Mississippi Valley Division,
Regional Planning and Environment Division South

St. Tammany Parish, Louisiana Feasibility Study

Appendix B – Plan Formulation

February 2024

CONTENTS

LIST OF TABLES

LIST OF FIGURES

Section 1
Introduction

This appendix provides supplemental information for the St. Tammany Parish, Louisiana Feasibility Study (study) that is contained in the Main Report of the RDIFR-EIS, and includes tables and maps used in the development, screening, evaluation and comparison of management measures, alternative plans and borrow sites.

The USACE planning process that was followed in the study, is a structured systematic and repeatable planning approach to ensure sound decisions are made in accordance with the processes laid out in the Planning Guidance Notebook (Engineer Regulation (ER) 1105-2-100) and the Principles and Guidelines for Federal Water Resource projects. The six planning steps (Figure B:1-1), though presented and discussed in a sequential manner for ease of understanding, usually occur iteratively and sometimes concurrently. Iterations of steps are conducted as necessary to formulate and evaluate efficient, effective, and reasonable array of alternative plans. As more information is acquired and developed, it may be necessary to reiterate some of the previous steps.

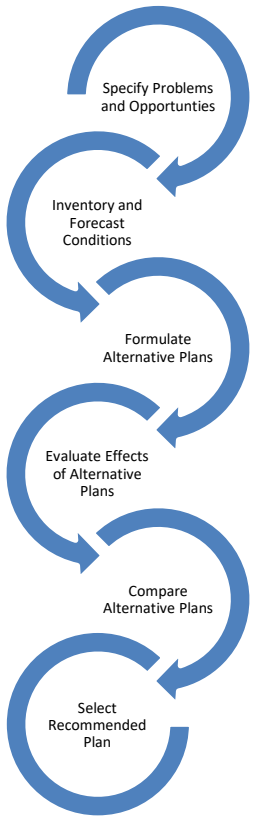


Figure B:1-1. USACE's Planning Process

Step 1 focuses on identifying the problems and opportunities in the study area. The PDT needed to understand the issues within the study area and what was driving the issues. The PDT was then able to define the objectives of the study, or what the PDT hopes to achieve with a project and identify any constraints that limit potential solutions.

In Step 2, the PDT documents and understands the affected environment and the historic existing and future conditions related to flood risk management (FRM) and coastal storm risk management (CSRM) in the study area. This was done by looking at historic and existing trends and forecasting changes in the future if no Federal actions are taken. The data and trends identified were used to define the

future without project (FWOP) conditions, or the No Action Alternative. The FWOP condition is the default baseline to which all other alternatives are compared. The without-project condition is the same as the National Environmental Policy Act (NEPA) “no action” condition, and it assumes that the USACE would take no action to solve the problem.

Step 3 involves developing a wide range of potential actions the PDT could take to solve the problems and meet the planning objectives. Individual actions, or measures, are combined to create different alternatives to meet the planning objectives. Input from the Coastal Protection and Restoration Authority Board of Louisiana (CPRAB), who is the non-Federal sponsor (NFS), St. Tammany Parish, key stakeholders, and the public was very important during this planning step.

In Step 4, the PDT looked at each potential measure and grouping of measures to form alternatives to see what its effects, benefits, costs, and potential impacts would be. This step involved using existing and new data to qualitatively determine and, in later iterations, model the physical, economic, and environmental conditions, along with measuring how well each alternative and measure performs at meeting the objectives and avoiding the constraints.

In Step 5, the PDT compared each alternative plan to the other alternative plans, including the no action alternative. Based on the comparisons, the PDT was able to determine which alternatives perform the best and warrant further investigation.

Step 6 was an additional screening step, where the selection of the tentatively selected plan (TSP) from the Final array of alternatives was informed by, among other things, economic modeling (HEC-FDA), hydrologic and hydraulic (H&H) modeling (HEC-RAS), analysis of ADCIRC results, USACE Class 4 cost estimates, engineering construction costs, design, supervision and administration costs, environmental impacts and mitigation, risk assessments and potential life safety concerns. Figure B:1-2 below gives an overview of the civil works project development.

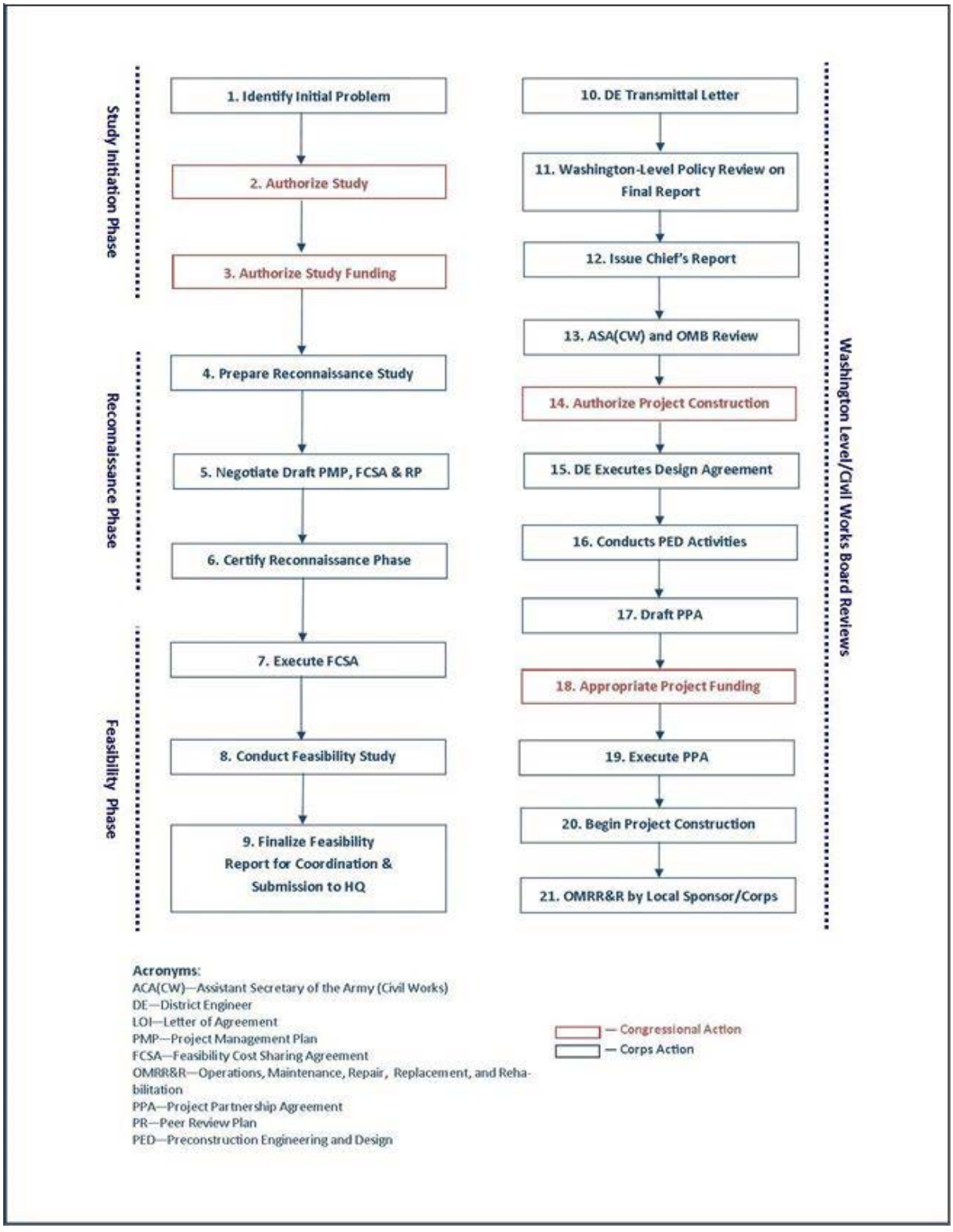
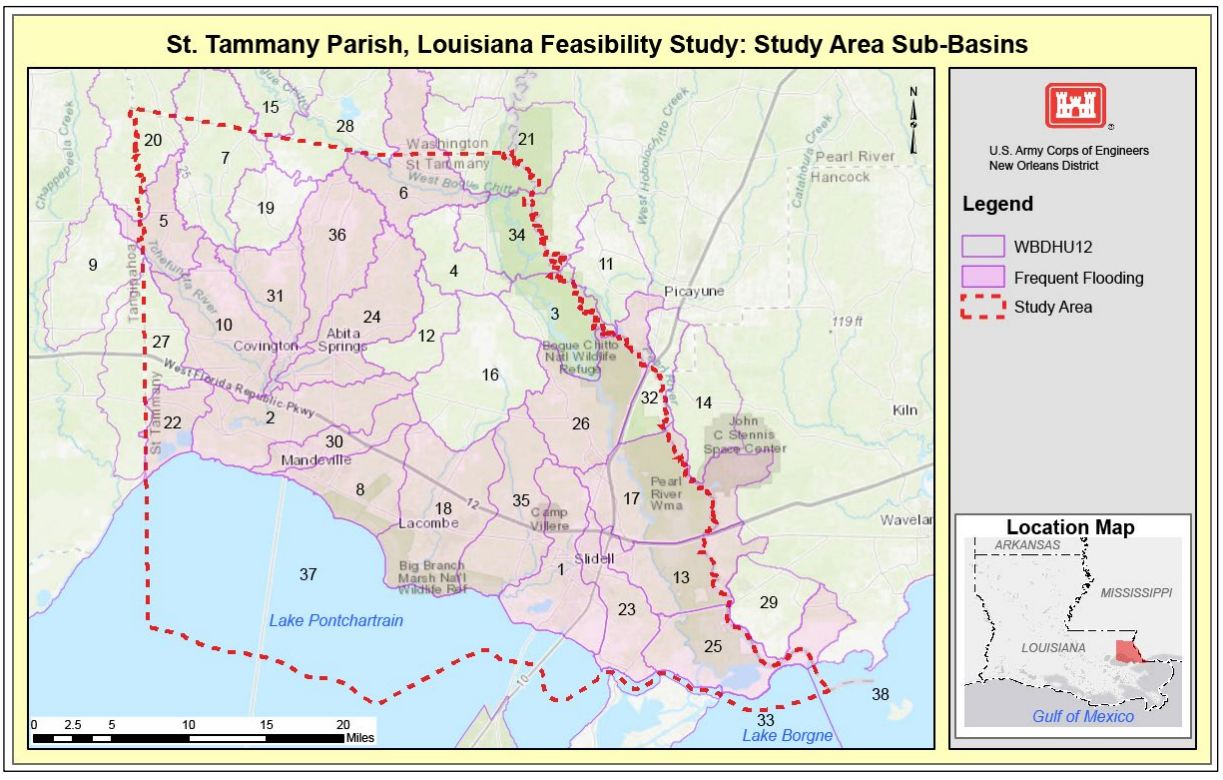


Figure B:1-2. Steps of Civil Works Project Development

The initial Draft Integrated Feasibility Report and Environmental Impact Statement (DIFR-EIS) was released in 2021 for concurrent public, agency, technical, independent external review and policy review. Subsequent to the release of the DIFR-EIS, the PDT conducted additional engineering, economic, and environmental investigations on the individual features of the Draft TSP which is comprised of a structural plan and a nonstructural plan. Using the information gathered by the PDT through these additional investigations, together with the consideration of comments received from the public, stakeholders, and the resource agencies, the PDT further refined the design of the Draft TSP as subsequently developed by the PDT into the Optimized TSP. Based on the public, ATR, and policy comments from the July 2023 review, the proposed plan, known as the Optimized TSP, was refined again. Section 6 of the Main Report provides additional detail on the Recommended Plan .

