Section 404(b)(1) Evaluation
Recommended Plan
St. Tammany Louisiana Feasibility Study

Project Description

Location: The St. Tammany Parish Feasibility Study: Recommended Plan (RP) consists of structural and non-structural features including a levee and floodwall system along an alignment in South Slidell, West Slidell, and channelization of a portion of the Mile Branch in Covington, LA. (Figure 1)

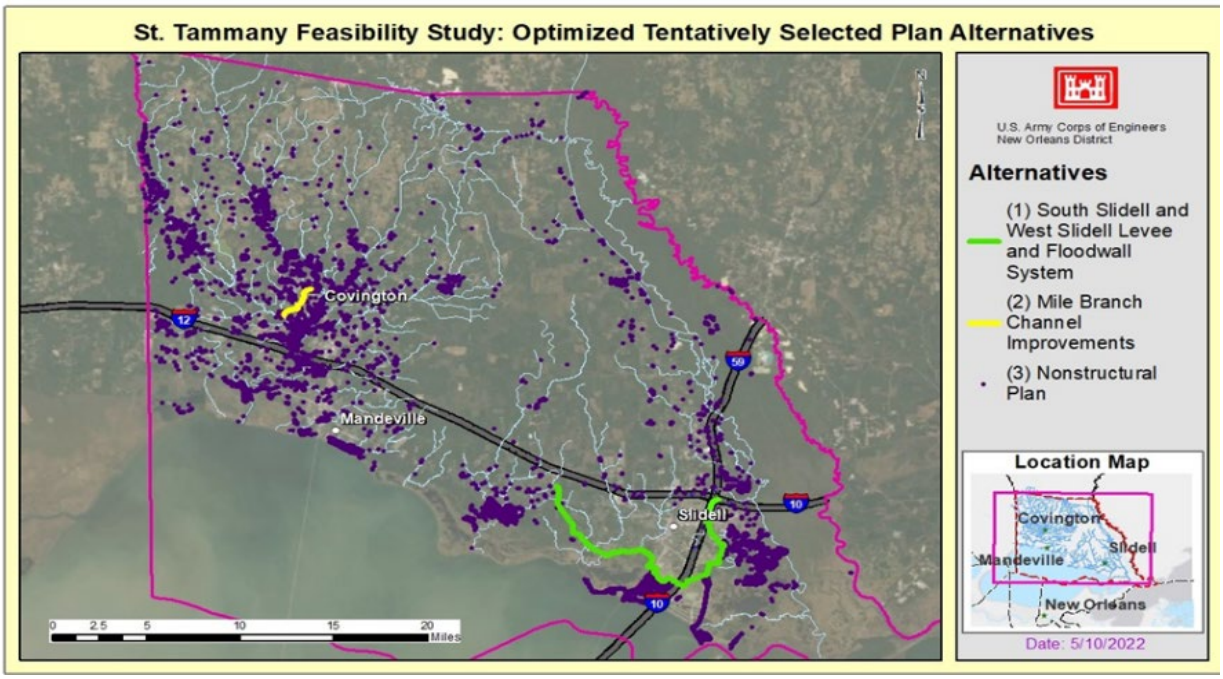

Figure 1. Recommended Plan

General Description: The RP includes a non-structural (NS) plan and a structural plan. For planning purposes, the 50-yr period of analysis for the study was estimated to be from the year 2032 to 2082. Our assumption was that Project authorization would occur in the year 2024 and kick-off Pre-construction Engineering and Design (PED). PED was originally estimated to be complete by the year 2027. Initial construction of the project would begin 2027 and conclude by the year 2032 (base year). Figure 1 illustrates the RP including the non-structural and structural features.

Non-Structural Plan: The purpose of NS measures is to reduce flood damages without significantly altering the nature or extent of flooding. Damage reduction from NS

measures is accomplished by changing the use of the floodplains, or by accommodating existing uses to the flood hazard. NS measures differ from structural measures in that they focus on reducing the consequence of flooding for a specific structure rather than reducing the probability of flooding in that area (for example elevating a structure in an area that is flooded to reduce damages rather than reducing the flooding source). NS measures, including floodproofing and structure raising to reduce damages from the flood hazard, were considered in areas of documented flood damage within the entire study area. The standalone comprehensive NS alternative was screened out in favor of the combined structural and NS alternative which would provide more net benefits.

Structural Plan: The structural portion of the RP consists of construction of a levee and floodwall system along an alignment in South and West Slidell and channelization of a portion of the Mile Branch in Covington. See Table 1.2 for a summary of the South Slidell and West Slidell Levee and Floodwall System.

A combined structural and NS measure was carried forward and included in the draft TSP presented in the 2021 Draft Integrated Feasibility Report. The draft TSP was further examined and divided into 20 sub aggregates (Abita River Rural, Bayou Castine, Bayou Chinchuba, Bogue Chitto River, Coastal Mandeville, Coastal Slidell, Coastal Madisonville, Lacombe Bayou, Lacombe Coastal, Rural Bogue Falaya, Rural Little Bogue Falaya, Rural Pearl River, Rural Tchefuncta, Tchefuncta, Urban Abta River, Urban Bogue Falaya, Urban Little Bogue Falaya, Urban Pearl River, Urban Tchefuncta, and Western Tchefuncta) based on combinations of structures that had the same source of flooding and community characteristics. Refer to Figure 2. This included consideration of underserved communities as identified by the Justice 40 criteria.

An incremental floodplain or flood frequency analysis was conducted for each of the aggregates. The results indicated that 16 of the 20 aggregates were economically justified up to the 4% (25 year) AEP Floodplain, Coastal Slidell was economically justified up to the 2% (50 year) AEP Floodplain and Coastal Lacombe, coastal Mandeville, and coastal Madisonville were economically justified up to the 1% (100 year) floodplain. The optimized NS Plan includes 6,684 structures that are not included in the areas benefitted from the structural measures of the TSP. A depiction of the structures included in the NS plan are included in Figure 1.

To be considered preliminarily eligible for participation, a structure must meet the following criteria:

- A structure must be economically justified meaning that the cost of the flood-proofing measure for the structure must not cost more than the total monetary value of the flood damages anticipated to be avoided over the 50-year period of analysis.
- Have a first-floor elevation (FFE) at or below the 25, 50 or 100-year storm surge floodplain, based on hydrologic conditions predicted to occur in 2032 for the sub

aggregate the structure included in (the beginning of the 50-year period of analysis)

- Structure must be outside of the area of influence of the structural features recommended in the TSP and not receiving flood risk reduction benefits from the structural features (i.e., outside of the area of influence of the West Slidell, South Slidell Levees, and Mile Branch Channel Improvements).

The NS elevations and floodproofing are voluntary. Property owners who have preliminarily eligible structures that wish to participate in the flood proofing measures would be required to apply and provide a right-of-entry for their structure to undergo site assessment, appraisal, and other inspections and evaluations to determine the final eligibility.

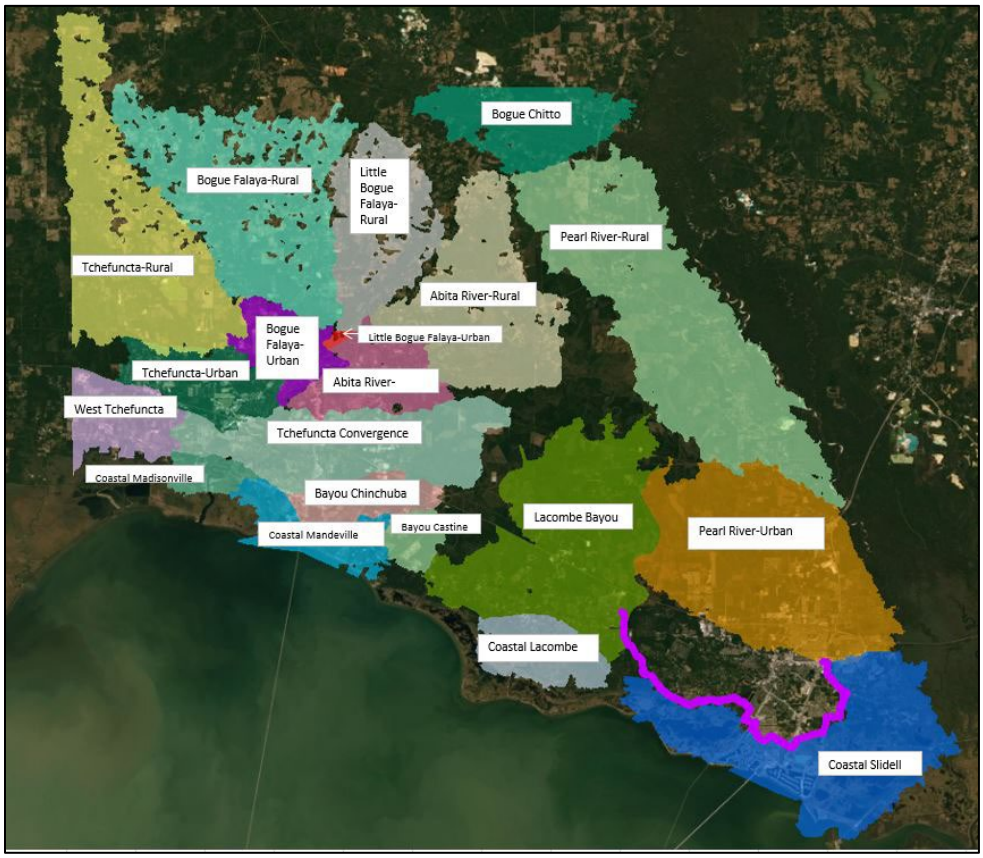

Figure 2 Sub Aggregates Identified

<u>Mile Branch Channel Improvement:</u> This measure consists of channel improvements on the lower 2.15 miles (11,341 ft channel) of Mile Branch in Covington, Louisiana. The proposed work would consist of approximately 21 acres of channel that would be cleared and grubbed prior to mechanical dredging. The mechanical dredging would consist of a maximum of 130,000 cubic yards of fill dredged from the channel. For the

channel improvements, approximately 38.8 acres of permanent ROW would be needed. This area would include 25 ft on each side of the Mile Branch channel. Included in the 38.8 acres, there would be 4.8 acres for a staging area that would become a backwater area after construction is complete. Mile Branch improvements would include seven (7) bridge replacements. Approximately 2.2 acres would be required as temporary ROW for staging along the various areas of the bridge replacements.

Table 1.1 Summary of RP for Mile Branch

Attribute	**Mile Branch Channel Improvements**
Total Length of improvements	2.15 miles (11,341 ft)
Material to be Mechanically Dredged	130,000 cubic yards
New Access Roads for both clearing and for bridge replacement	0 acres
Number of staging areas for clearing and grubbing and mechanical dredging and for bridge replacement	18 (7 for bridge replacements, 10 for clear and grubbing and mechanical dredging and one that becomes a backwater area)
Number of Bridge Replacements	7
Temporary ROW	7.3 acres (2.2 acres for bridge replacements and 5.1 acres for clear and grubbing and mechanical dredging)
Permanent ROW	38.8 acres (34 acres for clear and grubbing and mechanical dredging and 4.8 acres for one staging area that becomes a backwater area)

Table 1.2 Summary of South Slidell and West Slidell Levee and Floodwall System

Attribute	**South Slidell and West Slidell Levee and Floodwall System**
Total Length of alignment	18.5 miles (97,700 ft)
Length of Floodwall	3.5 miles (18,200 ft)
Length of earthen Levee	15 miles (79,500 ft)
Temporary Acres of Construction for Levee and Floodwall system	101 acres
Permanent Acres for Levee and Floodwall system	450 acres
Hydraulic Design Elevation Range (Dependent on location)	13.5 to 16 (year 2032) 17.5 to 20 (year 2082)
Pump Stations	8
Sluice Gates/Lift Gates	13
Number of Vehicular Floodgates	18
Number of Pedestrian Floodgates	1
Number of Railroad Gates	1

Number of Road Ramps	6 (includes the I-10 near Oak Harbor)
Fill (Borrow Material) Required	7,239,000 cubic yards

Marsh Mitigation Feature (M-2)

The proposed marsh mitigation site (M-2) (Figure 3-1) is located on the north shore of Lake Pontchartrain, east of the Causeway Bridge near Lacombe. The site is within the acquisition boundary of the Big Branch Marsh National Wildlife Refuge but is currently under private ownership. The site would provide 200 acres (-47 AAHUs) of fresh and intermediate marsh habitat to compensate for unavoidable wetland impacts from the construction of the South and West Slidell levee and floodwall system under the St. Tammany Parish, Louisiana Feasibility study. Estimated footprint is 200 acres with a dike perimeter of 16,067 feet. An open water site visit is recommended to conduct WVA evaluation, collect preliminary site data, and visually observe site conditions.

