelines as for swamp restoration areas regarding the general density of installed plants and the stock used. Where initial enhancement activities include the eradication of invasive and nuisance plant species, significant numbers of native canopy and/or midstory species may remain, but in a spatial distribution that leaves relatively large “gaps” in the canopy stratum and/or the midstory stratum. In such cases, areas measuring approximately 25 feet by 25 feet that are devoid of native canopy species should be planted and areas measuring approximately 45 feet by 45 feet that are devoid of native midstory species should be planted.

The typical guideline of having roughly 70% of the canopy species planted be cypress and 30% of the canopy species planted be tupelo and other non-cypress species may be altered in situations where several native trees remain after eradicating invasive/nuisance species. For example, if the remaining native trees are almost all cypress, then a greater proportion of the planted trees may consist of non-cypress species. Similarly, the composition of the species planted might also be altered to be more representative of the species composition present in nearby healthy swamp habitats.

2.3 SWAMP WVA MODEL – TARGET YEARS FOR MODELS

Typically use the target years specified below when analyzing swamp restoration polygons built in existing open water features and for any other swamp restoration polygons that require deposition of fill material as part of the construction process:

TY	Year	
0	2013	Baseline conditions (assume construction starts in 2014 even though anticipated start is late 2013)
1	2014	Initial construction activities begin and are completed. No plants installed. V1 = Class 1; V3 = permanent duration.
2	2015	Restoration feature settles to desired target grade. Any associated perimeter containment dikes are degraded or gapped. Plants installed. V1 = Class 1; V2 = 538 trees/ac.; V3 = seasonal duration.
3	2016	V1 = Class 2; V2 = 269 trees/ac.; V3 = seasonal duration.
4	2017	V1 = Class 2; V2 = 258 trees/ac.; V3 = seasonal duration.
15	2028	V1 = Class 6; V2 = 215 trees/ac.; V3 = seasonal duration.
35	2048	V1 = Class 6; V2 = 161 trees/ac.; V3 = seasonal or semi-permanent duration.
50	2063	End of project life for a HSDRRS mitigation feature. V2 = 161 trees/ac.; V3 = semi-permanent or permanent duration.

Typically use the target years specified below when analyzing swamp restoration polygons that do not require deposition of fill material as part of the construction process, and when analyzing BLH enhancement polygons:

TY	Year	
0	2013	Baseline conditions (assume construction starts in 2014 even though anticipated start is late 2013)
1	2014	Initial construction activities begin and are completed. Initial eradication of invasive & nuisance plant species is started and completed. Plants are installed (either in March or in December depending on construction activities. Appropriate planting season extends from November through February). V1 = Class 1; V2 = 538 trees/ac.; V3 = seasonal duration.
2	2015	V1 = Class 2; V2 = 269 trees/ac.; V3 = seasonal duration.
3	2016	V1 = Class 2; V2 = 258 trees/ac.; V3 = seasonal duration.
15	2028	V1 = Class 6; V2 = 215 trees/ac.; V3 = seasonal duration.
35	2048	V1 = Class 6; V2 = 161 trees/ac.; V3 = seasonal or semi-permanent duration.
50	2063	End of project life for a HSDRRS mitigation feature (adjusted end to be consistent with final TY used in impact WVAs). V2 = 161 trees/ac.; V3 = semi-permanent or permanent duration.

The user of these guidelines is cautioned that the construction schedule for proposed mitigation features may not follow the construction schedule assumed in the preceding sections. If this is the case, the model target years and their associated model assumptions may have to be adjusted accordingly.

3.1 FRESH MARSH MODEL – GENERAL ASSUMPTIONS

V1 – Percent of Wetland Area Covered by Emergent Vegetation

Marsh restore, FWP scenario:

TY	Year	Assumption
0	2013	Baseline conditions.
1	2014	10% credit.
3	2016	50% credit.
5	2018	100% credit.
6	2019	100% credit.

Note: Assume the created elevation settles to target grade by TY3. After TY5, cover of the land acres after land loss is applied will remain optimal until conditions in the mitigation polygon shift to open water (based on Ronny magic spreadsheet calculations).

FWOP scenario:
2010 land rolled forward by applying 3 years of loss.

General Notes:

1. Typically, no existing project benefits are considered under FWOP. Project sites were typically selected to avoid overlap with existing non-diversion projects. In the case of existing diversions, either the effect of the diversion is assumed to be captured in the historic loss rate or the diversion would have to substantially fill in the project site FWOP to affect the net changes under V1 and V4, plus marsh creation gets optimal credit on its own if or until accretion does not keep pace with RSLR. Doing marsh creation in diversion areas may be more sustainable. However, not capturing that potential higher sustainability effect within the WVA would be more conservative for compensatory purposes (i.e., would generate less AAHUs and require more acres), but would not allow differentiation between sites with or without existing diversion influence where that influence is not captured in the historic loss rate.

   In limited cases, some existing project benefits are indeed considered under FWOP. Coordinate directly with CEMVN to determine whether any benefits from existing projects should be considered under the FWOP scenario.
2. Under the FWP scenario, begin applying land loss once the marsh fill has settled to the desired target grade (i.e. in TY2, one year after completion of initial fill placement). The USGS loss rates derived from a linear regression will be applied using a linear loss rate.
3. For the FWP scenario, one must subtract the acreage of interior borrow areas (borrow used to build dikes) from the total acreage of marsh land to derive the percentage of the total feature acreage that will count as marsh land. These borrow areas will have a greater settlement rate than will other portions of the mitigation feature. Seek engineering input as to what percentage of the borrow area footprint will settle to an elevation whereby the area would be considered as shallow open water rather than marsh land.
4. For the FWP scenario, one must also subtract the acreage of any trenasses initially constructed from the total acreage of marsh land to derive the acreage that will count as marsh land. These trenasses will count as shallow open water areas (assuming they are not excavated over 1.5 feet deep in relation to the marsh surface elevation).
5. For the FWP scenario, only those portions of earthen retention dikes that fall within the intertidal range can be included in the marsh restoration feature acreage. Portions of such dikes that are not degraded such that their crest elevation is equal to the final marsh target elevation cannot be counted in the acreage of the marsh feature, nor can portions of the dikes that will remain underwater. Similarly, the footprints occupied by proposed foreshore dikes (rock dikes) cannot be counted in the acreage of the marsh feature.
6. It is assumed that proposed fresh marsh restoration features will not be planted. Instead, it is assumed that suitable vegetative cover will develop rapidly via natural recruitment and colonization of the feature.
7. For the FWP scenario, land loss will be assumed to begin once the restored marsh feature has settled to the desired target grade. This will occur 1 year after the initial construction (dike construction, placement of fill as slurry) has occurred.

V2 – Percent Open Water Area Covered by Submerged Aquatic Vegetation

Marsh restore, FWP scenario:

TY	Year	Assumption
0	2013	Baseline conditions (existing conditions).
1	2014	0%
3	2016	0%
5	2018	Same as baseline cover by SAV.
6	2019	Increase baseline SAV cover by 15%, then hold this through TY25 (i.e. the SI value plateaus).
25	2038	See guidance for TY6.
50	2063	50% of baseline cover by SAV.

Marsh restore, FWOP scenario:
TY50 (2063) = 30% of baseline

Note:
Base the SAV cover estimates on the average cover during the peak of the growing season. SAVs do not include floating aquatics (but do include floating-leaf aquatics).

General Notes:
Fresh and intermediate marshes often support diverse communities of floating-leaved and submerged aquatic plants that provide important food and cover to a wide variety of fish and wildlife species. A fresh/intermediate open water area with no aquatics is assumed to have low suitability (SI=0.1). Optimal conditions (SI=1.0) are assumed to occur when 100 percent of the open water is dominated by aquatic vegetation. Habitat suitability may be assumed to decrease with aquatic plant coverage approaching 100 percent due to the potential for mats of aquatic vegetation to hinder fish and wildlife utilization; to adversely affect water quality by reducing photosynthesis by phytoplankton and other plant forms due to shading; and contribute to oxygen depletion spurred by warm-season decay of large quantities of aquatic vegetation. These effects are highly dependent on the dominant aquatic plant species, their growth forms, and their arrangement in the water column; thus, it is possible to have 100 percent cover of a variety of floating and submerged aquatic plants without the above-mentioned problems due to differences in plant growth form and stratification of plants through the water column. Because predictions of which species may dominate at any time in the future would be tenuous, at best, the EnvWG decided to simplify the graph and define optimal conditions at 100 percent aquatic cover.

SAV coverage is site specific and should be considered on a case-by-case basis. However, in an attempt to provide some general assumptions, the following project specific conditions should be considered when assessing SAV coverage for FWP and FWOP:

- Water depth
- Project area location: inland/protected vs. open to lake or bay processes
- Salinity levels
- Nutrient input (e.g. within diversion outfall area)
- Rate of land loss and RSLR

Restoring marsh within open water areas will reduce wave fetch, increase shallow open water and buffer inland areas increasing tidal lag. Generally, SAV coverage should increase as a result. In some cases existing conditions are already optimal for SAV coverage and, therefore, under FWP conditions percent cover should be maintained.

Consideration of the rate of land loss and RSLR for the project life should also be factored in. For FWOP, an area supporting SAV coverage will likely continue to experience subsidence and marsh loss resulting in reduced SAV coverage, and potentially reaching a point of habitat collapse where SAV is not supported. While under FWP conditions the area will continue to experience subsidence and marsh loss, it is assumed that the rate of loss has been reduced as a result of bringing in external sediment.

For sites located in freshwater diversion outfall areas, SAV coverage will likely be maintained for FWP and FWOP conditions due to nutrient input. Consideration should still be given for land loss rates, RSLR, and juxtaposition to and coalescence with large open water areas.

V3 – Marsh Edge and Interspersion

Marsh restore, FWP scenario:

TY	Year	Assumption
0	2013	Baseline conditions (existing conditions).
1	2014	100% Class 5
3	2016	100% Class 3
5	2018	50% Class 3 and 50% Class 1
6	2019	100% Class 1

Notes:
When assigning SI values to variable V3, the percent marsh values (variable V1) should also be considered and interspersion classes developed accordingly. This could result in assumptions that differ from those indicated above.
Between TY6 and TY50, one must use best professional judgment coupled with land loss projections to determine appropriate SI values for variable V3.

V4 – Percent of the Open Water Area ≤ 1.5 Feet Deep (in relation to marsh surface)

Marsh restore, FWP scenario:

TY	Year	Assumption
0	2013	Baseline conditions (existing conditions).
1	2014	Any marsh lost becomes shallow open water.
3	2016	Any marsh lost becomes shallow open water.
5	2018	Any marsh lost becomes shallow open water.
6	2019	Any marsh lost becomes shallow open water.
50	2063	1/6th of the shallow open water becomes deep based on 0.5 feet of subsidence.

Marsh restore, FWOP scenario:

- Marsh lost between TY1 & TY50 becomes shallow open water.
- At TY50, 1/3 of existing shallow water becomes deep (based on subsidence rate used in determining SLR adjustment).

V5 – Salinity

Assume salinity scores will be the same for FWP and FWOP scenarios.

Assume salinity values will not change enough over time to force a shift from the fresh marsh model to the brackish marsh model.

Data Source --
CRMS site http://www.lacoast.gov/crms2/Home.aspx - Click on Basic Viewer under the Mapping link. Click on the nearest data station and then select the Water tab to get the salinities. The data are approximately average annual and most appropriate for the Brackish Marsh and Saline Marsh models if the period of record doesn't have an anomalous event (e.g., drought, unusual FW diversion operation). Average annual salinity may be accepted on a case-specific basis for the Fresh Marsh/Intermediate Marsh model as well.

V6 – Aquatic Organism Access (% wetland accessible & type of access)

Marsh restore, FWP scenario:

TY	Year	Assumption
0	2013	Baseline conditions (existing conditions).
1	2014	0.0001 (supratidal; retention dikes not gapped or degraded)
3	2016	0.0001 (supratidal; retention dikes have been gapped or degraded)
5	2018	1.0 (intertidal)
6	2019	1.0 (intertidal)
50	2063	1.0 (intertidal)

Note:
Suggested minimum standard for "gapping" containment dikes or similar dikes is no less than one 25-foot wide gap (bottom width) every 1,000 feet, with the "gap" excavated to the desired average marsh elevation. The preferred standard is one 25-foot wide gap (bottom width) every 500 feet, with the "gap" excavated to the pre-project elevation (i.e. the water bottom). If the project design does not provide the minimum gapping, then the organism access values indicated above will need to be adjusted accordingly (re the maximum score attained as of TY5).

Marsh restore, FWOP scenario:
The structure rating is based on site specific, existing conditions and how those may change over time with land loss.

3.2 INTERMEDIATE MARSH MODEL – GENERAL ASSUMPTIONS AS THEY DIFFER FROM FRESH MARSH MODEL ASSUMPTIONS

V1 – Percent of Wetland Area Covered by Emergent Vegetation

Marsh restore, FWP scenario:

Calendar Year	TY	Planted Marsh Platform (credit)	50% planting rate (credit)	Unplanted Marsh Platform (credit)
2013	0 (baseline)			
2014	1 (supratidal)	10%	5%	0%
2016	3 (supratidal)	25%	17.5%	15%
2018	5 (intertidal)	100%	50%	50%
2019	6 (intertidal)	100%	100%	100%

Note: Assume 7-ft center planting densities.

3.3 BRACKISH MARSH MODEL – GENERAL ASSUMPTIONS AS THEY DIFFER FROM FRESH MARSH MODEL ASSUMPTIONS

V1 – Percent of Wetland Area Covered by Emergent Vegetation

Marsh restore, FWP scenario:

Calendar Year	TY	Planted Marsh Platform (credit)	50% planting rate (credit)	Unplanted Marsh Platform (credit)
2013	0 (baseline)			
2014	1 (supratidal)	10%	5%	0%
2016	3 (supratidal)	25%	17.5%	15%
2018	5 (intertidal)	100%	50%	50%
2019	6 (intertidal)	100%	100%	100%

Note: Assume 7-ft center planting densities.

V2 – Percent Open Water Area Covered by Submerged Aquatic Vegetation

Marsh restore, FWP scenario:

TY	Year	Assumption
0	2013	Baseline conditions (existing conditions).
1	2014	0%
3	2016	0%
5	2018	Same as baseline conditions.
6	2019	Increase baseline by 10%, then maintain this through TY25 (i.e. SI value plateaus).
25	2038	See guidance for TY6.
50	2063	25% of baseline conditions.

Marsh restore, FWOP scenario:
TY50 (2063) = 15% of baseline conditions.

General Notes:
Brackish marshes also have the potential to support aquatic plants that serve as important sources of food and cover for several species of fish and wildlife. Although brackish marshes generally do not support the amounts and kinds of aquatic plants that occur in fresh/intermediate marshes, certain species, such as widgeon-grass, and coontail and milfoil in lower salinity brackish marshes, can occur abundantly under certain conditions. Those species, particularly widgeon-grass, provide important food and cover for many species of fish and wildlife. Therefore, the V_2 Suitability Index graph in the brackish marsh model is identical to that in the fresh/intermediate model.

3.4 ADDITIONAL GUIDANCE FOR MARSH RESTORATION FEATURES PROPOSED IN AREAS WHERE THERE IS NO SIGNIFICANT LAND LOSS OVER TIME

The guidance provided herein is only applicable to proposed marsh restoration (marsh creation) features located in areas where data indicate no land loss will occur over the life of the mitigation project. For proposed marsh restoration features located in areas where there will be land loss, the general assumptions previously provided for use in running WVA marsh models will remain applicable.

V1 - % of Wetland Area Covered by Emergent Vegetation

Guidance for determining how much of the restored marsh feature will be land and how much will be shallow open water:

- Assume 1% of the total feature acreage will be open water in TY1 and 99% of the total acreage will be land.
- After TY1, increase the open water area by 0.075% each year using the total feature acreage to determine the acreage increase. Decrease the total acreage of land accordingly.

Example Calculation:
Assume the proposed marsh restoration feature encompasses 100 acres that can all be counted as marsh land.
At TY1, the land area will be 99% of the 100 acres while the open water area will be 1% of the 100 acres.
The increase in the open water area per year after TY1 and the decrease in the land area per year after TY1 will be: 0.075% X 100 acres = 0.075 acre per year.

Determination of land area and open water area:

TY	Land Acres	Open Water Acres	Open Water Calculation	Land Calculation
1	99.00	1.00	100 ac.*0.01	100 ac.*0.99
3	98.85	1.15	(1.0 ac. at TY1) + (2 yrs * 0.075 ac./yr.) = A	(99.0 ac. at TY1) - A
5	98.70	1.30	(1.0 ac. at TY1) + (4 yrs * 0.075 ac./yr.) = B	(99.0 ac. at TY1) - B
6	98.625	1.375	(1.0 ac. at TY1) + (5 yrs * 0.075 ac./yr.) = C	(99.0 ac. at TY1) - C
21	97.50	2.50	(1.0 ac. at TY1) + (20 yrs * 0.075 ac./yr.) = D	(99.0 ac. at TY1) - D
25	97.20	2.80	(1.0 ac. at TY1) + (24 yrs * 0.075 ac./yr.) = E	(99.0 ac. at TY1) - E
50	95.325	4.675	(1.0 ac. at TY1) + (49 yrs * 0.075 ac./yr.) = F	(99.0 ac. at TY1) - F

Determination of land area covered by emergent vegetation (marsh area):

TY	Land Acres	Marsh Acres	Marsh Area Calculation
1	99.00	9.9	99.0 ac. land * 0.10 (i.e. 10% of land covered by emergent vegetation)
3	98.85	49.425	98.85 ac. land * 0.50 (i.e. 50% of land covered by emergent vegetation)
5	98.70	98.70	98.70 ac. land * 1.00 (i.e. 100% of land covered by emergent vegetation)
6	98.625	98.625	98.70 ac. land * 1.00 (i.e. 100% of land covered by emergent vegetation)
21	97.50	97.50	97.50 ac. land * 1.00 (i.e. 100% of land covered by emergent vegetation)
25	97.20	97.20	97.20 ac. land * 1.00 (i.e. 100% of land covered by emergent vegetation)
50	95.325	95.325	95.325 ac. land * 1.00 (i.e. 100% of land covered by emergent vegetation)

Notes:

1. Values for TY0 will be based on existing conditions within the marsh restoration features.
2. The general assumptions applicable to determining the percentage of the marsh feature acreage (e.g. land acreage) that is covered by emergent vegetation remain the same as those set forth in the original fresh marsh WVA model guidance. These assumptions are: TY1 = 10%; TY3 = 50%; TY5 = 100%; TY6 = 100%.
3. Refer to the notes under the variable V1 assumptions for fresh marsh models concerning how features such as dikes, interior borrow areas, and constructed trenasses must be handled as regards the acreage of marsh land.