1.1 OVERVIEW OF STUDY AREA, PROBLEMS, OPPORTUNITIES, OBJECTIVES AND CONTRAINTS

An overview of the study area and the problems, opportunities, objectives, and constraints are described in Sections 1 and 2 of the Main Report of the RDIFR-EIS and is summarized here as a point of reference. The study area encompasses all of St. Tammany Parish, Louisiana. The State of Mississippi, with the Pearl River, creates the eastern boundary; Lake Pontchartrain serves as the southern boundary; Tangipahoa Parish is serves as the western boundary; and Washington Parish is the northern boundary (Figure B:1-2). The highlighted hydrologic subbasins in Figure B:1-2 illustrates where documented flooding has occurred in the study area, whether from coastal or riverine, and repetitive flood loss. The project area, a



subset of the larger study area, defines the area where measures and alternatives could be developed to address the problems, opportunities and objectives. The hydrologic subbasins used were the U.S. Geological Survey, Hydrologic Unit Code 12, denoted on Figure B:1-3 as WBDHUC12.

Figure B:1-3. St. Tammany Parish, Louisiana Feasibility Study Area

The study area problems, opportunities, and objectives are identified in Section 2 of the Main Report. Table B:1-1 shows the relationship between the defined problems, opportunities, and objectives. The table categorizes the problems in the study area and then documents the opportunities for addressing a given problem and ultimately the project objective developed to address the linked problem and opportunity.

Table B:1-1. St. Tammany Parish, Louisiana Feasibility Study, Problems, Opportunities, and Objectives

PROBLEMS	OPPORTUNITIES	OBJECTIVES
St. Tammany Parish has experienced repeated, widespread flooding from rainfall and coastal storms that has caused riverine bank overtopping, drainage, and storm surge. • Study area prone to flood damages from rainfall, riverine bank overtopping, drainage, and storm surge. • 3,500 residential structures are on the Federal Emergency Management Agency (FEMA) repetitive and severe repetitive loss list. • Sea level rise and subsidence are expected to increase in the future, causing more frequent storm surge inundation and flood events.	Reduce Flood Damages • Provide FRM and CSRM alternatives to reduce the flood risks to public, commercial, and residential property, real estate, and infrastructure. • Reduce susceptibility of residential, commercial, and public structures and infrastructure to hurricane and rainfall induced storm damages. • Reduce storm surge heights and durations in protected areas. • Optimize water storage and conveyance needs.	Reduce flood damage to structures (i.e. businesses, residential, commercial, and public structures) from flooding in St. Tammany Parish.
Increasing risk to people from catastrophic flooding events. • Hurricanes, tropical storms, and locally heavy rainfall pose a significant flood risk to the 258,110 people residing in the study area.	Reduce Risk to Public Safety • Reduce the risk to human life during flooding.	Reduce the risk to public health and safety by reducing flood impacts to structures, and critical infrastructure in St. Tammany Parish.
Increasing risk of damage to residential and commercial property. • Hurricane Katrina damaged over 48,000 residential structures. • National and regional economic losses from flooding to industrial and commercial infrastructure/assets.	Reduce Flood Damages • Provide FRM and CSRM alternatives to reduce the flood risks to public, commercial, and residential property, real estate, and infrastructure. • Reduce the susceptibility of residential, commercial, and public structures and infrastructure to hurricane-induced and rainfall induced storm damages.	Reduce flood damage to structures (i.e., businesses, residential, commercial, and public structures) from flooding in St. Tammany Parish.
Critical infrastructure throughout the region including the I-10, I-12 and I-59 transportation system and evacuation routes, Government facilities, hospitals, and schools is expected to become more at risk of damage from potential floods. • The August 2016 flood impacted the Nation's critical infrastructure by shutting both the I-10 and I-12	Increase the reliability of the Nation's transportation corridor (I-10, I-12 and I-59) by providing alternatives that would potentially lessen damages from induced flooding.	Reduce interruption to the maximum extent practicable to the Nation's transportation corridor, and evacuation routes e.g., the I-10 and I-12 and the I-10 interchange in St. Tammany Parish.

PROBLEMS	OPPORTUNITIES	OBJECTIVES
transportation system. • Local roads that frequently flood have been identified.		
Economic losses from flooding to industrial and commercial infrastructure/assets. • The August 2016 flood impacted over 900 businesses and 8,000 employees.	Reduce Flood Damages Reduce economic damages and improve economic resiliency of the local economy and communities. Reduce the susceptibility of residential, commercial, and public structures and infrastructure to hurricane-induced and rainfall induced storm damages.	Reduce flood damage to structures (i.e. businesses, residential, commercial and public structures) from flooding in the study area. Reduce the risk to public health and safety by reducing flood impacts to structures, q and critical infrastructure in St. Tammany Parish.
Increased risk to historically significant structures in the study area	Reduce Flood Damages • Provide FRM and CSRM alternatives to reduce the flood risks to public, commercial, and residential property, real estate, and infrastructure. • Reduce the susceptibility of residential, commercial, and public structures and infrastructure to hurricane-induced and rainfall induced storm damages. • Reduction in storm surge heights and durations.	Reduce flood damage to structures (i.e., businesses, residential, commercial and public structures) from flooding in St. Tammany Parish.
Degrading of local channels and banks stability contribute to upstream and downstream flooding. • Diverse ecologically and important habitat within the study area is being lost and degraded due to saltwater intrusion, waves, subsidence, storm surge, and development. • Sea level rise and subsidence are expected to increase in the future, causing more frequent storm surge inundation and flood events.	Natural Resources: Protect the function and increase the resiliency of the ecosystem to reduce flood damages. • Reduce loss of coastal habitat. • Increase resiliency of coastal and riparian habitats to act as a natural resource to reduce flood damages.	Reduce flood damage to structures (i.e., businesses, residential, commercial and public structures) from flooding in St. Tammany Parish.
Sea level rise and subsidence are expected to increase in the future, causing more frequent storm surge inundation and flood events.	Develop robust alternatives that account for predicted relative sea level rise (RSLR) and climate change.	Reduce flood damage to structures (i.e., businesses, residential, commercial, and public structures) from flooding in St. Tammany Parish.

PROBLEMS	OPPORTUNITIES	OBJECTIVES
Development has led to increased flooding.	Enhance public education and awareness to FRM and CSRM risk. Optimize water storage and conveyance within the study area.	Reduce flood damage to structures (i.e., businesses, residential, commercial and public structures) from flooding in St. Tammany Parish.

The constraints for the study that were used in the plan formulation are:

- Proposed projects must meet minimum flow (800 cubic feet per second (cfs) for a 10 percent chance flood) and drainage area (1.5 square. miles) requirements (ER 1165-2-21).
- Avoid direct or indirect support of floodplain development (in accordance with Executive Order (EO) 11988), wherever there is a practicable alternative.
- Avoid locating project features on lands known to have hazardous, toxic, and radioactive waste (HTRW) and/or related concerns.

Additional considerations in the plan formulation process included:

- Avoid and or minimize impacts to threatened and endangered (T&E) species and their critical habitats.
- Avoid and or minimize impacts to managed habitats i.e., essential fish habitat (EFH).
- Avoid and or minimize impacts to established recreational areas.
- Avoid and or minimize impacts to viewshed.
- Avoid or minimize impacts to cultural resources.

1.2 MANAGEMENT STRATGEIES AND MEASURES

Management measures are the building blocks of alternative plans. Sometimes an alternative plan is one measure. More often it is a set of measures. The categories of measures considered to reduce flood risk from the multiple sources of flooding included structural, nonstructural and nature-based measures. The PDT identified 30 types of management strategies under the structural, nonstructural, and engineering with nature/nature-based categories to address flood risk reduction. These strategies included:

- Structural (S): Structural measures are physical modifications designed to reduce the frequency of damaging levels of flood inundation.

    1. Detention Ponds
    2. Diversion Channels
    3. Bridge Improvements
    4. Channels Improvements
    5. Dredging
    6. Elevate Roadways
    7. Flood Gates
    8. Levee Setback
    9. Levees and Floodwalls
    10. Pumping Stations
    11. Breakwaters
    12. Reservoir
    13. Revetments (shoreline)

14. Ring Berms
15. Seawall, Bulkhead
16. Snagging and Clearing
17. Weirs

- Nonstructural (NS): Nonstructural measures are permanent or contingent measures applied to a structure and/or its contents that prevent or provide resistance to damage from flooding. NS measures differ from structural measures in that they focus on reducing consequences of flooding instead of focusing on reducing the probability of flooding. NS measures reduce flood damages without significantly altering the nature or extent of flooding. Damage reduction from nonstructural measures is accomplished by changing the use made of the floodplains, or by accommodating existing uses to the flood hazard.

18. Elevations of Homes
19. Evacuation Plans
20. Flood Proofing Critical Infrastructure Dry
21. Flood Proofing Critical Infrastructure Wet
22. Flood Proofing Residential Dry
23. Flood Proofing Residential Wet
24. Flood Warning System
25. Optimize Operation of Existing Structures or Projects
26. Property Acquisition (Buyouts)
27. Relocations

- Nature Based (NB): Nature-based measures work with or restore natural processes with the aim of wave attenuation, storm surge reduction, slow and store floodwaters, wetlands or coastal habitat to store inland water.

28. Habitat Creation to attenuate wave energy, reduce erosion (marsh, ridge or coastal forest)
29. Habitat to Store and Slow Water
30. Shoreline Protection including Living Shorelines

The categories of potential types of management measures were evaluated to assist the PDT in identifying a broad range of potential site-specific solutions during the plan formulation process; the general evaluation provided information regarding the types of actions that could be used to address planning objectives, timescale, and acceptability. The categories were referred to during the development of site-specific management measures to make sure a comprehensive and robust list of measures was considered.