Figure 3-1

Project Description:

This project alternative (Figure 3-2) currently consists of 200 acres of marsh creation. The assumed existing elevation is -1.65' NAVD88. Initial target elevation for dredge fill would be to approximate elevation +2.5 NAVD88, to ultimately reach a target marsh

elevation of +1.0 NAVD88. At this 35% design level, total perimeter retention would be required to retain dredge material and allow for vertical accretion. Approximately 16,067 linear ft of new retention dike would be required along the limit of the project footprint. The dike would be built with borrow from within the footprint. The dike would be built with a 5 ft crown width to elevation +4.8' NAVD88, to provide 1 ft of freeboard during pumping operation and allow for settlement. This dike would be degraded in year 1, upon settlement and dewatering of the created marsh platform. The degraded material can be disposed of in the original borrow canal if settlement allows or cast into the open water immediately outside of the project footprint. Spill boxes or weirs would be constructed at pre-determined locations within the retention dike to allow for effluent water release from within the marsh creation area. If deemed necessary by the construction contractor, low level interior weir or baffle dikes can be constructed to assist in vertical stacking of dredged material.

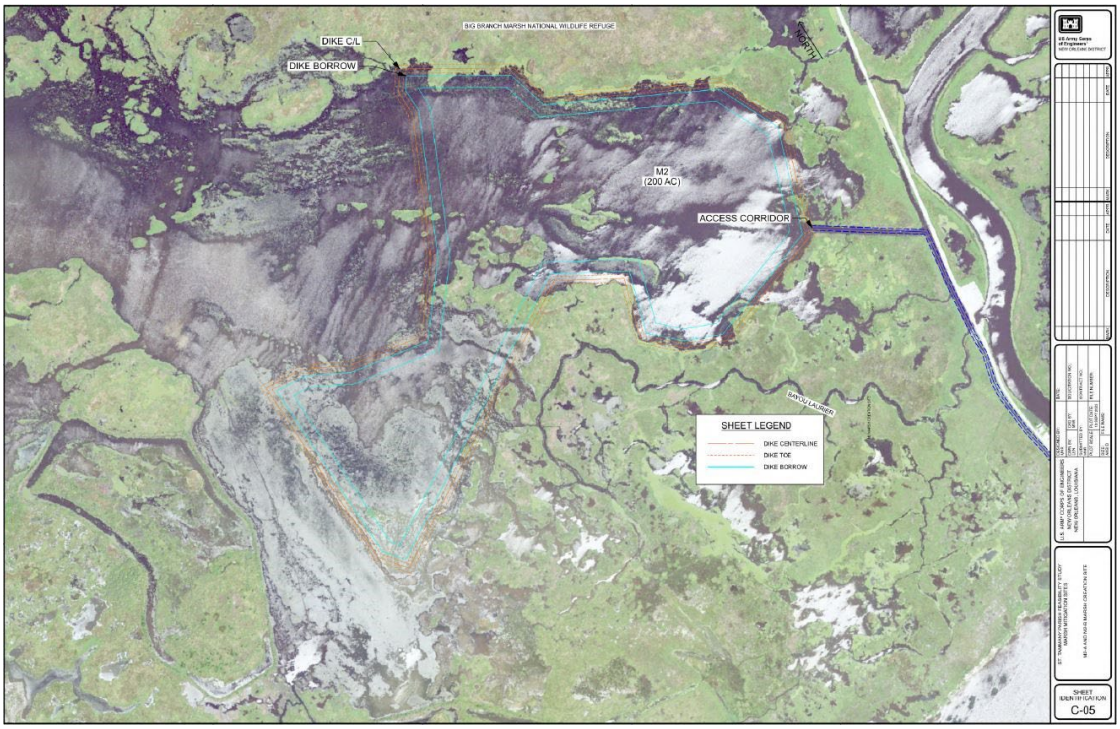

Figure 3-2

<u>Location: Refuge Pine Savanna Mitigation Site (PSR-1)</u>

The proposed refuge pine savanna mitigation site (PSR-1) is located entirely within the Big Branch Marsh National Wildlife Refuge (BBMNWR) in St. Tammany Parish Louisiana. The site is located south and east of Bayou Bonfouca, west of the Norfolk Southern and Pontchartrain Drive (state highway 11) and north of the Lake Pontchartrain Northshore, LA. The site would provide 9 acres (-7.4 AAHUs) of pine

savanna habitat for the red-cockaded woodpecker (RCW) and 50 acres (-2 AAHUs) for the pine warbler (PW) within the BBMNWR to compensate for unavoidable wetland impacts from implementation of the proposed project. The PSR-1 would also restore up to (~)70 acres of degraded wet Long-leaf Pine Savanna Forest as compensatory mitigation for coastal zone Pine Savanna impacts from construction of the South and West Slidell levee and floodwall system under the St. Tammany Parish, Louisiana Feasibility study shown in Figure 4.

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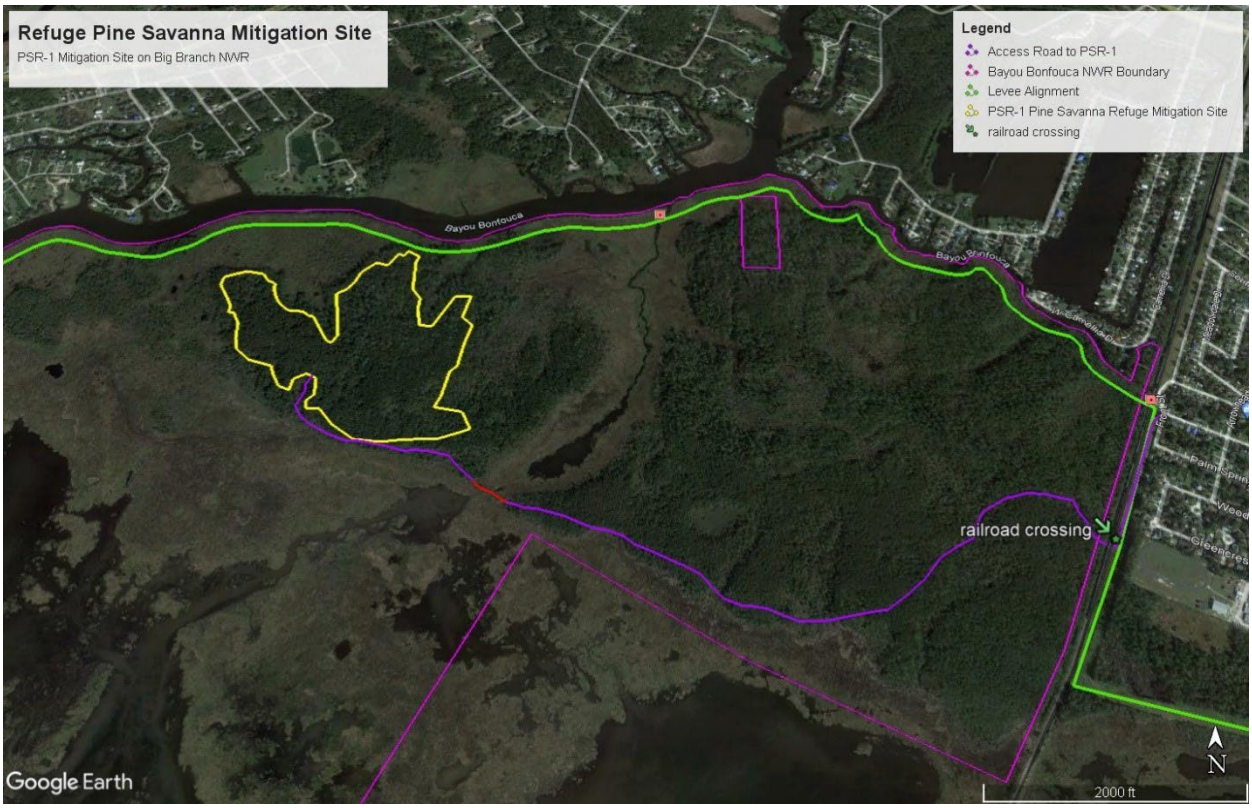

Figure 4

Project Description:

The project includes eradication of invasive species such as Tallow. Removal of undesirable hardwood species, and reintroduction of fire across the entire site. Removal of undesirable hardwood species coupled with the reintroduction of frequent fires can be effective in restoring ground cover in remnant longleaf pine savannas.

Potential earthwork activities include establishing/improving an existing access road, across the existing railroad crossing westward to the PSR-1 mitigation site. A staging area would be established within areas identified for the proposed levee work in proximity to improvement of the NWR access road.

Location: Mile Branch Backwater

The selected site encompasses the City of Covington boundary for the gravel/storage yard as well as the area adjacent to the cemetery and Mile Branch.

Project Description:

Mile Branch Backwater consist of wet areas such as existing ponds, water retention ponds as well as develop backwater concept design for Covington City Gravel yard. The site would be beneficially used for restoration of water bottoms as a backwater area. The creation of a backwater area (see figure below) would effectively minimize impacts that would occur within the entire Mile Branch FRM feature. See Figure 5-1 showing the location of backwater site to create stream mud bottom along Mile Branch. The light blue line is the approximate area. The purple line represents the extent of the city owned property adjacent to Mile Branch and Figure 5-2 shows a conceptual design for Mile Branch backwater feature.

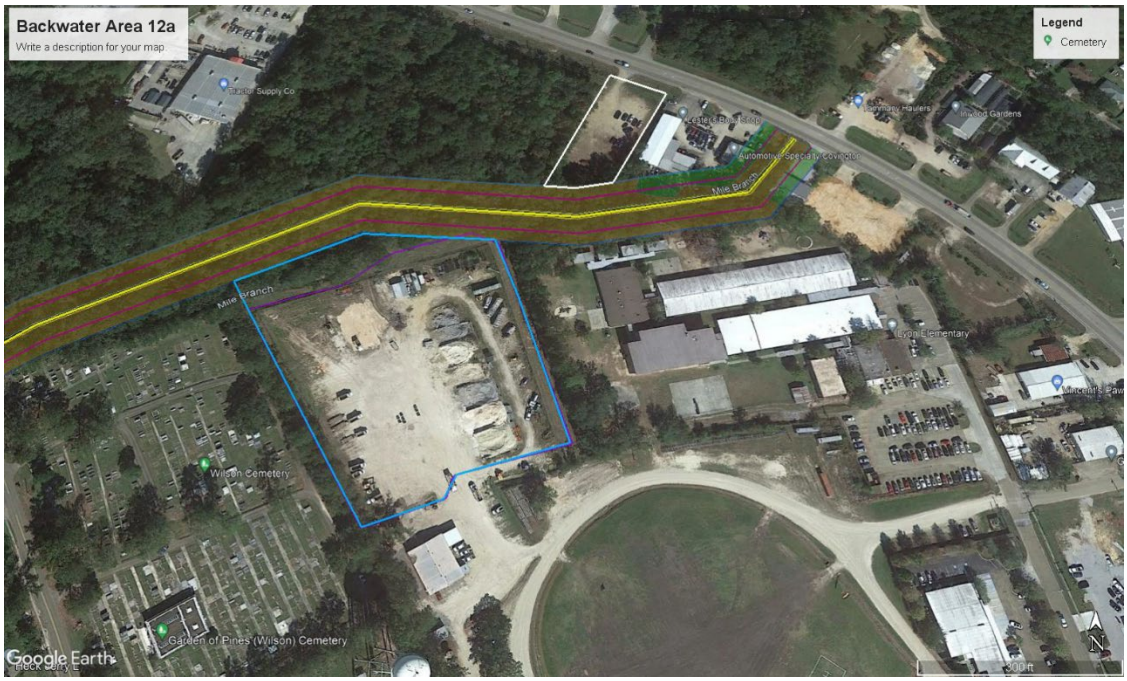

Figure 5-1

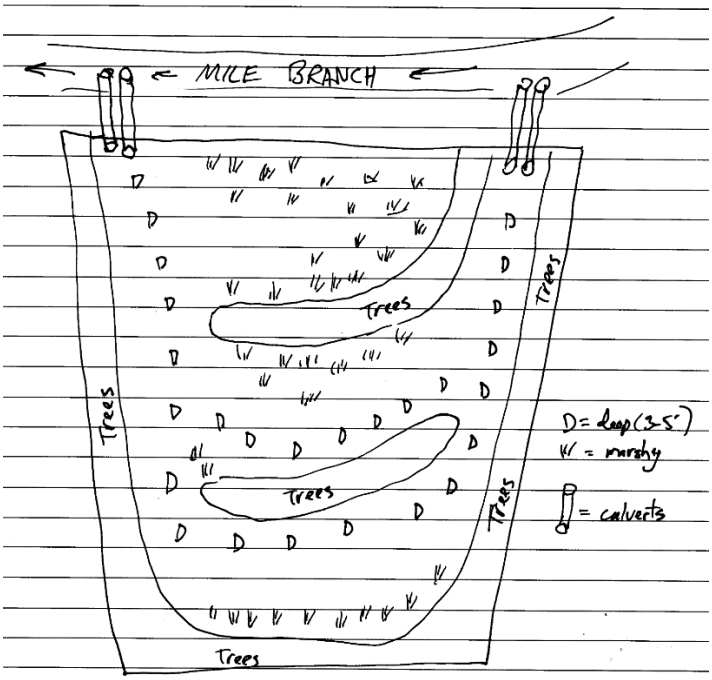

Figure 5-2

1. **<u>Review of Compliance</u>**
   <u>Subpart B Compliance with guidelines</u>