<u>V4 – Percent of the Open Water Area ≤1.5 Feet Deep (relative to marsh surface)</u>

Assume all of the open water areas that develop within the marsh feature (see variable V1 guidance) will be less than or equal to 1.5 feet deep. This assumption is applicable to target years 1 through 50.

3.5 PROJECT CONSTRUCTION NOTES FOR RESTORED MARSHES

The typical anticipated schedule for initial construction associated with the proposed marsh restoration features is as follows:

- Sept. 2013 – Begin construction
- May 2014 – Complete construction
- May 2015 – Initial marsh grade settles to target grade (1 year after end of construction). Degrade containment dikes, and/or install "fish gaps", and or establish gaps in other dikes.
- 2015 – Install plants (intermediate marsh and brackish marsh features only).

Note that none of the proposed fresh marsh restoration features will be planted. It was assumed that these areas would be sufficiently vegetated via natural recruitment and colonization. Planting would only occur if sufficient vegetative cover (herbaceous) does not develop through natural processes.

Remember that it is very important to review the most detailed design plans available (e.g. initial 35% design plans (drawings), or 65%+ design plans), and the project description narrative associated with these plans. These descriptions and drawings contain important information for specific mitigation features/sites that will affect assumptions used in the WVA models.

3.6 MARSH MODELS – MODEL TARGET YEARS

Typically use the target years specified below when analyzing marsh restoration polygons built in existing open water features:

TY	Year	
0	2013	Baseline conditions (assume construction starts in 2014 even though anticipated start is late 2013)
1	2014	Initial construction activities begin and are completed. No plants installed. V1 = 10% credit (but see calcs for areas where there is no land loss). V2 = 0%. V3 = 100% Class 5. V4 = lost land becomes shallow water. V6 = 0.0001.
3	2016	Restoration feature settles to desired target grade. Any associated perimeter containment dikes are degraded or gapped. Plants installed in intermediate and brackish marsh features (no planting in fresh marsh features since none required). V1 = 50% credit (but see calcs for areas where there is no land loss). V2 = 0%. V3 = 100% Class 3. V4 = lost land becomes shallow water. V6 = 0.0001.
5	2018	V1 = 100% credit (but see calcs for areas where there is no land loss). V2 = baseline SAV cover. V3 = 50% Class 3 and 50% Class 5. V4 = lost land becomes shallow water. V6 = 1.0
6	2019	V1 = 50% credit (but see calcs for areas where there is no land loss). V2 = increase baseline SAV cover by 15%. V4 = lost land becomes shallow water. V6 = 1.0
25	2038	V2 = increase baseline SAV cover by 15%.
50	2063	End project life. V2 = 50% of baseline SAV (FWP). V3 = 100% Class 3. V4 = 1/6th of shallow open water becomes deep (FWP); but if no land loss, all open water remains shallow. V6 = 1.0

The user of these guidelines is cautioned that the construction schedule for proposed mitigation features may not follow the construction schedule assumed in the preceding sections. If this is the case, the model target years and their associated model assumptions may have to be adjusted accordingly.

4.1 RELATED TOPICS – LAND LOSS AND ACCRETION

LAND LOSS RATES

To remain consistent with the WVAs run for the levees (including those for the 57-year period of analysis), the linear loss rates must be calculated in the linear loss spreadsheet. This requires 1984 to 2010 mitigation analysis/land change data from USGS within which a particular time period is chosen depending on water levels taken at that time with efforts to pick years that allow for the greatest time during this range. Data selection is subject to interagency approval. The rate should be calculated in acres/year for integration with below methods on SLR and accretion.

The land loss rate applied to restored marshes will be 50% of the background (FWOP) loss rate. However, land loss rates will revert back to baseline rates after 10 inches of soil have formed/accreted above the initially created marsh platform. Based on input from Dr. Andy Nyman and other academics, plant roots extend downward a maximum of approximately 10 inches below the marsh surface. Consequently, when the plant roots are no longer in contact with the created platform, loss rates revert back to those of the adjoining marshes (i.e., background loss rate).

Derivation and Application of Land Loss Rates

A linear regression is applied to USGS' hyper-year (hyper temporal) data of the extended boundary. The slope of the regression line provides the acres of marsh lost for the extended boundary during the years of USGS analysis. By dividing the slope (marsh lost in acres) by the acreage at the beginning of the USGS evaluation period (e.g. 1984), the percent loss rate is determined for the extended boundary. (Note: USGS provides a percent loss rate by dividing the marsh lost in acres by the total acres of the extended polygon, which is why the percent loss rates are different.)

The project area FWOP loss rate (in acres/year) is determined by applying the extended boundary percent loss rate to the marsh acres in the project area at the beginning of the USGS period of analysis (e.g. 1984 in this case) under FWOP. The project area FWP loss rate is determined by multiplying the acres of the marsh creation area by the percent loss rate and dividing by 2 to apply the 50% reduction in loss for marsh creation.

ACCRETION

Utilize the following accretion rates when running WVA models:

- Fresh Marsh and Intermediate Marsh = 7.2 mm/year.
- Brackish Marsh = 7.7 mm/year.

Accretion is incorporated into determining when the background loss rate resumes within a created marsh area. Normally, the loss of mechanically created or nourished marsh is considered to be half of background loss rate. In the year when post-construction accretion exceeds 10 inches, the loss rate returns to the background loss rate. However, when created marshes are higher than natural marshes, there could be a delay in the loss rate change. Depending on the mechanically created marsh elevation post-construction, cumulative accretion assumes a 3-year settling period (marsh creation sites are assumed to achieve full functionality and vegetation coverage 3 years after construction).

Marsh collapse is a 10-year period that begins when the calculated cumulative accretion deficit reaches limits determined by staff working on the modeling for the 2012 Coastal Master Plan (see below). Typically, the collapse criteria are reached only during the High SLR scenario, however this generalization may not hold true in all cases.

Collapse Threshold Ranges Used in Master Plan Work

- Intermediate Marsh (cm): Low = 30.7; High = 38.0; Median = 34.4
- Brackish Marsh (cm): Low = 20.0; High = 25.8; Median = 22.9.
- Saline Marsh (cm): Low = 16.0; High = 25.0; Median = 20.5.

Collapse threshold selected as the median range for type of marsh indicated. First year of collapse is the year when the Cumulative Accretion Deficit (inundation) is equal to or greater than the median range.

Accelerated Sea Level Rise

The land loss rates determined as described above, are for the constant historic or low SLR scenario (1.7 mm/yr). Based on water level gages and known historic SLR rates, the Corps has identified RSLR rates under the historic SLR scenario, and under the intermediate and high SLR scenarios. The intermediate and high SLR scenarios would result in gradually accelerating SLR rates and it is assumed that those scenarios would result in accelerating land loss rates. Using Corps-predicted water level rise, RSLR rates can be determined. RSLR rates are then converted into an annual adjustment factor that increases wetland loss rates in proportion to the magnitude of the RSLR rate. The annual wetland loss rate adjustment factors are based on a positive relationship observed between wetland loss rates and RSLR rates from coastwide non-fresh marshes. In this relationship, RSLR was calculated as the sum of subsidence per statewide subsidence zones (see Figure 1) plus a eustatic SLR rate of 1.7 mm/yr. Recent land loss rates in percent per year were plotted against RSLR determined for those subsidence zones.

Although this is approaching the limits of rigor for WVA, each of the above methods carry substantial averaging and compounding uncertainty. Users should be aware of the general limits of accuracy and avoid adding more complexity unless deemed necessary and reasonable.

4.2 RELATED TOPICS - GENERAL SHORELINE PROTECTION ISSUES

Hard structures (foreshore dikes, rock dikes, breakwaters) get credit for preventing 100% of loss from shoreline erosion as long as the structure is maintained. If it is not maintained, then a linear decrease in effectiveness must be assumed beginning after the end of the maintenance period. For example, if a rock dike is assumed to need a lift every 14 years but the last lift was at year 14 (TY14), then beginning TY28 (for the rock) it would have a linear decrease in effectiveness to the point of not reducing shoreline erosion at all by TY42.

Vegetative plantings get credit for reducing shoreline erosion by 50% until TY20. After TY20, the area would revert to 100% of the shoreline erosion rate.

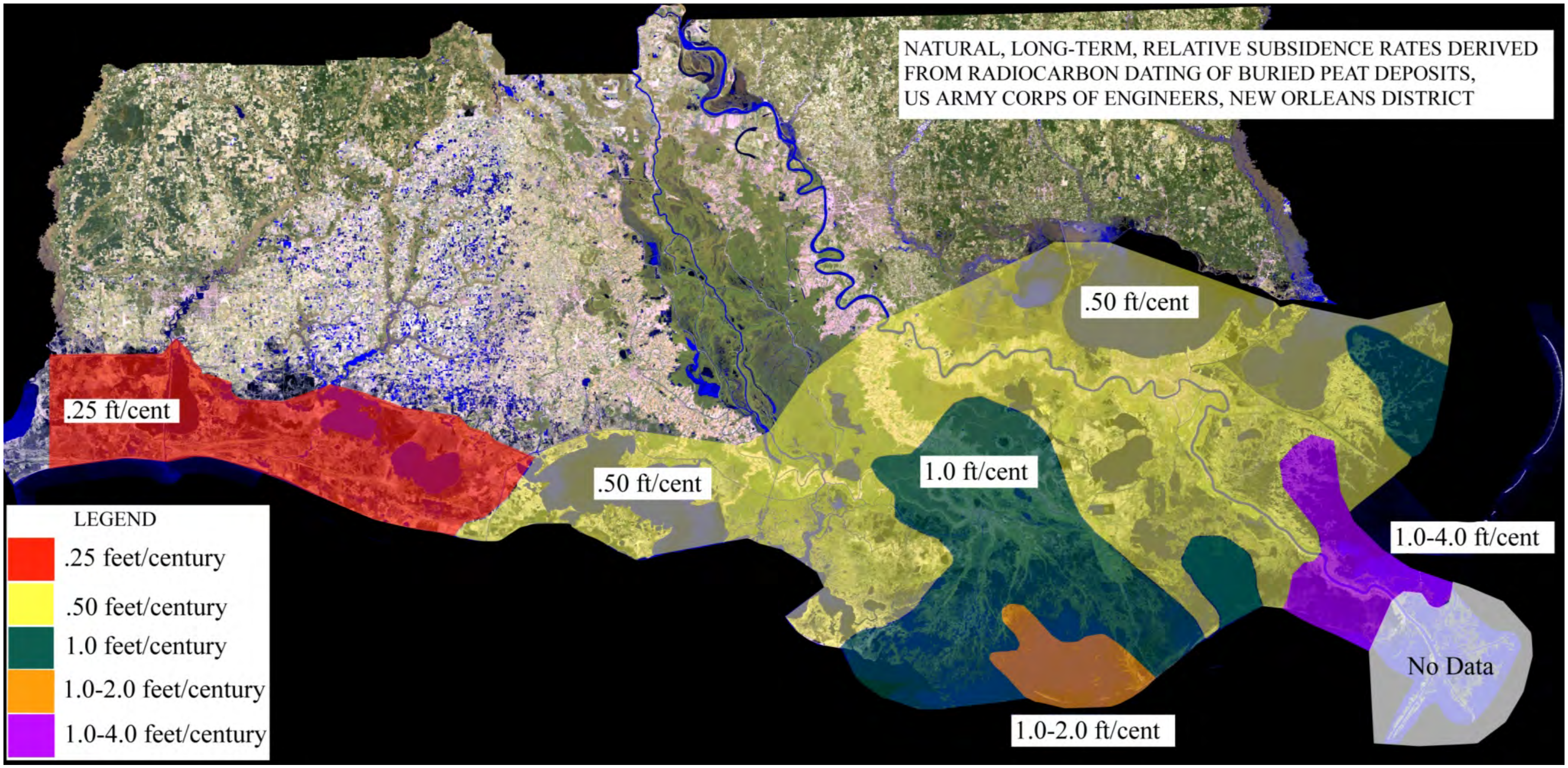

Figure 1. Long-term relative subsidence rates.

APPENDIX 1
Predicting Abrupt Marsh Collapse
(from MRGO Ecosystem Restoration Study methods doc, 3 Feb 2012)
Ronny Paille - USFWS

Research by Nyman et al. (1993) and Nyman et al. (2006) 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 (Table 1) to predicting onset of abrupt marsh collapse (Coastal Protection and Restoration Authority of Louisiana 2012). In this study, the median values by habitat type were used to predict onset of abrupt marsh collapse.

Table 1. Cumulative accretion deficits assumed to initiate marsh collapse.

Marsh Type	Range Low Limit (cm)	Range High Limit (cm)	Range Median (cm)
Intermediate	30.7	38.0	34.4
Brackish	20.0	25.6	22.8
Saline	16.0	25.0	20.5

It is assumed that it will take 10 years for the collapsing wetland landscape to completely convert to open water (the 10-year period was assumed to account for wetlands of varying elevations). These values incorporated the average area accretion rate of 7.4 mm per year (Table 2).

Table 2. Study area accretion measurements.

Site	Date	Wetland Type	Method	Accretion rate (cm yr-1)	Source
Breton Sound	1963-1999	Freshwater	^{137}Cs	0.65 ± 0.18	DeLaune and Pezeshki, 2003
Caernarvon diversion	1999	Freshwater	feldspar	1.57 ± 0.05*	Lane et al., 2006
Violet diversion	1999	Saline	feldspar	0.44 ± 0.01*	Lane et al., 2006
Central Wetlands				0.47	U.S. Army Corps *
St. Bernard Parish (Shell Beach)	1963-1992	Saline	^{137}Cs	0.54 ± 0.13	DeLaune et al., 1992
Rigolets	1963-1992	Saline	^{137}Cs	0.77 ± 0.09	DeLaune et al., 1992
Caernarvon	1963-1992	Freshwater	^{137}Cs	0.75 ± 0.12	DeLaune et al., 1992
				Avg. = 0.74	

** personal communication, Mr. Del Britsch, New Orleans District, U.S. Army Corps of Engineers*

Using this average accretion rate and the water level increases associated with sea level rise (post the SLR baseline year of 2011, see Figure 1), the cumulative accretion and cumulative water level rise were calculated for each year within the project life. The accretion deficit may then be calculated as the difference between the cumulative water level rise and the cumulative accretion. Based on those calculations, the collapse criteria were determined (Table 3).

Figure 1. Shell Beach predicted relative sea level rise estimates.

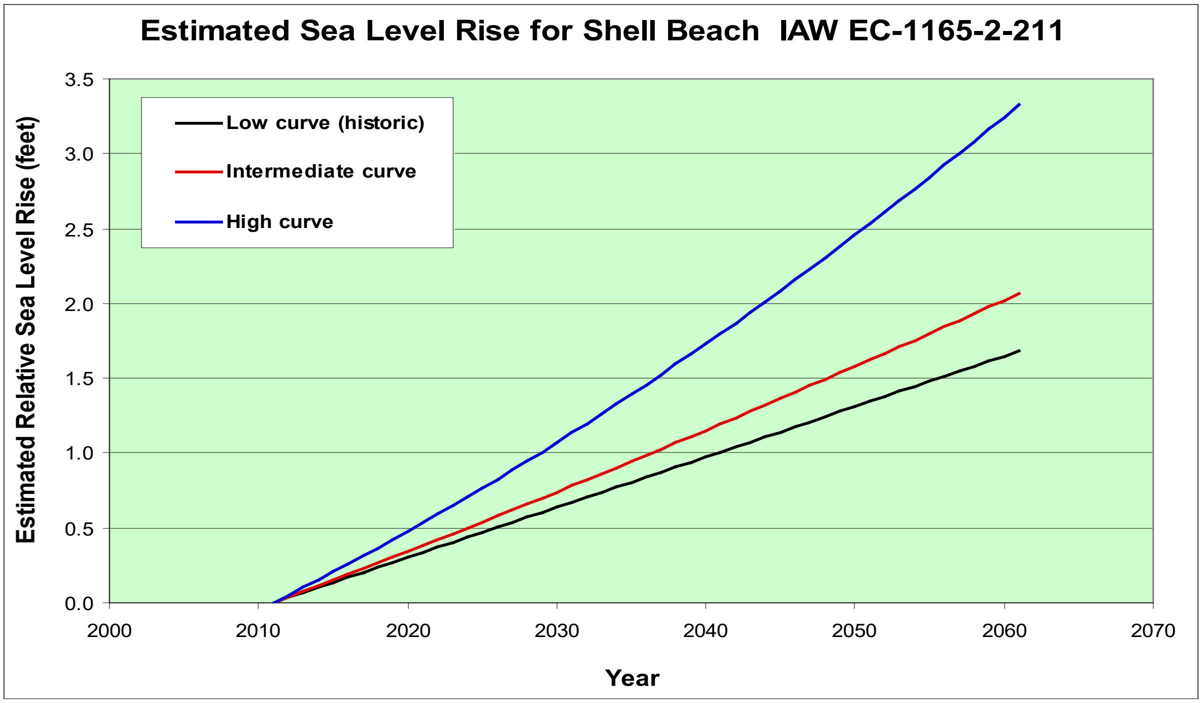

Table 3 Years when marsh collapse is predicted to begin.