Figure B:1-3 provides a summary of the general evaluation of these potential types of actions by evaluating three categories: (1) Planning Objectives, (2) Timescale and (3) Acceptability to evaluate measures. For example, the Timescale evaluation category assigns one of these five tiers to each study alternative: Maximum, Long, Midrange, Short, or Minimum timescales. These tiers are represented in Figure B:1-3 by the abbreviations MAX, LONG, MID, SHORT, or MIN, respectively. A key defining each evaluation category scale

and scoring system is found below Figure B:1-3. Table B:1-3 summarizes the results of the evaluation and whether the measures were further considered under this study.

Following the identification and evaluation of the types of management actions that could reduce flood risk to the area, specific site management measures within the categories and types were then identified and compiled from previous reports, and recommendations and comments received from NFS, stakeholders, and the public. A full list of all the identified site-specific management measures is presented in Table B:1-4. Initially, a total of 195 measures were identified.

Through the plan formulation process, and at the request of the NFS and the St. Tammany Parish Government for more measures at Eden Isle, an additional 13 management measures were added for a total of 208. The management measures were evaluated based on category type (Table B:1-4), planning measures objectives, existing data, professional judgment, avoiding study constraints and addressing the opportunities and problems of the area (See Table B: 1-4). The management measures were also screened on effectiveness and efficiency, which are two of the four principles and guidelines (P&G) evaluation criteria as defined in P&G Section VI.1.6.2(c). Effectiveness is the extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities (P&G Section VI.1.6.2(c)(2)). Alternative plans that clearly make little or no contribution to the planning objectives should be dropped from consideration. Efficiency is the extent to which an alternative plan is the most cost-effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the Nation's environment (P&G Section VI.1.6.2(c)(3)). Benefits can be both monetary and non-monetary. Alternative plans that provided little benefit relative to cost should be dropped from consideration.

Following this screening process, 62 measures remained, which are shown in bold in Table B:1-4. These measures were combined to form the Initial Array of Alternatives for flood prone areas based on hydrologic subunits.

			Does Action Meet Project Objectives?								Timescale	Acceptability	
Measures	USACE Category	FRM or CSRM	Reduces economic damage	Reduces flood impacts to structures, evacuation routes, critical infrastructure	Reduces interruption to nation's transportation corridor including the I-10/I-12 interchange	Improves regional scale conditions	Provides benefits beyond mitigating flood risk	Minimizes recreational user impacts	Minimizes view shed impacts	Minimizes environmental consequences	Time to implement	Included in CPRA Master Plan	Included in St. Tammany Master Plan
Habitat Creation to Attenuate Wave Energy, Reduce Erosion (marsh, ridge or coastal forest)	Nature-Based	CSRM	MAY	MAY	MAY	MTS	MTS	MTS	EXC	EXC	MAX	YES	YES
Riparian Habitat to Slow Inland Water Transfer	Nature-Based	FRM	MAY	MAY	MAY	MTS	MTS	MAY	EXC	EXC	MAX	NO	NO
Flood Proofing Residential (Dry and Wet)	Non-Structural	FRM/CSRM	IMP	IMP	NO	MTS	NO	MTS	EXC	EXC	MIN	YES	NO
Flood Proofing Critical Infrastructure (Dry and Wet)	Non-Structural	FRM/CSRM	IMP	IMP	NO	MTS	NO	MTS	EXC	EXC	MIN	YES	NO
Property Acquisition (Buyouts)	Non-Structural	CSRM	IMP	IMP	NO	MTS	NO	EXC	LKY	EXC	SHORT	NO	NO
Relocations	Non-Structural	CSRM	IMP	IMP	MAY	MTS	NO	LKY	LKY	MTS	SHORT	NO	NO
Evacuation Plans	Non-Structural	CSRM	NO	NO	MTS	MTS	NO	MTS	EXC	EXC	MIN	NO	NO
Optimize Operation of Existing Structures or Projects	Non-Structural	FRM/CSRM	MAY	MAY	MAY	MTS	LKY	MAY	MTS	MTS	MIN	NO	NO
Flood Warning System	Non-Structural	CSRM and FRM	NO	NO	MAY	MTS	NO	MTS	EXC	EXC	MIN	NO	NO
Elevations of Homes	Non-Structural	CSRM	IMP	IMP	NO	MTS	NO	MTS	NO	MAY	LONG	YES	NO
Levees and Floodwalls	Structural	CSRM and FRM	EXC	EXC	EXC	EXC	EXC	NO	NO	NO	MAX	YES	YES
Elevate Roadways	Structural	FRM and CSRM	IMP	IMP	EXC	MTS	MTS	MAY	MAY	EXC	MAX	NO	NO
Detention Ponds	Structural	FRM	MTS	MTS	MTS	IMP	MTS	MAY	MTS	MAY	MID	NO	NO
Bridge Improvements or Replacements	Structural	FRM	MTS	MTS	EXC	MTS	MAY	MAY	LKY	EXC	MAX	NO	NO
Breakwaters	Structural	CSRM	MTS	IMP	MAY	MTS	MAY	MAY	MAY	EXC	SHORT	NO	NO
Reservoir	Structural	FRM	EXC	IMP	MTS	MTS	MAY	MAY	MTS	NO	MID	NO	NO
Pumping Stations	Structural	FRM	IMP	MTS	MTS	MAY	NO	MAY	MTS	NO	SHORT	NO	NO
Seawall, Bulkhead	Structural	CSRM	IMP	IMP	LKY	MTS	MAY	MAY	MAY	MAY	MAX	NO	NO

Ring Berms	Structural	CSRM	IMP	IMP	LKY	MAY	NO	MAY	NO	NO	MAX	YES	YES
Flood Gates	Structural	CSRM	MTS	MTS	MTS	LKY	NO	NO	EXC	NO	MAX	YES	NO
Conveyance Channels	Structural	FRM	LKY	LKY	LKY	MTS	MAY	PSB	MAY	NO	SHORT	NO	NO
Diversion Channels	Structural	FRM	MAY	MTS	LKY	MTS	MAY	PSB	MAY	NO	SHORT	NO	NO
Snagging and Clearing	Structural	FRM	LKY	LKY	MAY	MTS	NO	NO	MTS	MAY	SHORT	NO	NO
Levee Setback	Structural	FRM/CSRM	MAY	MAY	MAY	MTS	MTS	MAY	NO	EXC	MAX	NO	NO
Revetments (shoreline)	Structural	FRM	LKY	LKY	LKY	MTS	MAY	MAY	MAY	NO	LONG	NO	NO
Dredging	Structural	FRM	LKY	LKY	MAY	MTS	MAY	NO	MAY	NO	SHORT	NO	NO
Weirs	Structural	FRM	MTS	MTS	LKY	LKY	NO	NO	MAY	MAY	LONG	NO	NO
Living Shoreline to break offshore waves, reduce erosion	Structural and Nature-Based	CSRM	MAY	MAY	MAY	MTS	MTS	MAY	EXC	EXC	LONG	NO	NO
No Action			NO	NO	NO	NO	NO	MAY	MTS	EXC	MAX	NO	NO

Scale Key:

Score	*Does the action meet project objectives?*	
0	NO	No
0.5	PSB	Possibly
1	MAY	May
1.5	LKY	Likely
2	MTS	Meets
2.5	IMP	Improves
3	EXC	Exceeds

Score	*Timescale*	
0	MAX	Maximum
1	LONG	Long
1.5	MID	Midrange
2	SHORT	Short
3	MIN	Minimum

Score	*Acceptability*
0	NO
2	YES

Figure B:1-3. Types of Measures Evaluated Under the St. Tammany Feasibility Study

Table B:1-3. Summary of Management Strategies Evaluation

Measures	USACE Category	FRM or CSRM	Comments
Habitat Creation to Attenuate Wave Energy, Reduce Erosion (marsh, ridge or coastal forest)	Nature-Based	CSRM	Marsh alone was eliminated as a standalone measure since it would be ineffective in significantly reducing the level of risk reduction. Considered under the shoreline protection alternatives in combination with other measures.
Riparian Habitat to Slow Inland Water Transfer	Nature-Based	FRM	Detention pond measure more effective at storing inland water; areas to covert to riparian habitat for inland water storage were not found in needed areas.
Flood Proofing Residential (Dry and Wet)	Non-Structural	FRM/CSRM	Considered under the non-structural alternatives.

Flood Proofing Critical Infrastructure (Dry and Wet)	Non-Structural	FRM/CSRM	Considered under the non-structural alternatives.
Property Acquisition (Buyouts)	Non-Structural	CSRM	Voluntary buyouts considered under the non-structural alternatives due to the limited life safety concerns.
Relocations	Non-Structural	CSRM	Considered under the non-structural alternatives. Limited to locations of severe repetitive loss.
Evacuation Plans	Non-Structural	CSRM	Needed offer assistance to local and NFS but not captured under this feasibility study.
Optimize Operation of Existing Structures or Projects	Non-Structural	FRM/CSRM	Considered as needed
Flood Warning System	Non-Structural	CSRM and FRM	Eliminated from consideration because the area has an ample forecast/warning system provided by local government.
Elevations of Homes	Non-Structural	CSRM	Considered under the non-structural alternatives. Limited to locations of severe repetitive loss.
Levees and Floodwalls	Structural	CSRM and FRM	Evaluated
Elevate Roadways	Structural	FRM and CSRM	Evaluated
Detention Ponds	Structural	FRM	Evaluated

Bridge Improvements or Replacements	Structural	FRM	Evaluated
Breakwaters	Structural	CSRM	Evaluated as a shoreline protection.
Reservoir	Structural	FRM	Evaluated in combination with detention ponds.
Pumping Stations	Structural	FRM	Evaluated
Seawall, Bulkhead	Structural	CSRM	Evaluated
Ring Berms	Structural	CSRM	Evaluated as a structural measure.
Flood Gates	Structural	CSRM	Evaluated as a structural measure.
Conveyance Channels	Structural	FRM	Evaluated as channel improvements.
Diversion Channels	Structural	FRM	Evaluated

Snagging and Clearing	Structural	FRM	Evaluated
Levee Setback	Structural	FRM/CSRM	Not standalone; will be considered as part of the levee design for alternatives.
Revetments (shoreline)	Structural	FRM	Considered under shoreline protection.
Dredging	Structural	FRM	Evaluated
Weirs	Structural	FRM	Evaluated as channel improvements.
Living Shoreline to break offshore waves, reduce erosion	Structural and Nature-Based	CSRM	Considered under shoreline protection.
No Action			Evaluated

Table B:1-4. Site Specific Management Measures (Measures used to develop the Initial Array of Alternatives and shown in bold.)

