Mississippi Valley Division,
Regional Planning and Environment Division South

St. Tammany Parish, Louisiana Feasibility Study

Appendix I Attachment 6 – Monitoring and Adaptive Management – Constructed Stream Project (Not Part of Recommended Plan

February 2024

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SECTION 1
Stream Mitigation Site

1.1 PROJECT LOCATION

***Stream impacts were associated with the Mile Branch Channel Improvements, which is not part of the Final RP. Due to this not being implemented, impacts will not need compensatory mitigation the analysis is included for information purposes only.*

The proposed stream mitigation site (M 6-2) is located off of Mile Branch and encompasses the City of Covington boundary for the gravel/storage yard as well as the area adjacent to the channel (Figure I5:1-1). This site will be used as staging during construction and when construction is completed on this segment of Mile Branch, the site will be beneficially used for restoration of water bottoms as the backwater area. The nature-based feature would rectify 3 acres of impacts (work will be done within the entire 5 acres) to Mile branch mud bottom from the construction of the Mile Branch channel improvements under the St. Tammany Parish, Louisiana Feasibility study.

Per ER 1105-2-100, Appendix C, 4e.(3): Separable Features. Full credit shall be given to the beneficial aspects of an alternative plan, or project, before consideration is given to adding separable ecological mitigation features. The significance of the ecological resources affected by an alternative plan/project, and the significance of adverse impacts to these resources shall be evaluated to determine the need for separable ecological mitigation features. Evaluation of a separable ecological mitigation feature is appropriate when it is determined that the net adverse impacts of an alternative plan/project exceed its net beneficial effects, and/or when the resulting losses include values (monetary and non-monetary) of such significance that specific consideration is justified.

This feature was also discussed and considered as a nature-based feature along Mile Branch as the restoration of stream bottoms and is expected to provide flood reduction benefits with additional overbank storage.

Figure I6:1-1. Location of Backwater Site to Create Stream Mud Bottom along Mile Branch

Note: The light blue line is the approximate area. The purple line represents the extent of the city owned property adjacent to Mile Branch.

1.2 PROJECT DESCRIPTION

A conceptual design was developed for the backwater feature off of Mile Branch that provides 3 acres of mud bottom as a project feature (Figure I5:1-2). It would be further designed during Pre-Construction Engineering and design (PED). A free exchange of water between Mile Branch and the backwater area would be preferred, however, if access to Mile Branch must be provided along the full length of Mile Branch, then culverts (4-60 feet; 2 inflow; 2 outflow) would be required to allow inflow and outflow between the two areas. The culverts should be placed at an elevation that allows frequent water exchange between Mile

Branch and the backwater area to avoid stagnation. The site would need to be excavated 3-5-feet deep below the average stage to Mile Branch to achieve both deep-water and shallow water habitat. A 40-feet buffer would be planted with bottomland hardwoods around the east, south, and west perimeter of the site. The 40-feet buffer should not be higher than the existing elevation to allow run-off from adjacent areas to flow into the backwater area. The deep-water area would be excavated at a 3:1 slope away from the buffer to achieve the required depth of the site. Finger islands would be created within the site and planted with BLH. Excavated material from within the site would be hauled off-site. The internal tree "fingers" would be at a lower elevation than the perimeter forested buffer. The fingers should be at the former natural ground elevation or maybe a foot or two lower but would be sufficient to support BLH species. Deep water "channels" (see "D" on Figure I5:1-2) would extend through the southern end of the tract to encourage circulation throughout the site. Some shallow areas should be provided for marsh or swamp vegetation growth.

1.2.1 **Real Estate**

Real estate will be acquired as needed for the channel improvements staging area, but should be permanent/conservation servitude to protect the area to function as intended post construction.

1.2.2 **Operating Plan**

The operating plan will be developed in PED when the features are further modeled. It is expected that named storm events and water elevation triggers would be used to determine closing. Final Operations Plan would be completed through coordination with NMFS and USFWS.