SLR Scenario	Year Marsh Collapse Begins		
	INT marsh	BR marsh	SAL marsh
Med SLR	**	2058	2054
High SLR	2044	2035	2033

** *collapse occurs beyond the 50-year project life*

According to this analysis, marsh collapse would begin in 2033 and 2035 for saline and brackish marshes, respectively, under the High RSLR scenario. Under the medium SLR scenario, collapse would begin in 2054 and 2058 for saline and brackish marshes, respectively.

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APPENDIX L

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

INTRODUCTION

This document contains general mitigation guidelines applicable to both the LPV HSDRRS Mitigation Project and the WBV HSDRRS Mitigation Project. They were developed by the USACE in coordination with the Interagency Team and the Non-Federal Sponsor (NFS). These guidelines served to help develop plans for the final array of mitigation projects considered and also served to help estimate preliminary mitigation construction, mitigation monitoring/reporting, and mitigation management/maintenance costs associated with the final array of mitigation projects considered.

It is important to understand that the guidelines addressed herein were not intended to serve as the final mitigation program/plan for a particular Tentatively Selected Mitigation Project (TSMP) addressed in Section 2 of the Programmatic Individual Environmental Report (PIER) for the WBV HSDRRS Mitigation. More detailed and project-specific mitigation plans for each TSMP will be prepared during the process of preparing the Tiered IER (TIER) covering a particular TSMP. Such mitigation plans, including components such as planting plans, success criteria, monitoring/reporting requirements, management/maintenance plans, etc., will be prepared by the USACE in coordination with the Interagency Team and the Non-Federal Sponsor. However, such final mitigation plans would not deviate substantially as regards the basic tenents set forth in this document.

It is also important to understand that certain provisions will apply to any Corps-constructed mitigation project. Some, but not necessarily all, of these provisions are discussed in the following paragraph.

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

MITIGATION PLANTING GUIDELINES

PLANTING GUIDELINES FOR BOTTOMLAND HARDWOOD (BLH) HABITATS

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

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

The canopy species installed will be in general accordance with the species lists provided in Tables 1A and 1B. Plantings will be conducted such that the total number of plants installed in a given area consists of approximately 60% hard mast-producing species (Table 1A) and approximately 40% soft mast-producing species (Table 1B). The species composition of the plantings for each of the two groups of canopy species (e.g. hard mast species and soft mast species) should mimic the percent composition guidelines indicated in Tables 1A and 1B. However, site conditions (factors such as hydrologic regime, soils, composition of existing native canopy species, etc.) and planting stock availability may necessitate deviations from the species lists and/or the percent composition guidelines indicated in these tables. In general, a minimum of 3 hard mast species and a minimum of 3 soft mast species should be utilized.

The midstory species installed will be selected from the species list provided in Table 1C. Plantings will consist of at least 3 different species. The species used and the proportion of the total midstory plantings represented by each species (percent composition) will be dependent on various factors including site conditions (composition and frequency of existing native midstory species, hydrologic regime, soils, etc.) and planting stock availability.

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

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

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

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

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

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

TBD = To Be Determined

Species for Dry Bottomland Hardwood Habitats (BLH-Dry Habitats)

The canopy species installed will be in general accordance with the species lists provided in Tables 2A and 2B. Plantings will be conducted such that the total number of plants installed in a given area consists of approximately 50% hard mast-producing species (Table 2A) and approximately 50% soft mast-producing species (Table 2B). The species composition of the plantings for each of the two groups of canopy species (e.g. hard mast species and soft mast species) should mimic the percent composition guidelines indicated in Tables 2A and 2B. However, site conditions (factors such as hydrologic regime, soils, composition of existing native canopy species, etc.) and planting stock availability may necessitate deviations from the species lists and/or the percent composition guidelines indicated in these tables. In general, a minimum of 3 hard mast species and a minimum of 3 soft mast species should be utilized.

The midstory species installed will be selected from the species list provided in Table 2C. Plantings will consist of at least 3 different species. The species used and the proportion of the total midstory plantings represented by each species (percent composition) will be dependent on various factors including site conditions (composition and frequency of existing native midstory species, hydrologic regime, soils, etc.) and planting stock availability.

Table 2A: Preliminary Planting List for Dry Bottomland Hardwood Habitat, Hard Mast-Producing Canopy Species (50% of Total Canopy Species)

Common Name	Scientific name	Percent Composition
Nuttall oak	*Quercus nuttalli* or *Q. texana*	10%
Willow oak	*Quercus phellos*	10%
Water oak	*Quercus nigra*	20%
Live oak	*Quercus virginiana*	20%
Cherrybark oak	*Quercus pagoda*	5%
Sweet Pecan	*Carya illinoensis*	20%
Southern red oak	*Quercus falcata*	5%
Cow oak	*Quercus michauxii*	10%

Table 2B: Preliminary Planting List for Dry Bottomland Hardwood Habitat, Soft Mast-Producing Canopy Species (50% of Total Canopy Species)

Common Name	Scientific name	Percent Composition
Drummond red maple	*Acer rubrum* var. *drummondii*	10%
Sugarberry	*Celtis laevigata*	15%
Green ash	*Fraxinus pennsylvanica*	15%
Sweetgum	*Liquidambar styraciflua*	20%
American elm	*Ulmus americana*	10% - 20%
Common persimmon	*Diospyros virginiana*	15%
Red mulberry	*Morus rubra*	5 - 10%
American sycamore	*Platanus occidentalis*	0 - 5%
River birch	*Salix nigra*	0 - 5%
Honey locust	*Gleditsia triacanthos*	0 – 5%

Table 2C: Preliminary Planting List for Dry Bottomland Hardwood Habitat, Midstory Species

Common Name	Scientific name	Percent Composition
Roughleaf dogwood	*Cornus drummondii*	TBD
Mayhaw	*Crataegus opaca*	TBD
Green hawthorn	*Crataegus viridis*	TBD
Deciduous holly	*Ilex decidua*	TBD
Yaupon	*Ilex vomitoria*	TBD
Palmetto	*Sabal minor*	TBD
Southern wax myrtle	*Morella cerifera*	TBD
Southern magnolia	*Magnolia grandiflora*	TBD
Southern crabapple	*Malus angustifolia*	TBD
Eastern red cedar	*Juniperus virginiana* var. *virginiana*	TBD
Elderberry	*Sambucus canadensis*	TBD

TBD = To Be Determined

Deviations from Typical Planting Guidelines

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

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

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

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

PLANTING GUIDELINES FOR SWAMP HABITATS

Canopy species will be planted on 9-foot centers (average) to achieve a minimum initial stand density of 538 seedlings (trees) per acre. Midstory species will be planted on 18-foot centers (average) to achieve a minimum initial stand density of 134 seedlings per acre. Stock used for canopy species will be at least 1 year old, at least 3 feet tall, and have a root collar diameter that exceeds 0.5 inch. Stock used for midstory species will be at least 1 year old and will be at least 3 feet tall. All stock must be obtained from a registered licensed regional nursery/grower and of a regional eco-type species properly stored and handled to ensure viability. The plants will typically be installed during the period from December through March 15 (planting season/dormant season); however, unanticipated events may delay plantings until late spring or early summer. The seedlings will be installed in a manner that that avoids monotypic rows of canopy and midstory species (i.e. goal is to have spatial diversity and mixture of planted species). If herbivory may threaten seedling survival, then seedling protection devices such as wire-mesh fencing or plastic seedling protectors will be installed around each planted seedling.

The canopy species installed will be in general accordance with the species lists provided in Table 3A. The species composition of the plantings should mimic the percent composition guidelines indicated in this table. However, site conditions (factors such as hydrologic regime, soils, composition of existing native canopy species, etc.) and planting stock availability may necessitate deviations from the species lists and/or the percent composition guidelines indicated. In general, a minimum of 3 canopy species should be utilized, the plantings must include baldcypress and tupelogum (water tupelo), and baldcypress should typically comprise at least 50% of the total number of seedlings installed.

The midstory species installed will be selected from the species list provided in Table 3B. Plantings will consist of at least 2 different species. The species used and the proportion of the total midstory plantings represented by each species (percent composition) will be dependent on various factors including site conditions (composition and frequency of existing native midstory species, hydrologic regime, soils, etc.) and planting stock availability.

Table 3A: Preliminary Planting List for Swamp Habitat, Canopy Species

Common Name	Scientific name	Percent Composition
Bald cypress	*Taxodium distichum*	60% - 75%
Tupelogum	*Nyssa aquatic*	20% - 25%
Green ash	*Fraxinus pennsylvanica*	10% - 15%
Drummond red maple	*Acer rubrum* var. *drummondii*	5%
Bitter pecan	*Carya x lecontei*	5% - 10%

Table 3B: Preliminary Planting List for Swamp Habitat, Midstory Species

Common Name	Scientific name	Percent Composition
Buttonbush	*Cephalanthus occidentalis*	TBD
Roughleaf dogwood	*Cornus drummondii*	TBD
Swamp privet	*Forestiera acuminata*	TBD
Possumhaw	*Ilex decidua*	TBD
Virginia willow	*Itea virginica*	TBD
Wax myrtle	*Myrica cerifera*	TBD
Swamp rose	*Rosa palustris*	TBD
American snowbell	*Styrax americanus*	TBD

TBD = To Be Determined

Deviations from Typical Planting Guidelines

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

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

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

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

PLANTING GUIDELINES FOR MARSH HABITATS

Planting Guidelines for Intermediate and Brackish Marsh Habitats

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

Species installed in proposed intermediate marsh habitats will be selected from the species list provided in Table 4. Plantings will consist of at least 2 different species. The species used and the proportion of the total plantings represented by each species will be dependent on various factors including site conditions and planting stock availability.

Table 4: Preliminary Planting List for Intermediate Marsh Habitats

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

Species installed in proposed brackish marsh habitats will be selected from the species list provided in Table 5. Plantings will consist of at least 2 different species. The species used and the proportion of the total plantings represented by each species will be dependent on various factors including site conditions and planting stock availability.

Table 5: Preliminary Planting List for Brackish Marsh Habitats

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

Planting Guidelines for Fresh Marsh Habitats

Planting of fresh marsh habitats is not proposed since it is anticipated that desirable fresh marsh vegetation would rapidly colonize such habitats through natural recruitment. Should the initial vegetation success criteria for such features not be achieved however, supplemental planting of herbaceous species would be conducted to help insure the establishment of sufficient vegetative cover. Stock will typically be either 4-inch container size or bare-root or liner stock, depending on the species involved. The required stock size for each plant species proposed for installation must be specified in the Mitigation Work Plan. Plants must be obtained from a registered licensed regional nursery/grower and of a regional eco-type species properly stored and handled to ensure viability. Plant installation should be conducted during the period from March 15 through June 15. Planting should not be undertaken later than approximately July 15, although planting during the early fall may be deemed acceptable on a case-by-case basis.

The plant species to be installed would be determined based on field inspections of the mitigation site as would the planting plan (e.g. location of supplemental plantings and density of such plantings). Potential species to be installed could include such plants as maidencane, giant cutgrass, arrowheads (*Sagittaria* spp.), pickerelweed (*Pontederia cordata*), arrow arum (*Peltandra virginica*), smartweed (*Polygonum* spp.), common rush (*Juncus effusus*), pennyworts (*Hydrocotyle* spp.), and spikerush (*Eleocharis* spp.), although other species could be utilized. Typically at least two different species would be utilized.

<u>Deviations from Typical Planting Guidelines</u>

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

It may be determined that the initial planting of brackish marsh features would best be conducted in phases. Using this approach, a certain percentage of the total number of plants required would be installed in the year that final marsh construction activities are completed while the remainder would be installed in the following year. The determination of whether to use phased planting or to install all the necessary plants upon completion of construction activities will be made during the final design phase of the mitigation project. The proposed planting scheme would be subject to review and approval by the Interagency Team.

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

ADDITIONAL MITIGATION GUIDELINES

<u>GUIDELINES FOR THE ERADICATION AND CONTROL OF INVASIVE AND NUISANCE PLANT SPECIES</u>

The eradication of invasive and nuisance plant species may incorporate a variety of eradication methods including mechanized removal (ex. hydroaxes, gyro-tracs, heavy machinery used in areas slated for topographic alterations), non-mechanized removal (use of hand implements such as chain saws and machetes, direct uprooting by hand), aerial herbicide applications (applications using aircraft), and ground herbicide applications (on-the-ground applications using backpack sprayers, hypo-hatchet, tube-injector, wick applicators, etc.). Only ground herbicide applications would be used in marsh habitats. Regardless of the methods involved, care will be exercised to avoid damage to desirable native species to the greatest extent practicable.

During the initial eradication process in forested habitats, larger quantities of felled materials may be removed from the mitigation site and disposed in a duly-licensed facility. Some felled woody plants may be chipped on-site with the chips spread in a layer not exceeding approximately 3 to 4 inches thick. Felled woody plants may also be gathered and stacked “teepee” style in scattered locations. In certain cases, larger invasive trees may be killed and allowed to remain standing if it is determined this would not interfere with mitigation goals. The Mitigation Work Plan must address the specific measures proposed to conduct initial eradication efforts, including handling of vegetative debris, and the recommended measures for the subsequent control of invasive and nuisance plant species.

The USACE will be responsible for the initial eradication of invasive and nuisance plants as well as for any subsequent eradication efforts until such time that the mitigation monitoring responsibilities are transferred to the NFS, pursuant to the provisions contained in the Introduction section. Thereafter, the NFS will be responsible for the successful control and eradication of invasive and nuisance plant species, subject to the cited provisions. The management objectives will be to maintain the mitigation site such that it is essentially free from invasive and nuisance plant species immediately following a given maintenance event and such that the total average vegetative cover accounted for by invasive and nuisance species each constitute less than 5% of the total average plant cover during periods between maintenance events.

GUIDELINES FOR CLEARING, GRADING, AND OTHER EARTHWORK ACTIVITIES

Enhancement or restoration activities in certain mitigation areas where the proposed habitat is BLH or swamp may include alterations to existing topography. This includes an array of potential actions such as lowering grades over relatively large areas, breaching or removal of existing berms and spoil banks, filling of drainage canals and ditches, construction of containment berms, etc. The construction process could involve mechanized clearing and grubbing of the areas to be graded followed by the actual grading work.

Prior to the clearing, grubbing, grading, and related earthwork activities, the exact limits of zones requiring clearing and grading/earthwork will be determined in the field and will be marked with protective barriers such as flagging, ropes, stakes, silt fence, enviro-fence, or a combination of such items. These marker barriers will remain in place until grading activities are completed. Prior to initiation of the clearing and grading/earthwork activities, silt fences or similar erosion/sediment control devices will also be installed at appropriate locations adjacent to existing wetlands to control erosion and sediment transport. These erosion/sediment control devices will remain in place until earthwork activities are completed and the disturbed areas are stabilized. Machinery/vehicle ingress and egress routes to the areas requiring earthwork will be restricted to avoid unnecessary damage to nearby upland and wetland areas.

Cleared vegetation will typically be removed from the mitigation site for disposal either within a duly licensed off-site disposal facility. There may be instances, however, where the cleared vegetation may be burned on-site or may be mulched on-site. Soil removed during the grading/earthwork process will either be disposed off-site in a licensed facility or used within the mitigation site as fill if the material is suitable and fill is needed. All other debris generated during the clearing and grading process will be disposed in a duly-licensed off-site facility.

If grading or other earthwork activities are necessary, the Mitigation Work Plan must include detailed plans depicting the required activities (ex. grading contours, cross-sections, stormwater pollution prevention plans, etc.). These plans will be developed by the USACE in coordination with the Interagency Team. The USACE will be responsible for the successful completion of all initial earthwork activities, subject to the provisions stated in the Introduction section. The NFS will typically be responsible for any subsequent earthwork activities necessary for the proper maintenance of the mitigation site, subject to the provisions stated in the Introduction section. However if the primary purpose of the initial grading/earthwork activities is to enhance site hydrology, then the USACE will typically be responsible for conducting any additional grading/earthwork activities necessary to ensure the hydrologic enhancement objectives (success criteria) are achieved, subject to the provisions contained in the Introduction section. Once it is demonstrated that these objectives have been satisfied, the NFS will then be responsible for any further earthwork activities needed to ensure proper maintenance, subject to the provisions mentioned in the Introduction section.

The construction of all proposed marsh habitats (fresh, intermediate, and brackish marshes) and the construction of some BLH restoration and swamp restoration features will be achieved by adding fill to existing open water areas. The Mitigation Work Plan for such construction must include a detailed Stormwater Pollution Prevention Plan that minimizes potential impacts to adjacent natural habitats and minimizes degradation of water quality in off-site areas. The USACE will be responsible for preparation of this plan and for the successful completion of all initial construction activities, subject to the provisions found in the Introduction section. Once the applicable topographic success criteria have been achieved, the NFS will thereafter be responsible for any topographic alterations necessary to achieve mitigation success, subject to the provisions set forth in the Introduction section.

GUIDELINES FOR SURFACE WATER MANAGEMENT FEATURES AND STRUCTURES

Enhancement or restoration efforts in some mitigation areas may include construction of surface water management systems and/or installation of water conveyance or water control structures (ex. drainage culverts, flap gates, weirs). If such actions are necessary, the Mitigation Work Plan must include detailed plans for these activities as well as operational specifications if applicable. These plans and specifications will be developed by the USACE in coordination with the Interagency Team. The USACE will be responsible for the successful construction of any surface water management features, drainage structures, and water control structures, subject to the provisions discussed in the Introduction section. The NFS will typically be responsible for the subsequent maintenance and operation activities required, subject to the provisions set forth in the Introduction section.