a. 230.10 Restrictions on discharge

b. *230.10(b)(1):* A 404 (b)(1) evaluation is required for the use of fill material for construction of the optimized levee alignment that runs through the Western and Southern portions of Slidell, Louisiana, M2 Marsh Mitigation site north of Lake Pontchartrain and the access road to PSR-01. Depositing dredged material into the aquatic environment in the optimized RP would occur with the construction of the west and south Slidell levee, Marsh mitigation site, called M2 and potentially road access to the PSR-1 pine savanna mitigation site. For the marsh mitigation site, borrow material from the identified dredging location in Lake Pontchartrain is not expected to carry contaminants. During construction of the retention dike and during placement of dredged material, minor and temporary elevation of oxygen demand in the marsh area is anticipated. However, long-term water quality effects from the proposed project are expected to be minor in nature.

For the optimized levee alignment, project construction includes the placement of material sourced from various HSDRSS approved borrow sites. Materials are not expected to be carriers of contaminants. Placement of materials during

construction may cause minor, temporary elevation of oxygen demand within five intersecting waterways along the alignment which could temporarily depress dissolved oxygen levels. However, the long-term water quality effects from the proposed project are expected to be moderate in nature.

1. The elements of this project requiring 404 (b)(1) evaluation is the use of fill material for construction of the Alternative west and south levee alignment that runs through the Western and Southern portions of Slidell, Louisiana and the associated mitigation for fresh/intermediate marsh and the refuge Pine Savanna mitigation site access road improvements.

   Project construction includes the placement of material sourced from various identified borrow sites, 2 of which were assessed and approved by IERs 19, 23, 31) . Materials are not expected to be carriers of contaminants. Placement of materials during construction may cause minor, temporary elevation of oxygen demand within five intersecting waterways along the alignment which could temporarily depress dissolved oxygen levels. However, the long-term water quality effects from the proposed project are expected to be moderate in nature.

   The Project, evaluation of reasonable alternatives, and compliance with other relevant laws and guidelines is documented in the St. Tammany Parish, Louisiana Feasibility Study, Revised Final Integrated Feasibility Report and Environmental Impact Statement (RDIFR-EIS). These 404(b)(1) analyses is included as an Appendix C to the RDIFR_EIS. The RDIFR-EIS would be released for public review on July 21, 2023. Comments would be accepted until September 6, 2023.

2. The proposed work would consist of a maximum of approximately 130,000 cubic yards of material to be mechanically dredged associated with Mile Branch Channel Improvement and the construction of the South and West Slidell Levee and Floodwall Alignment would consist of a maximum of approximately 7,239,000 cubic yards of fill material placed in a mixture of wetlands, pine savanna and upland habitat. associated with the Optimized Tentatively Selected Plan. The M2 marsh restoration sites would require the placement of fill in an open water site utilizing approximately 2,200,000 cubic yards of material hauled from 134 acre borrow site near the north banks of Lake Pontchartrain. Material dredged from Mile Branch would be hauled offsite and disposed of in the appropriate landfill. The material used for these attributes can be refence in Table 1.1 and Table 1.2.

3. The activity would contribute to major degradation of waters of the United States by the placement of significant quantities of fill material in

wetlands/pine savanna habitats. The placement of earthen fill would result in adverse effects on life stages of organisms dependent on the aquatic ecosystem, ecosystem diversity, productivity, and stability, and recreational, esthetics. The impacts would be mitigated for through the construction of a marsh mitigation site, a backwater area, and controlled burns of a pine savanna site. Riparian and Pine Savanna habitat impacts would also be compensated through the purchase of mitigation bank credits.

4. Design refinements would occur during PED based on field data collections. For example, future surveys would determine the final channel section and bridge replacements. Based on data collected, the design would be refined to minimize impacts to aquatic and riparian habitat. Riparian Zone bioengineering techniques and nature-based-solutions (NBS) would be incorporated as appropriate during PED in coordination with the NFS and resource agencies. . The conceptual backwater area in Mile Branch would convert a staging area into backwater area after construction activities associated with the Mile Brach Channel Improve Feature are completed. This concept would have to be further developed during PED. MVN Engineering has not performed any design of this concept during the study phase.

c. 230.11 Factual determinations

a. Physical Substrate Determinations
The nature and degree of effect that proposed discharge or placement of fill material will have on characteristics of the existing environment are important to consider for the RP. The South and West Slidell Combined Levee will require placement of borrow material in locations that may impact the aquatic environment. Elements of the levee system involve placement of fill material into the aquatic environment, therefore requiring 404(b)(1) evaluation. The Mile Branch channel improvements project will require hauling mechanically dredged material to an off-site disposal facility licensed to handle the material. This project does not have any occurrences of depositing dredged material into the aquatic environment and therefore will not require 404(b)(1) evaluation. The marsh mitigation project requires the dredging of material and placement of that material into marsh that parallels Lake Pontchartrain. Because the basis of this project is depositing dredge material into the aquatic environment to rebuild marsh habitat, it will require a 404(b)(1) evaluation.

(1) Substrate Elevation and Slope.

Figure 6 depicts existing study area and project footprint LIDAR elevations. Elevations in the study area generally range between -95.3ft and +324.9ft NAVD88. Within the footprint of the proposed levee right-of-way for South and West Slidell Combined Levee, the existing ground elevation ranges from -5.0ft to +15.0ft NAVD88 elevations. Existing ground elevations in the vicinity of the marsh mitigation site range between -1.20ft to -0.30ft.

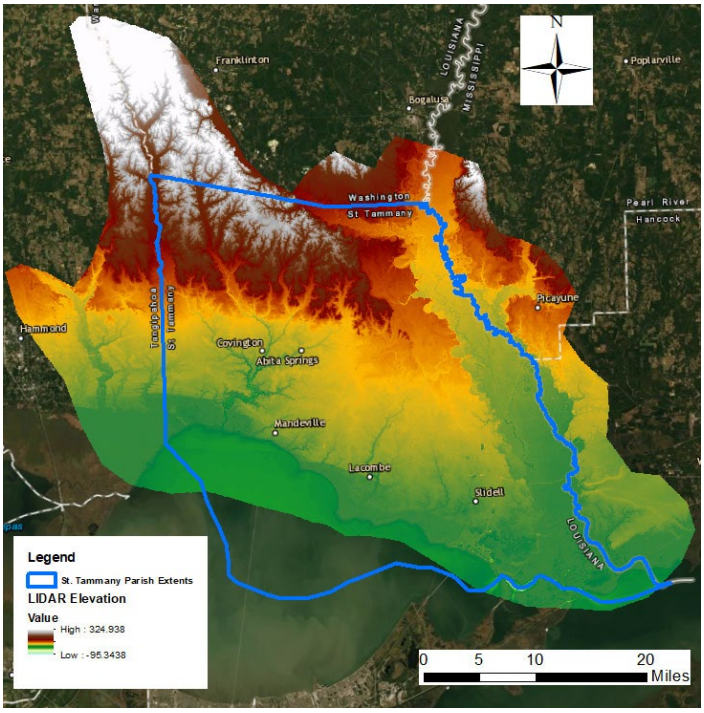

Figure 6. Study area and project footprint LIDAR Elevation

(2) Sediment Type.

General: The availability of Geotechnical data for the study area is very limited, however, the PDT utilized ongoing investigations conducted by Eustis Engineering in the Slidell area for descriptive soil data. For detailed boring information pulled from Eustis Geotechnical investigations, review Annex D. This boring data was used to analyze existing conditions along the levee footprint and to analyze potential borrow sources.

Levee and Floodwalls: NRCS soil data was utilized understand existing surface soils along the planned levee footprint. Figure 7 depicts the various soil types along the entire alignment and Table 3 has the map unit legend and associated acreage of each soil type. Existing soil types along the levee right of way include very poorly drained and very frequently flooded soils with mucky or loamy surface layer and clayey subsoil which occurs in broad low swamp and marsh areas.

Figure 7. NRCS soil types identified along the proposed levee alignment

Table 4. NRCS soil map legend and associated acreages for the proposed levee alignment

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Aa	Abita silt loam, 0 to 2 percent slopes	7.5	3.2%
AC	Allemands muck	17.0	7.2%
Ad	Allemands muck, drained	14.1	6.0%
Ag	Aquents, dredged	26.5	11.2%
AR	Arat silty clay loam	1.5	0.6%
Bg	Brimstone-Guyton silt loams, 0 to 1 percent slopes, rarely flooded	1.3	0.6%
CV	Clovelly muck, 0 to 0.2 percent slopes, very frequently flooded	23.0	9.7%
Gy	Guyton silt loam, 0 to 1 percent slopes, occasionally flooded	12.3	5.2%
Lt	Latonia fine sandy loam, 0 to 2 percent slopes	2.4	1.0%
Mt	Myatt fine sandy loam, 0 to 1 percent slopes	62.0	26.2%
My	Myatt fine sandy loam, frequently flooded	18.0	7.6%
Pr	Prentiss fine sandy loam, 0 to 1 percent slopes	7.1	3.0%
St	Stough fine sandy loam, 0 to 1 percent slopes	34.0	14.4%
W	Water	9.5	4.0%
Totals for Area of Interest		236.2	100.0%

Borrow locations for levee construction and associated available quantities are in Table 5 below. As described earlier, detailed boring analysis is not available. Many geotechnical assumptions were made for each of the five potential borrow sites. Below is a description of each site.

Site #	Site Name	Location	Estimated Borrow Pit Acreage	Estimated Fill Volume (cubic yards)	Prime and Unique Farmland Soil
STP-5	Cleared Site 5	Lacombe, LA	73	1,817,700	62 acres
STP-6	Cleared Site 6	Slidell, LA	10	249,000	<1 acre
STP-9	Cleared Site 9	Slidell, LA	17	423,300	5 acres
MS-1	Pearlington Dirt, Pearlington Dirt Phase II (IER	Hancock County, MS	326	8,000,000	None
MS-2	Port Bienville (IER 31)	Hancock County, MS	677	16,857,300	None

Table 5. Potential Borrow Site Identification for the St. Tammany Parish Feasibility Study

Location STP- 5 (figure 8): Geology is based on data contributed to by nine borings in the area. These borings show that marsh deposits, depending upon the location, make up the top 2 to 10 feet of the subsurface. These marsh deposits are composed of soft organic clays with some sand layers. Below marsh deposits and in some places at the surface, Pleistocene Prairie Terrace deposits are present. These deposits span at least 40 feet below and are composed of predominantly medium to very stiff clay, however, some borings show an approximately 10-foot thick sand layer around 5-20 feet below the ground surface. Location STP- 5 consists of 72.97 acres and the biggest risk to the area is the 10-feet thick or more sand layer present around 5-20 feet below the ground surface in some areas of Location STP- 5.