Nomenclature for Measure Identification (Measure ID): nature-based measures are denoted with NB; structural measures are denoted with an "S" and nonstructural measures are denoted with an "NS". Each measure within the NB, S and NS measure categories were given a unique numerical value based on the order in which the measure was proposed and/or documented during the study.

Site Specific Management Measure	Measure ID	Category (structural, nonstructural, Nature Based)	Type	Location	Type of Flooding Addressed (CSRM/FRM)	Source	Moved Forward (MF) to Alternatives, Screened (S) with Justification, Does Not Meet (DNM)
Guste Isle	NB-010	Nature Based	Ridge Restoration	Guste Isle	CSRM	Lake Pontchartrain Basin Foundation	S: Duplicative of another measure
Big Branch	NB-013	Nature Based	Living Shoreline	Lacombe	CSRM	St Tammany Coastal Protection and Restoration PO 167	S: Duplicative of another measure
Coastal Protection and Restoration Authority (CPRA) Planning Unit 1	NB-019	Nature Based	Marsh Creation and Restoration (Goose Point)	Lacombe	CSRM	CPRA	S: Duplicative of another measure
PO14 Green Point/Goose Point	NB-020	Nature Based	Marsh Creation and Restoration	Lacombe	CSRM	Coastal Wetlands Planning, Protection and Restoration Act, (CWPPRA)	S: Duplicative of another measure
East New Orleans Land Bridge	NB-022	Nature Based	Restoration	Lake Pontchartrain	CSRM	Coast 2050 Region 1 Strategy	S: Duplicative of another measure
Old Mandeville Shoreline Protection	NB-025	Nature Based	Shoreline Protection	Mandeville	CSRM	City of Mandeville	S: Duplicative of another measure
Eden Isle PO- 21	NB-038	Nature Based	Shoreline Protection	Slidell	CSRM	CWPPRA	S: Duplicative of another measure
Tchefuncte Shoreline PO 167	NB-039	Nature Based	Shoreline Restoration	Tchefuncte	CSRM	St Tammany Coastal Protection and Restoration	S: Duplicative of another measure
St. Tammany Parish Marsh	NB-046	Nature Based	Marsh Restoration	Parish-wide	CSRM	CPRA	S: Duplicative of another measure
Hog Island Restoration	NB-049	Nature Based	Marsh Restoration	Pearl River	CSRM	CWPPRA	S: Duplicative of another measure
Louisiana Coastal	NB-	Nature Based;	Shoreline	Slidell	CSRM	USACE	S: Duplicative of another

Site Specific Management Measure	Measure ID	Category (structural, nonstructural, Nature Based)	Type	Location	Type of Flooding Addressed (CSRM/FRM)	Source	Moved Forward (MF) to Alternatives, Screened (S) with Justification, Does Not Meet (DNM)
Protection and Restoration Authority (LACPRA) Planning Unit 1	051	Structural	Protection; Marsh Creation (Land bridge)				measure
Land bridge	NB-063	Nature Based	Land bridge Restoration	Lake Pontchartrain	CSRM	St Tammany Coastal Protection and Restoration	S: Duplicative of another measure
PO 167 Fritchie Marsh	NB-064	Nature Based	Hydrologic Restoration	Slidell	CSRM	St Tammany Coastal Protection and Restoration	S: Duplicative of another measure
Bayou Chinchuba Plan (Mandeville)	NS-03	Nonstructural	Home Raising	Mandeville	FRM	Southeast Louisiana Urban Flood Damage Reduction Project (SELA)	S: Duplicative of another measure
Home Raising	NS-04	Nonstructural	Home Raising	Parish-wide	CSRM & FRM	USACE	S: Duplicative of another measure
Unknown Pass to Rigolets- (001.SP.101)	S-065	Structural	Shoreline Protection	Rigolets	CSRM	CPRA	S: Duplicative of another measure
Northshore Breakwater	S-066	Structural	Breakwaters	Slidell	CSRM	None Known	S: Duplicative of another measure
Northshore Eden Isle PO 167	S-067	Structural	Breakwaters	Slidell	CSRM	St Tammany Coastal Protection and Restoration	S: Duplicative of another measure
Ring Levees	S-068	Structural	Ring Levees	Slidell	CSRM	CPRA	S: Duplicative of another measure
PO-04 North Goose Point	NB-018	Nature Based	Marsh Creation and Restoration	Lacombe	CSRM	CWPPRA	S: Duplicative of another measure

Site Specific Management Measure	Measure ID	Category (structural, nonstructural, Nature Based)	Type	Location	Type of Flooding Addressed (CSRM/FRM)	Source	Moved Forward (MF) to Alternatives, Screened (S) with Justification, Does Not Meet (DNM)
Lake Pontchartrain Breakwaters	S-034	Structural	Offshore Breakwaters; Armored Shorelines; Shoreline Protection	Lake Pontchartrain	FRM	Lake Pontchartrain Basin Foundation	S: Duplicative of another measure captured in location specific breakwaters
Abita Springs Structure Raising	NS-01	Nonstructural	Structure Raising	Abita	FRM	SELA	S: Duplicative of another measure captured in nonstructural
Lacombe	NS-02	Nonstructural	Structure Raising	Lacombe	FRM & CSRM	SELA	S: Duplicative of another measure captured in nonstructural
St Tammany Parish	NS-06	Nonstructural	Flood proofing, buyouts, relocations, raising, cluster structures	Parish-wide	CSRM & FRM	CPRA	S: Duplicative of another measure captured in nonstructural
West Shoreline Protection	NB-43	Nature Based	Shoreline Protection	West Parish	CSRM	St Tammany Parish	S: Duplicative of another measure captured in Tchefuncte Shoreline Protection
Lake Tension Gate Barrier	S-035	Structural	Floodgate	Lake Pontchartrain	CSRM	None Known	S: Duplicative of another measure included in Surge Barrier Measures
Lake Pontchartrain Shoreline Integrity	NB-023	Nature Based	Maintain Shoreline Integrity	Lake Pontchartrain	CSRM	Coast 2050 Region 1 Strategy	S: Duplicative of another measure included with location specific shoreline measures
Tchefuncte Sub Area	NB-	Nature Based	Shoreline	Tchefuncte	CSRM	Lake Pontchartrain	S: Duplicative of another

Site Specific Management Measure	Measure ID	Category (structural, nonstructural, Nature Based)	Type	Location	Type of Flooding Addressed (CSRM/FRM)	Source	Moved Forward (MF) to Alternatives, Screened (S) with Justification, Does Not Meet (DNM)
	040		Protection; Backfill			Basin Foundation	measure included with location specific shoreline measures
PO 167 Guste Island Living Shoreline	NB-08	Nature Based	Living Shoreline	Guste Isle	CSRM	St Tammany Coastal Protection and Restoration	S: Duplicative of another measure moved forward with Gust Isle measures
Lake Pontchartrain Surge Reduction Alignment	S-036	Structural	Barrier Wall	Lake Pontchartrain	CSRM	CPRA, USACE	S: Duplicative of another measure moved forward with Lake Pontchartrain Barrier Measures
Lake Pontchartrain	S-037	Structural	Closure Gates; Weirs	Lake Pontchartrain	CSRM	CPRA, USACE	S: Duplicative of another measure moved forward with Lake Pontchartrain Barrier Measures
Lake Pontchartrain Surge Reduction Alignment	S-038	Structural	Structures at Bayous & Canals	Lake Pontchartrain	CSRM	CPRA	S: Duplicative of another measure moved forward with Lake Pontchartrain Barrier Measures
Master Plan Nonstructural	NS-05	Nonstructural	Flood proofing, buyouts, relocations, raising, cluster structures	Parish-wide	CSRM & FRM	CPRA	S: Duplicative of another measure of nonstructural measures
Faciane Canal	NB-05	Nature Based	Marsh Creation and Restoration	Bayou Bonfouca	FRM & CSRM	St Tammany Parish	S: Duplicative of another measure with Bayou Bonfouca and West Slidell nature-based measures
Bayou Vincent Detention Pond	S-016	Structural	Detention Pond	Bayou Vincent	FRM	St Tammany Parish	S: Duplicative of another measure with Ben Thomas Pond
Cane Bayou	NB-06	Nature Based	Marsh Creation	Bayou Cane	CSRM	CWPPRA; St.	S: Duplicative of another measure with Big Branch

Site Specific Management Measure	Measure ID	Category (structural, nonstructural, Nature Based)	Type	Location	Type of Flooding Addressed (CSRM/FRM)	Source	Moved Forward (MF) to Alternatives, Screened (S) with Justification, Does Not Meet (DNM)
						Tammany Parish	restoration
Bayou Lacombe	NB-014	Nature Based	Shoreline protection: living shoreline	Lacombe	CSRM	St Tammany Parish	S: Duplicative of another measure with Lacombe shoreline protection, breakwaters, living shoreline
Buyouts	**NS-08**	**Nonstructural**	**Buyouts**	**Parishwide**	**FRM or CSRM**	**PDT**	**MF**
Flood proofing	**NS-09**	**Nonstructural**	**Flood proofing**	**Parishwide**	**FRM or CSRM**	**PDT**	**MF**
Relocations	**NS-010**	**Nonstructural**	**Relocations**	**Parishwide**	**FRM or CSRM**	**PDT**	**MF**
Structure Raising	**NS-011**	**Nonstructural**	**Structure Raising**	**Parishwide**	**FRM or CSRM**	**PDT, CPRA**	**MF**
Maintain East Orleans Land Bridge-Marsh and Shoreline	**NB-024**	**Nature Based**	**Land bridge Restoration**	**Land bridge**	**CSRM**	**CPRA**	**MF**
Pearl river island Marsh Creation	**NB-030**	**Nature Based**	**Marsh Creation**	**Pearl River**	**CSRM**	**CPRA**	**MF**
Pearl river island shoreline protection	**NB-031**	**Nature Based**	**Shoreline Protection**	**Pearl River**	**CSRM**	**CPRA**	**MF**
Lake Pontchartrain Barrier (001.HP.08)	**S-039**	**Structural**	**Flood Gates-Rigolets**	**Lake Pontchartrain**	**CSRM**	**CPRA**	**MF**
Lake Pontchartrain Barrier (001.HP.08)	**S-040**	**Structural**	**Flood Gates-Chef Menteur**	**Lake Pontchartrain**	**CSRM**	**CPRA**	**MF**
Bayou Lacombe restoration	**NB-015**	**Nature Based**	**Marsh Creation and cypress**	**Lacombe**	**CSRM**	**Parish**	**MF**