It is noted that there is a strong preference for mitigation sites that are self-sustaining from a hydrologic perspective. While active water management might be needed in the short-term for establishment of plantings or other reasons, sites that require active hydrologic management to achieve long-term success should generally be avoided.

SWAMP HYDROLOGY GUIDELINES

The optimal hydrologic regime for baldcypress/tupelogum swamps involves both seasonal flooding and good surface water exchange between a particular swamp and adjacent systems. The typical hydroperiod should include several periods of flooding (inundation) and drawdown, or a “pulsing” hydrology. Surface water should be present for extended periods, especially during portions of the growing season, but should be absent (water table at or below the soil surface) by the end of the growing season in most years. At a minimum, standing surface water should be absent for approximately 2 months during the growing season once every 5 years. Abundant and consistent freshwater input from riverine systems is most desirable, as is relatively consistent surface water flow through the swamp during flooded periods. However, other sources of sheetflow into the swamp can be similarly beneficial. The main objective is to have sufficient surface water exchange between the swamp and adjacent habitats. Situations involving permanent flooding and/or no surface water exchange should be avoided when possible.

The following provides some general hydrologic guidelines for mitigation projects involving swamp restoration and for those mitigation projects involving swamp enhancement where enhancement of the existing hydrologic regime is a component of the mitigation work program. It is emphasized that these are merely guidelines and the attainment of one or more of these guidelines may not be possible in some situations.

- Strive for a minimum of about 200 consecutive days but no more than roughly 300 consecutive days of inundation (flooding). This period of inundation should overlap a portion of the growing season (preferably the early portion or late portion).
- Strive for a minimum of roughly 40 to 60 consecutive days during the growing season where the water table is at or below the soil surface (i.e. non-inundated period). This non-inundated period should preferably occur during the middle portion of the growing season. The non-inundated period should not exceed approximately 90 to 120 days.
- Strive to achieve an average maximum (peak) water table elevation that ranges between approximately 1.0 feet to 2.0 feet above the soil surface (i.e. depth of average peak inundation is 1.0 to 2.0 feet). Water table elevations greater than 2 feet above the soil surface may occur, however such occurrences should be of relatively short duration (i.e. brief “spikes” in the depth of inundation).

- Locate the mitigation area such that it naturally receives freshwater inputs via surface flow from adjacent lands and such that, during periods of inundation, there is good sheet flow through the mitigation area including a means for surface water discharge from the mitigation area. If the mitigation area cannot be located to attain these goals naturally, then mitigation activities should include actions to achieve these goals to the greatest degree practicable (e.g. include measures to provide for good surface water exchange between the swamp and adjacent systems), while at the same time not jeopardizing hydrology objectives pertaining to the swamp's hydroperiod.

WET BOTTOMLAND HARDWOOD HYDROLOGY GUIDELINES

The optimal hydrologic regime for wet bottomland hardwood (BLH) forests also involves both brief seasonal flooding and sufficient surface water exchange between the forest and adjacent systems. Wet BLH forests (BLH-Wet habitats) are commonly flooded for some portion of the year, although the timing, extent, depth, duration, and source of floodwaters can be highly variable. The hydroperiod commonly includes temporary flooding for brief periods during the growing season; however the water table is typically below the soil surface for the majority of the growing season. When flooding (inundation) does occur, freshwater input from riverine systems is most desirable as is relatively consistent surface water flow through the forest. Having good surface water exchange between the BLH forest and adjacent habitats is the primary objective, thus other sources of sheetflow into the forest besides riverine sources can be similarly beneficial.

The following provides some general hydrologic guidelines for mitigation projects involving BLH-Wet habitat restoration and for those mitigation projects involving BLH-Wet habitat enhancement where enhancement of the existing hydrologic regime is a component of the mitigation work program. These are simply guidelines and the attainment of one or more of these guidelines may not be possible in some situations.

- Avoid extended periods of inundation, particularly during the early portion of the growing season. Brief periods of flooding typically should occur during the winter and early spring, but the water table should be greater than 1 foot below the soil surface for an extended period during the growing season.
- The hydroperiod should be such that the forest is irregularly inundated or soils are saturated to the soil surface for a period ranging from approximately 15 to 30 days during the growing season.
- Locate the mitigation area such that it naturally receives occasional freshwater inputs via surface flow from adjacent lands and such that, during periods of inundation, there is good sheet flow through the mitigation area including a means for surface water discharge from the mitigation area. If the mitigation area cannot be located to attain these goals naturally, then mitigation activities should include actions to achieve these goals to the greatest degree practicable (e.g. include measures to provide for good surface water exchange between the BLH forest and adjacent systems), while at the same time not jeopardizing hydrology objectives pertaining to the forest's hydroperiod.

**MITIGATION SUCCESS CRITERIA AND MITIGATION MONITORING:
BOTTOMLAND HARDWOOD MITIGATION FEATURES (BLH-Wet and BLH-Dry)**

MITIGATION SUCCESS CRITERIA

The success (performance) criteria described herein are applicable to both proposed BLH-Wet habitats and BLH-Dry habitats, unless otherwise indicated.

1. General Construction

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

B. For mitigation features established in existing open water areas, complete all final construction activities in Mitigation TY2 (2015), and in accordance with the mitigation work plan as well as the final project plans and specifications. The necessary activities will vary with the mitigation site. Examples include, but are not limited to: degrading or "gapping" of perimeter retention dikes; construction of water management structures (weirs, etc.). These requirements classify as initial success criteria.

2. Native Vegetation

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

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

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

C. 4 Years Following Completion of Initial Plantings –

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

D. Within 10 Years Following Completion of Initial Plantings –

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

E. 15 Years Following Completion of Initial Plantings –
- Achieve a minimum average density of 75 living native plants per acre in the midstory stratum (planted midstory and/or naturally recruited native midstory species). This requirement classifies as an intermediate success criterion.

F. 25 Years Following Completion of Initial Plantings –
- Average cover by native species in the midstory stratum must be greater than 20% but cannot exceed 50%. This criterion will thereafter remain in effect for the duration of the overall monitoring period.
- Average cover by native species in the understory stratum must be greater than 30% but cannot exceed 60%. This criterion will thereafter remain in effect for the duration of the overall monitoring period.
- The requirements above classify as long-term success criteria.

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

3. Invasive and Nuisance Vegetation

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

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

4. Topography

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

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

5. Thinning of Native Vegetation (Timber Management)

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

6. Hydrology (applicable to BLH-Wet habitats only)

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

B. If the mitigation program includes actions intended to enhance site hydrology or hydroperiod, demonstrate that the affected site is irregularly inundated or soils are saturated to the soil surface for a period ranging from 7% to approximately 13% of the growing season during a year having essentially normal rainfall. The Mitigation Work Plan for a specific site may establish more specific hydrologic enhancement goals. If this is the case, demonstrate attainment of the specific goals identified in the plan. These hydrology/hydroperiod requirements classify as long-term success criteria.

MITIGATION MONITORING GUIDELINES

The following guidelines for mitigation monitoring and reporting are applicable to both BLH-Wet and BLH-Dry habitats unless otherwise indicated.

"Time Zero" Monitoring Report (Monitoring Report #1)

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

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

Additional Monitoring Reports

All monitoring reports generated after the initial "time zero" report will typically provide the following information unless otherwise noted:

- A plan view drawing of the mitigation site showing the approximate boundaries of different mitigation features (ex. planted areas, areas only involving eradication of invasive and nuisance plant species; surface water management features, etc.), monitoring transect locations, sampling plot locations, photo station locations, and, if applicable, piezometer and staff gage locations.

- A brief description of maintenance and/or management and/or mitigation work performed since the previous monitoring report along with a discussion of any other significant occurrences.

- Photographs documenting conditions in the mitigation site at the time of monitoring. Photos will be taken at permanent photo stations within the mitigation site. At least two photos will be taken at each station with the view of each photo always oriented in the same general direction from one monitoring event to the next. The number of photo stations required as well as the locations of these stations will vary depending on the mitigation site. The USACE will make this determination in coordination with the Interagency Team and will specify the requirements in the Mitigation Monitoring Plan. For mitigation features involving habitat enhancement rather than restoration, the permanent photo stations will primarily be established in areas slated for planting of canopy and midstory species, but some may also be located in areas where plantings are not needed.

- Quantitative plant data collected from permanent monitoring plots measuring approximately 90 feet X 90 feet in size or from circular plots having a radius of approximately 53 feet. Data recorded in each plot will include: number of living planted canopy species present and the species composition; number of living planted midstory species present and the species composition; average density of all native species in the canopy stratum, the total number of each species present, and the wetland indicator status of each species; average cover by native species in the canopy stratum; average density of all native species in the midstory stratum, the total number of each species present, and the wetland indicator status of each species; average cover by native species in the midstory stratum; average percent cover accounted for by invasive plant species (all vegetative strata combined); average percent cover accounted for by nuisance plant species (all vegetative strata combined). The permanent monitoring plots will be located within mitigation areas where initial planting of canopy and midstory species is necessary. The number of plots required as well as the locations of these plots will vary depending on the mitigation site. The USACE will make this determination in coordination with the Interagency Team and will specify the requirements in the Mitigation Monitoring Plan. Typically there will be at least one monitoring plot for every 20 acres planted.

- Quantitative plant data collected from either: (1) permanent transects sampled using the point-centered quarter method with a minimum of 20 sampling points established along the course of each transect, or; (2) permanent belt transects approximately 50 feet wide. The number of transects necessary as well as the location and length of each transect will vary depending on the mitigation site. The USACE will make this determination in coordination with the Interagency Team and will specify the requirements in the Mitigation Monitoring Plan. Data recorded from the sampling transects will include: average density of living planted canopy species present and the species composition; average density of living planted midstory species present and the species composition; average density of all native species in the canopy stratum along with the species composition and the wetland indicator status of each species; average percent cover by all native species in the canopy stratum; average height of native species in the canopy stratum; average density of native species in the midstory stratum, the total number of each species present, and the wetland indicator status of each species; average percent cover by native species in the midstory stratum; average height of native species in the midstory stratum; if present, average percent cover accounted for by invasive and nuisance species present in the canopy and midstory strata (combined).

- Quantitative data concerning plants in the understory (ground cover) stratum and concerning invasive and nuisance plant species will be gathered from sampling quadrats. These sampling quadrats will be established either along the axis of the belt transects discussed above, or at sampling points established along point-centered quarter transects discussed above, depending on which sampling method is used. Each sampling quadrat will be approximately 2 meters X 2 meters in size. The total number of sampling quadrats needed along each sampling transect will be determined by the USACE with the Interagency Team and will be specified in the Mitigation Monitoring Plan. Data recorded from the sampling quadrats will include: average percent cover by native subcanopy species; composition of native subcanopy species and the wetland indicator status of each species; average percent cover by invasive plant species; average percent cover by nuisance plant species.

- For BLH-Wet habitats only -- A summary of rainfall data collected during the year preceding the monitoring report based on rainfall data recorded at a station located on or in close proximity to the mitigation site. Once all hydrology success criteria have been achieved, collection and reporting of rainfall data will no longer be required.

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

- Various qualitative observations will be made in the mitigation site to help assess the status and success of mitigation and maintenance activities. These observations will include: general estimates of the average percent cover by native plant species in the canopy, midstory, and understory strata; general estimate of the average percent cover by invasive and nuisance plant species; general estimates concerning the growth of planted canopy and midstory species; general observations concerning the colonization by volunteer native plant species. General observations made during the course of monitoring will also address potential problem zones, general condition of native vegetation, trends in the composition of the plant communities, wildlife utilization as observed during monitoring, and other pertinent factors.

- For mitigation features restored from existing open water areas, provide an as-built topographic survey of all such mitigation features in the year immediately following the “time zero” monitoring event. No additional topographic surveys will typically be required following this second survey. However if the second survey indicates topographic success criteria have not been achieved and supplemental topographic alterations are necessary, then another topographic survey may be required following completion of the supplemental alterations. This determination will be made by USACE in coordination with the Interagency Team.

- A summary assessment of all data and observations along with recommendations as to actions necessary to help meet mitigation and management/maintenance goals and mitigation success criteria.

- A brief description of anticipated maintenance/management work to be conducted during the period from the current monitoring report to the next monitoring report.

Monitoring Reports Involving Timber Management Activities

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

Monitoring Reports Following Re-Planting Activities

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

MITIGATION MONITORING SCHEDULE AND RESPONSIBILITIES

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

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

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

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

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

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

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

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

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

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

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

MITIGATION SUCCESS CRITERIA AND MITIGATION MONITORING: SWAMP MITIGATION FEATURES

MITIGATION SUCCESS CRITERIA

The success criteria specified herein apply to both swamp restoration projects and swamp enhancement projects unless otherwise indicated.

1. General Construction

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

B. For mitigation features established in existing open water areas, complete all final construction activities in Mitigation TY2 (2015), in accordance with the mitigation work plan as well as the final project plans and specifications. The necessary activities will vary with the mitigation site. Examples include, but are not limited to: degrading or “gapping” of perimeter retention dikes; construction of water management structures (weirs, etc.). These requirements classify as initial success criteria.

2. Native Vegetation

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

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

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

C. 4 Years Following Completion of Initial Plantings –

- Achieve a minimum average density of 250 living native canopy species per acre (planted trees and/or naturally recruited native canopy species).
- Achieve a minimum average density of 125 living baldcypress trees (planted trees and/or naturally recruited native canopy species). The species composition of the additional native canopy species present must be generally consistent with the planted ratios for such species.
- Achieve a minimum average density of 85 living native midstory species per acre (planted midstory and/or naturally recruited native midstory species).
- Demonstrate that vegetation satisfies USACE hydrophytic vegetation criteria. This criterion will thereafter remain in effect for the duration of the overall monitoring period.
- The requirements above classify as intermediate success criteria; with the exception that the requirement to demonstrate vegetation satisfies USACE hydrophytic vegetation criteria throughout the duration of the overall monitoring period classifies as a long-term success criterion.

D. Within 15 Years Following Completion of Initial Plantings –

- Achieve one of the two following vegetative cover requirements:
  1. The average percent cover by native species in the canopy stratum is at least 50%, <u>and</u>; the average percent cover by native species in the midstory stratum exceeds 33%, <u>and</u>; the average percent cover by native species in the ground cover stratum (herbaceous cover) exceeds 33%.
  2. The average percent cover by native species in the canopy stratum is at least 75%, and: (a) the average percent cover by native species in the midstory stratum exceeds 33%, or; (b) the average percent cover by native species in the ground cover stratum (herbaceous cover) exceeds 33%.
- The requirements above classify as intermediate success criteria.

E. Within 45 Years Following Completion of Initial Plantings –

- Demonstrate that the average diameter at breast height (DBH) of living baldcypress trees exceeds 10 inches. This criterion will thereafter remain in effect for the duration of the overall monitoring period.
- Demonstrate that the average DBH of the other living native trees in the canopy stratum (trees other than baldcypress) exceeds 12 inches. This criterion will thereafter remain in effect for the duration of the overall monitoring period.
- Demonstrate that the average total basal area accounted for by all living native trees in the canopy stratum combined exceeds approximately 161 square feet per acre. This criterion will thereafter remain in effect for the duration of the overall monitoring period.
- The requirements above classify as long-term success criteria.

F. 45 Years Following Completion of Initial Plantings –

- Demonstrate that a minimum of 160 living native trees remain in the canopy stratum.
- Demonstrate that either success criteria D.1 or D.2 above have been maintained.
- The requirements above classify as long-term success criteria.

Note: The above requirements may need to be modified later due to factors such as the effects of sea level rise or salinity on vegetative cover. Proposed modifications must first be approved by the USACE in coordination with the Interagency Team.

3. Invasive and Nuisance Vegetation

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

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

4. Topography

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

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

5. Thinning of Native Vegetation (Timber Management)

The USACE, in cooperation with the Interagency Team, may determine that thinning of the canopy and/or midstory strata is warranted to maintain or enhance the ecological value of the site. This determination will likely be made after it is demonstrated that the average total basal area accounted for by living native canopy species exceeds 170 square feet per acre. If it is decided that timber management efforts are necessary, the NFS will develop a Timber Stand Improvement/Timber Management Plan, and associated long-term success criteria, in coordination with the USACE and Interagency Team. Following approval of the plan, the NFS will perform the necessary thinning operations and will demonstrate the successful completion of these operations. Timber management activities will only be allowed for the purposes of ecological enhancement of the mitigation site.

6. Hydrology

The following applies to mitigation features involving swamp restoration and to those involving swamp enhancement where hydrologic enhancement is a component of the mitigation program.

A. In a year having essentially normal rainfall, demonstrate compliance with each of the following criteria:

- Achieve inundation of the majority of the mitigation area for a minimum of 200 consecutive days but for no more than approximately 300 consecutive days, preferably with periods of inundation overlapping a portion of the growing season.
- Achieve non-inundation of the majority of the mitigation (water table at or below the soil surface) for a minimum of approximately 60 consecutive days but for no more than approximately 90 consecutive days, preferably during the period from June through August.
- The average maximum (peak) water table elevation must range between approximately 1.0 feet to 2.0 feet above the soil surface.
- The requirements above classify as intermediate success criteria.

Note: The specific mitigation work program generated for the mitigation area may include deviations from one or more of the above criteria to better reflect the desired wetland hydroperiod. Such deviations must be approved by the USACE in coordination with the Interagency Team, and would supersede the above criteria once approved.

The following applies to swamp enhancement mitigation areas where hydrologic enhancement is not a component of the mitigation program.

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

MITIGATION MONITORING GUIDELINES

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

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

- A detailed discussion of all mitigation activities completed.