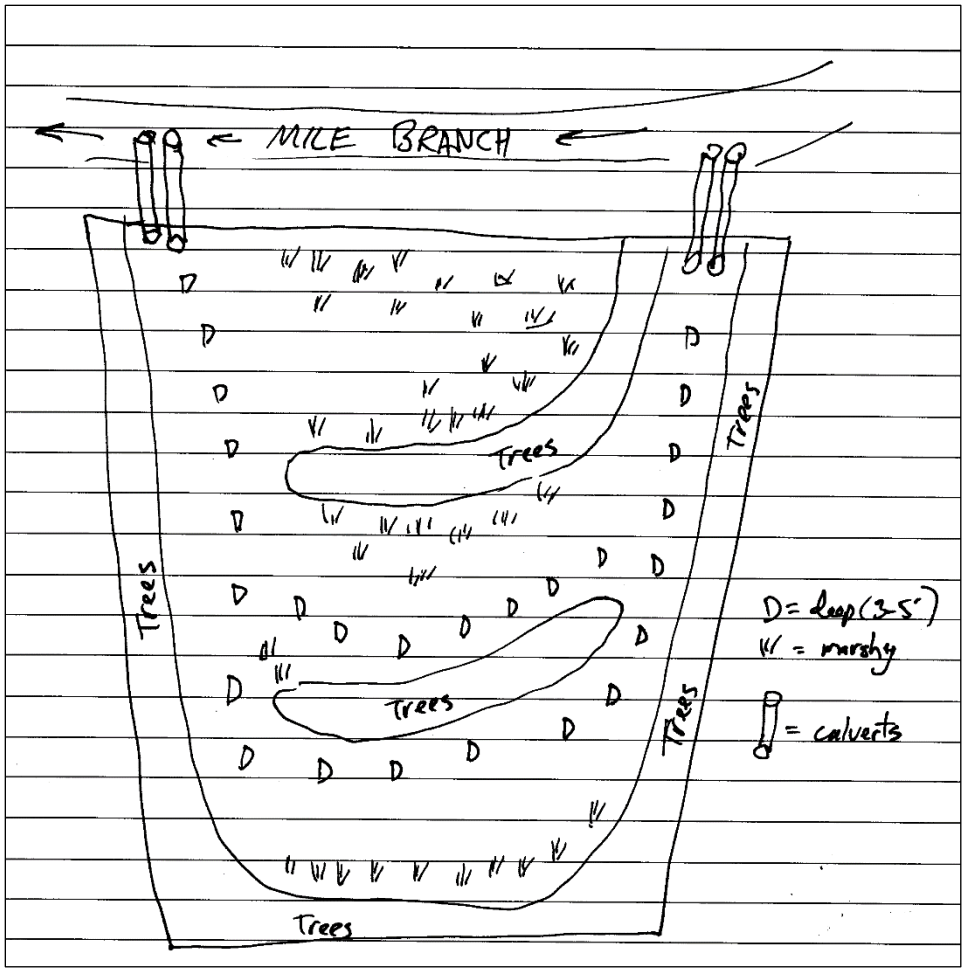

Figure I6:1-2. Conceptual Design for Mile Branch Backwater Feature

SECTION 2

USACE Guidance

U.S. Army Corps of Engineers (USACE) monitoring and adaptive management policy is required by the Water Resources Development Act of 2007 and presented in planning guidance (Engineering Regulation (ER) 1105-2-100, Engineering Circular (EC) 1105-2-409, and Memorandum on Implementation Guidance for Section 2036 of the Water Resources Development Act of 2007). Monitoring includes the systematic collection and analysis of data that provides information useful for assessing project performance, determining whether ecological success has been achieved, or whether adaptive management will be needed to attain project benefits. Adaptive management addresses the uncertainties about a project's actual performance that exist when implementation decisions are made to undertake a water resources project. This technique allows decision making and implementation to proceed with the understanding that outputs will be assessed and evaluated and that some structural or operational changes to the project may be necessary to achieve desired results. At the heart of adaptive management is an appropriate monitoring program to determine if the outputs/results meet the required mitigation need, and to determine if any adjustments are needed.

The purpose of this plan is to demonstrate ecological success of the project. This success is determined by monitoring metrics that are specifically tied to project objectives, and success criteria. In addition, the plan identifies what adaptive management (contingency) is proposed if the performance targets are not met. This plan presents the framework for the above methodology, and will be refined as the project proceeds into Pre-construction, Engineering, and Design (PED) phase in collaboration with the non-Federal sponsors, as well as other stakeholders who may take responsibility for monitoring ecological variables in the watershed.

SECTION 3

Mitigation Success Criteria

3.1 GENERAL CONSTRUCTION

- Complete all initial mitigation construction activities (e.g. construction of temporary retention/perimeter dikes, placement of fill (borrow material/dredged material), construction of permanent dikes if applicable, etc.) in accordance with the mitigation work plan and final project plans and specifications. Upon completion of construction, USACE or its contractor shall provide construction surveys to include all project features. These activities are classified as "initial construction requirements."
- Approximately 1 year following completion of all initial mitigation construction activities (when the constructed feature has stabilized to the point that the containment berms are no longer required to prevent the loss of fill material from the project site), USACE or its contractor shall complete all final mitigation construction activities, in accordance with the mitigation work plan and final project plans and specifications. Such activities may include, but are not limited to: degrading temporary retention/perimeter dikes; completion of armoring of permanent dikes; "gapping" or installation of "fish dips"; soil testing; completion of plantings; and construction of trenasses or similar features within backwater area as a means of establishing shallow water and deep water interspersion areas. Finishing the aforementioned construction activities will be considered as the "completion of final construction requirements".

3.2 TOPOGRAPHY

- Initial Success Criteria:
    - One year after final construction:
        - Demonstrate that at least 80% of each mitigation feature has a surface elevation that is within +0.5 to – 0.5 feet of the desired target surface elevation as determined by the settlement curve for that year.
- Two years after final construction:
    - Demonstrate that at least 80% of the mitigation site has a surface elevation that is within +0.5 feet to – 0.25 of the desired target surface elevation as determined by the settlement curve for that year.
- Intermediate Success Criteria:
    - Two years following achievement of Topography Criteria 2.A.2. —

- Demonstrate that at least 80% of the mitigation site has a surface elevation that is within the functional marsh elevation range[2].
- There are no additional monitoring or attainment requirements for topography beyond meeting the Intermediate Success Criteria for topography.

Notes:

[1]Elevation survey data and report will be provided to the IET for review in order to determine concurrence. The surveys must include water levels inside and outside the backwater site at locations representative of site conditions.

[2]The "functional elevation range", i.e. the range of the surface elevation that is considered adequate to achieve proper backwater area functions and values, is determined during the final design phase.

3.3 VEGETATION

- Fresh marsh:
  - Initial Success Criteria (2 growing seasons following completion of initial construction activities in General Construction 1.A.):
  - Achieve a minimum average cover of 50% comprised of native herbaceous species.
  - Demonstrate that vegetation satisfies USACE hydrophytic vegetation criteria. (USACE 2010)
    - Intermediate Criteria (2 years following attainment f Native Vegetation Criteria 3.A.1.):
  - Achieve a minimum average cover of 60% comprised of native herbaceous species.
  - Demonstrate that vegetation satisfies USACE hydrophytic vegetation criteria.
- Long-Term Success Criteria[3] (Every monitoring event after attainment of Native Vegetation Criteria 3.A.2.):
  - Achieve a minimum average cover of 60% comprised of native herbaceous species.
  - Demonstrate that vegetation satisfies USACE hydrophytic vegetation criteria.

Notes:

[1]Fresh marsh is typically not planted due to the expectation that it will naturally vegetate more quickly than intermediate or brackish marsh. However, if percent cover success criteria are not met, plantings may become necessary in the absence of other recommended actions

- Riprian BLH:
    - In mature riparian floodplain forests, canopy tree stem density is roughly 150 stems per acre, indicating a tree spacing of 16 to 18 feet, according to USDA-NRCS Riparian Forest Buffer Specifications. This stem density of native trees will be used as the success criteria. Total average vegetative cover accounted for by invasive species constituting less than 5% of the total average plant cover would be used as success criteria. If tree density and/or invasive species success criteria are not met, adaptive management would be required.

3.4 INVASIVE AND NUISANCE VEGETATION

3.4.1 Initial, Intermediate, and Long-term1 Success Criteria

- Maintain the project area such that the total average vegetative cover accounted for by invasive species and the total average vegetative cover accounted nuisance species each constitute less than 5% of the total average plant cover each throughout the 50- year project life. The list of invasive and nuisance species will be developed and tailored to reflect specific site needs.

Note:

[1]Yearly inspections to determine the need for invasive/nuisance control would be conducted until the long term success criteria for vegetation is achieved. After it is achieved, the frequency of inspections to determine the need for invasive/nuisance control would be adjusted based on site conditions.