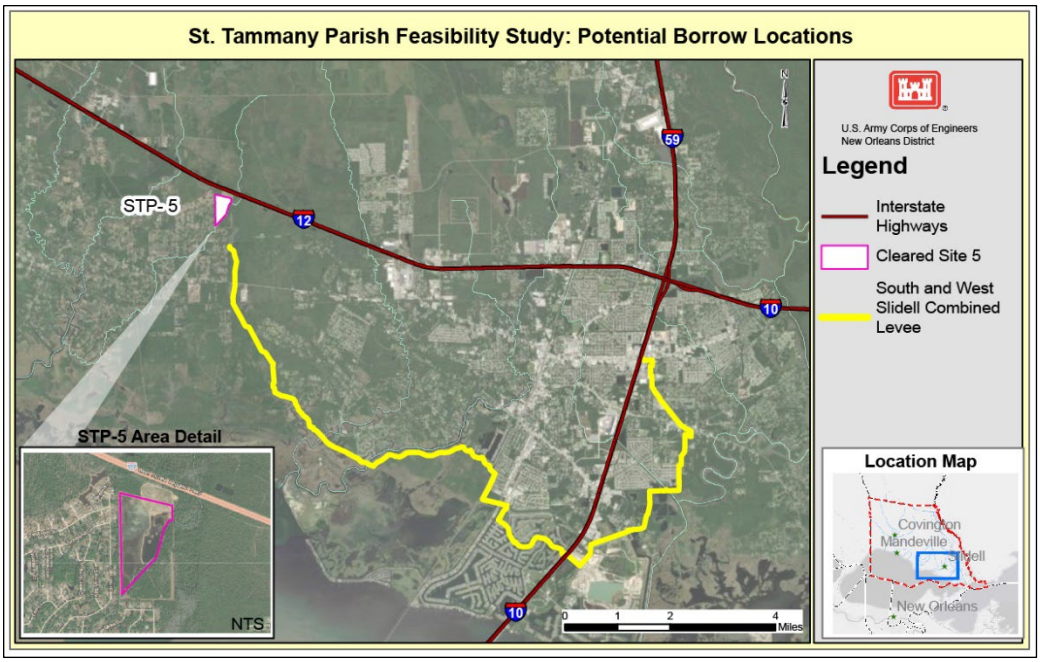

Figure 8. Borrow Site STP-5

Location STP- 6 (Figure 9): Geology is based off two 20-foot borings in the location. These borings show that the top 20 feet of the subsurface is composed of Pleistocene Prairie Terrace deposits, medium to very stiff lean and fat clay. A 5-foot layer of silt exists directly below the ground surface. Location STP- 6 consists of 9.83 acres and serves as the best potential source of borrow material. The biggest risk for Location STP- 6 is that the borings show only 20-feet below the ground surface, so it is unknown exactly what is below this layer.

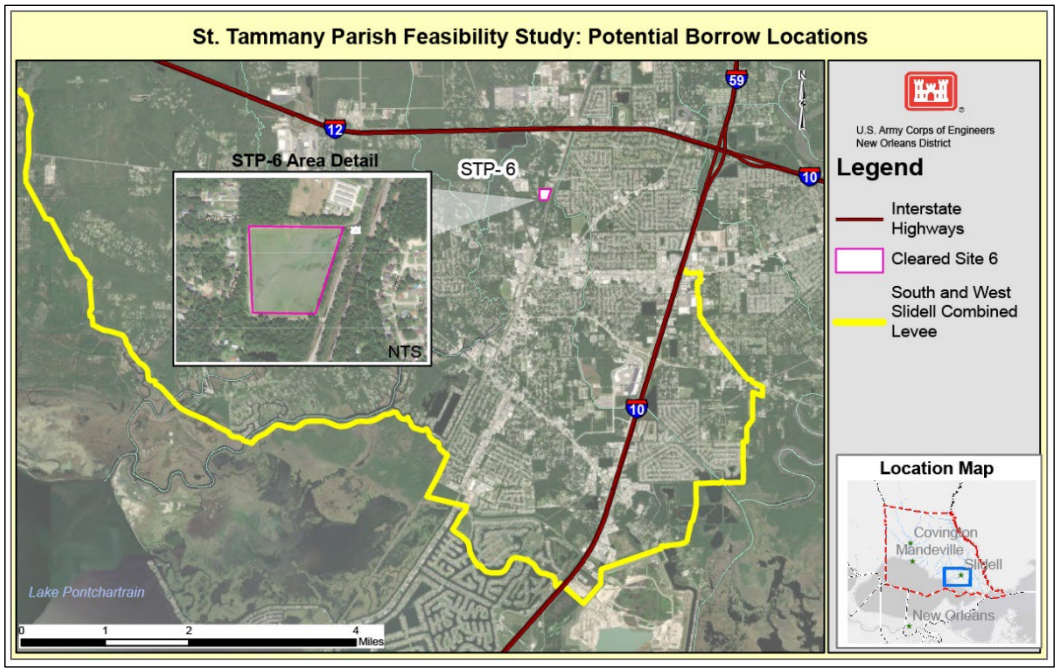

Figure 9. Borrow Site STP-6

Location STP- 9 (Figure 10): Geology is based off data contributed to by three borings near the area. Closer to Location STP- 9, borings show that marsh deposits make up the top approximately 10 feet of the subsurface. These marsh deposits are composed of organic lean and fat clay with some silt layers. Below the marsh deposits, beginning around 7 to 10 feet below the ground surface, Pleistocene Prairie Terrace deposits are present. These deposits span up to 60 feet below (in borings closer to Location STP- 9) and are composed of predominantly medium to very stiff clay. However, borings indicate that with increasing distance from Location STP- 9, a deep abandoned channel nears the surface, appearing at a depth of approximately 60 feet below the ground surface just 0.15 miles from the site and only 10 feet below the ground surface just 0.25 miles from the site. This abandoned channel is composed of poorly graded sands and silty sands and is approximately 35 feet thick. There is a possibility the abandoned channel is present at Location STP- 9, too. Additional boring, CPT, or geologic profile data would confirm exact locations of this abandoned channel layer, but currently, the data is not present. Location STP- 9 consists of 17.44 acres and the biggest risk to the site is the potential of a 35 feet thick sand layer present, although signs indicate that it might be deeper than 60 feet below the ground surface at Location STP- 9.

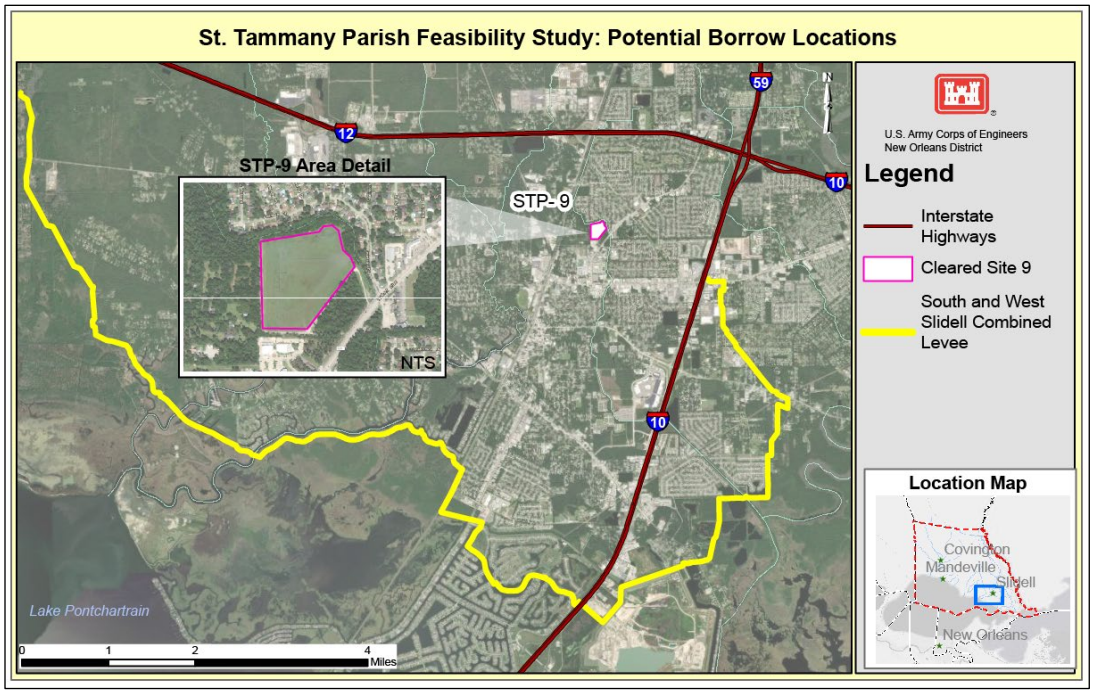

Figure 10. Borrow Site STP-6

Structures: Fill material used in construction of structures would either consist of backfill from adjacent areas, or offsite borrow. Adjacent backfill characteristics would be dependent on location and depth; however, as described earlier, a majority of soils within the footprint of the proposed alternative are considered to be very poorly drained, flooded soils with a mucky or loamy surface layer and clayey subsoil. Both adjacent and offsite borrow material may be required to meet HSDRRS guidelines for levee grade material.

Mitigation Site M2:
The mitigation site is located on the north shore of Lake Pontchartrain, east of the Causeway Bridge near Lacombe Figure 11. NRCS soil data was utilized to determine approximately 98% of the mitigation area is made up of Clovelly Muck (CV) while 2% is made of Lafitte Muck (LF). These two soil types have very similar properties and are common to most marsh habitat. Both CV and LF are very poorly drained, are slightly to moderately saline, and have a high water supply of approximately 12-19 inches.

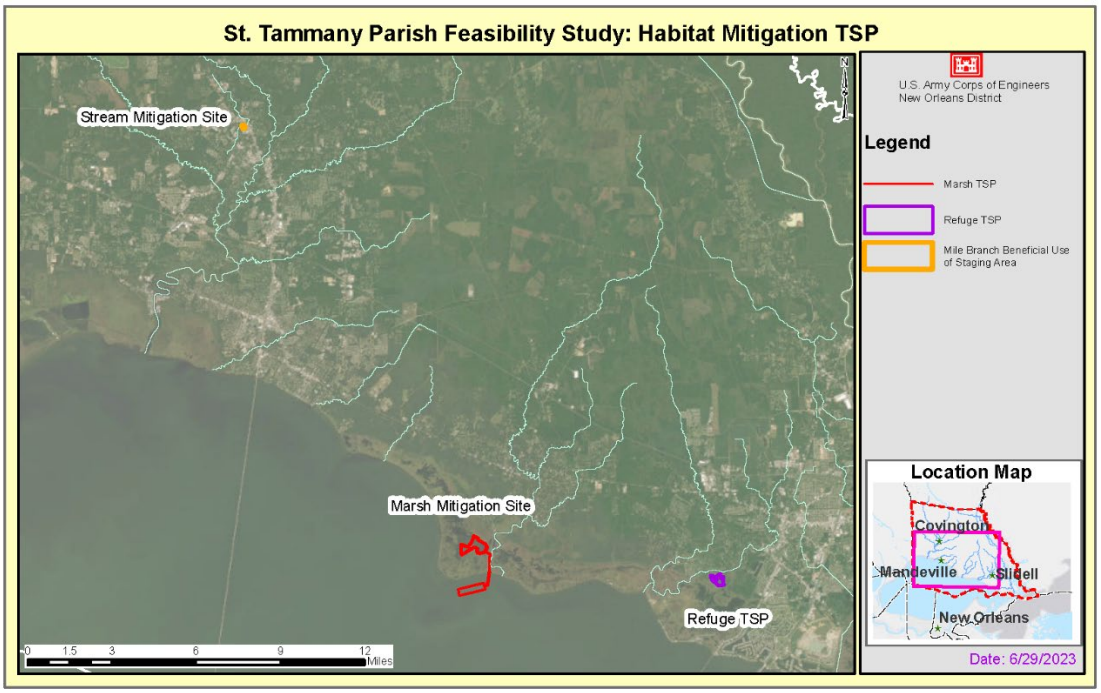

Figure 11. Marsh Mitigation Site M2

A location off the northern shore of Lake Pontchartrain would be used as the borrow location of dredged material for mitigation site M2, see Figure 11 for its location. Lake Pontchartrain has a maximum depth of 5 meters which occurs near the center of the lake. Significant sand fractions are found in the northern and eastern part of Lake Pontchartrain. In the remainder of the lake bottom, the sand content is usually less than 10%. Figure 12 depicts the sand content distribution throughout the lake.