- A description of the various features and habitats within the mitigation site.

- A plan view drawing of the mitigation site showing the approximate boundaries of different mitigation features (ex. planted areas, areas only involving eradication of invasive and nuisance plant species; surface water management features, etc.), monitoring transect locations, sampling plot locations, photo station locations, and piezometer and staff gage locations.

- An as-built survey of finished grades for any relatively large areas subject to topographic alterations and an as-built survey of any surface water drainage features, drainage culverts, and/or water control structures constructed. Detailed surveys of topographic alterations simply involving the removal of existing linear features such as berms/spoil banks, or involving the filling of existing linear ditches or canals, will not be required. However, the as-built survey will include spot cross-sections of such features sufficient to represent typical conditions. The as-built survey must include a survey of areas where existing berms, spoil banks, or levees have been breached in sporadic locations. For mitigation features involving habitat restoration in existing open water areas, the as-built survey must include a topographic survey of the entire restoration feature.

- A detailed inventory of all canopy and midstory species planted, including the number of each species planted and the stock size planted. In addition, provide a breakdown itemization indicating the number of each species planted in a particular portion of the mitigation site and correlate this itemization to the various areas depicted on the plan view drawing of the mitigation site.

Additional Monitoring Reports

All monitoring reports generated after the initial "time zero" report will typically provide the following information unless otherwise noted:

- A plan view drawing of the mitigation site showing the approximate boundaries of different mitigation features (ex. planted areas, areas only involving eradication of invasive and nuisance plant species; surface water management features, etc.), monitoring transect locations, sampling plot locations, photo station locations, and piezometer and staff gage locations.

- A brief description of maintenance and/or management and/or mitigation work performed since the previous monitoring report along with a discussion of any other significant occurrences.

- Photographs documenting conditions in the mitigation site at the time of monitoring. Photos will be taken at permanent photo stations within the mitigation site. At least two photos will be taken at each station with the view of each photo always oriented in the same general direction from one monitoring event to the next. The number of photo stations required as well as the locations of these stations will vary depending on the mitigation site. The USACE will make this determination in coordination with the Interagency Team and will specify the requirements in the Mitigation Monitoring Plan. Permanent photo stations will primarily be established in areas slated for planting of canopy and midstory species. For mitigation involving swamp enhancement, some photo stations may also be located in areas where plantings are not needed.

- Quantitative plant data collected from permanent monitoring plots measuring approximately 80 feet X 80 feet in size. Data recorded in each plot will include: number of living planted canopy species present and the species composition; number of living planted midstory species present and the species composition; average density of all native species in the canopy stratum, the total number of each species present, and the wetland indicator status of each species; average percent cover by native species in the canopy stratum; average density of all native species in the midstory stratum, the total number of each species present, and the wetland indicator status of each species; average percent cover by native species in the midstory stratum; average percent cover accounted for by invasive plant species (all vegetative strata combined); average percent cover accounted for by nuisance plant species (all vegetative strata combined). In addition to these data, the following information will be recorded for native tree species in the canopy stratum: the average diameter at breast height (DBH; expressed in inches) of baldcypress trees; average DBH of all other native tree species excluding baldcypress; the average total basal area of living native trees (expressed in square feet per acre). The DBH of planted canopy species will not need to be documented until the average DBH of these trees reaches approximately 2 inches. Total basal area data will also not need to be documented until such time that the average total basal area is estimated to exceed approximately 100 square feet per acre. The permanent monitoring plots will typically be located within mitigation areas where initial planting of canopy and midstory species is necessary. The number of plots required as well as the locations of these plots will vary depending on the mitigation site. The USACE will make this determination in coordination with the Interagency Team and will specify the requirements in the Mitigation Monitoring Plan.

- Quantitative data concerning plants in the understory (ground cover) stratum and concerning invasive and nuisance plant species will be gathered from permanent sampling quadrats nested within the permanent monitoring plots described above. There will be a total of 4 quadrats with each quadrat measuring approximately 2 meters X 2 meters in size. Data recorded from the sampling quadrats will include: average percent cover by native ground cover species; composition of native ground cover species and the wetland indicator status of each species; average percent cover by invasive plant species; average percent cover by nuisance plant species.

- Quantitative plant data collected from either: (1) permanent transects sampled using the point-centered quarter method with a minimum of 20 sampling points established along the course of each transect, or; (2) permanent belt transects approximately 50 feet wide. The number of transects necessary as well as the location and length of each transect will vary depending on the mitigation site. The USACE will make this determination in coordination with the Interagency Team and will specify the requirements in the Mitigation Monitoring Plan. Data recorded from the sampling transects will include: average density of living planted canopy species present and the species composition; average density of living planted midstory species present and the species composition; average density of all native species in the canopy stratum along with the species composition and the wetland indicator status of each species; average percent cover by all native species in the canopy stratum; average density of native species in the midstory stratum, the total number of each species present, and the wetland indicator status of each species; average percent cover by native species in the midstory stratum; if present, average percent cover accounted for by invasive and nuisance species present in the canopy and midstory strata (combined). In addition to these data, the following information will be recorded for native tree species in the canopy stratum: the average diameter at breast height (DBH; expressed in inches) of baldcypress trees; average DBH of all other native tree species excluding baldcypress; the average total basal area of living native trees (expressed in square feet per acre). The DBH of planted canopy species will not need to be documented until the average DBH of these trees reaches approximately 2 inches. Total basal area data will also not need to be documented until such time that the average total basal area is estimated to exceed approximately 100 square feet per acre.

- Quantitative data concerning plants in the understory (ground cover) stratum and concerning invasive and nuisance plant species will be gathered from sampling quadrats. These sampling quadrats will be established either along the axis of the belt transects discussed above, or at sampling points established along point-centered quarter transects discussed above, depending on which sampling method is used. Each sampling quadrat will be approximately 2 meters X 2 meters in size. The total number of sampling quadrats needed along each sampling transect will be determined by the USACE with the Interagency Team and will specify be specified in the Mitigation Monitoring Plan. Data recorded from the sampling quadrats will include: average percent cover by native ground cover species; composition of native ground cover species and the wetland indicator status of each species; average percent cover by invasive plant species; average percent cover by nuisance plant species.

- A summary of rainfall data collected during the year preceding the monitoring report based on rainfall data recorded at a station located on or in close proximity to the mitigation site. Once all hydrology success criteria have been achieved, collection and reporting of rainfall data will no longer be required.

- A summary of water table elevation data collected from piezometers coupled with staff gages installed within the mitigation site. The number of piezometers and staff gages required as well as the locations of these devices will vary depending on the mitigation site. The USACE will make this determination in coordination with the Interagency Team and will specify the requirements in the Mitigation Monitoring Plan. Data (water table elevations) will be collected at least bi-weekly throughout the year. For mitigation areas involving swamp enhancement where hydrologic enhancement is not a component of the mitigation program, it may also be necessary to collect water table elevations on a daily basis over the course of 3 to 4 weeks in order to demonstrate that the water table is less than or equal to 12 inches below the soil surface for a period of at least 14 consecutive days during the growing season. Once it is demonstrated that all applicable hydrology success criteria have been satisfied, water table monitoring will no longer be required. However, monitoring reports generated subsequent to the attainment of success criteria will include a general discussion of water levels and hydroperiod based on qualitative observations.

- Various qualitative observations will be made in the mitigation site to help assess the status and success of mitigation and maintenance activities. These observations will include: general estimates of the average percent cover by native plant species in the canopy, midstory, and ground cover strata; general estimate of the average percent cover by invasive and nuisance plant species; general estimates concerning the growth of planted canopy and midstory species; general observations concerning the colonization by volunteer native plant species; general observations regarding the growth of non-planted native species in the canopy and midstory strata. General observations made during the course of monitoring will also address potential problem zones, general condition of native vegetation, trends in the composition of the plant communities, wildlife utilization as observed during monitoring, and other pertinent factors.

- For mitigation features restored from existing open water areas, provide an as-built topographic survey of all such mitigation features in the year immediately following the "time zero" monitoring event. No additional topographic surveys will typically be required following this second survey. However if the second survey indicates topographic success criteria have not been achieved and supplemental topographic alterations are necessary, then another topographic survey may be required following completion of the supplemental alterations. This determination will be made by USACE in coordination with the Interagency Team.

- A summary assessment of all data and observations along with recommendations as to actions necessary to help meet mitigation and management/maintenance goals and mitigation success criteria.

- A brief description of anticipated maintenance/management work to be conducted during the period from the current monitoring report to the next monitoring report.

Monitoring Reports Involving Timber Management Activities

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

Monitoring Reports Following Re-Planting Activities

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

MITIGATION MONITORING SCHEDULE AND RESPONSIBILITIES

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

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

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

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

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

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

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

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

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

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

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

MITIGATION SUCCESS CRITERIA AND MITIGATION MONITORING:
MARSH MITIGATION FEATURES (Fresh, Intermediate, and Brackish Marsh Habitats)

MITIGATION SUCCESS CRITERIA

The success (performance) criteria described herein are applicable to all proposed marsh habitats (fresh marsh, intermediate marsh, and brackish marsh restoration features), unless otherwise indicated.

1. General Construction

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

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

2. Topography

A. Upon completion of final mitigation construction activities (approximate Target Year 2) –
- Demonstrate that at least 80% of each mitigation feature has a surface elevation that is within 0.5 feet of the desired target surface elevation. This requirement classifies as an initial success criterion.

B. 1 Year following completion of final mitigation construction activities (approximate Target Year 3) –
- Demonstrate that at least 80% of the mitigation site has a surface elevation that is within 0.5 feet of the desired target surface elevation. This requirement classifies as an initial success criterion.

C. 3 years following completion of final mitigation construction activities (approximate Target Year 5) –
- Demonstrate that at least 90% of the mitigation site has a surface elevation that is within the functional marsh elevation range. This requirement classifies as an intermediate success criterion.

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

3. Native Vegetation

A. For intermediate marsh and brackish marsh restoration features only –
- Complete initial marsh planting in accordance with applicable initial marsh planting guidelines. This requirement classifies as an initial success criterion.

B. For fresh marsh restoration features only; 1 year following completion of final mitigation construction activities:
- Achieve a minimum average cover of 50%, comprised of native herbaceous species.
- Demonstrate that vegetation satisfies USACE hydrophytic vegetation criteria. This criterion will thereafter remain in effect for the duration of the overall monitoring period.
- The requirements above classify as initial success criteria; with the exception that the requirement to demonstrate vegetation satisfies USACE hydrophytic vegetation criteria throughout the duration of the overall monitoring period classifies as a long-term success criterion.

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

D. For fresh marsh restoration features only; 3 years following completion of final mitigation construction activities:
- Achieve a minimum average cover of 85%, comprised of native herbaceous species. This requirement classifies as an intermediate success criterion.

E. For intermediate marsh and brackish marsh restoration features only; 3 years following completion of initial plantings –
- Achieve a minimum average cover of 75%, comprised of native herbaceous species (includes planted species and volunteer species). This requirement classifies as an intermediate success criterion.

F. For all marsh restoration features (fresh, intermediate, and brackish) –
- For the period beginning 5 years following completion of final mitigation construction activities and continuing through 20 years following completion of final mitigation construction activities, maintain a minimum average cover of 80%, comprised of native herbaceous species. This requirement classifies as a long-term success criterion.

4. Invasive and Nuisance Vegetation

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

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

MITIGATION MONITORING GUIDELINES

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

<u>"Time Zero" Monitoring Report (First Monitoring Report)</u>

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

- A detailed discussion of all mitigation activities completed.

- A plan view drawing of the mitigation site showing the approximate boundaries of the restored marsh features, significant interspersion features established within the marsh features (as applicable), monitoring transect locations, sampling plot locations, photo station locations, and staff gage locations.

- An as-built survey of surface elevations (topographic survey) within each marsh feature, along with an as-built survey of any permanent dikes constructed as part of the marsh restoration features including any "gaps" or "fish dips" established in such dikes. If a particular marsh feature is immediately adjacent to existing marsh habitat, the topographic survey will include spot elevations collected within the existing marsh habitat near the restored marsh feature. In addition to the survey data, an analysis of the data will be provided addressing attainment of topographic success criteria.

- Photographs documenting conditions in each restored marsh feature at the time of monitoring. Photos will be taken at permanent photo stations within the marsh features. At least two photos will be taken at each station with the view of each photo always oriented in the same general direction from one monitoring event to the next. The number of photo stations required as well as the locations of these stations will vary depending on the mitigation site. The USACE will make this determination in coordination with the Interagency Team and will specify the requirements in the Mitigation Monitoring Plan. At a minimum, there will be at least 4 photo stations established within each marsh feature.

- For restored intermediate marsh and brackish marsh features only -- A detailed inventory of all species planted, including the number of each species planted and the stock size planted. For mitigation sites that include more than one restored marsh feature, provide a breakdown itemization indicating the number of each species planted in each marsh and correlate this itemization to the marsh features depicted on the plan view drawing of the mitigation site.

- Water level elevation readings collected at the time of monitoring from a single staff gage installed within one of the restored marsh features. The location of the staff gage will be determined by the USACE in coordination with the Interagency Team during the final design phase of the mitigation project and will be specified in the Mitigation Monitoring Plan. The monitoring report will provide the staff gage data along with mean high and mean low water elevation data as gathered from a tidal elevation recording station in the general vicinity of the mitigation site. The report will further address estimated mean high and mean low water elevations at the mitigation site based on field indicators.

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

- A summary assessment of all data and observations along with recommendations as to actions necessary to help meet mitigation and management/maintenance goals and mitigation success criteria.

- A brief description of anticipated maintenance/management work to be conducted during the period from the current monitoring report to the next monitoring report.

Additional Monitoring Reports

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

- All items listed for the “time zero” (baseline) monitoring report with the exception of: (a) the topographic/as-built survey, although additional topographic/as-built surveys are required for specific monitoring reports (see below); (b) the inventory of planted species; although such an inventory must be provided in any monitoring report generated for a year in which a restored intermediate or brackish marsh feature is re-planted to meet applicable success criteria, and such an inventory must be provided in any monitoring report generated for a year in which a restored fresh marsh feature is planted to meet applicable success criteria.

- Quantitative data concerning plants in the ground cover stratum. Data will be collected from permanent sampling quadrats established at approximately equal intervals along permanent monitoring transects established within each marsh feature. Each sampling quadrat will be approximately 2 meters X 2 meters in size, although the dimensions of each quadrat may be increased if necessary to provide better data in planted marsh features. The number of monitoring transects and number of sampling quadrats per transect will vary depending on the mitigation site. This will be determined the USACE in coordination with the Interagency Team during the final design phase of the mitigation project and the resulting requirements, including quadrat dimensions, will be specified in the final Mitigation Monitoring Plan for the project. Data recorded from the sampling quadrats will include: average percent cover by native plant species; average percent cover by invasive plant species; average percent cover by nuisance plant species; composition of plant species and the wetland indicator status of each species. The average percent survival of planted species (i.e. number of living planted species as a percentage of total number of plants installed) will also be recorded in intermediate and brackish marsh features. However, data for percent survival of planted species will only be recorded until such time as it is demonstrated that success criteria for plant survivorship has been achieved.

- A brief description of maintenance and/or management work performed since the previous monitoring report along with a discussion of any other significant occurrences.

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

Monitoring Reports Following Re-Planting Activities in Intermediate or Brackish Marsh Features & Monitoring Reports Following Planting Activities in Fresh Marsh Features

Re-planting of certain areas within restored intermediate and/or brackish marsh habitats may be necessary to ensure attainment of applicable native vegetation success criteria. Planting of herbaceous species within restored fresh marsh features may also be necessary to attain applicable native vegetation success criteria.

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

MITIGATION MONITORING SCHEDULE AND RESPONSIBILITIES

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

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

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

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

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

In certain cases it is possible that the marsh mitigation features may be established along with other mitigation features, like swamp or bottomland hardwood habitats, at the same mitigation site. This scenario could require some adjustments to the typical monitoring schedule described above in order to develop a reasonable and efficient monitoring schedule that covers all the mitigation features. Such adjustments, if necessary, would be made at the time final mitigation plans are generated. This schedule must be in general accordance with the guidance provided above and will be prepared by the USACE in coordination with the Interagency Team and the NFS.

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

(A) For intermediate and brackish marsh features –

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

(B) For fresh marsh features --

- If the initial vegetative cover criterion is not achieved (i.e. the requirement specified in success criteria 3.B), a monitoring report will be required for each consecutive year until two sequential annual reports indicate that the applicable vegetative cover criteria have been satisfied (i.e. that corrective actions were successful). Since failure to meet the success criterion would mandate planting the subject marsh, the USACE would also be responsible for the purchase and installation of the required plants.

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

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

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

(A) For intermediate and brackish marsh features –

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

(B) For fresh marsh features --

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

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

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

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

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

DEFINITION OF TERMS

Certain terms used herein shall have the meaning discussed in the following section.

Interagency Team
The “Interagency Team” consists of representatives from the following resource agencies; US Fish and Wildlife Service, National Marine Fisheries Service, US Environmental Protection Agency, Louisiana Department of Wildlife and Fisheries, State of Louisiana Office of Coastal Protection and Restoration, Louisiana Department of Natural Resources. In cases where proposed mitigation features will be established within Jean Lafitte National Historical Park and Preserve, representatives from the National Park Service would also comprise the Interagency Team.

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

Target Year
This document often refers to mitigation “target years” or a particular mitigation “target year” (abbreviated “TY”). Target Year 0 (TY0) is the year in which mitigation construction activities are anticipated to commence, which is presently estimated to occur in calendar year 2013. Target years increase from this time forward. Hence, based on construction beginning in 2013, target year 1 (TY1) would be calendar year 2014, target year 2 (TY2) would be calendar year 2015, etc.