3.5 HYDROLOGY

Success criteria includes increased connectivity compared to baseline conditions.

3.6 AQUATIC FAUNA -FISH AND INVERTEBRATE

Habitat conditions and faunal communities would be compared to baseline conditions to document changes. There are no specific performance criteria for this. Generally, increased habitat complexity will result in new habitats for aquatic communities.

SECTION 4
Mitigation Monitoring Guidelines

A diverse riverine fauna is dependent on habitat diversity, such as diversity in connection frequency, substrate heterogeneity and structural complexity. This monitoring plan proposes the framework for monitoring the changes in aquatic species and habitat that will occur with construction of the backwater mitigation project. Fish, invertebrate, water quality and habitat data will ideally be collected seasonally in habitats affected by project measures or stratified representative habitats within the project reach. Proposed monitoring will be finalized during Preconstruction, Engineering and Design (PED). As monitoring is completed, data will be reported and analyzed by USACE and the NFS to facilitate adaptive management.

The following activities summarize the basic monitoring steps.

- Complete: bathymetry, aquatic habitat, hydrologiy, and aquatic fauna surveys.
- Conduct field work to document species and habitat pre- and post-project
- Elevation – channel or waterbody bed surveys
- Benthic invertebrates and mussels – grab samples
- Adult and juvenile fish –seine
- Hydrology – YSI hydrolab and turbidimeter (temperature, pH, conductivity, dissolved oxygen, turbidity)
- Physical parameters – stadia rod and flowmeter (substrate, aquatic vegetation coverage, velocity, and depth cross section)

4.1 TOPOGRAPHY

Elevation Surveys will be used to estimate pre and post project connectivity. Additional more frequent surveys may be needed by engineering to monitor project design and channel conditions.

Eco-mapper: For small, isolated floodplain waterbodies, bathymetric data could be collected by a YSI i3XO EcoMapper ® autonomous underwater vehicle (AUV) or other remote survey vehicle such as ERDC-CHL's remotely operated survey vessel. Where possible, an evenly < 20 ft spaced grid of depth readings collected during higher water would provide good coverage of the waterbody's bed. If a grid is not possible, the depth readings could be recorded parallel and closest to the shoreline and then in transects perpendicular to the waterbody's long axis with a transect spacing of < 100 ft and at least three transects per waterbody. Stadia rod readings with GPS coordinates may provide supplemental depth readings for large shallow < 2 ft deep areas of the waterbody.

Depending on time and monetary constraints, water surface elevation to convert depth readings may be determined in several ways. The National Geodetic Survey database could be searched to find suitable benchmarks. A Trimble R8 RTK GPS receiver could be utilized to provide survey vessel navigation and positioning. This would provide real time sub-meter level accuracy latitude and longitude for each depth reading. An R8 Base Station affixed with a high output radio could allow for RTK water surface elevation collection at random intervals throughout the survey. A less time-consuming low-cost alternative may be used by intersecting GPS points collected at the water's edge with Lidar data, or by using a surveyor's level set up on the nearby levee slope. For this method, multiple water surface elevations would be calculated, where possible, and averaged to improve accuracy.

4.2 HYDROLOGY

Maximum water depth, water velocity, and instream structure, if any, will be recorded along with water quality (temperature C, dissolved oxygen mg/l, conductivity microsiemiens/cm, pH, and turbidity nephelometric turbidity units (NTU)). Water quality will be recorded in flowing and floodplain waterbodies with a YSI ProDss unit. Readings will be taken throughout the water column and sampling area to characterize sampling conditions and if stratification is present. In select waterbodies, data loggers may be deployed to collect more frequent readings.

4.3 VEGETATIVE MONITORING

Vegetative monitoring would utilize established monitoring techniques and published scientific resources to 1) document increases in wetland functions as a result of the restoration activities, 2) identify data-driven success trajectories and milestones, 3) adaptively manage wetland conditions within the project area based upon observed data related to changes in wetland functional capacity over time, and 4) promote native species.

4.3.1 Data Acquisition

- tree density (e.g., tree basal area, density by coverage),
- vegetative speciation (e.g., overstory composition),
- sustainability (e.g., regeneration, species represented in vertical strata)
- soil conditions (e.g., O and A horizon)

4.3.2 Native species

To promote the native vegetation, with an emphasis on those hard mast species lacking in the study area, appropriate vegetation should be planted on sites designated for reforestation of bottomland hardwood (BLH) and riparian buffers. Only native plants should be planted (Table A9-3) depending on availability at nurseries. Typical planting densities were assumed to be on 10-ft centers; however, site specific determinations would be determined once a site and specific vegetation suite has been selected.

Table I6:4-1. Native vegetation targeted for planting at restoration sites.

Acer drummondii	Planera aquatica
Acer negundo	Platanus occidentalis
Acer rubrum	Populus heterophylla
Acer saccharinum	Quercus lyrata
Carya aquatica	Quercus nigra
Carya laciniosa	Quercus nuttallii
Celtis laevigata	Quercus pagoda
Diospyros virginiana	Quercus palustris
Forestiera acuminata	Quercus phellos
Fraxinus pennsylvanica	Salix nigra
Fraxinus tomentosa	Taxodium distichum
Gleditsia aquatica	Taxodium ascendens
Liquidambar styraciflua	Ulmus americana
Nyssa aquatica	Ulmus crassifolia
Nyssa sylvatica	Emergent Wetland Seed Mix

Monitoring would also be conducted to demonstrate that vegetation satisfies USACE hydrophytic vegetation criteria. The community would be monitored to ensure it exhibits characteristics and diversity indicative of a viable native forested wetland community, i.e. vegetation community where more than 50% of all dominant species are facultative (FAC), FAC wet and/or obligate. Table A9-4 shows the common wetland vegetation; a site-specific list will be developed in conjunction with the resource agencies.

Table I6:4-2. Common vegetation of the Lower Mississippi Valley.