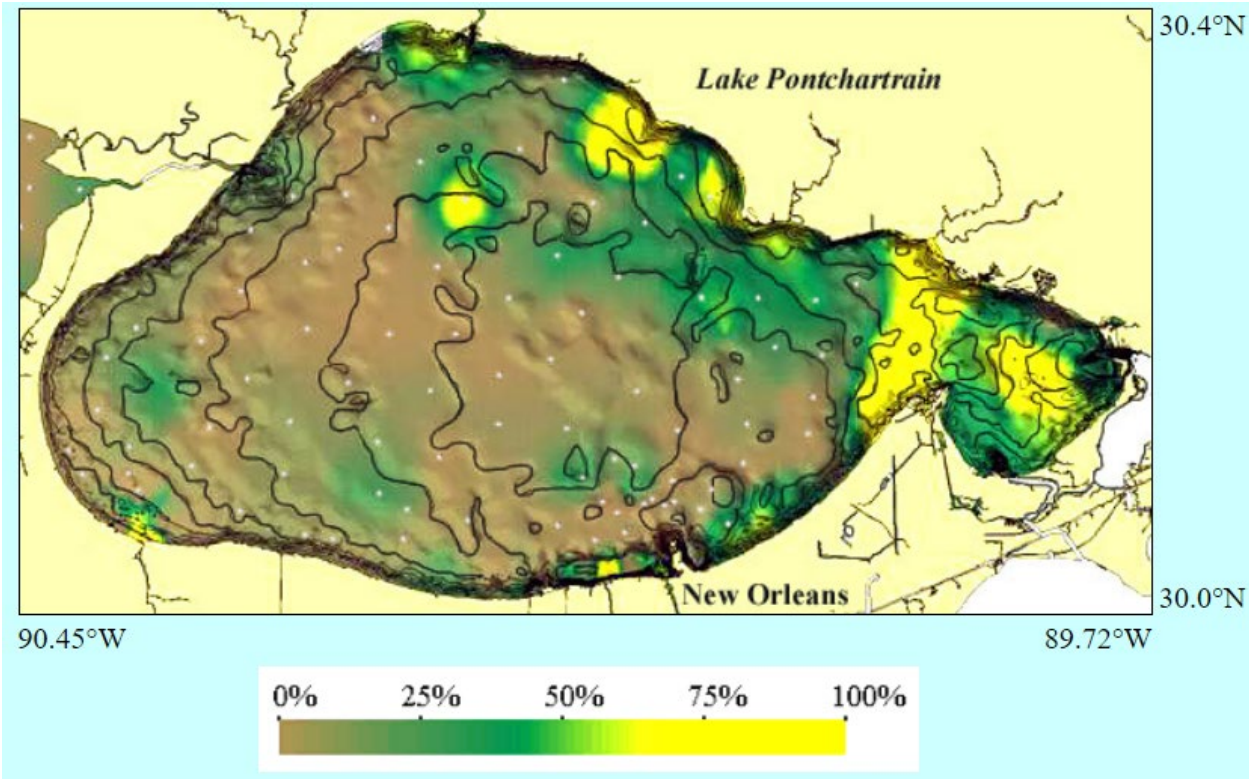

Figure 12. Sand content distribution overlayed with Lake Pontchartrain contoured bathymetry
(https://pubs.usgs.gov/pp/p1634j/html/fm_sand.htm)

Strong currents through the narrow Rigolets channel transport a small amount of coarse material. A much larger amount of material of sand fraction size has been transported historically through "crevasses" or breakthrough channels from the Mississippi River during floods and high stages including Bonnet Carré Spillway openings. However, most of the coarse fraction is dropped within a few kilometers of the entry channel, leaving mostly silts and clay to be transported farther into the lake. It should be noted that the borrow location identified for the M2 mitigation site is in a location with a course fraction percentage of 40%-75%.

(3) Fill Material Movement

Levee and Floodwalls: Material placed for levee construction and foundation for floodwalls would be contained within the levee right of way with berms or small dikes. Movement of material beyond the levee right of way is not anticipated.

Structures: Structure materials would not be expected to move or shift after final material placement.

Mitigation Site M2: Material placed for marsh creation at site M2 would be contained within a newly placed retention dike to retain the dredged material. Movement of material beyond the retention dike is possible as this area is subjected to tidal

exchange. It should be noted that the establishment of marsh will likely be aided by the dredged material having a high course faction because is capable of draining at a faster rate.

(4) Physical Effects on Benthos.

Levee and Floodwalls: Sessile aquatic organisms within the footprint of the proposed levee and foundation for floodwalls would be smothered by placement of fill and construction materials, and these organisms would not be expected to reestablish. The proposed levee alignment crosses five waterways including Bayou Paquet, Bayou Liberty, Bayou Bonfouca, Schneider Canal, and W-14 canal. Most impact from waterway crossing to sessile aquatic organisms would be realized during construction of gate and pump station structures where construction materials would be in very close proximity to aquatic habitat. Additionally, the planned alignment crosses the northern portion of Big Branch Marsh National Wildlife Refuge, and existing aquatic organisms would be impacted during construction in that area.

Structures: Sessile aquatic organisms within the footprint of proposed structures would be smothered by placement of fill and construction materials, and these organisms would not be expected to reestablish. Gate and pump station complex construction would be the main drivers of impact on benthos populations in this project. Additionally, operation of pump stations and gated structures are conditions based, and that would change year to year. Gates are planned so that they can be open to allow natural gravity drainage, navigation, and natural tidal exchange, and can also be closed to maintain lower water levels in the interior when there is a threat of high water levels. When in operation, pump stations and gate structures would disturb sessile aquatic organisms that re-establish following construction.

Mitigation Site M2: Sessile aquatic organisms within the footprint of the proposed mitigation site would be smothered by placement of dredged fill material. These organisms would not be expected to reestablish immediately. However, the intent of this project is to rebuild marsh habitat. Once the mitigation site dewaters and settlement of material occurs, aquatic organisms would likely return and inhabit the newly established marsh habitat.

(5) Other Effects.
No substantial additional effects to report for this project at this phase in design.

(6) Actions Taken to Minimize Impacts.

During construction activities, berms, confinement dikes, and existing ridges would be utilized to prevent lateral movement of fill and construction materials.

b. Water Circulation, Fluctuation, and Salinity Determinations

Surface water circulation, fluctuation and salinity will be evaluated using Louisiana Department of Environmental Quality (LDEQ) surface water quality monitoring sites in proximity to the RP levee alignment and the marsh mitigation site. Table 6 below summarizes the monitoring sites in proximity to the levee alignment and Figure 13 depicts their locations. Table 7 summarizes the monitoring sites in proximity to the mitigation site and Figure 14 depicts their locations.

Table6. LDEQ water quality monitoring sites used for historic and existing conditions water quality investigation in proximity to the RP Levee Alignment

Site ID	Site Description	Proximity to Optimized TSP Levee
1043	Unnamed Canal in Eden Isle South of Slidell, Louisiana	0.40 miles from alignment on flood side
1045	W-14 Canal Southeast of Slidell, Louisiana	0.75 miles upstream from alignment on protected side
1078	Bayou Bonfouca Southwest of Slidell, Louisiana	Intersects alignment on protected side
4863	Bayou Bonfouca Southeast of Bonfouca, Louisiana	Parallels alignment on flood side
1076	Bayou Liberty West-Southwest of Slidell, Louisiana	Intersects alignment on flood side
1077	Bayou Liberty at Bonfouca, Louisiana	0.70 miles upstream from alignment on protected side

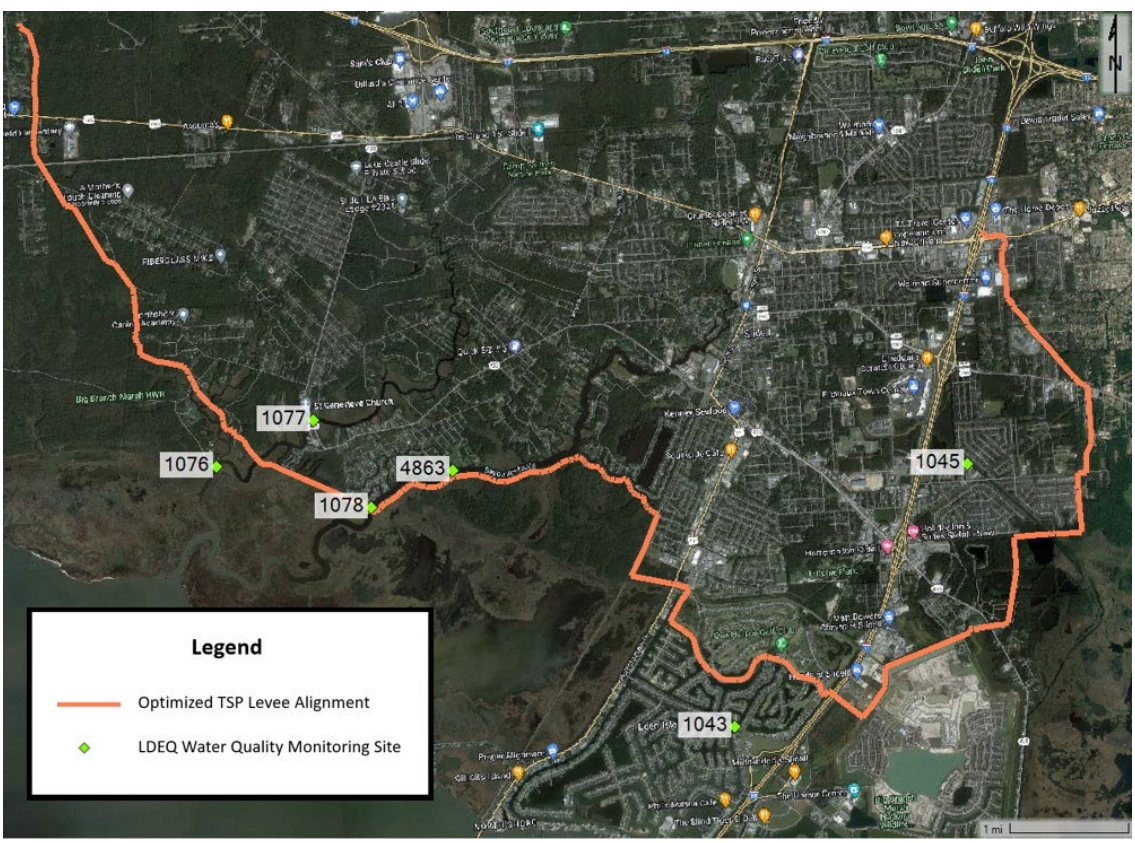

Figure 13. Ambient surface water quality monitoring sites in proximity to the RP levee alignment

Table 7. LDEQ water quality monitoring sites used for historic and existing conditions water quality investigation in proximity to mitigation site M2

Site ID	Site Description	Proximity to Mitigation Site M2
1047	Bayou Lacombe Southeast of Mandeville, Louisiana	0.25 miles southeast of site M2 on Lacombe Bayou
3698	Bayou Lacombe (at Lake Pontchartrain) West of Slidell, Louisiana	0.75 miles southeast of site M2 at the mouth of Lacombe Bayou

Figure 14. Ambient surface water quality monitoring sites in proximity to the marsh mitigation site M2

(1) Water

(a) Salinity

General: Ambient surface water salinity for brackish water generally ranges between 2.0 and 10.0 parts per thousand (PPT). These values were pulled from Tile 33 Environmental Quality report published by LDEQ. Further inland from the Lake Pontchartrain coastline, salinity decreases appreciably. Table 8 and 9 depict average annual salinity at monitoring sites in proximity to the levee and marsh mitigation site respectively. Most values are within range typical of a brackish environment. At sites further inland, salinity decreases appreciably.

Levee and Floodwalls: Fill material used for levee and floodwall foundation construction would be dewatered prior to placement. Placement of fill for these construction projects would have little direct impact on salinity levels in adjacent waterways to the levee alignment.

Because the proposed levee alignment would create a new hydrologic barrier along some reaches, the proposed project has the potential to induce changes to water circulation and water level patterns in the study area. These localized changes in water circulation and water level patterns may induce localized changes in salinity levels within the study area.