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

> Louisiana Aquatic Invasive Species Task Force. 2005. State Management Plan for Aquatic Invasive Species in Louisiana, Appendix B. Invasive Species in Louisiana (plants). Center for Bioenvironmental Research, Tulane & Xavier Universities, New Orleans, LA.
> (Website - http://is.cbr.tulane.edu/docs_IS/LAISMP7.pdf)
>
> Barataria-Terrebonne National Estuary Program (BTNEP). 2012. Exotic Invasive Species of the Barataria-Terrebonne, Invasive Species in Louisiana. BTNEP, Thibodaux, LA. (Website - http://invasive.btnep.org/invasivesvsnatives/invasivesinla2list.aspx)

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

Nuisance Plant Species
Nuisance plant species will include native species deemed detrimental due to their potential adverse competition with desirable native species. Nuisance plant species identified for the mitigation project include; dog-fennel (*Eupatorium* spp.), ragweed (*Ambrosia* spp.), cattail (*Typha* spp.), grapevine (*Vitis* spp.), wild balsam apple (*Momordica charantia*), climbing hempvine (*Mikania scandens, M. micrantha*), pepper vine (*Ampelopsis arborea*), common reed (*Phragmites australis*), catbrier (*Smilax* spp.), blackberry (*Rubus* spp.), black willow (*Salix nigra*), and box elder (*Acer negundo*). Following completion of the initial mitigation activities (e.g. placement of fill, initial plantings), the preceding list may be expanded to include other nuisance plant species. Any such addition to the list would be based on the results of the standard monitoring reports. The

determination of whether a particular new plant species should be considered as a nuisance species and therefore eradicated or controlled would be determined by the USACE in coordination with the Non-Federal Sponsor and Interagency Team.

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

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

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

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

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

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

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

Point-Centered Quarter Method
A plot-less method of forest sampling. Use of this method will be in general compliance with the applicable methodology described in the following reference:

> Cottam, Grant and J. T. Curtis. 1956. The use of distance measures in phytosociological sampling. Ecology, 37(3):451-460.

Piezometer
Typically a small-diameter observation well employed as a means of measuring water elevations in the surficial aquifer (water table elevations). Piezometers used for monitoring purposes should be constructed in general accordance with the following reference, unless otherwise approved by the USACE:

> U. S. Army Corps of Engineers. 2005. Technical standard for water-table monitoring of potential wetland sites. ERDC TN-WRAP-05-02. Vicksburg, MS: U.S. Army Engineer Research and Development Center. (website - http://el.erdc.usace.army.mil/wrap/pdf/tnwrap05-2.pdf)

Interspersion Features

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

APPENDIX M

LAKE BOEUF BLH-DRY/WET RESTORATION PROJECT: MITIGATION PROGRAM FOR WEST BANK AND VICINITY NON-PARK/404(C) PROTECTED SIDE IMPACTS TO BOTTOMLAND HARDWOOD HABITATS

PREFACE

A mitigation program (mitigation plan) was developed by the USACE, in coordination with the Interagency Environmental Team (IET), to compensate for protected side (PS) bottomland hardwood (BLH) impacts incurred during construction of the West Bank and Vicinity (WBV) Hurricane Storm Damage and Risk Reduction System (HSDRRS) and protected side BLH impacts incurred during construction of the original WBV hurricane protection system as documented in EA 437. These impacts occurred on lands outside of National Park Service (NPS) and 404(c) boundaries and are thus referred to as non-Park/404(c) impacts. These impacts affected dry bottomland hardwood (BLH-Dry) and wet bottomland hardwood (BLH-Wet) habitats situated on protected side (PS) of the levee system. This appendix provides detailed information concerning the proposed mitigation program.

As discussed in Section 2 of the PIER, the Tentatively Selected Mitigation Project (TSMP) for mitigating the cited impacts would involve the purchase of BLH-Wet mitigation credits from a mitigation bank. The mitigation program (mitigation project) discussed herein would only be implemented if the TSMP for non-Park/404(c) protected side BLH impacts cannot be implemented (refer to PIER Section 2). Certain details of the Lake Boeuf PS BLH Project (the mitigation program) discussed herein may be slightly refined and modified if it is necessary to implement this project. The USACE will coordinate with the IET, the Non-Federal Sponsor (NFS), and other members of the Project Delivery Team (PDT) in making any refinements and modifications to the mitigation program. Such modifications, if necessary, would ensure that the mitigation program fully compensates for the cited BLH impacts. It is highly unlikely that these modifications would significantly alter the environmental impacts assessment for this mitigation project as discussed in Sections 4 and 5 of the PIER. If this should not be the case however, a supplemental NEPA document would be prepared by the USACE in coordination with the IET, NFS, and PDT prior to implementing the mitigation project.

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

The figure cited herein is provided at the end of this appendix. Section 9 contains definitions of certain terms used in this appendix. All elevations mentioned herein are expressed in feet NAVD88(2004.65).

1. MITIGATION OBJECTIVES

The primary objective of the proposed mitigation project is to restore approximately 573.6 acres of BLH-Dry forest and 18.1 acres of BLH-Wet forest at the mitigation site in order to compensate for approximately 316.73 acres of BLH-Dry and 16.15 acres of BLH-Wet WBV HSDRRS PS non-Park/404(c) impacts and to compensate for approximately 162.1 acres of BLH-Dry impacts from WBV original construction as documented in EA 437. The USFWS ran Wetland Value Assessment (WVA) models for the impacts and for the proposed mitigation project. As indicated in the table below, these models predicted that the habitat functions and values, expressed in Average Annual Habitat Units (AAHUs), lost as a result of the impacts would be fully compensated by the net gain in habitat functions and values that would be realized via the mitigation project over the course of the 50-year period of analysis.

……Table 1-1. Impacts to BLH Habitats Compared to Proposed Mitigation.

Habitat	Acres Impacted	Net AAHUs Lost via Impacts	Acres Restored in Mitigation Plan	Net AAHUs Gained via Mitigation Plan
BLH-Wet	16.15	9.41	18.05	10.29
BLH-Dry	478.83	252.55	573.54	258.09
Totals	**494.98**	**261.96**	**591.59**	**268.38**

The proposed restoration of BLH habitats will occur within various mitigation features, which are essentially separate geographic areas (polygons) where BLH forests will be restored. The proposed mitigation features encompass areas that have been severely disturbed by past clearing and agricultural operations. These activities have drastically altered normal topography and have cleared prior BLH forests. The proposed mitigation project will restore appropriate topography and native BLH forests in these areas, thereby increasing the current habitat functions and values provided by the current agricultural operations.

One of the secondary objectives of the proposed mitigation project is to prevent/control invasive and nuisance plant species within the mitigation features. Invasive/nuisance plant species have the potential for jeopardizing the growth and development of native BLH species, thereby reducing typical functions and values associated with BLH forests. The eradication and control of invasive/nuisance plant species will help ensure the restored BLH forests provide habitat and habitat functions/values typical of such forests.

2. MITIGATION WORK PLAN

2.1 KEY COMPONENTS OF MITIGATION WORK PLAN

Section 2.9.2.1 in the main body of the PIER provides a detailed description of the proposed mitigation work plan (i.e. mitigation project description). Figure M-1 depicts the proposed BLH-Dry and BLH-Wet restoration features (mitigation features BWP1 and BDP1 through BDP2) discussed herein. The key elements of the proposed work plan or mitigation construction/implementation plan are as follows.

- Initial clearing and grubbing of any existing woody vegetation (trees and shrubs) within the proposed mitigation features (e.g. within the "footprints" of the proposed BLH restoration features). These activities will include mechanized removal (mechanized eradication) of invasive and nuisance plant species present within the mitigation features. In addition, degrading agricultural berms and row crop beds, filling agricultural furrows, filling existing agricultural drainage ditches and swales within each mitigation feature will occur to achieve the desired final target grade elevation of the mitigation features.

- As necessary, follow-up eradication of invasive/nuisance plant species within the mitigation features through ground-based application of appropriate herbicides to the target species, prior to the initial planting of native BLH species within these features.

- Removal of up to 2.5 feet of soil within the BLH-Wet mitigation feature to bring this feature to the desired final target elevation, prior to initial planting of the features.

- Initial planting (initial installation) of native BLH canopy and midstory species in the mitigation features following final grading of the mitigation features. Refer to the planting specifications that follow. The successful completion of this initial planting event will mark the end of the mitigation construction phase.

- One re-planting of native BLH canopy and midstory species in the mitigation features following completion of the initial planting event. It was assumed that approximately 20% of the total number of canopy species and approximately 20% of the total number of midstory species initially planted would have to be re-planted in order to satisfy the plant survival requirements set forth in native vegetation success criterion 2.B (see Section 6). However, this re-planting event will not be performed if the applicable success criteria are satisfied.

- As necessary, follow-up eradication of invasive/nuisance plant species within the mitigation features through ground-based application of appropriate herbicides to the target species, following the initial planting cited above. There will likely be multiple invasive/nuisance plant species eradication events performed during various years following completion of the initial planting event.

The USACE will be responsible for conducting all mitigation construction activities, although the costs associated with these activities will be cost shared with the NFS, subject to the provisions addressed in the Preface section above. Refer to the following sections for a discussion of responsibilities for other activities required as part of the proposed mitigation program.

2.2 INITIAL PLANTING OF MITIGATION FEATURES

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

The BLH-Dry canopy species installed will be in general accordance with the species list provided in Table 2-1. The BLH-Wet canopy species installed will be in general accordance with the species list provided in Table 2-3. Plantings will be conducted such that the total number of plants installed in a given mitigation feature consists of approximately 60% hard mast-producing species and approximately 40% soft mast-producing species. Site conditions (factors such as hydrologic regime, soils, etc.) and planting stock availability may necessitate deviations from the species lists and/or the percent composition guidelines indicated in this table. Any deviations would have to first be approved by the USACE in coordination with the IET and NFS.

The BLH-Dry midstory species installed will be in general accordance with the species list provided in Table 2-2. The BLH-Wet midstory species installed will be in general accordance with the species list provided in Table 2-4. The species used and the proportion of the total midstory plantings represented by each species (percent composition) may vary somewhat from the data provided in Table 2-2 depending on various factors including site conditions (hydrologic regime, soils, etc.) and planting stock availability. Any deviations would have to first be approved by the USACE in coordination with the IET and NFS.

Table 2-1. BLH-Dry Planting List for Native Canopy Species.

Common Name	Scientific name	Percent Composition
Hard Mast-Producing Canopy Species (60% of Total Canopy Plants Installed)		
Nuttall oak	*Quercus nuttalli, Q. texana*	10%
Willow oak	*Quercus phellos*	10%
Water oak	*Quercus nigra*	10%
Live oak	*Quercus virginiana*	20%
Cherrybark oak	*Quercus pagoda*	5%
Sweet Pecan	*Carya illinoensis*	20%
Soft Mast-Producing Canopy Species (40% of Total Canopy Plants Installed)		
Drummond red maple	*Acer rubrum* var. *drummondii*	10%
Sugarberry	*Celtis laevigata*	15%
Green ash	*Fraxinus pennsylvanica*	15%
Sweetgum	*Liquidambar styraciflua*	20%
American elm	*Ulmus americana*	10-20%
Common persimmon	*Diosypros virginiana*	15%
American sycamore	*Platanus occidentalis*	0-5%
River birch	*Betula nigra*	0-5%
Honey locust	*Gleditsia triacanthos*	0-5%

Table 2-2. BLH-Dry Planting List for Native Midstory Species.

Common Name	Scientific name	Percent Composition
Mayhaw	*Crataegus opaca*	20%
Green hawthorn	*Crataegus viridis*	20%
Deciduous holly	*Ilex deciduas*	
Yaupon	*Ilex vomitoria*	
Southern wax myrtle	*Myrica cerifera*	20%
Southern crabapple	*Malus angustifolia*	
Eastern red cedar	*Juniperus virginiana var. virginiana*	
Red mulberry	*Morus rubra*	

Table 2-3. BLH-Wet Planting List for Native Canopy Species.

Common Name	Scientific name	Percent Composition
Hard Mast-Producing Canopy Species (60% of Total Canopy Plants Installed)		
Nuttall oak	*Quercus nuttalli, Q. texana*	40%
Willow oak	*Quercus phellos*	30%
Water oak	*Quercus nigra*	10%
Overcup oak	*Quercus lyrata*	10%
Water hickory	*Carya aquatica*	10%
Soft Mast-Producing Canopy Species (40% of Total Canopy Plants Installed)		
Drummond red maple	*Acer rubrum* var. *drummondii*	20%
Sugarberry	*Celtis laevigata*	20%
Green ash	*Fraxinus pennsylvanica*	20%
American elm	*Ulmus americana*	20%
Common persimmon	*Diosypros virginiana*	10%
Bald cypress	*Taxodium distichum*	10%

Note:

Percent composition values indicated represent the percentage of the total number of plants that will be installed for each of the two categories of canopy species, i.e. hard mast-producing category and soft mast-producing category.

Table 2-4. BLH-Wet Planting List for Native Midstory Species.

Common Name	Scientific name	Percent Composition
Saltbush	*Baccharis halimifolia*	10%
Buttonbush	*Cephalanthus occidentalis*	10%
Mayhaw	*Crataegus opaca*	20%
Green hawthorn	*Crataegus viridis*	20%
Possumhaw	*Ilex decidua*	10%
Dahoon holly	*Ilex cassine*	10%
Wax myrtle	*Myrica cerifera, Morella cerifera*	20%

The initial planting of the mitigation features will be the responsibility of the USACE. Costs associated with this initial planting will be cost shared with the NFS, subject to the provisions addressed in the Preface section above.

3. MAINTENANCE AND MANAGEMENT PLAN

The primary maintenance and management activities anticipated involve the short-term and long-term eradication and control of invasive and nuisance plant species. It is anticipated that there will be 1 invasive/nuisance plant eradication event during the year mitigation construction begins, 2 such events in the following year, 2 such events during the year the mitigation features are first planted, and at least 2 such events during each of the three years following the year of initial planting. It is anticipated that there will be at least 1 invasive/nuisance plant eradication event per year in the fourth and fifth year following the year of initial planting. Thereafter, it is anticipated that there will be one invasive/nuisance plant eradication event every three to five years.

One should note that the actual frequency of invasive/nuisance plant eradication events may differ from the frequency discussed above. The frequency and intensity of these events will largely be determined based on the degree of invasive/nuisance plant infestation observed during mitigation monitoring activities, as well as that observed during periodic inspections of the mitigation features conducted outside the framework of prescribed mitigation monitoring events.

The methods used to eradicate invasive and nuisance plant species will vary. Mechanized clearing and removal of such species may be employed during eradication events occurring prior to the initial planting of native species, using equipment such as hydro-axes, gyro-tracs, bulldozers, etc. Hand-held equipment such as chain saws and machetes may also be used. It is doubtful that mechanized clearing/removal of invasive/nuisance plants will be employed once the initial planting of native species has occurred. Instead, invasive/nuisance plants will be eradicated using ground-based applications of appropriate herbicides to the target plants. The specific equipment (e.g. backpack sprayers, hand application, hypo-hatchet, tube-injector, ATVs with boom sprayers, etc.) and methods (e.g. cut stump treatment, basal bark application, hack and squirt, etc.) used to apply the herbicides will be determined by the contractor to maximize effectiveness. Note that ground-based applications of herbicides would also be employed to treat any stumps or other above-ground portions of invasive/nuisance plants remaining following mechanized clearing and removal of such plants. Ground-based herbicide applications will typically occur during the early part of the growing season in cases where there will be 1 or 2 application events during a given year, and will typically occur again during the latter part of the growing season in cases where there will be 2 application events during a given year.

As mentioned in Section 2, short-term maintenance/management activities may include one re-planting event conducted after the initial planting of native canopy and midstory species. It was assumed that this event, involving the re-planting of approximately 20% of the total number of canopy species and 20% of the total number of midstory species first installed, would be necessary to satisfy native vegetation success criterion 2.B (see Section 6). However if the referenced success criterion is satisfied, this re-planting event will not be performed. It is not anticipated that subsequent re-planting of native canopy and/or midstory species will be necessary, with the potential exception of re-planting required for adaptive management (see Section 4). Should additional re-plantings be necessary to satisfy applicable mitigation success criteria, then these re-plantings would become part of the long-term management/maintenance activities.

Several years following the initial planting of the mitigation features, it may be determined that the density of living native canopy species and/or the density of living native midstory species is excessive in one or more of the mitigation features. This determination would be made by the USACE and NFS in coordination with the IET based on monitoring reports. Assuming such a determination was made, based strictly on the need for density reduction in order to sustain a healthy forest, a Timber Stand Improvement/Timber Management Plan addressing removal/thinning of native canopy and/or midstory species will be developed by the NFS. The actions called for in this plan would be implemented by the NFS following approval of the plan by the USACE and IET.

The USACE will be responsible for performing invasive/nuisance plant eradication events, as necessary, until mitigation success criteria 1, 2.A., 2.B., 3.A., and 4.A are all satisfied (refer to Section 6). During this period of responsibility, the USACE will also be responsible for ensuring mitigation success criterion 3.B. is satisfied (refer to Section 6). The cost of performing the activities conducted as the responsibility of the USACE will be cost shared with the NFS, subject to the provisions addressed in the Preface section above. The NFS will be responsible for performing invasive/nuisance plant eradication events once the cited success criteria are satisfied. The costs for performing these events will be borne solely by the NFS.

Subject to the provisions addressed in the Preface, the USACE will be responsible for performing the single re-planting event discussed above, including provision of the necessary plants, and the cost of this re-planting will be cost shared with the Non-Federal Sponsor. It is again emphasized that this re-planting event may not be necessary and thus would not be performed if re-planting is not required. The NFS will be responsible for any subsequent re-plantings required to meet applicable mitigation success criteria and the cost for such re-plantings will be borne solely by the NFS. As mentioned above, the NFS will be responsible for conducting any authorized Timber Stand Improvement/Timber Management activities and the cost for such activities will be borne solely by the NFS.