Site Specific Management Measure	Measure ID	Category (structural, nonstructural, Nature Based)	Type	Location	Type of Flooding Addressed (CSRM/FRM)	Source	Moved Forward (MF) to Alternatives, Screened (S) with Justification, Does Not Meet (DNM)
			restoration				
Lacombe shoreline protection, breakwaters, living shoreline	NB-016	Nature Based	Shoreline Protection	Lacombe	CSRM	Parish	MF
Bayou Lacombe LA 434	S-026	Structural	Detention Ponds	Lacombe	FRM	Parish	MF
Big Branch	S-027	Structural	Detention Ponds	Lacombe	FRM	2016 STP Watershed Study	MF
Lacombe Levee-pump station	S-028	Structural	Levee, Flood Wall	Lacombe	CSRM	CPRA	MF
Combined Levee	S-120	Structural	Levees	Lacombe/ West Slidell	CSRM	PDT	MF
Bayou Bonfouca Breakwaters, living shoreline, marsh creation revetments, etc.	NB-03	Nature Based	Shoreline Protection	Bayou Bonfouca	CSRM	USACE	MF
Bayou Bonfouca Regional Detention Pond	S-004	Structural	Detention Ponds	Bayou Bonfouca	FRM	Parish	MF
Bayou Bonfouca	S-005	structural	Channel Improvements	Bayou Bonfouca	FRM	USACE	MF
Camp Salmen	S-006	Structural	Detention Pond	Bayou Bonfouca	FRM	St Tammany Parish	MF
Camp Villere	S-007	Structural	Detention Ponds	Bayou Bonfouca	FRM	Parish	MF
Bayou Liberty Snagging and	S-010	Structural	Channel Improvements	Bayou Liberty	FRM	Bayou Liberty Watershed Plan	MF

Site Specific Management Measure	Measure ID	Category (structural, nonstructural, Nature Based)	Type	Location	Type of Flooding Addressed (CSRM/FRM)	Source	Moved Forward (MF) to Alternatives, Screened (S) with Justification, Does Not Meet (DNM)
Clearing							
Belair North	**S-011**	**Structural**	**Detention Ponds**	**Bayou Liberty**	**FRM**	**Parish**	**MF**
Belair South	**S-012**	**Structural**	**Detention Ponds**	**Bayou Liberty**	**FRM**	**Parish**	**MF**
Upper Watershed	**S-013**	**Structural**	**Detention Ponds**	**Bayou Liberty**	**FRM**	**Parish**	**MF**
Bayou Vincent	**S-017**	**Structural**	**Channel Improvements**	**Bayou Vincent**	**FRM**	**Parish**	**MF**
Bayou Patassat	**S-080**	**structural**	**Channel Improvements**	**Slidell**	**FRM**	**USACE SELA**	**MF**
West Slidell Levee, pump station	**S-081**	**structural**	**Levee, Flood Wall**	**Slidell**	**CSRM**	**CPRA**	**MF**
Eden Isle breakwaters, shoreline protection, living shoreline	**NB-033**	**Nature Based**	**Shoreline Protection**	**Slidell**	**CSRM**	**CWPPRA**	**MF**
Eden Isle Levee	**S-070**	**Structural**	**Levee, Flood Wall**	**Slidell**	**CSRM**	**CPRA**	**MF**
Levee West of I-10	S-123	Structural	Levee	Eden Isle, Slidell	CSRM	St Tammany Parish	S: Efficiency criteria;
Levee East of I-10	S-124	Structural	Levee	Eden Isle, Slidell	CSRM	St Tammany Parish	S: Efficiency criteria; space for levee and 1-10 crossing
I-10 Median	S-125	Structural	Floodwall	Eden Isle, Slidell	CSRM	St Tammany Parish	S: Efficiency criteria
Floodwall East of I-10	S-126	Structural	Floodwall	Eden Isle, Slidell	CSRM	STPFS-PDT	S: Efficiency criteria

Site Specific Management Measure	Measure ID	Category (structural, nonstructural, Nature Based)	Type	Location	Type of Flooding Addressed (CSRM/FRM)	Source	Moved Forward (MF) to Alternatives, Screened (S) with Justification, Does Not Meet (DNM)
Eastern Lakefront Floodwall	S-127	Structural	Floodwall	Eden Isle, Slidell	CSRM	STPFS-PDT	S: Efficiency criteria
Levee Berm North Lakeview Drive	S-128	Structural	Levee	Eden Isle, Slidell	CSRM	St Tammany Parish	S: Efficiency criteria
Lake Surge Barrier	S-129	Structural	Surge Barrier	Eden Isle, Slidell	CSRM	St Tammany Parish	S: Efficiency criteria
Eden Isle Seawall with Backfill	S-130	Structural	Seawall	Eden Isle, Slidell	CSRM	STPFS-PDT	S: Efficiency criteria
Highway 11 T-wall Median	S-131	Structural	Floodwall	Eden Isle, Slidell	CSRM	St Tammany Parish	S: Efficiency criteria
Levee West of Railroad to Lake	S-132	Structural	Levee	Eden Isle, Slidell	CSRM	St Tammany Parish	MF
Levee East of Hwy 11	S-133	Structural	Levee	Eden Isle, Slidell	CSRM	St Tammany Parish	S: Could be included in optimization of S-132
Schneider Canal Pump Station Improvements	**S-074**	**Structural**	**Pump Stations**	**Slidell**	**CSRM**	**USACE**	**MF**
South Slidell Levees West of 1-10- would include pumps	**S-075**	**Structural**	**Levee, Flood Wall**	**Slidell**	**CSRM**	**CPRA, St Tammany Parish USACE**	**MF**
South Slidell Levees East of 1-10- would include pumps	**S-076**	**Structural**	**Levee, Flood Wall**	**Slidell**	**CSRM**	**Slidell**	**MF**
W-14 Pump Station	**S-077**	**Structural**	**Pump Stations**	**Slidell**	**FRM**	**SELA**	**MF**
Fritchie North Marsh Creation	**NB-34**	**Nature Based**	**Marsh Creation**	**Slidell**	**CSRM**	**St Tammany Parish**	**MF**
Levee North of 1-10	**S-060**	**Structural**	**Levee, Flood**	**Pearl River**	**FRM**	**USACE**	**MF**

Site Specific Management Measure	Measure ID	Category (structural, nonstructural, Nature Based)	Type	Location	Type of Flooding Addressed (CSRM/FRM)	Source	Moved Forward (MF) to Alternatives, Screened (S) with Justification, Does Not Meet (DNM)
along Pearl River-pump station is needed			**Wall**				
Levee South of 1-10 along Pearl River-pump station is needed	**S-061**	**Structural**	**Levee, Flood Wall**	**Pearl River**	**FRM**	**USACE**	**MF**
Doubloon Bayou	S-069	Structural	Channel Improvements	Slidell	FRM	Public	MF
French Branch	S-071	Structural	Channel Improvements	Slidell	FRM	St Tammany Parish	MF
Gum Bayou Diversion	S-072	Structural	Channel Improvements	Slidell	FRM	St Tammany Parish	MF
Poor Boy	S-073	Structural	Channel Improvements	Slidell	FRM	USACE	MF
W-15 Detention Facility	S-078	Structural	Detention Ponds	Slidell	FRM	SELA	MF
W-15 Diversion/ lateral	S-079	Structural	Channel Improvements	Slidell	FRM	PDT	MF
W-15 French Branch	S-119	Structural	Channel Improvements	Slidell	FRM	St Tammany Parish	MF
Mile Branch	S-057	Structural	Channel Improvements	Mile Branch, Covington	FRM	USACE SELA	MF
Bridge restrictions new bridge LA 21 and Tchefuncte	S-101	Structural	Channel improvements	Tchefuncte	FRM	Public	MF

Site Specific Management Measure	Measure ID	Category (structural, nonstructural, Nature Based)	Type	Location	Type of Flooding Addressed (CSRM/FRM)	Source	Moved Forward (MF) to Alternatives, Screened (S) with Justification, Does Not Meet (DNM)
Diverting water west from the Tchefuncte and then south to Lake Pontchartrain	S-105	Structural	Diversion Channel	Tchefuncte	FRM	USACE	MF
Upper Tchefuncte	S-106	Structural	Detention Ponds	Tchefuncte	FRM	St Tammany Parish	MF
Mile Branch- Lateral A	S-121	Structural	Channel Improvements	Mile Branch, Covington	FRM	USACE, SELA	MF
Mandeville Lakefront Living shoreline	NB-026	Nature Based	Shoreline Protection	Mandeville	CSRM	CPRA	MF
Mandeville Lakefront Wetlands Restoration	NB-027	Nature Based	Shoreline Protection	Mandeville	CSRM	CPRA	MF
Mandeville Seawall Replacement	S-046	Structural	Levee, Flood Wall	Mandeville	CSRM	CPRA, St. Tammany Parish Government (STPG)	MF
Raise Seawall with Passive Drainage	S-047	Structural	Levee Flood Wall	Mandeville	CSRM	CPRA	MF
Raise Seawall with Pump Stations	S-048	Structural	Levee, Flood Wall	Mandeville	CSRM	CPRA	MF
Mandeville Flood Barrier/ Floodwall	S-118	Structural	Flood Barrier	Mandeville	FRM	USACE	MF
Mandeville Seawall 18 ft. (100 year)	S-122	Structural	Levee, Flood Wall	Mandeville	CSRM	USACE	MF
Bayou Chinchuba	S-045	Structural	Channel Improvements	Mandeville	FRM	SELA	MF
Abita River Diversion Channel to Lake	S-001	Structural	Channel Improvements	Abita	FRM	PDT	MF
Bush Levee	S-019	Structural	Levee, Flood Wall	Bogue Chitto	FRM	PDT	MF