Structures: Material used for structure backfill would be dewatered prior to placement. Placement of dewatered fill materials for construction of gate and pump station control complexes would have little direct impact on the salinities of adjacent waters. Construction materials are not expected to contain salts and therefore would not directly impact the salinities of adjacent waterbodies. The operation of gate structures and pump stations during perceived threat of incoming hurricanes would also impact the salinity levels along intersecting waterways with the levee alignment.

As stated previously, salinity levels would be impacted during operation of the structures. Operation of pump stations and gated structures are conditions based, and that would change year to year. Gate design, construction, and operations would be planned so that they can be open to allow natural gravity drainage, navigation, and natural tidal exchange, and can also be closed to maintain lower water levels in the interior when there is a threat of high-water levels. Gate structures when operated would keep salt water from propagating inland during risk of hurricane storm surge. This would cause higher salinity levels in waterways on the flood side of the alignment. Additionally, pump station operation during a storm event would pump fresh water from the protected to the flood side of the alignment. This would aid in diluting the concentrated salinity levels at gate locations.

Table 8. Annual Average salinity values from LDEQ Ambient Surface Water Quality records for sites in proximity to the RP levee alignment (units in PPT)

Site ID	*2001*	*2007*	*2010*	*2011*	*2014*	*2015*	*2018*	*2019*	*2022*	*2023*
1043	5.42	7.47	6.21	5.44	7.36	4.66	5.46	1.72	3.40	2.08
1045	0.58	0.31	0.28	0.28	0.82	0.98	0.15	0.17	0.13	0.21
1078	3.05	3.54	3.21	4.09	3.92	1.33	N/A	N/A	N/A	N/A
4863	N/A	N/A	N/A	N/A	N/A	N/A	1.05	0.18	2.20	0.31
1076	3.79	4.43	4.03	3.60	4.61	2.69	N/A	N/A	N/A	N/A
1077	2.30	3.20	3.45	2.93	4.23	1.79	1.15	0.15	1.61	0.15

Mitigation Site M2: Material used for the marsh mitigation site M2 is planned to be dredged just offshore of the mitigation site in Lake Pontchartrain. This marsh habitat is exposed to brackish water due to tidal action with Lake Pontchartrain. Because material would be dredged form the bed of the lake, it is possible that the agitating the stratified water column may cause higher concentrations of saline water to be transported with the dredged material and placed on the mitigation site. Because the proximity of the site and the borrow location is close, it is not predicted that the introduction of dredged material with potentially higher salinity content would impact marsh vegetation or habitat appreciably.

Table9. Annual Average salinity values from LDEQ Ambient Surface Water Quality records for sites in proximity to marsh mitigation site M2 (units in PPT)

Site ID	*2001*	*2007*	*2010*	*2011*	*2014*	*2015*	*2018*	*2019*	*2022*	*2023*
1047	2.01	2.96	1.67	N/A	3.39	1.58	N/A	N/A	N/A	N/A
3698	N/A	N/A	N/A	N/A	N/A	N/A	3.08	0.57	1.44	1.095

(b) Water Chemistry

General: Ambient surface water pH values for the estuarine study area generally range between 6.0 and 9.0. These values were pulled from Tile 33 Environmental Quality report published by LDEQ. Table 5 features ambient surface water monitoring sites along the levee alignment, and Table 10 displays average annual pH values for years 2001, 2007, 2010, 2011, 2014, 2015, 2018, 2019, 2022 and 2023. Figure 12 depicts the location of these sites. Overall, the averages for each LDEQ water quality monitoring site

remain within the designated range from Title 33 Environmental Quality report.

Table 101. Annual Average pH values from LDEQ Ambient Surface Water Quality records for sites in proximity to the RP levee alignment

Site ID	2001	2007	2010	2011	2014	2015	2018	2019	2022	2023
1043	7.13	7.35	7.93	8.00	7.72	7.48	7.57	7.80	7.46	8.06
1045	7.29	6.88	7.47	7.79	7.23	7.14	7.07	7.18	7.62	7.87
1078	6.93	6.87	7.28	7.19	7.12	7.06	N/A	N/A	N/A	N/A
4863	N/A	N/A	N/A	N/A	N/A	N/A	7.40	6.94	7.21	6.78
1076	6.83	6.57	7.40	7.11	7.11	6.96	N/A	N/A	N/A	N/A
1077	6.62	6.43	7.23	6.88	6.86	7.05	6.83	6.68	7.33	6.29

Levee and Floodwalls: Material proposed for use as levee fill and flood wall foundations would be confined by berms. Therefore, only minimal amounts of fill material (primarily material associated with berm construction) would directly impact adjacent waterbodies. Associated impacts to surface water pH levels from placement of levee fill material would be localized and temporary.

Placement of fill materials can result in short term effects on pH. Factors typically associated with fill material placement activities may cause pH in receiving area waters to shift toward more acidic conditions. These factors include increased turbidity, organic enrichment, chemical leaching, reduced dissolved oxygen, and elevated carbon dioxide levels, among others.

Because the proposed levee alignment would create a new hydrologic barrier along some reaches, the proposed project has the potential to induce changes to water circulation and water level patterns in the study area, these localized changes in water circulation and water level patterns may induce localized changes in pH levels within the study area.

Structures: Minor and localized impacts to pH levels in adjacent waters may occur during placement of construction and backfill materials. These impacts would be expected to last the duration of construction activities. Gates and pump stations when operated would have the potential to temporarily alter pH levels, by restricting or eliminating surface water flows during construction activities. Upon re-opening of gates following a storm event, changes in pH associated with restriction of upload flows would diminish. Additionally, pump station operation during a storm event would pump fresh water from the land to the flood side of the alignment. This would likely alter pH levels on flood side.

Mitigation: As previously stated, the ambient surface water pH values for the estuarine study area generally range between 6.0 and 8.0. Table 11 displays average annual pH values for years 2001, 2007, 2010, 2011, 2014, 2015, 2018, 2019, 2022 and 2023. These average annual values were calculated using LDEQ ambient surface water quality records.

Placement of dredged material can result in short term effects on pH, typically causing the impacted footprint area to become more acidic. The impacts would be expected to last the duration of construction activities, including building up the retention dike and depositing the material. It is anticipated that following establishment of the marsh area, pH conditions would equalize and return to pre-project conditions.

Table 2. Annual Average pH values from LDEQ Ambient Surface Water Quality records for sites in proximity to the RP levee alignment

Site ID	2001	2007	2010	2011	2014	2015	2018	2019	2022	2023
1047	6.10	6.68	6.87	N/A	7.72	7.36	N/A	N/A	N/A	N/A
3698	N/A	N/A	N/A	N/A	N/A	N/A	7.30	7.26	7.05	6.785

(c) Clarity

General: Placement of fill material is expected to result in localized turbidity plumes, which could affect water clarity and color. Following completion of construction activities and vegetation of constructed project features, the occurrence of these turbidity plumes would no longer occur.

Levee and Floodwalls: To minimize construction-related impacts to surface water, including water clarity and turbidity, a Stormwater Pollution Prevention Plan (SWPPP) would be implemented for construction activities. SWPPPs would be prepared in accordance with good engineering practices emphasizing storm water Best Management Practices and complying with Best Available Technology Economically Achievable and Best Conventional Pollutant Control Technology. The SWPPP would identify potential sources of pollution which may reasonably be expected to affect storm water discharges associated with the construction activity. In addition, the SWPPP would describe and ensure the implementation of practices which are to be used to reduce pollutants in storm water discharges associated with the construction activity and to assure compliance with the terms and conditions of this permit.

Mitigation Site M2: Local turbidity plumes would be generated when the dredge material is placed on the marsh mitigation site. Following the construction of the retention dike and once the dredge material has time to

settle and become established, overall clarity in the marsh would return to pre-project conditions.

(d) Color

General: Refer to section 2.b.(1)© on Clarity for additional information.

(e) Odor

General: No significant odors are anticipated to be associated with earthen borrow material from the five potential borrow sources for levee construction, or any construction materials, or dredged material from lake Pontchartrain for the mitigation site.

(f) Taste

General: The nearest surface drinking water intakes to the study area are located on the Mississippi River, which is generally hydrologically isolated from the study area by the Mississippi River levees. The proposed projects are therefore not expected to affect area drinking water resources.

(g) Dissolved Gas Levels

General: Ambient dissolved oxygen values for the project area water quality monitoring stations generally averages 4.0mg/L according to LDEQ Tile 33 Environmental Quality report.

Levee: Because the proposed levee alignment would create a new hydrologic barrier along some reaches, the proposed project has the potential to induce changes to water circulation and water level patterns in the study area, despite the incorporation of gravity drainage structures and canals into the proposed alternative. These localized changes in water circulation and water level patterns may induce localized changes in dissolved oxygen levels within the study area.

Structures: Minor, localized impacts to dissolved oxygen levels in adjacent waters may occur during placement of construction and backfill materials. These impacts would be expected to last the duration of construction activities. Gates when operated would have the potential to temporarily alter dissolved oxygen levels, by restricting or eliminating surface water flows during construction activities. Upon reopening of gates following a storm event, changes in dissolved oxygen levels associated with the temporary gate closure would diminish. Additionally, pump station operation during a storm event would pump fresh water from the land to the flood side of the alignment. This would likely alter DO levels on the flood side because runoff seen on the landside has higher occurrences of agricultural runoff high in nutrients which then aid in depletion of available dissolved oxygen.

Mitigation Site M2: Placement of dredged material onto the identified mitigation site is expected to temporarily alter dissolved oxygen in the existing marsh. The localized changes in water circulation and water level patterns due to placement of dredged material may induce localized changes in dissolved oxygen levels within the study area. Associated impacts to dissolved oxygen from placement of levee fill material would therefore be localized and temporary.

(h) Nutrients

General: The proposed levee alignment would create a new hydrologic barrier along some reaches which potentially induces changes to water circulation and water level patterns in the study area. These localized changes in water circulation and water level patterns may induce localized changes in the distribution of nutrients within the study area.

Levee: Material proposed as levee fill would be confined by berms. Therefore, only minimal amounts of fill material (primarily material associated with berm construction) would directly impact adjacent waterbodies. Associated impacts to the water column from placement of levee fill material would therefore be localized and temporary.

Structures: Fill and construction materials used for closure gate and pump station complex construction are not expected to contain high nutrient levels. Therefore, placement of these materials for structure construction is not expected to directly impact nutrient levels for adjacent surface waters. Additionally, pump station operation during a storm event would pump fresh nutrient rich water from the land to the flood side of the alignment. This would likely alter nutrient levels on the flood side. Impacts to nutrient levels in waterways would diminish after gates are reopened and pumps are shut down following a storm event.

Mitigation: Placement of dredged material onto the identified mitigation site would likely alter nutrient content of the marsh temporarily. Dredged material is planned to come from the bed of Lake Pontchartrain in proximity to the mitigation site. Sediment in the lake is not appreciably more nutrient rich, however, nutrients including phosphorus and nitrogen stored in the lakebed sediment would likely be introduced to the site through the dredge material. As the mitigation site establishes with vegetative growth, nutrient uptake would take place by the marsh vegetation and nutrient content in the mitigation site is anticipated to return to pre-project conditions.

(i) Eutrophication

For potential eutrophication impacts, refer to section 2.b.(1)(h) on nutrients.

(j) Other as Appropriate
No additional water circulation, fluctuation, or salinity determinations apparent at this phase of design.

(2) Current Patterns and Circulation

(a) Current Patterns and Flow

General: The proposed levee alignment would create a new hydrologic barrier along some reaches, the proposed project has the potential to induce changes to water circulation and water level patterns in the study area. Changes to hydraulics and hydrology within the study area are anticipated to occur.

Levee and Floodwalls: Existing aquatic habitat that spans both sides of the levee footprint would exhibit impacts from the levee in place. Hydraulic connectivity for portions of existing aquatic habitat on the landside of the alignment would be converted to upland habitat due to the barrier of the levee. Surface waters within the landside aquatic habitat would then be converted to upland habitat unless other sources of water feed the area that are not obstructed by the levee. It should be noted that sluice gates would be strategically placed along the alignment to maintain some hydraulic connectivity for locations impacted the greatest from the presence of the levee.

Structures: Much of the proposed structures whose footprints would be within existing aquatic habitat would convert their footprints to upland habitat, thus eliminating surface waters within portions of structure footprints. Structure openings would not be converted to upland habitats. Impacts to current circulation and flow patterns would likely remain following construction of gate and pump station complexes as these structures are permanent.