4. ADAPTIVE MANAGEMENT PLAN

If the results of the monitoring program support the need for physical modifications to the project, the cost of the changes will be cost-shared with the NFS in accordance with USACE Implementation Guidance for Section 2036(a) of the Water Resources Development Act of 2007 (WRDA 07) - Mitigation for Fish and Wildlife Losses and subject to the provisions set forth in the Preface. The NFS will be responsible for actually implementing/conducting actions required by the adaptive management plan.

One should note that the re-planting event called for in the adaptive management plan is in addition to the single re-planting event already accounted for in the mitigation maintenance and management plan (see Section 3). Similarly, the mitigation monitoring and reporting events called for in the adaptive management plan are also in addition to the -mitigation monitoring and reporting events discussed in the mitigation monitoring and reporting section (see Section 7.1). The mitigation monitoring and reporting events discussed in Section 7.1 are based on the assumption that two annual monitoring events will be necessary simply due to the single re-planting event mentioned above.

It is possible that the adaptive management plan (AMP) described above might have to be amended in the future to include additional adaptive management activities. Should the need for an amendment arise, changes to the AMP would be developed by the NFS in coordination with CEMVN and the IET. Any such changes would also be coordinated with HQUSACE prior to finalizing and implementing the changes.

5. LAND ACQUISITION & PRESERVATION/PROTECTION OF MITIGATION SITE

The lands encompassing the proposed mitigation features as well as the lands encompassing areas required for mitigation project construction access and future mitigation maintenance and management access are currently privately owned. Thus, this mitigation project will require land acquisition in the name of the NFS, i.e., fee acquisition for the mitigation site as well as temporary construction easements/servitudes and perpetual access easements/servitudes, as deemed necessary.

The NFS will be required to preserve and protect the mitigation features in perpetuity. This requirement will be assured via the existing Project Partnership Agreement (PPA) between the USACE and the NFS. The PPA requires that the NFS perform operations and maintenance activities in accordance with the Operation, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) manual that will be prepared by CEMVN and provided to the NFS. The OMRR&R manual will set forth detailed operations and maintenance information and will provide the NFS with instructions for the management and maintenance of the mitigation features.

6. MITIGATION SUCCESS CRITERIA

The ecological success (performance) criteria applicable to the proposed mitigation are described in the sub-sections that follow.

1. General Construction

A. Complete all necessary initial clearing, grubbing, earthwork, grading, and related construction activities in accordance with the mitigation work plan and in accordance with final project plans and specifications. This requirement classifies as an initial success criterion.

2. Native Vegetation

A. Complete initial planting of canopy and midstory species in accordance with Section 2.2. This requirement classifies as an initial success criterion.

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

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

C. 4 Years Following Completion of Initial Plantings –

- Achieve a minimum average density of 300 living native canopy species per acre (planted trees and/or naturally recruited native canopy species).
- Achieve a minimum average density of 120 living, native, hard mast-producing species in the canopy stratum but no more than approximately 150 living hard-mast producing species in the canopy stratum (planted trees and/or naturally recruited native canopy species). The remaining trees in the canopy stratum must be comprised of soft mast-producing native species. These criteria will thereafter remain in effect for the duration of the overall monitoring period. Modifications to these

criteria could be necessary for reasons such as avoidance of tree thinning if thinning is not warranted and the long-term effects of sea level rise on tree survival. Proposed modifications must first be approved by the USACE in coordination with the IET and NFS.

- Achieve a minimum average density of 85 living native midstory species per acre (planted midstory and/or naturally recruited native midstory species).
- Demonstrate that vegetation satisfies USACE hydrophytic vegetation criteria. This criterion (requirement) will thereafter remain in effect for the duration of the overall monitoring period.
- The requirements above classify as intermediate success criteria; with the exception that the requirement to demonstrate vegetation satisfies USACE hydrophytic vegetation criteria throughout the duration of the overall monitoring period classifies as a long-term success criterion.

D. Within 10 Years Following Completion of Initial Plantings –

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

E. 15 Years Following Completion of Initial Plantings –

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

F. 25 Years Following Completion of Initial Plantings –

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

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

3. Invasive and Nuisance Vegetation

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

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

4. Topography

A. In the year after initial construction activities are completed (i.e. year following completion of initial clearing, grubbing, and fill placement), demonstrate that at least 85% of the total area within the BLH-

Wet feature is within approximately 0.5 feet of the proposed target soil surface elevation (e.g. the desired soil surface elevation). This requirement classifies as an initial success criterion.

5. Hydrology

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

B. In a year having essentially normal rainfall, demonstrate that the BLH-Wet mitigation feature is irregularly inundated or soils are saturated to the soil surface for a period ranging from 7% to approximately 13% of the growing season. Note that this success criterion is more of a goal than it is a specific criterion; hence, some latitude is allowed as regards attaining this criterion, which classifies as a long-term success criterion.

6. Thinning of Native Vegetation (Timber Management)

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

7. MITIGATION MONITORING AND REPORTING

7.1 STANDARD MITIGATION MONITORING AND MITIGATION MONITORING REPORTS

7.1.1 "Time Zero" Monitoring Report (Monitoring Report #1)

Shortly after completion of all initial mitigation activities (e.g. initial eradication of invasive and nuisance plants, first/initial planting of native species, completion of initial earthwork, grading, etc.), the mitigation site will be monitored and a "time zero" or "baseline" monitoring report prepared. Information provided will include the following items:

- A detailed discussion of all mitigation activities completed.
- A description of the various features and habitats within the mitigation site.
- A plan view drawing of the mitigation site showing the approximate boundaries of the different mitigation features, monitoring transect locations, sampling plot locations, photo station locations, and piezometer and staff gage locations.
- An as-built survey of finished grades in the mitigation features, along with an assessment of whether the topography success criterion has been satisfied. The topographic as-built survey may be conducted using LiDAR or conventional ground-survey methods. Note that this topographic survey would be performed prior to the initial planting of mitigation features and would be evaluated by the USACE prior to installing plants. If this evaluation indicates the topography success criterion has been achieved, then plants would be installed. However, if this evaluation indicates success has not been achieved, then supplemental topographic alterations would be performed by the USACE (subject to the provisions contained in the Preface), a second as-built topographic survey of the affected areas would be conducted following completing of the supplemental topographic alterations,

and plants would not be installed until the topography success criterion is achieved. Should this scenario arise, the time-zero monitoring report would not be submitted until the year plants are installed.

- A detailed inventory of all canopy and midstory species planted, including the number of each species planted and the stock size planted. In addition, provide a breakdown itemization indicating the number of each species planted in each separate mitigation feature within the mitigation site and correlate this itemization to the various areas depicted on the plan view drawing of the mitigation site.

7.1.2 Additional Monitoring Reports

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

- A plan view drawing of the mitigation site showing the approximate boundaries of the different mitigation features, monitoring transect locations, sampling plot locations, photo station locations, and piezometer locations.

- A brief description of maintenance and/or management and/or mitigation work performed since the previous monitoring report along with a discussion of any other significant occurrences.

- Photographs documenting conditions in the mitigation features at the time of monitoring. Photos will be taken at permanent photo stations within these features. At least two photos will be taken at each station with the view of each photo always oriented in the same general direction from one monitoring event to the next.

  The number of permanent photo stations in each mitigation feature will be as follows:

  - BLH-Wet feature BWP1 = 2 photo stations.
  - BLH-Dry feature BDP1 = 8 photo stations.
  - BLH-Dry feature BDP2 = 16 photo stations.
  - BLH-Dry feature BDP3 = 12 photo stations.

- Quantitative plant data collected from permanent monitoring plots measuring approximately 90 feet X 90 feet in size. Data recorded in each plot will include: number of living planted canopy species present and the species composition; number of living planted midstory species present and the species composition; average density of all native species in the canopy stratum, the total number of each species present, and, for BLH-Wet restoration features only, the wetland indicator status of each species; average percent cover by native species in the canopy stratum; average density of all native species in the midstory stratum, the total number of each species present, and, for BLH-Wet restoration features only, the wetland indicator status of each species; average percent cover by native species in the midstory stratum; average percent cover accounted for by invasive plant species (all vegetative strata combined); average percent cover accounted for by nuisance plant species (all vegetative strata combined).

  The number of permanent monitoring plots in each mitigation feature will be as follows:

  - BLH-Wet feature BWP1 = 1 plot.
  - BLH- Dry feature BDP1 = 3 plots.
  - BLH- Dry feature BDP2 = 6 plots.
  - BLH- Dry feature BDP3 = 6 plot.

- Quantitative plant data collected from permanent transects sampled using the point-centered quarter method with sampling points established at approximately 100-foot intervals along the course of each transect. Data recorded from the sampling transects will include: average density of living planted canopy species present and the species composition; average density of living planted midstory species present and the species composition; average density of all native species in the canopy stratum along with the species composition and the wetland indicator status of each species; average percent cover by all native species in the canopy stratum; average density of native species in the midstory stratum and the total number of each species present, and the wetland indicator status of each species; average percent cover by native species in the midstory stratum; average height of native species in the midstory stratum; if present, average percent cover accounted for by invasive and nuisance species present in the canopy and midstory strata (combined).

The number of permanent transects and sampling points along each transect for each mitigation feature will be as follows:

- BLH-Wet feature BWP1 = 1 transect with 15 sampling points.
- BLH- Dry feature BDP1 = 2 transects with 15 sampling points each.
- BLH- Dry feature BDP2 = 4 transect with 15 sampling points each.
- BLH- Dry feature BDP3 = 4 transect with 15 sampling points each.

- Quantitative data concerning plants in the understory (ground cover) will be gathered from sampling quadrats. These sampling quadrats will be established at each of the sampling points established along the point-centered quarter transects discussed above. Each sampling quadrat will be approximately 2 meters X 2 meters in size. Data recorded from the sampling quadrats will include: average percent cover by native understory species; composition of native understory species and the wetland indicator status of each species; average percent cover by invasive plant species; average percent cover by nuisance plant species.

  The number of sampling quadrats for each mitigation feature will be as follows:

  - BLH-Wet feature BWP1 = 15 quadrats.
  - BLH-Wet feature BDP1 = 30 quadrats.
  - BLH-Wet feature BDP2 = 60 quadrats.
  - BLH-Wet feature BDP3 = 60 quadrats.

- A summary of rainfall data collected during the year preceding the monitoring report based on rainfall data recorded at a station located on or in close proximity to the mitigation site. Once all hydrology success criteria have been achieved, collection and reporting of rainfall data will no longer be required.

- A summary of water table elevation data collected from piezometers installed within the BLH-Wet mitigation feature. Data (water table elevations) will be collected at least bi-weekly. Once the monitoring indicates the water table may be rising to an elevation that would meet hydrologic success criteria, water table elevations will be collected on a daily basis until it is evident the success criteria has been satisfied. The schedule of water table elevation readings can shift back to a bi-weekly basis for the remainder of the monitoring period. Once hydrology success criteria have been satisfied, water table monitoring will no longer be required. However, monitoring reports generated subsequent to the attainment of success criteria will include a general discussion of water levels and hydroperiod based on qualitative observations.

  Three piezometers will be installed in the BLH-Wet mitigation BWP1 feature.

- Various qualitative observations will be made in the mitigation site to help assess the status and success of mitigation and maintenance activities. These observations will include: general estimates of the average percent cover by native plant species in the canopy, midstory, and understory strata; general estimates of the average height of planted canopy and midstory species; general estimates of the average percent cover by invasive and nuisance plant species; general estimates concerning the growth of planted canopy and midstory species; general observations concerning the colonization by volunteer native plant species. General observations made during the course of monitoring will also address potential problem zones, general condition of native vegetation, trends in the composition of the plant communities, wildlife utilization as observed during monitoring, and other pertinent factors.

- A summary assessment of all data and observations along with recommendations as to actions necessary to help meet mitigation and management/maintenance goals and mitigation success criteria.

- A brief description of anticipated maintenance/management work to be conducted during the period from the current monitoring report to the next monitoring report.

7.1.3 Monitoring Reports Following Re-Planting Activities

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

7.1.4 Monitoring Reports Involving Timber Management Activities

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

7.2 DISTRICT CONSULTATION REPORTS & USACE CIVIL WORKS PROJECT MITIGATION DATABASE REPORTS

Section 2036(a) of WRDA 2007 requires the USACE to conduct annual consultation with appropriate Federal and State agencies to assess the success of mitigation plans and to prepare annual reports summarizing the results of the consultations. To satisfy these requirements, annual consultation reports (District Consultation Reports) will be prepared and submitted to the USACE Mississippi Valley Division (MVD), or the reports will be submitted as directed by MVD. Each report will provide the following information:

- List of the types of mitigation implemented.
- Brief description of the mitigation, including acres implemented and acres remaining to be implemented (if any).
- Description of the consultation process (steps taken to consult with other Federal agencies and State agencies).
- Discussion of the status of consultation, identifying the agencies involved and the outcome. If consultation is complete, a listing of the outcome as one of the following: no action needed; no response from Federal or state agencies on consultation; on schedule with no adaptive management implemented due to consultation, or on schedule with adaptive management implemented due to consultation; behind schedule with adaptive management implemented due to consultation, or; behind schedule for reasons not related to consultation.

- Discussion of the outcome of consultation (if completed). This discussion will include: an assessment of the likelihood that the mitigation will achieve the success criteria specified in the mitigation plan (copy of plan provided); the projected timeline for achieving mitigation success, and; any recommendations for improving the likelihood of success.

In addition to the District Consultation Reports discussed above, data and information concerning the mitigation will be entered into the USACE's Civil Works Project Mitigation Database on an annual basis. The data and information required for entry into this database are specified within the database itself (website URL: https://sam-db01mob.sam.ds.usace.army.mil:4443/pls/apex/f?p=107).

7.3 MITIGATION MONITORING & REPORTING SCHEDULE AND RESPONSIBILITIES: STANDARD MONITORING AND REPORTING

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

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

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

Monitoring events associated with the above will include the "time zero" (first or baseline) monitoring event plus annual monitoring events thereafter until the mitigation monitoring responsibility is transferred to the NFS. The Non-Federal Sponsor will be responsible for conducting the required monitoring events and preparing the associated monitoring reports after the USACE has demonstrated the mitigation success criteria listed above have been achieved.

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

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

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

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

The following table indicates the currently anticipated monitoring report schedule and the party responsible for conducting the monitoring and preparing the report.

Table 7-1. Standard mitigation monitoring report schedule and monitoring responsibility.

Year	Monitoring Report Number	Party Responsible for Monitoring and Reporting
0 (start of construction)	N/A	N/A
1 (completion of initial construction activities)	N/A	N/A
2 (complete initial plantings early in year; completion of construction)	1 (Time Zero Report)	USACE
3 (1 year after initial plantings)	2	USACE
4 (re-planting, if necessary)	2A*	USACE
5	2B*	USACE*
6	3	USACE*
11	4	CPRA
16	5	CPRA
21	6	CPRA
26	7	CPRA
31	8	CPRA
36	9	CPRA
41	10	CPRA
46	11	CPRA
51	12	CPRA

* Monitoring reports 2A and 2B would only be necessary if re-planting is necessary, as determined by the monitoring results documented in monitoring report #2.

It is again noted that monitoring reports 2A and 2B indicated in the preceding table will only be necessary if the second monitoring report indicates that native vegetation success criterion #2.B pertaining to the survival of planted canopy and midstory species has not been achieved, thereby requiring re-planting in Year #4. If re-planting is unnecessary, there would be no monitoring in years 5 and 6. However, it has been assumed that some re-planting will be necessary. The schedule provided in the table does not account for the need to physically adjust topography in the mitigation features once final construction activities have been completed. Should such adjustments be necessary to achieve applicable topographic success criteria, then the monitoring schedule presented would likely require adjustments.

Although the USACE will be responsible for conducting the monitoring necessary for monitoring reports 1, 2, 2A, and 2B and will be responsible for preparing these reports, the costs for these activities will be cost shared with the NFS, subject to the provisions stated in the Preface. The costs associated with conducting the monitoring and preparing monitoring reports for all subsequent monitoring reports will be solely borne by the NFS, pursuant to the provisions stated in the Preface.

It is not feasible at this time to accurately estimate the actual calendar year when mitigation construction activities will be initiated. This explains why the years indicated in the preceding table are not actual calendar years. Should it be necessary to implement the subject mitigation project rather than the current TSMP, this mitigation plan will be revised to include a monitoring/reporting schedule using estimated calendar years.

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

7.4 MITIGATION MONITORING & REPORTING SCHEDULE AND RESPONSIBILITIES: DISTRICT CONSULTATION REPORTS AND USACE CIVIL WORKS PROJECT MITIGATION DATABASE REPORTS

The USACE will be responsible for preparing and submitting all District Consultation Reports. These reports will be submitted on annual basis beginning in the year the mitigation plan is implemented (i.e. start of mitigation construction) and continuing throughout the 50-year period of analysis. The date for submittal of each report will be in accordance with guidance provided by MVD and/or HQUSACE (USACE Headquarters). Presently, MVD guidance is each annual report must be submitted at least 14 working days prior to October 1st each year; however, this guidance is subject to change.

The agencies involved in the consultation process will include, at a minimum: USACE, Mississippi Valley Division, New Orleans District (CEMVN); the Non-Federal Sponsor (i.e. CPRA); US Fish and Wildlife Service (USFWS); Louisiana Department of Natural Resources (LDNR). The USACE will be responsible for conducting the consultation until the mitigation monitoring responsibilities are transferred to the NFS. Thereafter, the NFS will be responsible for conducting the consultation and for providing results of the consultation to USACE (i.e. NFS will be responsible for obtaining and providing to USACE all information necessary for preparing the District Consultation Report).