Abbreviation	Scientific Name	Common Name	Status
ACNE	Acer negundo	box elder	FACW
ACRU	Acer rubrum	red maple	FACW
ACSA	Acer saccharinum	silver maple	FAC
ALPH	Alteranthera philoxeroides	alligator weed	OBL
AMTR	Ambrosia trifida	ragweed	FAC
AMAR	Ampelopsis arborea	pepper vine	FAC+
AMBR	Amphicarpa bracteata	hog peanut	FAC

ANVI	Adropogon virginicus	Broom sedge	FAC-
ANCA	Anisostichus capreolata	cross vine	Upland
ARGI	Arundinaria gigantea	river cane	FACW
ARTE	Arundinaria tecta	switch cane	FACW
ARTR	Arisaema triphyllum	Jack-in-the-pulpit	FACW-
ASPE	Asclepias perenius	milkweed	OBL
ASPA	Asimina parviflora	Paw Paw	FACU
BESC	Berchemia scandens	rattan vine	FACW
BICA	Bignonia capreolata	cross vine	FAC
BOCY	Boehmeria cylindrica	bog hemp	FACW+
BRCI	Brunnichia cirrhosa	redvine	FACW
CACAM	Callicarpa americana	beauty-berry	FACU-
CAFL	Calycanthus floridus	spicebush	FACU+
CARA	Campsis radicans	trumpet creeper	FAC
CACH	Carex cherokeensis	Cherokee sedge	FACW
CATA	Chaerophyllum tainturieri	Hairfruit chervil	FAC
CACA	Carpinus caroliniana	ironwood	FAC
CAAQ	Carya aquatica	bitter pecan	OBL
CAGL	Carya glabra	pignut hickory	FACU
CAIL	Carya illinoinensis	pecan	FACU
CATO	Carya tomentosa	mockernut hickory	Upland
CEOC	Cephalanthus occidentalis	buttonbush	OBL
CECA	Cercis canadensis	redbud	FACU
CELA	Celtis laevigata	sugarberry	FACW
COCA	Cocculus carolina	Caroline snailseed	FAC
COCO	Commelina communis	dayflower	FAC
COAM	Cornus amomum	swamp dogwood	FACW+
COFL	Cornus florida	flowering dogwood	FACU
COST	Cornus foemina (stricta?)	stiff dogwood	FACW-
CRSP	Crataegus spathulata	hawthorne	FAC
DEBA	Decumaria barbara	climbing hydrangea	FACW
DEIL	Desmanthus illinoensis	Illinois bundleflower	FAC
DIVI	Diospyros virginiana	persimmon	FAC
ECCR	Echinochloa crus-galli	American barnyard grass	FACW

ELUM	Elaeagnus umbellata	silverberry	FACU
ELCA	Elephantopus carolinianus	elephant's-foot	FAC
FIAU	Fimbristylis autumnalis	beak rush	OBL
FOAC	Forestiera acuminata	swamp privet	OBL
FRVI	Fragaria virginiana	wild strawberry	FAC-
FRAM	Fraxinus americana	white ash	FACU
FRPE	Fraxinus pennsylvanica	green ash	FACW
GECA	Geum canadense	white avens	FAC
GLTR	Gleditsia triacanthos	honey locust	FAC-
HACA	Halesia carolina	Carolina silverbell	FACU+
HIMI	Hibiscus laevis (militaris)	rose mallow	OBL
ILDE	Ilex decidua	deciduous holly	FACW-
IMCA	Impatiens capensis	jewel-weed	FACW
IVAN	Iva annua	Sump weed	FAC
JUNI	Juglans nigra	black walnut	FACU
JURE	Juncus repens	lesser creeping rush	OBL
JUTE	Juncus tenuous	path rush	FAC
LELE	Leersia lenticularis	catchfly cutgrass	OBL
LISI	Ligustrum sinense	privet	FAC
LIST	Liquidambar styraciflua	sweetgum	FAC+
LITU	Liriodendron tulipifera	yellow poplar	FAC
LOJA	Lonicera japonica	Japanese honeysuckle	FAC-
LUPA	Ludwigia papilloides	floating primrose-willow	OBL
MIVI	Microstegium virmineum	Microstegium	NL
MORU	Morus rubra	red mulberry	FAC
NYSY	Nyssa sylvatica	blackgum	FAC
OPHI	Oplismenus hirtellus	basket grass	FACU+
OSVI	Ostrya virginiana	hop hornbeam	FACU-
PAQU	Parthenocissus quinquefolia	Virginia creeper	FAC
PHAU	Phyllostachys aurea	Chinese bamboo	
PIPU	Pilea pumila	clearweed	FACW+
PITA	Pinus taeda	loblolly pine	FAC
PLAQ	Planera aquatica	water elm	OBL

PLOC	Platanus occidentalis	sycamore	FACW-
POAC	Polystichum acrostichoides	Christmas fern	FAC
PODE	Populus deltoides	cottonwood	FAC+
POHY	Polygonum hydropiperoides	swamp smartweed	OBL
POPU	Polygonum punctatum	knotweed	FACW+
POPE	Polygonum pennsylvanica	Pennsylvania Smartweed	FACW
PRSE	Prunus serotina	black cherry	FACU
PULO	Pueraria lobata	kudzu	Upland
QULY	Quercus lyrata	overcup oak	OBL
QUNI	Quercus nigra	water oak	FAC
QUNU	Quercus nuttallii	Nuttall oak	OBL
QUPA	Quercus pagoda	cherrybark oak	FAC
QUPH	Quercus phellos	willow oak	FACW-
QURU	Quercus rubra	red oak	FACU
RUAR	*Rubus argutus*	blackberry	FAC-
RUCR	*Rumex crispus*	Curly dock	FAC
SACE	*Saururus cernuus*	lizard's tail	OBL
SANI	*Salix nigra*	black willow	OBL
SACA	*Sambucus canadensis*	elderberry	FACW-
SEEX	*Sesbania exaltata*	bigpod sesbania	FACW
SMLA	*Smilax laurifolia*	green briar	FACW+
SMRO	*Smilax rotundifolia*	green briar	FAC
SOAL	*Solidago altisima*	Goldenrod	FACU
SOHA	*Sorghum halpense*	Johnson grass	FACU
TADI	*Taxodium distichum*	Cypress	OBL
TORA	*Toxicodendron radicans*	poison ivy	FAC
TRDE	*Treclospermum deforma*	climbing star-jasmine	FACW
TOVI	*Tovara virginiana*	jumpseed	FAC
ULAL	*Ulmus alata*	winged elm	FACU+
ULAM	*Ulmus americana*	American elm	FACW
UNLA	*Chasmanthium latifolium*	Spikegrass	FACU
VAST	*Vaccinium stamineum*	huckleberry	FACU
VEHA	*Verbena hastata*	swamp verbena	FAC

VIFL	*Viola floridana*	common blue violet	FACW-
VICI	*Vitus cinerea*	graybark grape	FAC+
VIRO	*Vitus rotundifolia*	muscadine	FAC

4.3.3 Invasive species

The promotion of native vegetation, often requires control of invasive vegetative species. A list of invasive species that would be monitored for at the backwater sites that could trigger adaptive management actions will be developed and included in the monitoring and adaptive management plan during PED.