Mitigation: Impacts to current circulation patterns and flow of the mitigation site M2 is anticipated to be impacted during construction of the retention dike and placement dredged material. Due to tidal action with Lake Pontchartrain, it is likely that changes to the existing marsh would diminish and patterns in the marsh surrounding the mitigation site would return to baseline conditions.

(b) Velocity

For potential impacts to hydraulic velocities, refer to section II.b.(2)(a) on Current Patterns and Flow.

(c) Stratification

Because project area salinities are generally low and area waterbodies are generally shallow (less than 10 ft in depth), the proposed levee alignment and marsh mitigation site is not expected to contribute to water column stratification.

(d) Hydrologic Regime

For potential impacts to the hydrologic regime, refer to section II.b.2(a) on Current Patterns and Flow**.**

(3) Normal Water Level Fluctuations

For potential impacts to normal water level fluctuations, refer to section II.b.(2)(a) on Current Patterns and Flow**.**

(4) Salinity Gradients

For potential impacts to salinity gradients, refer to section II.b.(1)(a) on Salinity

(5) Actions That Would Be Taken to Minimize Impact

To minimize construction-related impacts to water quality, a SWPPP would be implemented for construction activities. SWPPPs shall be prepared in accordance with good engineering practices emphasizing storm water best management practices and complying with best available technology, Economically Achievable and Best Conventional Pollutant Control Technology. The SWPPP shall identify potential sources of pollution which may reasonably be expected to affect storm water discharges associated with the construction activity. In addition, the SWPPP shall describe and ensure the implementation of practices which are to be used to reduce pollutants in storm water discharges associated with the construction activity and to assure compliance with the terms and conditions of this permit.

c. Suspended Particulate/Turbidity Determinations

(1) Expected Changes in Suspended Particulates and Turbidity Levels in Vicinity of Disposal Site.

Levee: Material proposed as levee fill would be confined by berms. Therefore, only minimal amounts of fill material (primarily material associated with berm construction) would directly impact adjacent waterbodies. Associated impacts to the water column from placement of levee fill material would therefore be localized and temporary.

Structures: Minor, localized impacts to turbidity levels and water clarity in adjacent waters may occur during construction and placement of backfill materials. These impacts would be expected to last the duration of construction activities. Gates and pump stations when operated would have the potential to temporarily alter suspended particulate matter on both the land and flood side of the structures. Upon reopening of

gates following a storm event, changes in turbidity and suspended particulate levels associated with the temporary gate closure would diminish.

Mitigation: Localized and temporary impacts to turbidity levels and suspended solids are anticipated during placement of the dredged material into the mitigation site. Impacts are anticipated diminish once the dredge material settles and the marsh begins to establish.

(2) Effects on Chemical and Physical Properties of the Water Column.

(a) Light penetration.

For potential impacts to light penetration, refer to section II.c.(1) on Expected Changes in Suspended Particulates and Turbidity Levels in Vicinity of Disposal Sites.

(b) Dissolved oxygen

For potential impacts to dissolved oxygen, refer to section II.b.(1)(g) on Dissolved Gas Levels.

(c) Toxic metals and organics

For potential impacts from toxic metals and organics, refer to section II.d on Contaminant Determinations.

(b) Pathogens

Levee and Floodwall: Elevated fecal coliform densities are the fourth most commonly cited suspected cause of impairment for study area waterbodies. Because the proposed levee alignment would create a new hydrologic barrier along some reaches, the proposed project has the potential to induce changes to water circulation and water level patterns in the study area. These localized changes in water circulation and water level patterns may induce localized changes in the distribution of waterborne pathogens within the study area.

Changes to pathogen concentrations within the study area may be more significant.

Mitigation: There are no anticipated impacts from pathogens foreseen associated with the mitigation features.

<u>d. Contaminant Determinations.</u>

General: As described above, borrow site(s) for this project has not yet been finalized. Evaluation of contaminants in the selected borrow location would be conducted at the next phase of this project. Additionally, known contaminants in the sediment at the

proposed dredging location for the marsh mitigation site is unknown at this time. Evaluation of contaminants in the specific dredging location of Lake Pontchartrain would be conducted at the next phase of this study.

2. Technical Evaluation Factors
Subpart C Physical and Chemical Characteristics of the Aquatic Ecosystem

a. *230.20- Substrate:* The proposed project includes 14 miles of hurricane and storm damage risk reduction levees, 2.3 miles of floodwall, five pumping stations, four floodgates, three sluice gates, one gated railroad crossing, and seven roadway ramps. Placement of fill and construction materials at staging sites and along the footprint of the proposed hurricane storm damage risk reduction project would directly impact 111 acres of marsh on the western portion of the alignment. Fill placement would convert nearly all aquatic habitat within the footprint to upland habitat. There are 122.5 impacted acres (40 net acres) of fresh and intermediate marsh wet, 440.5 impacted acres (150 net acres) of Pine Savanna habitat (67 AAHU), 35 impacted acres (35 net acres) of Riparian habitat (23 AAHU), and 3 acres of Stream habitat that would be directly or indirectly impacted by the proposed project. Additionally, the alignment crosses the northern extent of Big Branch Wildlife Refuge and would directly impact existing substrate characteristics in that area.

b. *230.21- Suspended Particulates/ Turbidity*: Turbidity and suspended particulates in the water column would be impacted initially due to construction activities and staging of construction materials. Material proposed as levee fill would be confined by berms. Therefore, only minimal amounts of fill material would directly impact adjacent waterbodies. Most impact would come from displaced earth from operation of construction machinery in close proximity to waterbodies. Associated impacts to the water column from placement of levee fill material would therefore be localized and temporary.

   Construction of structures, including gate closures and pump station complexes, would also directly impact suspended particulates and water column turbidity. These impacts would be caused by operating machinery within waterways during placement of backfill materials for these structures. The placement of materials may generate turbidity plumes and release suspended particulates. Elevated turbidity and suspended particulates may cause minor temporary elevation of oxygen demand in the five waterbodies that cross the proposed alignment footprint. Additionally, gates and pump stations when operated would have the potential to temporarily alter suspended particulate matter on both the protected and unprotected side of the structures. Upon reopening of gates following a storm event, changes in turbidity and suspended particulate levels associated with the temporary gate closure would diminish.

Generally, impacts during construction are expected to be moderate and transient in nature. As materials settle and compact, and loose sediments are dispersed by flows and wave energy, the direct effects of project features on suspended particulates and turbidity are expected to gradually diminish.

Impacts to the water column of adjacent waterbodies from the RP alignment would be moderate in nature. Majority of impacts would occur during construction of the alignment and associated floodgates that cross Bayou Liberty and Bayou Bonfouca as well as construction of numerous sluice gates and sector gates. Additionally, operation of the floodgates and pump stations would impact water column characteristics.

230.22-Water: Impacts during construction would predominantly be caused by the placement of staging and fill materials for levee and floodwall construction in waterbodies or the floodplains of waterbodies. Impacts caused by disruption in floodplains include temporary modifications to turbidity and suspended solids, dissolved gas levels, nutrient levels, and water clarity. Following construction, these impacts to waterbodies would diminish and return relatively close to baseline conditions. However, during operation of the structures there would likely be impacts associated with alterations in dissolved oxygen levels, pathogen concentration in waterbodies, turbidity and suspended solids, and water clarity. It is predicted that following operation of these structures, alterations of the listed water column characteristics would return to baseline conditions on both the protected and unprotected side of the alignment. As materials settle and loose sediment is carried downstream direct impacts are expected to diminish following construction and operation of structures. The preliminary water control structure operations plan is located in Environmental Appendix E, Annex Q of the RDIFR-EIS. No structure can be closed or re-opened when the pressure head differential exceeds the structure design capability. No structure can be re-opened until storm force winds have dropped to a level safe for personnel to access the area and operate the machinery. Additional modeling and design would be conducted during PED.

c. *230.23 – Current Patterns and Water Circulation:* The proposed levee alignment would create a new hydrologic barrier along five reaches and has the potential to induce changes to water circulation and water level patterns in the study area. In addition, with the increase in sea-level rise and more frequent severe weather events. Long term impacts to water circulation patterns in the floodplains of crossed waterways are anticipated, because water would no longer circulate in the same patterns (e.g., sheetflow /overland flow) when banks are overtopped as it does in the existing condition. Pump stations w alleviate flooding in the floodplains on the protected side, but current patterns would not be maintained.

Additionally, when structures are operated in anticipation of potential hurricane threat, water circulation would be impacted on the unprotected and protected side of the system due to gate closure and pump operation. When gates are reopened and pumps are not in operation, it is expected that conditions within waterbodies would return to baseline conditions.

d. *230.24- Alternation of Normal Water Fluctuations:* The proposed levee alignment would create a new hydrologic barrier along five reaches and has the potential to induce changes in water fluctuations of waterbodies throughout the study area. The gate structures along with the levee and floodwall alignment constricts the flow that is able to pass through the waterway and floodplain. Discharge velocity and volume would be fractionally elevated at locations of the five gate structures as flows would be more channelized in the waterbodies and additional runoff would drain to the gated openings.

e. *230.25- Salinity Gradients:* The project passes through five low salinity (e.g., freshwater) waterbodies that flow into Lake Pontchartrain which is a large oligohaline waterbody. Day-to-day changes in salinity gradients is likely to not be a significant impact because this project would impact waterbody salinity only when the gates are closed in preparation for hurricane storm surge. This would artificially stop saltwater propagation up the waterways, restricting its landward effects to the unprotected side of the levee alignment. When the gates are reopened, the increased concentration of salt water on the unprotected side would dilute and mix with freshwater. This would likely lead to temporarily decreased salinities on the protected side of the system during and immediately after operation during a storm event.

<u>Subpart D Biological Characteristics of the Aquatic Ecosystem</u>

a. 230.25- Threatened and Endangered Species

The proposed levee construction would have no effect on the Ringed Map Turtle or the Gopher Tortoise. Impacts resulting from the proposed construction activities along with proposed compensatory mitigation sites would not likely adversely affect the West Indian Manatee. Gopher Tortoise, and red-cockaded woodpecker. The proposed project could result in crushing and/or uprooting of Louisiana Quillwort by heavy machinery and/or foot traffic. However, these impacts are expected to be temporary, occurring mostly during construction of the Project. Indirect impacts could occur due to siltation from construction activities reducing the ability of plants to absorb sunlight. Impacts are expected to be limited to construction times. Impacts to Louisiana Quillwort could be reduced through use of best management practices and adherence to regulations governing stormwater runoff at construction sites and staging areas. In addition, monitoring for the presence

of plant colonies at construction sites and prohibiting use of heavy machinery in these areas would minimize potential negative impacts to the species.

b. 230.31 Fish, crustaceans, mollusks, and other aquatic organisms in the food web

Effects on Plankton

Levee System: Due to the presence of forest canopy and floating vegetation (primarily *Salvinia* spp. and water hyacinth), a plankton community within the swamps is unlikely to be a significant resource. The plankton community within the marsh and open waterbodies would be affected during construction within the ROW and vicinity.

Mitigation: It is likely that a plankton community is present in the open water areas in The Marsh Mitigation Site (M2), Lake Pontchartrain and Refuge Pine Savanna Mitigation Site (PSR-001). The excavation and movement of material to construct the mitigation is likely to create sufficient turbidity in the vicinity of construction to adversely affect.

Effects on Benthos.

Levee system /Mitigation: Benthic organisms would be smothered by the placement of clay and dredged material at the sites and eliminate benthic habitats.

Mile Branch: Benthic organisms would be removed or damaged by the channelization activities of widening and deepening Mile Branch. Material from the channel would be removed to make the waterway 3-ft deeper and several feet wider.

Effects on Nekton.

Levee system: Some species of the nekton community would be temporarily displaced during construction operations. The levee footprint in the marsh and open water areas would remove habitat (e.g., foraging, breeding, spawning) for a variety of nekton.

Mile Branch: Some species of the nekton community would be temporarily displaced during construction activities. Some may be trapped in pools of water and then directly impacted by the dredging/channelization of Mile Branch. Widening and deepening of Mile Branch would temporarily remove habitat but it would be reestablished once construction activities are complete, and the nekton community would return following construction activities. Mud bottoms may be reduced due to placement of riprap along the banks and water bottom toe.

Mitigation: Construction of the mitigation projects would have similar temporary effects to the existing nekton communities. However, once construction has

completed, there would be no net loss of nekton habitat associated with the project.