The USACE will be responsible for inputting all information required for the USACE's Civil Works Mitigation Project Database as regards this mitigation project. This information will be input by CEMVN on an annual basis beginning in the year the mitigation is implemented and continuing throughout the 50-year period of analysis. The information will be input by the deadline(s) established by HQUSACE. The USACE will be responsible for gathering the information necessary for database input until the mitigation monitoring responsibilities are transferred to the NFS. Thereafter, the NFS will be responsible for gathering this information and providing it to CEMVN for input.

7.5 COST OF MITIGATION MONITORING AND REPORTING

The total cost of mitigation monitoring and reporting activities addressed herein is currently estimated to be approximately $1,111,000. This preliminary estimate includes all mitigation monitoring and reporting costs throughout the 50-year period of analysis. This estimate also includes the cost of conducting the additional monitoring required due to the need for one re-planting event following the initial planting event. It was assumed that one re-planting event would be necessary to meet the initial survival success criteria for planted native vegetation. If this assumption is erroneous, the estimated monitoring and reporting cost would decrease. These cost estimates do not account for any further topographic alterations following completion of the final mitigation construction activities since it is not anticipated that such physical alterations will be necessary. If this assumption is violated, the estimated mitigation monitoring and reporting cost would increase due to the need for additional monitoring/reporting events. Note that this cost estimate also does not include additional monitoring and reporting costs that would be incurred should the adaptive management plan need to be implemented.

8. FINANCIAL ASSURANCES

Financial assurances are required to ensure that the compensatory mitigation project would be successful. In this case the WBV HSDRRS Project Partnership Agreement between the CPRA of Louisiana (the Non-Federal Sponsor) and the Federal Government provides the required financial assurance for this mitigation project. In the event that the Non-Federal Sponsor fails to perform, the CEMVN has the right to complete, operate, maintain, repair, rehabilitate or replace any project feature, including mitigation features, but such action would not relieve CPRA of its responsibility to meet its obligations and would not preclude the US from pursuing any remedy at law or equity to ensure CPRA's performance.

9. DEFINITION OF TERMS

Certain terms used herein shall have the meaning discussed in the following subsections.

Interagency Environmental Team (IET)
The "Interagency Environmental Team" consists of representatives from the following resource agencies; US Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), US Environmental Protection Agency (EPA), State of Louisiana Office of Coastal Protection and Restoration (CPRA), Louisiana Department of Natural Resources (DNR), Louisiana Department of Wildlife and Fisheries (LDWF).

Non-Federal Sponsor (NFS)
This term refers to the Non-Federal Sponsor for the mitigation project, which is CPRA.

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

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

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

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

Nuisance Plant Species
Nuisance plant species will include native species deemed detrimental due to their potential adverse competition with desirable native species. Nuisance plant species identified for the mitigation project include; dog-fennel (*Eupatorium capillifolium, Eupatorium compositifolium*), marsh thoroughwort (*Eupatorium leptophyllum*), late-flowering thoroughwort (*Eupatorium serotinum*), common ragweed (*Ambrosia artemisiifolia*), giant ragweed (*Ambrosia trifida*), cattail (*Typha* spp.), grapevine (*Vitis* spp.), wild balsam apple (*Momordica charantia*), climbing hempvine (*Mikania scandens, M. micrantha*), pepper vine (*Ampelopsis arborea*), common reed (*Phragmites australis*), catbrier (*Smilax* spp.), blackberry (*Rubus* spp.), blue vervane (*Verbena hastata*), white vervane (*Verbena urticifolia*), wingstem (*Vervesina alternifolia*), frostweed (*Verbesina virginica*), tall ironweed (*Vernonia gigantea*), black willow (*Salix nigra*), and box elder (*Acer negundo*). Following completion of the initial mitigation activities (e.g. placement of fill, initial plantings), the preceding list may be expanded to include other nuisance plant species. Any such addition to the list would be based on the results of the standard monitoring reports. The determination of whether a particular new plant species should be considered as a nuisance species and therefore eradicated or controlled would be determined by the USACE in coordination with the NFS and IET.

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

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

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

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

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

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

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

Point-Centered Quarter Method
A plot-less method of forest sampling. Use of this method will be in general compliance with the applicable methodology described in the following reference:

> Cottam, Grant and J. T. Curtis. 1956. The use of distance measures in phytosociological sampling. Ecology, 37(3):451-460.

Piezometer
Typically a small-diameter observation well employed as a means of measuring water elevations in the surficial aquifer (water table elevations). Piezometers used for monitoring purposes will be constructed in general accordance with the following reference, unless otherwise approved by CEMVN:

> U. S. Army Corps of Engineers. 2005. Technical standard for water-table monitoring of potential wetland sites. ERDC TN-WRAP-05-02. Vicksburg, MS: U.S. Army Engineer Research and Development Center. (website - http://el.erdc.usace.army.mil/wrap/pdf/tnwrap05-2.pdf)

Appendix M: Lake Boeuf, Mitigation Program for General BLH Impacts

MITIGATION FEATURE	TARGET HABITAT TYPE	ACRES
BWP1	BLH-WET	18.1
BDP1	BLH-DRY	96.0
BDP2	BLH-DRY	270.3
BDP3	BLH-DRY	207.3

Figure M-1. Lake Boeuf PS BLH Project

APPENDIX N
ADAPTIVE MANAGEMENT PLAN
LAKE BOEUF PROTECTED-SIDE
WET AND DRY BOTTOMLAND HARDWOOD RESTORATION

1.0 Introduction

This Adaptive Management (AM) Plan is for compensatory mitigation projects related to unavoidable impacts due to construction of the West Bank and Vicinity (WBV) Hurricane and Storm Damage Risk Reduction System (HSDRRS). The Water Resources Development Act (WRDA) of 2007, Section 2036 (a) and USACE implementation guidance for Section 2036 (a) (CECW-PC 31 August 2009 Memorandum: "*Implementation Guidance for Section 2036 (a) of the Water Resources Development Act of 2007 (WRDA 2007) – Mitigation for Fish and Wildlife and Wetland Losses*") requires adaptive management and monitoring plans be included in all mitigation plans for fish and wildlife and wetland losses.

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

2.0 Adaptive Management Planning

AM planning elements include development of a Conceptual Ecological Model (CEM), identification of key project uncertainties and associated risks, evaluation of mitigation plans for AM actions and the identification of potential AM actions (contingency plan) to better ensure the mitigation project meets identified success criteria. The AM Plan is a living document and will be refined, if and as necessary, for subsequent mitigation projects as they are developed in future Tiered Individual Environmental Reports (TIER).

The level of detail in this AM Plan is based on the best currently available information developed as part of the Programmatic IER. The PIER presents the entire TSMPA for mitigating all the WBV HSDRRS impacts, but only proposes implementation of a portion of the identified projects at this time to facilitate mitigating impacts as quickly as possible. As discussed in Section 2 of the PIER, the TSMP for mitigating protected-side wet and dry bottomland hardwood impacts would involve the purchase of mitigation credits from a mitigation bank. The Lake Boeuf mitigation projects (Figure 1) to restore dry and wet bottom land hardwood (BLH-Dry and BLH-

Wet, respectively) habitats as described in the Mitigation Plan (Appendix M) would only be implemented if the current TSMP (the purchase of mitigation bank credits) for non-Park/404(c) PS BLH-Dry and BLH-Wet could not be implemented. If the current TSMP is implemented, an AM plan would not be necessary as WRDA 2007, Section 2036(c) provides that the purchase of mitigation bank credits relieves USACE and the NFS from responsibility for monitoring or demonstrating mitigation success.

Figure1. BLH-Dry and BLH-Wet Mitigation Project Sites

2.1 Conceptual Ecological Model

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

Table 1. Conceptual Ecological Model

Alternatives/ Issues, Driver	Non-Park Protected Side BLH-Dry	Non-Park Protected Side BLH-Wet
Hydrology (water table; wet/dry days; soil inundation, overflow from Bayou Lafourche)	+/-	+/-
Vegetative Invasive Species	-	-
Herbivory	-	-
Subsidence	-	-
Storm Surge[1]	-	-
Sea Level Rise[1]	-	-
Runoff	-	-
Topography (elevation)	+/-	+/-

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

[*]Risk associated with Storm Surge and Sea Level Rise on the protected side is less than Flood Side but still should be considered.

2.2 Sources of Uncertainty and Associated Risks

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

- Climate change, such as relative sea level rise, drought conditions, and variability of tropical storm frequency, intensity, and timing
- Subsidence and water level trends
- Uncertainty Relative to Achieving Ecological Success:
    - Water, sediment, and nutrient requirements
    - Magnitude and duration of wet/dry cycles for BLH
    - Nutrients required for desired productivity

  - Growth curves based on hydroperiod and nutrient application
  - Tree and marsh litter production based on nutrient and water levels
  - Tree propagation in relation to management/regulation of hydroperiod
- Uncertainty Relative to Implementability
- Reliability and Resiliency of Design
- Self-Sustainability of Project Once Ecological Success Criteria are Achieved
- Long-Term Sustainability of Project Benefits
- Adaptability

2.3 Adaptive Management Evaluation

The TSMP project features were evaluated against the potential need for AM actions. However, prior to AM evaluation, the proposed alternatives were evaluated through the AEP to select a TSMP with minimal risk and uncertainty. The AM Team, in coordination with the project delivery team (PDT), determined that uncertainties and risk elements identified for the project features had been avoided or reduced during the AEP evaluation. During the plan formulation and the AEP, alternatives were analyzed, screened, and compared against a robust set of screening criteria (including Risk and Reliability) resulting in selection of mitigation plans which had the least amount of residual risks. The AEP is further detailed in Appendix G.

To further reduce uncertainties and diminish potential future risks the items listed below were incorporated into the WPV Mitigation project implementation plan and Operation, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) plan to better ensure project success.

- Planting Guidelines for BLH
- General monitoring guidelines for Project success
- Guidelines for Clearing, Grading, and other Earthwork Activities
- Specified Success Criteria (i.e., mitigation targets)
- Invasive Species Control
- Hydrologic Enhancement
- Supplementary Plantings as required (contingency)
- Corrective actions to meet topographic success as required (contingency)
- Timber management activities

The mitigation project would restore BLH-Dry and BLH-Wet forests within existing agricultural fields. Since the existing elevations and hydrology already exist to support BLH-Dry forests and one additional re-planting has been built into the mitigation plan to account for plant mortality there are few remaining risks and AM actions (contingency plan) are not needed on the BLH-dry project features.

Construction of the BLH-Wet habitats requires an appropriate wetland hydrologic regime, which increases project risk. In the event that monitoring reveals the project does not meet the identified hydrologic success criteria, additional construction and/or operational activities would be conducted to increase the amount of water available at the site (e.g. elevation changes, changes in operation and control of culverts and/or other manipulations of surface hydrology). If the hydrologic regime requires corrections, it is likely that an additional planting beyond what is proposed in the mitigation plan may be needed.

Additionally, if seedling survivorship does not meet relevant success criteria, the NFS shall take appropriate actions, as recommended by CEMVN in consultation with the NFS and the Interagency Environmental Team (IET), to address the causes of mortality and shall replace seedlings of the appropriate species during the following planting season. Replanting, monitoring and reporting, as previously described in Appendix M, shall occur as needed to achieve and document the required survival rate.

It is recommended that funding for one additional BLH-Wet planting be included as an AM action. Such additional re-plantings could also trigger the need for additional mitigation monitoring. Hence, funding for one additional monitoring and reporting event is included as a potential AM action at an estimated cost of $110,000 for the Lake Boeuf BLH-Wet mitigation feature. In addition, the need for AM actions will be reviewed and revised, as necessary, for subsequent TIER projects.

3.0 Monitoring for Project Success

A monitoring plan consistent with WRDA 2007 Section 2036 specific to the Lake Boeuf BLH mitigation alternative has been developed (see Appendix L-M).The monitoring plan identifies success criteria and targets, a schedule for the monitoring events and the specific content for the monitoring reports that measure progress towards meeting the success criteria. Detailed monitoring plans will be developed for the remaining WBV mitigation projects following completion of the design of these projects. These detailed plans will be provided in one or more of the future TIERs.

Table 2 summarizes the success criteria outlined in Appendix L-M and may be used to assess project progress towards achieving the identified success criteria. In the event monitoring results reveal that any success criteria have not been met, the CEMVN or the NFS, as applicable pursuant to the policy set forth above, in consultation with CEMVN and the IET, will modify management practices in order to achieve these criteria in the future.

The current estimate for set-up and implementing the Monitoring Program for the Lake Boeuf BLH mitigation alternative is $1,111,000. These costs include data collection, data assessment, data management, and development of required reports.

Table 2: Summary of Mitigation Success Criteria for Bottom Land Hardwood Corps-Constructed Mitigation Projects - Report Card.

Performance Categories	Bottom Land Hardwood
Mitigation Construction	Criteria 1A: Complete necessary initial earthwork and construction activities.
Native Vegetation	Criteria 2A: Complete initial plantings. Criteria 2B: 1 year after initial plantings achieve: • Survival of ≥50% canopy species. • Survival of ≥85% midstory species. Criteria 2C: 4 years after initial plantings achieve: • ≥300 living native canopy species per acre. • 120-150 hard mast trees per acre

	• ≥85 midstory species per acre. For BLH-wet must meet hydrophytic vegetation criteria. Criteria 2D: Within 10 years after initial plantings, achieve: ≥80% coverage by native canopy species. Criteria 2E: 15 years after initial plantings, achieve: ≥75 mid-story native canopy trees per acre. Criteria 2F: 25 years after initial plantings, achieve: • 20-50% cover by native midstory species. • 30-60% cover by native understory vegetation.
Invasive and Nuisance Vegetation (INV)	Criteria 3A. Complete initial Eradication of INV. Criteria 3B. Maintain <5% cover by INV.
Topography	Criteria 4: After completion of construction, ≥ 80% of total graded area must be within 0.5 ft of target elevation.
Thinning of Native Vegetation	Criteria 5: TBD; at 15 to 20 years following initial plantings IET will determine if thinning of canopy and midstory strata is warranted.
Hydrology	Criteria 6A: Demonstrate water table is ≤ 12 inches above soil surface for 14 consecutive days in a normal rainfall year (for BLH-Wet only). Criteria 6B: demonstrate soils are inundated or saturated between 7-13% of growing season (for BLH-Wet only).

APPENDIX O

INTERAGENCY ENVIRONMENTAL TEAM

Stephanie Zumo	Coastal Protection and Restoration Authority Board
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APPENDIX P

ABBREVIATIONS

AAHU	Average Annual Habitat Units
AM	Adaptive Management
BLH-Dry	Bottomland Hardwood Dry
BLH-Wet	Bottomland Hardwood Wet
BMP	Best Management Practice
CAA	Clean Air Act
CAR	Coordination Act Report
CEMVN	U.S Army Corps of Engineers Mississippi Valley Division, U.S. Army Corps of Engineers New Orleans District
CEQ	Council on Environmental Quality
CF	Contractor Furnished
CFR	Code of Federal Regulations
CIAP	Coastal Impact Assistance Program
CRMS	Coastwide Reference Monitoring System
CWPPRA	Coastal Wetlands Planning, Protection, and Restoration Act
dB	Decibel
dBA	Weighted Decibel
DNL	Day-Night Average Sound Level
DOI	Department of Interior
DR	Decision Record
EA	Environmental Assessment
ECO-PCX	National Ecosystem Restoration Planning Center of Expertise
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ER	Engineering Regulation
ESA	Endangered Species Act
°F	Fahrenheit
FMC	Fisheries Management Council
FMP	Fisheries Management Plan
FONSI	Finding of No Significant Impact
FS	Flood Side
FWP	Future with Project
FWOP	Future without Project
GIWW	Gulf Intracoastal Waterway
HPS	Hurricane Protection System
HSDRRS	Hurricane and Storm Damage Risk Reduction System
HTRW	Hazardous, Toxic, or Radioactive Waste
IER	Individual Environmental Report
IERS	Supplemental Individual Environmental Report
LA	Louisiana
LaCPR	Louisiana Coastal Protection and Restoration
LCRP	Louisiana Coastal Resources Program

Appendix P: Abbreviations

LDNR	Louisiana Department of Natural Resources
LDWF	Louisiana Department of Wildlife and Fisheries
LDEQ	Louisiana Department of Environmental Quality
LIDAR	Laser Identification Detection and Ranging
LPV	Lake Pontchartrain and Vicinity
L&WCF	Land and Water Conservation Fund
MBI	Mitigation Banking Instrument
MPA2	Mitigation Plan Alternative 2
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
NAAQS	National Ambient Air Quality Standards
NCC	Notice of Construction Complete
NEPA	National Environmental Policy Act
NFS	Non-Federal Sponsor
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOV	New Orleans to Venice
NWR	National Wildlife Refuge
PDT	Project Delivery Team
PED	Preconstruction Engineering & Design
PIER	Programmatic Individual Environmental Report
PL	Public Law
ppt	Parts per Thousand
PM	Particulate Matter
PS	Protected Side
RDB	Right Descending Bank
REC	Recognized Environmental Conditions
ROD	Record of Decision
ROE	Right of Entry
RSLR	Relative Sea Level Rise
SAV	Submerged Aquatic Vegetation
SCORP	Statewide Comprehensive Outdoor Recreation Plan
SHPO	State Historic Preservation Office
SHS	State Historic Site
TIER	Tiered Individual Environmental Report
TSMP	Tentatively Selected Mitigation Project
TSMPA	Tentatively Selected Mitigation Plan Alternative
USACE	U.S Army Corps of Engineers
USC	United States Code
USFWS	US Fish and Wildlife Service
USGS	United States Geological Survey
WMA	Wildlife Management Area
WRDA	Water Resources Development Act
WVA	Wetland Value Assessment
ZIP	Zone Improvement Plan