4.4 AQUATIC FAUNA SURVEYS

Sampling is proposed seasonally by seining, and possibly gillnets.

These surveys will provide information on fish and invertebrate species that utilize the backwater mudbottom area. Collected fish and invertebrate data will be used to compare species presence/absence, abundance, and richness before and after project construction.

Ponar/Ekman: The inaccessibility of floodplain waterbodies means these cannot be sampled with the boat pulled benthic sled. Floodplain waterbodies will be sampled with either a petite Ponar or Ekman grab sampler. These samplers are spring loaded catchment devices. They are lowered to the waterbody bed and the spring released at which point the device snaps closed scooping up soft bed material. Three samples will be taken along each transect with the objective of acquiring samples from all substrates present. Upon retrieval, a standardized 8-L sample of the collected substrate will be processed. Sediments will be washed on-board and sieved to separate living organisms from inorganic particles and characterize substrate. Organisms will be returned to the laboratory in Vicksburg, MS, for counting and identification. Insects will be identified to genus when possible. Early instars and Chironomidae will likely be identified to family. Mollusks captured live will be identified to family and released (relict mollusks will not be identified). Aquatic worms will be identified to subclass or family if possible. Macroinvertebrates will be assigned into different functional groups (environment, habit, functional feeding group) using available taxonomic literature and professional opinion. The differences in abundance, richness and functional group will be compared pre and post project and between habitats.

Seining: Seining will be used to sample the mitigation site. A seine sample consists of ten seine hauls stratified among all apparent macrohabitats. A sample will be gathered in the upper, middle, and lower sections of the waterbody. Seines consist of a 10' long and 4' deep net tied to 6’ tall poles. The net consists of 3/16" mesh knotless 34lb test nylon with a 1/8" braided nylon top and bottom rope. A lead weight is placed every 12" on the bottom rope and SB3 floats occur every 18" on the top rope. Large fish will be identified to species,

measured, and released. Small fish will be preserved in ethanol and transported to the lab for identification and measuring.

Vegetative monitoring would utilize established monitoring techniques and published scientific resources to 1) document increases in wetland functions as a result of the restoration activities, 2) identify data-driven success trajectories and milestones, 3) adaptively manage wetland conditions within the project area based upon observed data related to changes in wetland functional capacity over time, and 4) promote native species.

4.4.1 Data Acquisition

- tree density (e.g., tree basal area, density by coverage),
- vegetative speciation (e.g., overstory composition),
- sustainability (e.g., regeneration, species represented in vertical strata)
- soil conditions (e.g., O and A horizon)

4.4.2 Native species

To promote the native vegetation, with an emphasis on those hard mast species lacking in the study area, appropriate vegetation should be planted on sites designated for reforestation of bottomland hardwood (BLH) and riparian buffers. Only native plants should be planted (Table A9-3) depending on availability at nurseries. Typical planting densities were assumed to be on 10-ft centers; however, site specific determinations would be determined once a site and specific vegetation suite has been selected.

Table I6:4- 1. Native vegetation targeted for planting at mitigation site

Acer drummondii	Planera aquatica
Acer negundo	Platanus occidentalis
Acer rubrum	Populus heterophylla
Acer saccharinum	Quercus lyrata
Carya aquatica	Quercus nigra
Carya laciniosa	Quercus nuttallii
Celtis laevigata	Quercus pagoda
Diospyros virginiana	Quercus palustris
Forestiera acuminata	Quercus phellos
Fraxinus pennsylvanica	Salix nigra
Fraxinus tomentosa	Taxodium distichum
Gleditsia aquatica	Taxodium ascendens
Liquidambar styraciflua	Ulmus americana
Nyssa aquatica	Ulmus crassifolia
Nyssa sylvatica	Emergent Wetland Seed Mix

Since the mitigation site is within the active floodplain, monitoring would also be conducted to demonstrate that vegetation satisfies USACE hydrophytic vegetation criteria. The community would be monitored to ensure it exhibits characteristics and diversity indicative of a viable native forested wetland community, i.e. vegetation community where more than 50% of all dominant species are facultative (FAC), FAC wet and/or obligate. Table A9-4 shows the common wetland vegetation likely at the proposed site.

Table I6:4- 2. Common vegetation of the Lower Mississippi Valley.

Abbreviation	Scientific Name	Common Name	Status
ACNE	*Acer negundo*	box elder	FACW
ACRU	*Acer rubrum*	red maple	FACW
ACSA	*Acer saccharinum*	silver maple	FAC
ALPH	*Alteranthera philoxeroides*	alligator weed	OBL
AMTR	*Ambrosia trifida*	ragweed	FAC
AMAR	*Ampelopsis arborea*	pepper vine	FAC+
AMBR	*Amphicarpa bracteata*	hog peanut	FAC

ANVI	*Adropogon virginicus*	Broom sedge	FAC-
ANCA	*Anisostichus capreolata*	cross vine	Upland
ARGI	*Arundinaria gigantea*	river cane	FACW
ARTE	*Arundinaria tecta*	switch cane	FACW
ARTR	*Arisaema triphyllum*	Jack-in-the-pulpit	FACW-
ASPE	*Asclepias perenius*	milkweed	OBL
ASPA	*Asimina parviflora*	Paw Paw	FACU
BESC	*Berchemia scandens*	rattan vine	FACW
BICA	*Bignonia capreolata*	cross vine	FAC
BOCY	*Boehmeria cylindrica*	bog hemp	FACW+
BRCI	*Brunnichia cirrhosa*	redvine	FACW
CACAM	*Callicarpa americana*	beauty-berry	FACU-
CAFL	*Calycanthus floridus*	spicebush	FACU+
CARA	*Campsis radicans*	trumpet creeper	FAC
CACH	*Carex cherokeensis*	Cherokee sedge	FACW
CATA	*Chaerophyllum tainturieri*	Hairfruit chervil	FAC
CACA	*Carpinus caroliniana*	ironwood	FAC
CAAQ	*Carya aquatica*	bitter pecan	OBL
CAGL	*Carya glabra*	pignut hickory	FACU
CAIL	*Carya illinoinensis*	pecan	FACU
CATO	*Carya tomentosa*	mockernut hickory	Upland
CEOC	*Cephalanthus occidentalis*	buttonbush	OBL
CECA	*Cercis canadensis*	redbud	FACU
CELA	*Celtis laevigata*	sugarberry	FACW
COCA	*Cocculus carolina*	Caroline snailseed	FAC
COCO	*Commelina communis*	dayflower	FAC
COAM	*Cornus amomum*	swamp dogwood	FACW+
COFL	*Cornus florida*	flowering dogwood	FACU
COST	*Cornus foemina (stricta?)*	stiff dogwood	FACW-
CRSP	*Crataegus spathulata*	hawthorne	FAC
DEBA	*Decumaria barbara*	climbing hydrangea	FACW
DEIL	*Desmanthus illinoensis*	Illinois bundleflower	FAC
DIVI	*Diospyros virginiana*	persimmon	FAC
ECCR	*Echinochloa crus-galli*	American barnyard grass	FACW