Site Specific Management Measure	Measure ID	Category (structural, nonstructural, Nature Based)	Type	Location	Type of Flooding Addressed (CSRM/FRM)	Source	Moved Forward (MF) to Alternatives, Screened (S) with Justification, Does Not Meet (DNM)
Alignment							
Sun Levee Alignment	S-020	Structural	Levee, Flood Wall	Bogue Chitto	FRM	USACE	MF
Lower Tchefuncte Shoreline Protection	NB-041	Nature Based	Shoreline Protection	Tchefuncte	CSRM	CWPPRA	MF
Lower Tchefuncte Marsh Creation	NB-042	Nature Based	Marsh Creation	Tchefuncte	CSRM	CWPPRA	MF
Tchefuncte and West St. Tammany Shoreline Restoration	NB-044	Nature Based	Shoreline Protection	West Parish	CSRM	CPRA	MF
Big Branch (BBMNWR); Fontainebleau State Park	NB-017	Nature Based	Dredging and Marsh restoration and creation	Lacombe	CSRM	Lake Pontchartrain Basin Foundation	S: DNM planning objectives
White Kitchen Preserve	NB-035	Nature Based	Restoration	Slidell	CSRM	Nature Conservancy	S: DNM planning objectives
Tchefuncte River/ Madisonville Lighthouse	S-102	Structural	Breakwaters	Tchefuncte	CSRM	Lake Pontchartrain Basin Foundation	S: DNM planning objectives
Bayou Lacombe	NS-07	Non-Structural	Dredging, Navigation	Lacombe		USACE	S: Authorized under another USACE project
Tchefuncte River/ Bogue Falaya	S-103	Structural	Dredging, Navigation	Tchefuncte	FRM	St Tammany Parish	S: Already Authorized Project
Tchefuncte River/Bogue Falaya	S-113	Structural	Channel Improvements	Tchefuncte	FRM & CSRM	USACE operation and maintenance (O&M)	S: Already Authorized Project
Schneider Canal	S-083	Structural	Levee; Floodwall	Slidell	CSRM	USACE SELA	S: Authorized; alternate alignment moved forward

Site Specific Management Measure	Measure ID	Category (structural, nonstructural, Nature Based)	Type	Location	Type of Flooding Addressed (CSRM/FRM)	Source	Moved Forward (MF) to Alternatives, Screened (S) with Justification, Does Not Meet (DNM)
East Fork Little Bogue Falaya	S-021	Structural	Detention Pond	Bogue Falaya	FRM	2020 St Tammany Parish Watershed Study	S: Based on available storage capacity
Parish Wide	S-058	Structural	Drainage Improvements	Parishwide	FRM& CSRM	National Resource Conservation Service (NRCS), STPG, Coast Guard, FEMA	S: Captured in other specific measures
Talisheek Pine Wetlands Preserve	NB-01	Nature Based	Restoration	Abita	FRM	Nature Conservancy	S: Constructed
Abita Creek Flatwoods Preserve	NB-02	Nature Based	Restoration	Abita	FRM	Nature Conservancy	S: Constructed
PO-48 Green Property Preservation	NB-054	Land Acquisition	Preservation of ~22 acres near Lacombe	Lacombe	CSRM	Coastal Impact Assistance Program (CIAP); LA Recovery Authority	S: Constructed
Big Branch; BBMNWR	NB-057	Land Acquisition	6,000 acres of lands	Lacombe	CSRM	Lake Pontchartrain Basin Foundation	S: Constructed
W STP at Lake Pontchartrain	NB-059	Land Acquisition	West STP Coastal Wetland Habitat Purchase	West Parish	CSRM	Lake Pontchartrain Basin Foundation	S: Constructed
Tammany Trace Detention Ponds	S-051	Structural	Detention Ponds	Mandeville	FRM	St Tammany Parish	S: Constructed
City of Slidell (W15; Eastwood; Markhalm/Peachtree)	S-084	Structural	Channel Improvements	Slidell	FRM	FEMA	S: Constructed
S Slidell PO 89	S-085	Structural	Levee Improvements	Slidell	CSRM	CWPPRA;	S: Constructed

Site Specific Management Measure	Measure ID	Category (structural, nonstructural, Nature Based)	Type	Location	Type of Flooding Addressed (CSRM/FRM)	Source	Moved Forward (MF) to Alternatives, Screened (S) with Justification, Does Not Meet (DNM)
Bayou Bonfouca; Northshore Beach	NB-04	Nature Based	Marsh Creation and Restoration	Bayou Bonfouca	CSRM	Lake Pontchartrain Basin Foundation; CIAP; St Tammany Parish	S: Constructed
Fritchie Marsh	NB-036	Nature Based	Marsh creation	Slidell	CSRM	CIAP; St Tammany Parish	S: Constructed
Fritchie North PO 172	NB-037	Nature Based	Marsh Creation & Terracing	Slidell	CSRM	CWPPRA	S: Constructed
Fritchie North Marsh Creation	NB-050	Nature Based	Marsh Creation & Terracing	Slidell	CSRM	CWPPRA; NMFS; STPG	S: Constructed
Abita Detention Pond	S-002	Structural	Detention Ponds	Abita	FRM	St Tammany Parish	S: Constructed
Abita River	S-003	Structural	Detention Pond	Abita	FRM	St. Tammany Parish	S: Constructed
Huntwyck Village	S-018	Structural	Detention Pond	Bayou Vincent	FRM	St. Tammany Parish	S: Constructed
Graci Drive & Briar Lakes Detention Pond	S-031	Structural	Detention Pond	Lacombe	FRM	St. Tammany Parish	S: Constructed
Bayou Castine	S-049	Structural	Detention Pond; Channel Improvements	Mandeville	FRM	St Tammany Parish	S: Constructed
Riverwood Subdivision & Country Club Estates	S-062	Structural	Detention Pond & Drainage Improvements	Ponchitalawa	FRM	St Tammany Parish	S: Constructed
Lake Village Area Slidell	S-086	Structural	Drainage Improvements	Slidell	FRM	St. Tammany Parish	S: Constructed
Robert Road	S-087	Structural	Detention Pond	Slidell	FRM	2024 St Tammany Parish Watershed Study	S: Constructed

Site Specific Management Measure	Measure ID	Category (structural, nonstructural, Nature Based)	Type	Location	Type of Flooding Addressed (CSRM/FRM)	Source	Moved Forward (MF) to Alternatives, Screened (S) with Justification, Does Not Meet (DNM)
Quail Creek/Hidden Pines	S-107	Structural	Detention Pond	Bayou Castine	FRM	St Tammany Parish	S: Constructed
PO-07 Big Branch	NB-045	Nature Based	Cypress Plantings	Lacombe	CSRM	CWPPRA; Nature Conservancy	S: Constructed; duplicative
Cane Bayou; Tammany Trace	NB-052	Land Acquisition	Conservation of natural forest	Bayou Cane	CSRM & FRM	Lake Pontchartrain Basin Foundation	S: DNM planning objectives
Big Branch; Expand BBMNWR	NB-055	Land Acquisition	Expand BBMNWR North of current boundary	Lacombe	CSRM	Lake Pontchartrain Basin Foundation	S: DNM planning objectives
Green Property Preservation Study	NB-056	Land Acquisition	purchase 27.2 acres cypress swamp and bottomland hardwood (BLH)	Lacombe	CSRM	Lake Pontchartrain Basin Foundation	S: DNM planning objectives
Big Branch; BBMNWR	NB-61	Restoration	Restore pine Flatwoods and savannahs.	Lacombe	CSRM	Lake Pontchartrain Basin Foundation	S: DNM planning objectives
Big Branch; BBMNWR	NB-062	Restoration	Prescribed Burning; restoration around ponds	Lacombe	CSRM	Lake Pontchartrain Basin Foundation	S: DNM planning objectives
Tammany Trace Bridge Improvements	S-088	Structural	Channel Improvements	Slidell	FRM	St Tammany Parish 2012 Study	S: DNM planning objectives
Brewster Road	S-041	Structural	Detention Pond	Madisonville	FRM	St Tammany Parish	S: DNM planning objectives; effectiveness
Guste Isle	NB-09	Nature Based	Restoration of Natural Drainage	Guste Isle	CSRM	Lake Pontchartrain Basin Foundation	S: Does not meet planning objectives
Guste Island purchase	NB-053	Land Acquisition	Incorporate Guste Isle into	Guste Isle	CSRM	Lake Pontchartrain Basin Foundation	S: Does not meet planning objectives

Site Specific Management Measure	Measure ID	Category (structural, nonstructural, Nature Based)	Type	Location	Type of Flooding Addressed (CSRM/FRM)	Source	Moved Forward (MF) to Alternatives, Screened (S) with Justification, Does Not Meet (DNM)
			BBMNWR				
LA 30; Lake Pontchartrain	S-109	Structural	Debris Removal	Lake Pontchartrain	CSRM	FEMA	S: Does not meet planning objectives
Northwood Drive/ W15 canal	S-112	Structural	Channel Improvements	Slidell	FRM & CSRM	St Tammany Parish	S: Duplicative
Bayou Chinchuba	S-114	Structure	Detention Pond	Mandeville	FRM	St Tammany Parish	S: Duplicative of another measure
W15 canal	S-089	Structural	Channel Improvements	Slidell	FRM	St Tammany Parish	S: Duplicative (SELA)
PO-09 NW Lake Pontchartrain Shoreline Protection	S-104	Structural	Breakwaters	Tchefuncte	CSRM	CWPPRA; NRCS; CPRA	S: Duplicative included in measures lower Tchefuncte
Tributary 1 to Cypress Bayou	S-108	Structural	Detention Pond	Lacombe	FRM	St Tammany Parish	S: Duplicative to Constructed Project
W14 W Diversion	S-090	Structural	Detention Pond	Slidell	FRM	St Tammany Parish Watershed Study	S: Duplicative of another measure: Constructed
Cypress Bayou	S-032	Structural	Detention Pond	Lacombe	FRM	St Tammany Parish	S: Duplicative of another measure; local drainage
S of North Blvd, Slidell	S-091	Structural	Detention Pond	Slidell	FRM	St. Tammany Parish	S: Duplicative of another measure; W14 W Diversion
Hog Island Restoration	NB-048	Nature Based	Plantings; Restoration	Pearl River	CSRM	St Tammany Parish	S: Effectiveness in meeting planning objectives
Bayou de Zaire (Myrtle Grove)	S-043	Structural	Channel improvements/ Detention Pond	Madisonville	FRM &CSRM	St Tammany Parish	S: Effectiveness: Not recommended in previous study
Invisible Floodwall	S-052	Structural	Floodwall	Mandeville	CSRM	Public	S: Efficiency in meeting