Impacts to Mile Branch water bottom would be offset by the construction of a 5-acre backwater area that would create 3-acres of water bottom.

Effects on the Aquatic Food Web.

Levee System: The levee footprint would impact the aquatic food web. Placement of fill and construction materials at staging sites and along the footprint of the proposed hurricane storm damage risk reduction project would directly impact 111 acres of marsh on the western portion of the alignment. Fill placement would convert nearly all aquatic habitat within the footprint to upland habitat. There are 123 impacted acres (40 net acres) of fresh and intermediate marsh wet, 430 impacted acres (150 net acres) of Pine Savanna habitat (75 AAHU (16.36 RCW AAHU; 59 PW AAHU)), 35 impacted acres (35 net acres) of Riparian habitat (23 average annual habitat units), and 3 acres of Stream habitat that would be directly or indirectly impacted by the proposed project.

Mitigation: At all mitigation sites aquatic food web would benefit from both short and long-term changes resulting from the wetland mitigation projects, including additions in energy to basal elements of the food web, habitat preservation, and increased habitat complexity. Nutrients and detritus provided by the connection to marsh habitats would be added to the existing food web. The proposed action would reestablish numerous microenvironments that would be utilized by invertebrates and juvenile fishes that serve as prey items for larger fauna.

c. 230.32 Other Wildlife: The levee measure would directly result in the loss of marsh and forested habitat for terrestrial wildlife species with the potential for species mortality and displacement for species present during construction. Conversion of marsh to uplands would reduce use and function of these areas for brown pelicans, seabirds, dabbling and diving ducks, coots, and gallinules and other species that feed in the shallow open waters, it is anticipated they would utilize adjacent areas of open water habitat that are abundant in close proximity to the proposed features. Indirect impacts would be on adjacent habitats that would experience a burden due to displacement of wildlife to those adjacent areas. Where there is a permanent loss of habitat resulting from construction, the affected species would not return or utilize the affected habitat in the same manner. Mobile wildlife would be impacted by the construction noise and vibration and likely leave the area. These impacts are expected to be temporary, and the wildlife would return once construction activities are complete. There could be adverse impacts to adjacent habitat resulting from the wildlife migration if the carrying capacity is already weakened or threatened with over population. Less mobile species would suffer from the construction activity and likely suffer death from the placement of dirt directly on them or from being

run over by construction equipment. Noise and vibration from construction activities would be expected to only cause a temporary impact by potentially scaring away those present in the immediate vicinity, though they would be expected to return upon completion.

Subpart E Potential Impacts on Special Aquatic Sites

a. 230.40 Sanctuaries and refuges: There were no identified bird rookeries within 1,000 feet of the project site however a bird survey would be conducted prior to construction by USACE and FWS personnel. Construction of the levee and floodgates would occur on the Big Branch NWR. There would be 77 acres of direct fresh/intermediate marsh impacts and 21 acres of direct pine savanna/flatwood habitat impacts. Direct impacts include the construction of an earthen levee on currently owned refuge property. Prior to construction a land exchange would occur between the USACE and NWR of property of equal habitat quality and value to offset the direct fresh/intermediate marsh and pine savanna/flatwood impacts to the refuge. There are no indirect fresh/intermediate marsh impacts to the refuge but there is 36 acres of indirect impacts to pine savanna habitat on refuge property. Indirect impacts would be mitigated by the maintenance of PSR-1 mitigation site which would include regular controlled burns to reestablish a typical pine savanna/flatwood ecosystem.

b. 230.41 Wetlands: Levee System: The levee would directly remove 123 acres of fresh/intermediate marsh and 192 acres of pine savanna. While the construction of the levee would enclose wetland habitat, the natural tidal exchange would be maintained by the inclusion of sluice gates that would be closed for a brief time during named storm events.

Mitigation: The complete mitigation plan would fully compensate for the impacts to aquatic habitats due to this project.

c. 230.42 Mudflats

Not Applicable

d. 230.43 Vegetated Shallows

Levee System: The placement of clay material for levee construction would create unsuitable conditions for their continued vigor by covering them up, changing water circulation patterns, releasing nutrients that increase undesirable algal populations, and increasing turbidity levels during construction, thereby reducing light penetration and hence photosynthesis.

Mitigation: The connection to swamp habitats would reestablish numerous microenvironments including some freshwater vegetated shallows.

e. 230.44 Coral reefs

Not Applicable

f. 230.45 Riffle and pool complexes

The proposed channel work including dredging and widening of Mile Branch would result in direct impacts such as to aquatic organisms.

g. Actions to Minimize Impacts

Adverse impacts on benthic organisms are unavoidable. However, the loss of benthic habitat by the placement of excavated/dredged material in Waters of the United States would be compensated by the wetland mitigation proposed for the project. Additional benthic habitat would be provided by the construction of conveyance channels.

The plankton community of the project would be affected by increased concentrations of turbidity/suspended solids during construction. Best management practices, such as silt fencing and hay bales, would minimize impacts. Turbidity/suspended solid concentrations would return to preconstruction activities following completion of the project.

Avoidance of activities in an area within 660 feet of the bald eagle nest, particularly during the nesting season, is expected to minimize disturbances.

To deter colonial nesting water birds from establishing active nesting colonies in the construction areas, a Nesting Prevention Plan would be developed during PED in coordination with the USFWS and LDWF. If measures to prevent nesting of colonial nesting bird populations are not successful in the area, construction-related activities that would occur within 1,000 feet of a colony could be restricted to the non-nesting period, which in this region generally extends from September 1 to February 15, depending on the species present. This restriction would likely pose significant problems to construction activity schedules. If wading bird nesting colonies become established in the area, the 1,000-foot buffer must be maintained unless coordination with the USFWS indicates that the buffer zone may be reduced based on the species present or an agreement is reached with USFWS that allows a modified process to be adopted.

No adverse impacts found on threatened/endangered species and their habitat, the aquatic food web, and other wildlife (mammals, birds, reptiles, and amphibians). Therefore, the placement of material would have little if any effect on the aquatic ecosystem.

Subpart F Human Use Characteristics

h. 230.50 Municipal and private water supply
The nearest surface drinking water intakes to the study area are located on the Mississippi River, which is generally hydrologically isolated from the study area by the Mississippi River levees. The proposed projects are therefore not expected to affect area drinking water resources.

i. *230.51 Recreational and commercial fisheries:* There would be long term impacts associated with alteration of access within the waterbodies where the levee system and floodgates would be built. Floodgates on Bayou Bonfouca and Bayou Liberty would be open until there is a named storm in the Gulf of Mexico and certain conditions are being met that require the floodgates to be closed. The closure of the gates would be temporary not lasting longer than is necessary until conditions improve allowing the gates to be opened. Navigation on these waterways would be prevented for a short period of time but would be a permanent occurrence through the period of analysis. Once the floodgates are closed, vessels would either be stuck on protected side of the gates or the floodside of the gates until the storm passes and conditions improve that would trigger the gates to be reopened. Negative impacts associated with a loss of marsh and shallow water habitats to recreational and commercial fisheries within the levee system project area and immediate vicinity would occur. These habitat impacts would be fully mitigated in accordance with applicable laws and guidelines as described in the mitigation plan.

j. *230.52 Water-related recreation:* With the proposed 18 mile-long Slidell Levee measure, there would be no direct impacts to existing recreation resources in the area. Heritage Park is in proximity to the western side of the system and could see temporary, indirect impacts such as interrupted access related to construction. Coordination with the NFS and local stakeholders would be implemented to minimize potential recreational impacts at Heritage Park. The proposed 2.15 mile-long Mile Branch would directly impact the free-flow of these tributaries of the Tchefuncte River, which is part of the Louisiana Natural and Scenic Rivers System ("Louisiana Scenic Rivers Act". Acts 1988, No. 947, §1, eff. July 27, 1988.) (Appendix C: Environmental Table C:3-11).

k. 230.53 Aesthetics: This measure includes the introduction of new visual elements (levee, access gate, floodgates, sluicegates, and pump stations) to the area's viewshed that have the potential to indirectly impact known and previously undocumented cultural resources that may be listed or eligible for listing in the NRHP. The introduction of new visual elements that are inconsistent with the historic or cultural character of these resources could indirectly diminish the integrity of the property's setting, feeling, or association and/or cause changes to the integrity of feeling or character associated with a historic resource or TCP.

l. 230.54 Parks, national and historical monuments, national seashores, wilderness areas, research sites, and similar preserves: The Big Branch NWR is located within the project area. Seventy-seven acres of fresh/intermediate marsh habitat and 57 acres of pine savanna habitat on the NWR would be directly or indirectly impacted by the construction of the levee system. Archaeological sites are located within the levee footprint and would require further investigation as to whether they may be adversely affected by construction. No previously recorded historic built resources are located within the proposed alternative.

Mile Branch Channel Improvements: One archaeological site, Wilson Cemetery, is adjacent to the Mile Branch at the northern end. A staging area (that would become Backwater improvements) is proposed just east of this cemetery. There are previously recorded historic built resources adjacent to the location; however, there are no previously recorded historic built resources within the footprint of Mile Branch.

<u>Subpart G Evaluation of Dredged or Fill Material</u>

a. *230.61 Chemical, biological, and physical evaluation and testing*
Considerations in Evaluating the Biological Availability of Possible Contaminants in Dredged or Fill Material: The project would follow the soil standards set for suitable levee grade material outlined in the USACE Hurricane Storm Damage Risk Reduction System (HSDRRS) Guidelines. Suitable borrow material is defined as meeting the following current criteria after placement as levee fill: soils classified as clays (CH or CL) are allowed as per the Unified Soils Classification System, soils with organic contents greater than 9% are not allowed, soils with plasticity indices (PI) less than 10 are not allowed, soils classified as Silts (ML) are not allowed, and clays would not have more than 35% sand content. A comprehensive list of regulations and authorities dictating the acquisition of borrow material can be viewed in the Borrow Source Investigations writeup. At this point in time, no soil testing has occurred for any of the five potential borrow sites. Additionally, there is no reason to believe any of the five sites hold contaminants as none are in close proximity to environmentally hazardous areas. Prior to use, the selected borrow site would be tested for contaminants.

The dredged borrow material planned for the mitigation site is in Lake Pontchartrain close to the mitigation site. At this time of the study, there is no indication of contaminates at the identified location in the lake. During the next phase of the study, soil testing would be required to confirm the absence of contaminates.

An evaluation of the appropriate information above indicates that there is reason to believe the proposed dredge or fill material is not a carrier of contaminants, or the material meets the testing exclusion criteria: Yes

Material placed for levee construction would be contained within the levee right of way with berms or small dikes. Movement of material beyond the levee right of way is not anticipated.

Structure materials, including any associated cofferdams, would not be expected to move or shift after final material placement.

Fill material placed for berm construction is not expected to move after final material placement.

Material placed for marsh creation at site M2 would be contained within a newly placed retention dike to retain the dredged material. Movement of material beyond the retention dike is possible as this area is subjected to tidal exchange. It should be noted that the establishment of marsh would likely be aided by the dredged material having a high course faction because is capable of draining at a faster rate.

Physical Effects on Benthos

Levee: Sessile aquatic organisms within the footprint of the proposed levee would be smothered by placement of fill and construction materials, and these organisms would not be expected to reestablish.

Structures: Sessile aquatic organisms within the footprint of proposed structures would be smothered by placement of fill and construction materials, and these organisms would not be expected to reestablish. Cofferdam construction, if implemented for construction of any structures included in the proposed project, would also smother sessile aquatic organisms. Following cofferdam removal, sessile and mobile aquatic organisms are expected to reestablish within cofferdam footprints.

Mitigation Site M2: Sessile aquatic organisms within the footprint of the proposed mitigation site would be smothered by placement of dredged fill material. These organisms would not be expected to reestablish immediately. However, the intent of this project is to rebuild marsh habitat. Once the mitigation site dewaters and settlement of material occurs, aquatic organisms would likely return and inhabit the newly established marsh habitat

1. **Subpart H Actions to Minimize Adverse Effects**

a. All appropriate and practicable steps have been taken, through application of the recommendations of *230.70 – 230.77* sited in Guidelines for Specification of Disposal Sites for Dredged or Fill Material to ensure minimal adverse effects of

the proposed discharge. Additional discussion on actions to minimize adverse effects may be viewed in the 404(b)(1) report.

2. **Evaluation Responsibility**

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