ELUM	*Elaeagnus umbellata*	silverberry	FACU
ELCA	*Elephantopus carolinianus*	elephant's-foot	FAC
FIAU	*Fimbristylis autumnalis*	beak rush	OBL
FOAC	*Forestiera acuminata*	swamp privet	OBL
FRVI	*Fragaria virginiana*	wild strawberry	FAC-
FRAM	*Fraxinus americana*	white ash	FACU
FRPE	*Fraxinus pennsylvanica*	green ash	FACW
GECA	*Geum canadense*	white avens	FAC
GLTR	*Gleditsia triacanthos*	honey locust	FAC-
HACA	*Halesia carolina*	Carolina silverbell	FACU+
HIMI	*Hibiscus laevis (militaris)*	rose mallow	OBL
ILDE	*Ilex decidua*	deciduous holly	FACW-
IMCA	*Impatiens capensis*	jewel-weed	FACW
IVAN	*Iva annua*	Sump weed	FAC
JUNI	*Juglans nigra*	black walnut	FACU
JURE	*Juncus repens*	lesser creeping rush	OBL
JUTE	*Juncus tenuous*	path rush	FAC
LELE	*Leersia lenticularis*	catchfly cutgrass	OBL
LISI	*Ligustrum sinense*	privet	FAC
LIST	*Liquidambar styraciflua*	sweetgum	FAC+
LITU	*Liriodendron tulipifera*	yellow poplar	FAC
LOJA	*Lonicera japonica*	Japanese honeysuckle	FAC-
LUPA	*Ludwigia papilloides*	floating primrose-willow	OBL
MIVI	*Microstegium virmineum*	Microstegium	NL
MORU	*Morus rubra*	red mulberry	FAC
NYSY	*Nyssa sylvatica*	blackgum	FAC
OPHI	*Oplismenus hirtellus*	basket grass	FACU+
OSVI	*Ostrya virginiana*	hop hornbeam	FACU-
PAQU	*Parthenocissus quinquefolia*	Virginia creeper	FAC
PHAU	*Phyllostachys aurea*	Chinese bamboo	
PIPU	*Pilea pumila*	clearweed	FACW+
PITA	*Pinus taeda*	loblolly pine	FAC
PLAQ	*Planera aquatica*	water elm	OBL

PLOC	*Platanus occidentalis*	sycamore	FACW-
POAC	*Polystichum acrostichoides*	Christmas fern	FAC
PODE	*Populus deltoides*	cottonwood	FAC+
POHY	*Polygonum hydropiperoides*	swamp smartweed	OBL
POPU	*Polygonum punctatum*	knotweed	FACW+
POPE	*Polygonum pennsylvanica*	Pennsylvania Smartweed	FACW
PRSE	*Prunus serotina*	black cherry	FACU
PULO	*Pueraria lobata*	kudzu	Upland
QULY	*Quercus lyrata*	overcup oak	OBL
QUNI	*Quercus nigra*	water oak	FAC
QUNU	*Quercus nuttallii*	Nuttall oak	OBL
QUPA	*Quercus pagoda*	cherrybark oak	FAC
QUPH	*Quercus phellos*	willow oak	FACW-
QURU	*Quercus rubra*	red oak	FACU
RUAR	*Rubus argutus*	blackberry	FAC-
RUCR	*Rumex crispus*	Curly dock	FAC
SACE	*Saururus cernuus*	lizard's tail	OBL
SANI	*Salix nigra*	black willow	OBL
SACA	*Sambucus canadensis*	elderberry	FACW-
SEEX	*Sesbania exaltata*	bigpod sesbania	FACW
SMLA	*Smilax laurifolia*	green briar	FACW+
SMRO	*Smilax rotundifolia*	green briar	FAC
SOAL	*Solidago altisima*	Goldenrod	FACU
SOHA	*Sorghum halpense*	Johnson grass	FACU
TADI	*Taxodium distichum*	Cypress	OBL
TORA	*Toxicodendron radicans*	poison ivy	FAC
TRDE	*Treclospermum deforma*	climbing star-jasmine	FACW
TOVI	*Tovara virginiana*	jumpseed	FAC
ULAL	*Ulmus alata*	winged elm	FACU+
ULAM	*Ulmus americana*	American elm	FACW
UNLA	*Chasmanthium latifolium*	Spikegrass	FACU
VAST	*Vaccinium stamineum*	huckleberry	FACU
VEHA	*Verbena hastata*	swamp verbena	FAC

VIFL	*Viola floridana*	common blue violet	FACW-
VICI	*Vitus cinerea*	graybark grape	FAC+
VIRO	*Vitus rotundifolia*	muscadine	FAC

4.4.3 **Invasive species**

The promotion of native vegetation, often requires control of invasive vegetative species. A list of invasive species that would be monitored for at the backwater sites that could trigger adaptive management actions will be developed and included in the monitoring and adaptive management plan during PED.