Site Specific Management Measure	Measure ID	Category (structural, nonstructural, Nature Based)	Type	Location	Type of Flooding Addressed (CSRM/FRM)	Source	Moved Forward (MF) to Alternatives, Screened (S) with Justification, Does Not Meet (DNM)
Mandeville Lakefront							planning objectives
PO 0184 Levee	S-117	Structural	Levee	Slidell	CSRM	CPRA	S: In design; S: Duplicative of another measure
Guste Isle	NB-11	Nature Based	Marsh Creation	Guste Isle	CSRM	Lake Pontchartrain Basin Foundation: CWPPRA: CPRA: St Tammany Parish	S: Incorporated into West STP/lower Tchefuncte nature-based shoreline protection measure to move forward.
Guste Isle	NB-12	Nature Based	Restore Cypress Shoreline; Breakwaters	Guste Isle	CSRM	Lake Pontchartrain Basin Foundation	S: Incorporated into West STP/lower Tchefuncte nature-based shoreline protection measure to move forward.
J Smith Pond	S-092	Structural	Detention Pond	Slidell	FRM	St Tammany Parish	S: Limited Information; Local Drainage
Storage Facility North of Cane Bayou Estates	S-008	Structural	Detention Pond	Bayou Cane	FRM	St Tammany Parish	S: local drainage
New Canaan Hills	S-009	Structural	Detention Pond; Channel Improvements	Bayou Castine	FRM	St Tammany Parish	S: local drainage
Drainage Connector to I 12 (Bayou Pacquet)	S-014	Structural	Channel Improvements	Bayou Pacquet	FRM	St Tammany Parish	S: Local Drainage
Century Oaks	S-015	Structural	Detention Pond	Bayou Tete L'Ours	FRM	St Tammany Parish	S: Local Drainage
LA Tice Branch	S-023	Structural	Detention Pond	Covington	FRM	2019 St Tammany Parish Watershed Study	S: Local Drainage
S I12/W HWY 1077	S-024	Structural	Detention Pond	Covington	FRM	St Tammany Parish	S: Local drainage
Cloverland Acres Channel relocation &	S-029	Structural	Conveyance Channel;	Lacombe	FRM	St. Tammany Parish	S: Local drainage

Site Specific Management Measure	Measure ID	Category (structural, nonstructural, Nature Based)	Type	Location	Type of Flooding Addressed (CSRM/FRM)	Source	Moved Forward (MF) to Alternatives, Screened (S) with Justification, Does Not Meet (DNM)
Storage			Detention Pond				
N Cloverland Acres	S-030	Structural	Detention Pond	Lacombe	FRM	St Tammany Parish	S: Local Drainage
Cypress Bayou Intermediate Pond	S-033	Structural	Detention Pond	Lacombe	FRM	St. Tammany Parish	S: Local drainage
Dominion; Ruelle de Chenne	S-042	Structural	Channel Improvements/ Detention Pond	Madisonville	FRM	St. Tammany Parish	S: Local Drainage
N Perriloux Rd (Fox Branch Pond)	S-044	Structural	Detention Pond	Madisonville	FRM	St. Tammany Parish	S: Local drainage
Westwood Regional Detention Pond	S-054	Structural	Detention Pond	Mandeville	FRM	St Tammany Parish (Watershed Initiative)	S: Local drainage
Woodlands & LBC Hazard Mitigation Grant Program Project	S-055	Structural	Detention Pond	Mandeville	FRM	St Tammany Parish	S: Local drainage
Controls at Lakes (Greenleaves)	S-056	Structural	Control Structures	Mandeville	FRM	St Tammany Parish	S: Local drainage
Western STP	S-059	Structural	Channel Improvements	Parishwide	FRM	St Tammany Parish	S: Local Drainage
Crestwood outfall to Harold Park	S-063	Structural	Dry Detention Pond	Ponchitalawa	FRM	St. Tammany Parish	S: Local drainage
Soell St Area	S-064	Structural	Raise Mire Dr	Ponchitalawa	FRM & CSRM	St. Tammany Parish	S: Local Drainage
Cherrywood Subdivision (Slidell)	S-093	Structural	Detention Pond	Slidell	FRM	St Tammany Parish	S: Local drainage
Extend Lowe Pond	S-094	Structural	Channel	Slidell	FRM	St Tammany Parish	S: Local Drainage

Site Specific Management Measure	Measure ID	Category (structural, nonstructural, Nature Based)	Type	Location	Type of Flooding Addressed (CSRM/FRM)	Source	Moved Forward (MF) to Alternatives, Screened (S) with Justification, Does Not Meet (DNM)
Canal			Improvements				
Haas RD Pond	S-095	Structural	Detention Pond	Slidell	FRM	St Tammany Parish	S: Local Drainage
Lakewood Subdivision Channel Improvements & Storage	S-096	Structural	Channel Improvements & Detention Pond	Slidell	FRM	St Tammany Parish	S: Local Drainage
N Forest Subdivision; Queens Property	S-097	Structural	Drainage Improvements	Slidell	FRM	St Tammany Parish	S: Local Drainage
Revere Road	S-110	Structural	Detention Pond	Madisonville	FRM	St. Tammany Parish	S: Local drainage
Harrison Avenue Singing River Subdivision	S-115	Structural	Drainage Improvements	Abita	FRM	St. Tammany Parish	S: Local Drainage
Lynnwood Drive	S-116	Structural	Conveyance Channel	Lacombe	FRM	St. Tammany Parish	S: Local Drainage
N Forest Brook, Pine View Heights Farm	S-082	Structural	Detention Pond	Slidell	FRM	St. Tammany Parish	S: Local Drainage)
Venchy Branch	S-025	Structural	Detention Pond	Covington	FRM	2023 St Tammany Parish Watershed Study	S: Local Drainage/ Development
Pawns LN	S-098	Structural	Channel Improvements (Concrete Lining)	Slidell	FRM	St Tammany Parish	S: Localized benefits
Sludge Pond	S-099	Structural	Sludge Pond	Slidell	FRM	SELA	S: Mitigation Project
LA-39 Coastwide	NB-028	Nature Based	Plantings	Parishwide	CSRM	CWPPRA; CPRA; NRCS	S: Ongoing Construction
Charter Oak Preserve	NB-032	Nature Based	Marsh Restoration	Pearl River	CSRM	Nature Conservancy	S: Ongoing Construction
National Resource Conservation Service	NB-047	Nature Based	Restoration Plantings	Parishwide	CSRM	CPRA; NCRS; LA State Program	S: Ongoing Construction

Site Specific Management Measure	Measure ID	Category (structural, nonstructural, Nature Based)	Type	Location	Type of Flooding Addressed (CSRM/FRM)	Source	Moved Forward (MF) to Alternatives, Screened (S) with Justification, Does Not Meet (DNM)
(NRCS) Vegetative Plantings							
LA-13 Coastal Forest Conservation Initiative	NB-058	Land Acquisition	Coast Forest Initiative	Parishwide	CSRM	CIAP; BOEMRE	S: Ongoing Construction
Goose Point	NB-021	Nature Based	Vegetative Plantings; Restoration	Lacombe	CSRM	St Tammany Parish	S: Ongoing Construction
Lake Ramsey Preserve	NB-07	Nature Based	Marsh Creation and Restoration	Covington	FRM	Nature Conservancy; LDWF	S: Ongoing project
Mandeville Hurricane Risk Reduction	S-053	Structural	Levee	Mandeville	FRM	SELA	S: Public Acceptability/ Sponsor Support
NRCS Biomass Production Program (Coastwide)	NB-060	Research; Nature Based	Restoration Research	Parishwide	CSRM	CPRA; NCRS; LA State Program	S: Research
LA-16 Shoreline Protection Demonstration	NB-029	Nature Based	Shoreline Protection (Research on non-rock)	Parishwide	CSRM	CWPPRA; NCRS	S: Research: DNM planning objectives
Fairway Drive E Detention	S-050	Structural	Detention Pond	Mandeville	FRM	St Tammany Parish	S: Similar Project Constructed
Little Bogue Falaya	S-022	Structural	Detention Pond	Bogue Falaya	FRM	2021 STP Watershed Study	S: Local Benefits only
Mayhaw Branch Detention	S-111	Structural	Detention Pond	Mandeville	FRM	St Tammany Parish	S: Unknown location
W13, W14, W15 Canals Slidell	S-100	Structural	Channel Improvements, Detention Pond	Slidell	FRM	SELA	S: W-14 authorized and W-13 and W-15 duplicative of

Site Specific Management Measure	Measure ID	Category (structural, nonstructural, Nature Based)	Type	Location	Type of Flooding Addressed (CSRM/FRM)	Source	Moved Forward (MF) to Alternatives, Screened (S) with Justification, Does Not Meet (DNM)
			expansion, Culverts, Pump station				other measures

Measures used to develop the Initial Array of Alternatives and shown in bold

Section 2

Formulation of Alternatives

The remaining 62 site-specific management measures were used to develop the Initial Array of Alternatives. Because the study area has separate gravity drainage basins based on United States Geological Survey (USGS) hydrologic sub-basins, Alternatives were developed separately for each distinct drainage area. This plan formulation approach was based on separable elements as defined in Water Resources Development Act (WRDA) 1986 Section 103(f) and Engineer Regulation 1105-2-100, Appendix E, Paragraph E-3, Section c (2). The distinct drainage areas were evaluated independently by the PDT to determine the measures and alternatives that were incrementally justified. In areas where multiple causes for flooding were documented, measures to reduce the risk from the multiple sources were included in an Alternative. Alternatives and measures from the different drainage areas or sub-basins were not compared to each other at this point in the study process. As the study moved through the plan formulation process towards the identification of a Draft TSP, the justified measures from the alternatives were then combined into a comprehensive alternative intended to reduce flood risk to multiple parts of the study area.

This section provides information on the development and screening of the Initial Array of Alternatives and the Focused Array of Alternatives. Also provided is supplementary information on the Final Array of Alternatives that is included in Section 4 of the Main Report.

2.1 INITIAL ARRAY OF ALTERNATIVES

Thirteen Initial Alternatives were assembled by combining the remaining 61 management measures by geographic area/hydrologic sub-units. Alternatives were developed for each of the following areas: Lacombe, Mandeville lakefront, Bayou Chinchuba, Abita, Bogue Chitto, Lower Tchefuncte, Upper Tchefuncte, Eastern Slidell, South Slidell, Bayou Liberty, Bayou Bonfouca, Bayou Vincent and Lake Pontchartrain surge. In some areas, such as Bayou Liberty, Bayou Bonfouca and Bayou Vincent. The drainage areas and hydraulic influence overlap were looked at in combination with adjacent areas. In addition, nonstructural measures were considered across the study area along with a No Action Alternative. The separate alternatives were developed by the PDT by combining all measures related to a given geographic area or source of flooding into a geographic based alternative. The evaluation of alternatives was done by assessing each area and source of flooding separately and were not compared to each other or flood source type. For example, an alternative to address flooding along the Mandeville lakefront was evaluated and screened separately from an alternative that addressed measures to address flooding from the Bogue Chitto River in the northeastern part of the study area.

Figure B:2-1 and Table B:2-1 provide an overview of the measures included in the Initial Array of Alternatives. Figures B:2-2 to Figure B:2-13 show each Alternative that was considered in the Initial Array. Table B:2-2 provides screening notes on the Initial Array of

Alternatives and shows which alternatives were not carried forward to the Focused Array of Alternatives.