SECTION 5

Monitoring Reports

5.1 BASELINE MONITORING REPORT (FIRST MONITORING REPORT)

A “baseline” monitoring report will be prepared upon completion of Final Construction Requirements 1.B. and upon any re-plantings associated with construction. Information provided will typically include the following:

- A detailed discussion of all mitigation activities completed.
- A plan view drawing of the mitigation site showing the approximate boundaries of the restored marsh, significant interspersion features established within the marsh features (as applicable), proposed monitoring transect locations, proposed sampling plot locations, photo station locations and water level survey locations.
- Initial and final construction surveys of all project features (including but not limited to the fill area, fish dips, weirs, culverts, etc.) and an analysis of the survey data will be provided addressing attainment of topographic success criteria. If a project is immediately adjacent to existing marsh habitat, the topographic survey will include spot elevations collected within the existing marsh habitat near the restored marsh.
- Photographs documenting conditions in the project area will be taken at the time of monitoring. Photos will be taken at permanent photo stations within the restored marsh. 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 and 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, 4 photo stations will be established within each marsh cell.
- For planted marsh only -- A detailed inventory of all species planted, including the number of each species planted, the stock size planted, and where the species were planted will be documented. For mitigation sites that include more than one planted marsh cell/feature, provide a breakdown itemization indicating the number of each species planted in each feature and correlate this itemization to the marsh features depicted on the plan view drawing of the mitigation site.
- As part of the as-built/final construction survey, water level surveys will be taken inside and outside the marsh creation site at predetermined locations identified in coordination with the IET and NFS. Each interior water level elevation should have a corresponding exterior water level elevation taken consecutively and within close proximity. If there appears to be disparity in water levels within the marsh creation site, additional shots may be required. The baseline monitoring report will provide the surveyed water level data and will compare it to mean high and mean low

water elevation data collected 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 project.
- 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.

5.2 ADDITIONAL MONITORING REPORTS

All monitoring reports generated after the Baseline Monitoring Report will be called either Initial, Intermediate or Long-Term Monitoring Reports and shall include the year in which the monitoring occurred (i.e. Monitoring Report 2019). All Monitoring Reports shall provide the following information unless otherwise noted:

- All items listed for the Baseline Monitoring Report with the exception of: (a) the topographic surveys, although additional topographic surveys are required for specific monitoring reports (see below); and (b) the inventory of species and location map for all planted species.
- Quantitative data for all plants in each 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 1 meter X 1 meter 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 size of the mitigation site and will be determined by the IET during the final design phase of the project. 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 but not be limited to: average total percent cover by native plant species; average total percent cover by invasive plant species; average total percent cover by nuisance plant species; percent cover of each plant species; the wetland indicator status of each species; and the average percent survival of each planted species (i.e. number of living planted species as a percentage of total number of plants installed), if discernable at the time of monitoring.

- One photograph shall be taken from the SE corner of each sampling plot to clearly capture the vegetation plot and must include a sign that indicates the plot number and sampling date.
- A brief description of maintenance and/or management work performed since the previous monitoring report along with a discussion of any other significant occurrences.
- Topographic surveys of each marsh restoration feature for initial and intermediate monitoring events (at approximately 2 years and 4 years following completion of final construction activities (General Construction 1.B.)). These surveys will cover the same components as described for the topographic survey conducted for the Baseline Monitoring Report. In addition to the surveys themselves, each of the two monitoring reports will include an analysis of the topographic data in regards to the attainment of applicable topographic success criteria. If the surveys indicate topographic success criteria have not been achieved and supplemental topographic alterations are necessary, then another topographic survey will be required following completion of the supplemental alterations. This determination will be made by USACE and the IET.

5.3 MONITORING REPORTS FOLLOWING PLANTING OR RE-PLANTING ACTIVITIES

Planting or re-planting of certain areas within restored marsh habitats may be necessary to ensure attainment of applicable native vegetation success criteria. Any monitoring report submitted following completion of a planting event must include an inventory of the number of each species planted, the stock size used, and the locations for each species planted. 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. The perimeter of re-planted area should be documented with GPS coordinates. If single rows are replanted, then GPS coordinates should be taken at the end of the transect.

SECTION 6

Mitigation Monitoring Schedule and Responsibilities

Stream restoration is an evolving field and the urban stream environment presents the possibility for rapid, unpredicted changes in conditions that would affect the success of the project. It is expected that this site will be dynamic and evolve. To verify that project objectives are met, it will be necessary to monitor the restored stream backwater area following a multiple faceted cost-shared, post- construction monitoring plan. To evaluate the success of the stream restoration measures, collaborative monitoring efforts and information sharing would occur between the team, the non- Federal sponsor, and other organizations involved in assessing the health of the stream.

Monitoring is proposed pre-construction and at years 1,5,10, 20, 30 and 50. A five year cost shared monitoring period was selected because stream restoration is still a relatively new science, and it is uncertain how long it will take to gauge the ecological success of the project and to make necessary adjustments. Cost shared monitoring will be discontinued once ecological success is determined. It is expected that riparian plantings will be established within a five year period of time and that recolonization of fish and benthic organisms will occur within one year or less. All post- construction monitoring will be cost shared between USACE and the non-Federal sponsor.

Monitoring will typically take place in mid to late summer during the required years for 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 to the USACE, NFS, and the IET. The various monitoring and reporting responsibilities addressed in this section are all subject to the provisions set forth in the previous sections.

The USACE and the NFS 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
2. Topography
3. Hydrology
4. Native Vegetation (marsh and riparian/BLH)
5. Invasive & Nuisance Vegetation
6. Aquatic Fauna-Fish and Invertebrate

The USACE will be responsible for conducting Baseline and Initial Success Monitoring events and preparing the associated monitoring reports.

The NFS will be responsible for conducting the required monitoring events and preparing the associated monitoring reports for all other required years after the USACE has achieved the initial success criteria listed above. The responsibility for management, maintenance, and monitoring of the non-structural components of the mitigation project (i.e. vegetation) 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 the initial success criteria. Once monitoring responsibilities have been transferred to the NFS, the next monitoring event (Intermediate) should take place 2 growing seasons after Initial Success (Topography and Native Vegetation) has been met. After Intermediate Success Criteria (Topography and Native Vegetation) has been met, Long-Term Success Criteria monitoring will be conducted every 5 years throughout the remaining 50- year period of analysis.

In certain cases, it is possible that the 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 and the IET.

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 in the following instances:

- If the initial vegetative cover success criteria are not achieved, 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. This requirement only exists if planting the marsh mitigation feature is required to meet the success criteria, the USACE would be responsible for the purchase and installation of the required plants.
- If initial topographic success criteria are not achieved, the IET would convene to determine whether corrective actions are necessary. If corrective actions are necessary additional surveys and a monitoring report will be required to indicate whether applicable criteria have been satisfied. The USACE would also be responsible for performing the necessary corrective actions.
- If initial invasive and nuisance species criteria are not achieved a monitoring report will be required for each consecutive year until two sequential annual reports indicate that the applicable criteria have been satisfied. The USACE would be responsible for the irradiation activities needed to attain the success criteria.
- If initial aquatic fish and invertebrate species criteria are not achieved a monitoring report will be required for each consecutive year until two sequential annual

reports indicate that the applicable criteria have been satisfied. The USACE would be responsible for the irradiation activities needed to attain the success criteria.

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:

- If the native vegetation intermediate success criteria are not achieved, a monitoring report will be required for each consecutive year until two sequential annual reports indicate that the success criteria have been satisfied. The Sponsor would also be responsible for the purchase and installation of supplemental plants needed to attain the success criteria.
- If the topographic intermediate success criteria (are not achieved, the IET would convene to determine whether corrective actions are necessary. If corrective actions are necessary, additional surveys and a monitoring report will be required to indicate whether applicable criteria have been satisfied. The NFS would also be responsible for performing the necessary corrective actions if the IET determines such corrective actions are necessary.
- If the intermediate and long term aquatic fish and invertebrate species criteria are not achieved a monitoring report will be required for each consecutive year until two sequential annual reports indicate that the applicable criteria have been satisfied. The NFS would be responsible for the irradiation activities needed to attain the success criteria.
- If the native vegetation long term success criteria are not achieved, the IET would convene to discuss whether corrective actions would be necessary. If corrective actions are necessary, a monitoring report will be required for each consecutive year following completion of the corrective actions until two sequential annual reports indicate that the native vegetative cover criteria have been attained. The NFS would be responsible for performing the corrective actions, conducting the additional monitoring events, and preparing the associated monitoring reports.
- If the intermediate and long term invasive and nuisance species criteria are not achieved a monitoring report will be required for each consecutive year until two sequential annual reports indicate that the applicable criteria have been satisfied. The NFS would be responsible for the irradiation activities needed to attain the success criteria.

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. Fifteen years following achievement of Long Term Success Criteria, 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 and the IET.

SECTION 7
Adaptive Management

Adaptive Management prescribes a process (Figure I4:7-1) wherein management actions can be changed in response to monitored system response, as to maximize restoration efficacy or achieve a desired ecological state. For this project Adaptive Management will be used to ensure that the required AAHUs needed for compensatory mitigation are met. The basic steps include:

- Plan: Defining the desired goals and objectives, evaluating alternative actions, and selecting a preferred strategy with recognition of sources of uncertainty.
- Design: Identifying or designing a flexible management action to address the challenge.
- Implement: Implementing the selected action according to its design.
- Monitor: Monitoring the results or outcomes of the management action.
- Evaluate: Evaluating the system response in relation to specified goals and objectives.
- Adjust: Adjusting (adapting) the action if necessary to achieve the stated goals and objectives.

Figure I6:7-1. Adaptive Management Process

7.1 ADAPTIVE MANAGEMENT PLANNING

Adaptive management planning elements included: 1) development of a Conceptual Ecological Model (CEM), 2) identification of key project uncertainties and associated risks, 3) evaluation ofthe mitigation project as a candidate for adaptive management and 4) the identification of potential adaptive management actions (contingency plan) to better ensure the mitigation projectmeets identified success criteria. The adaptive management plan is a living document and will be refined as necessary as new mitigation project information becomes available.

7.2 CONCEPTUAL ECOLOGICAL MODEL

A CEM was developed to identify the major stressors and drivers affecting the proposed mitigation project (see Table 1). The CEM does not attempt to explain all possible relationships of potential factors influencing the mitigation site; rather, the CEM presents only those relationships and factors deemed most relevant to obtaining 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.

A Conceptual Ecological Model (CEM) was developed to identify the major stressors and drivers affecting the proposed project.

Table I6:7-1. Stream Conceptual Ecological Model (adapted from ERDC/EL Sr-20-6)

Alternatives/Issues/Drivers	Mile Branch and Backwater Habitat
Channel Stability-Cross Section	+
Hydrologic Alteration	+
Riparian Zone	+
Bank Stability	+
Fish Cover	+
Nutrient Enrichment	N/A
Pools	+
Canopy	+
Embeddedness (substrate)	+
Hydrology (water table; wet/dry days; soil inundation)	+
Topography (elevation)	+

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

7.3 SOURCES OF UNCERTAINTY AND ASSOCIATED RISKS

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

- Climate change, such as relative sea level rise, drought conditions, and variability of tropicalstorm frequency, intensity, and timing

- Subsidence and water level trends at the mitigation sites
- Uncertainty Relative to Achieving Ecological Success:
    - Water, sediment, and nutrient requirements for Riparian/BLH and backwater shallow water habitat
    - Magnitude and duration of wet/dry cycles
    - Nutrients required for desired productivity
    - Growth curves based on hydroperiod and nutrient application
    - Tree litter production based on nutrient and water levels
    - Tree propagation in relation to management/regulation of hydroperiod
- Loss rate of vegetative plantings
- Long-Term Sustainability of Project Benefits

7.4 ADAPTIVE MANAGEMENT EVALUATION

The project site was evaluated and planned to develop a project with minimal risk and uncertainty. The items listed below will be incorporated into the mitigation project implementation plan and Operation, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) plan to minimize project risks.

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

Adaptive Management Evaluation

Subsequently, as part of the adaptive management planning effort the mitigation project features were re-evaluated against the CEM and sources of uncertainty and risk were identified to determine if there was any need for additional actions and costs under the adaptive management plan to ensure that the project meets the required success criteria. Based on the uncertainties and risks associated with the project implementation the following contingency actions have been identified to be implemented if needed to ensure the required AAHUs are met.

Table I6:7-2. Adaptive Management Actions- Stream Backwater

Element	Expected Condition	Potential Issue	Potential Corrective Action
Landscape characteristics	Bathymetry appropriate for water bottoms and the sustainable growth	Water that is deeper or shallower than ideal conditions	Modify water depth. Add perimeter features or

	of targeted riparian vegetation	Water spills out of backwater area during high flow events.	pumps to control water levels.
Stream connectivity	Water exchange during Flow event.	Limited flow exchange or excessive flooding.	Resize culverts or move feature to control water during non-storm conditions.
Vegetation community composition	Healthy vegetative communities free of invasive species.	Invasive species dominance,	Invasive species control Vegetative plantings

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

SECTION 8

References and Resources

USACE 1987 Wetland Delineation Manual

USACE November 2010 Regional Supplement for the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region Version 2.0. Performance standards

USDA/NRCS, Soil Survey of St. Tammany Parish, LA, March 1990

Websites:

The Final Policy on the NWR System and Compensatory Mitigation Under the Section 10/404 Program (federal register notice (64 FR 49229)

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