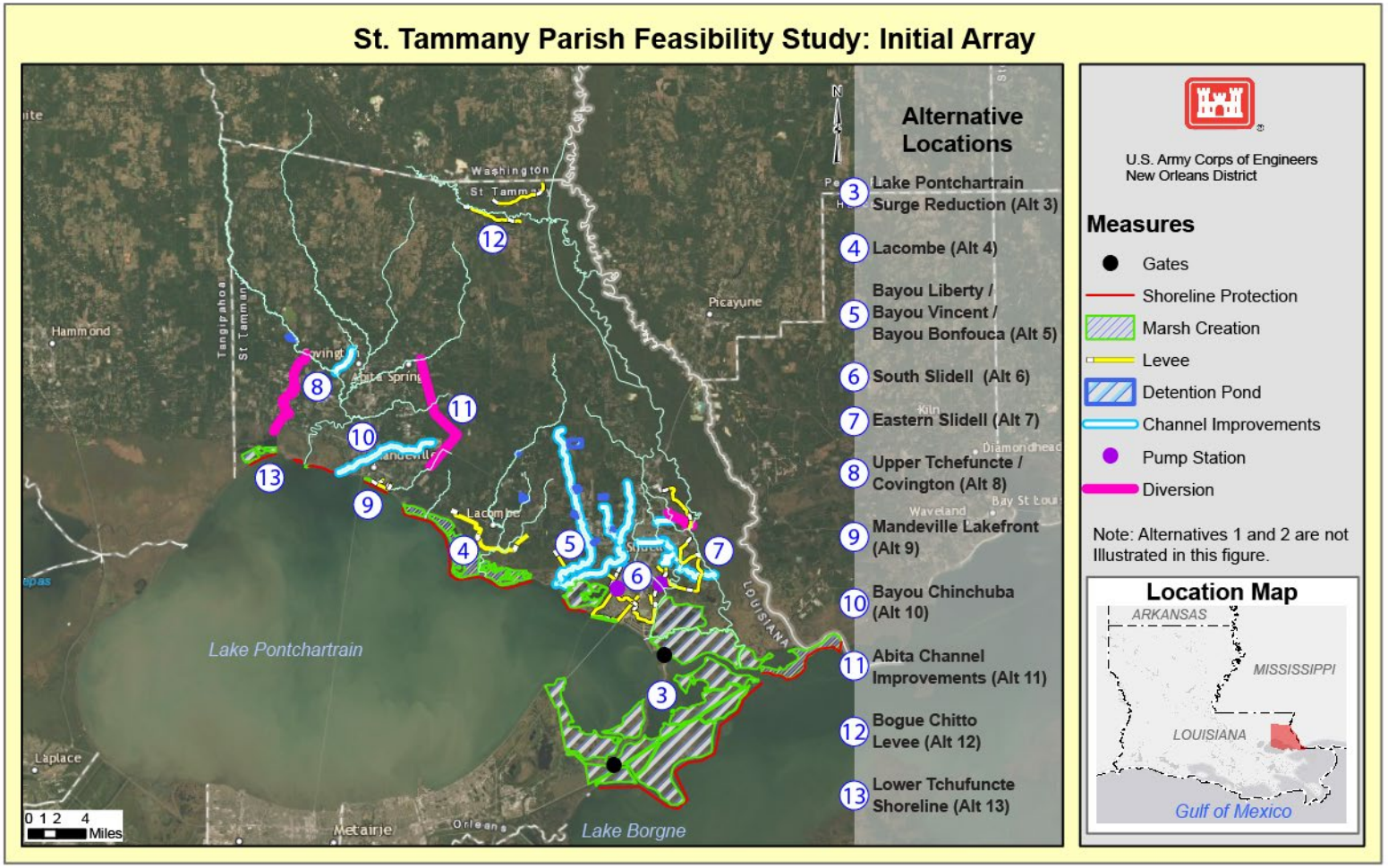


Figure B:2-1. Initial Array of Alternatives (Alternative 1 and Alternative 2 are not depicted on the map)

Table B:2-1. Initial Array of Alternatives (Bolded superscript denotes subbasins with expected flood risk reduction)

	Alternative Name	**Management Measures**								
	Initial Array	Detention ponds (FRM)	Channel / restriction improve (FRM/CSRM)	Diversion channel (FRM)	Pump stations (FRM/CSRM)	Levee, floodwall, seawall (FRM/CSRM)	Flood gates (CSRM)	Shoreline protection breakwater (CSRM)	Marsh creation (CSRM)	Non Structural (FRM/CSRM)
1	No Action Parishwide									
2	Nonstructural Parishwide									NS-008, NS-009, NS-010, NS-011
3	Lake Pontchartrain Surge Reduction 1, 2, 8, 18, 22, 23, 25, 30, 35					S-039, S-040	S-039, S-040	NB-024, NB-031	NB-024, NB-030	NS-008, NS-009, NS-010, NS-011
4	Lacombe 18	S-026, S-027			S-028,	S-028,	S-028,	NB-016	NB-015	NS-008, NS-009, NS-010, NS-011
5	Bayou Liberty/Bayou Vincent/Bayou Bonfouca 1 & 35	S-004, S-006, S-007, S-011, S-012, S-13	S-005, S-017, S-010,		S-80, , S-81	S-80, S-081,	S-80, S-081	NB-003	NB-003	NS-008, NS-009, NS-010, NS-011
6	South Slidell 1 & 23				S-74, S-075, S-076, S-077	S-70, S-075, S-076	S-70, S-075, S-076	NB-33		NS-008, NS-009, NS-010, NS-011
7	Eastern Slidell 1, 13, 17, 23	S-078	S-069, S-071, S-073, S-119	S-072, S-079	S-060, S-061	S-060, S-061	S-060, S-061		NB-34	NS-008, NS-009, NS-010, NS-011
8	Upper Tchefuncte/Covington 2, 10, 31	S-106	S-057, S-101, S-121	S-105						NS-008, NS-009, NS-010, NS-011
9	Mandeville Lakefront 8				S-048	S-046, S-118,	S-047	NB-026	NB-027	NS-008, NS-009, NS-010, NS-011
10	Bayou Chinchuba 30		S-045							NS-008, NS-009, NS-010, NS-011
11	Abita Channel Improvements 2, 24, 31			S-001						NS-008, NS-009, NS-010, NS-011

12	Bogue Chitto Levee 6				S-019, S-020	S-019, S-020	S-019, S-020			NS-008, NS-009, NS-010, NS-011
13	Lower Tchefuncte Shoreline 2,22							NB-041, NB-044	NB-042	NS-008, NS-009, NS-010, NS-011

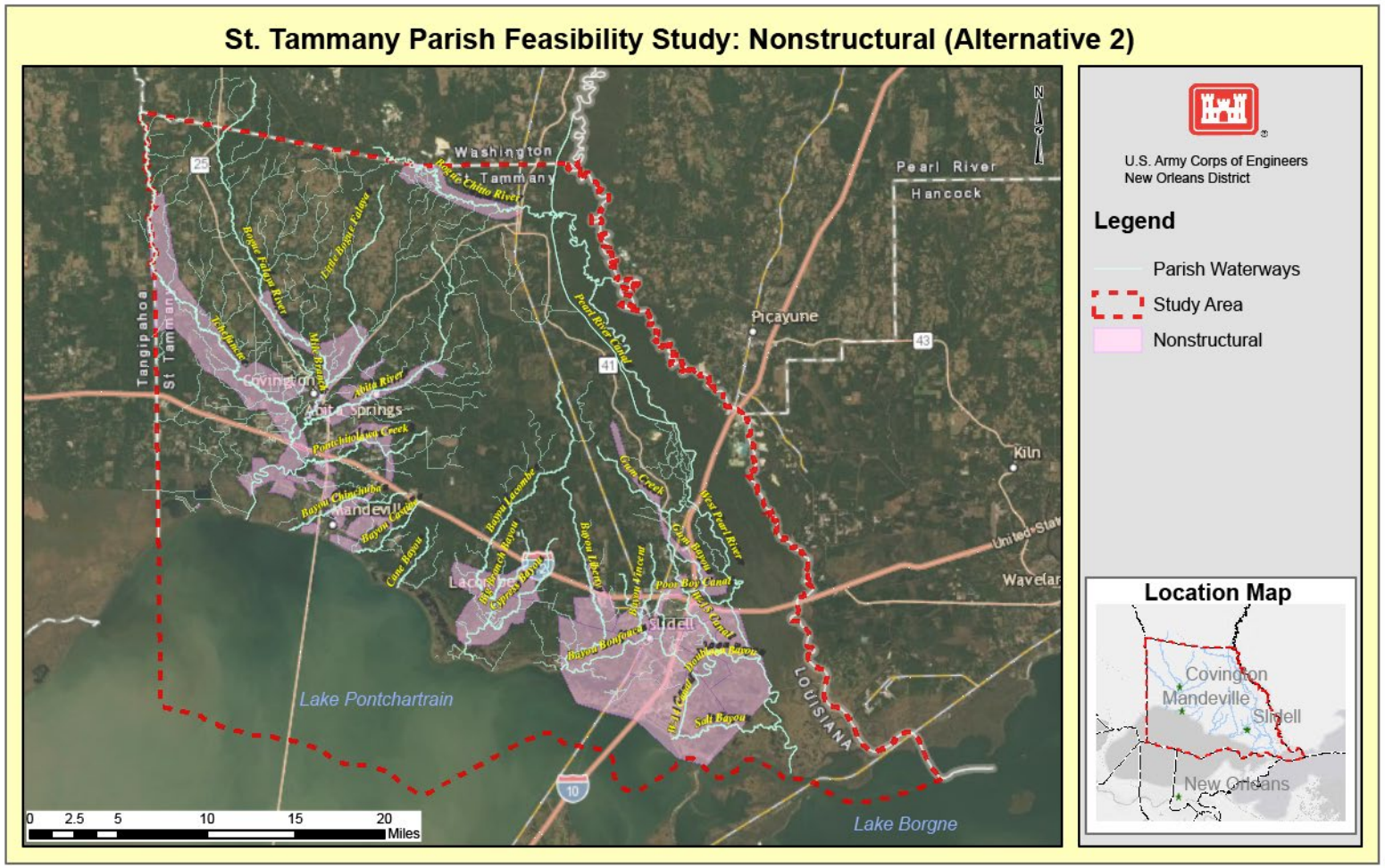


Figure B:2-2. Alternative 2 - Nonstructural

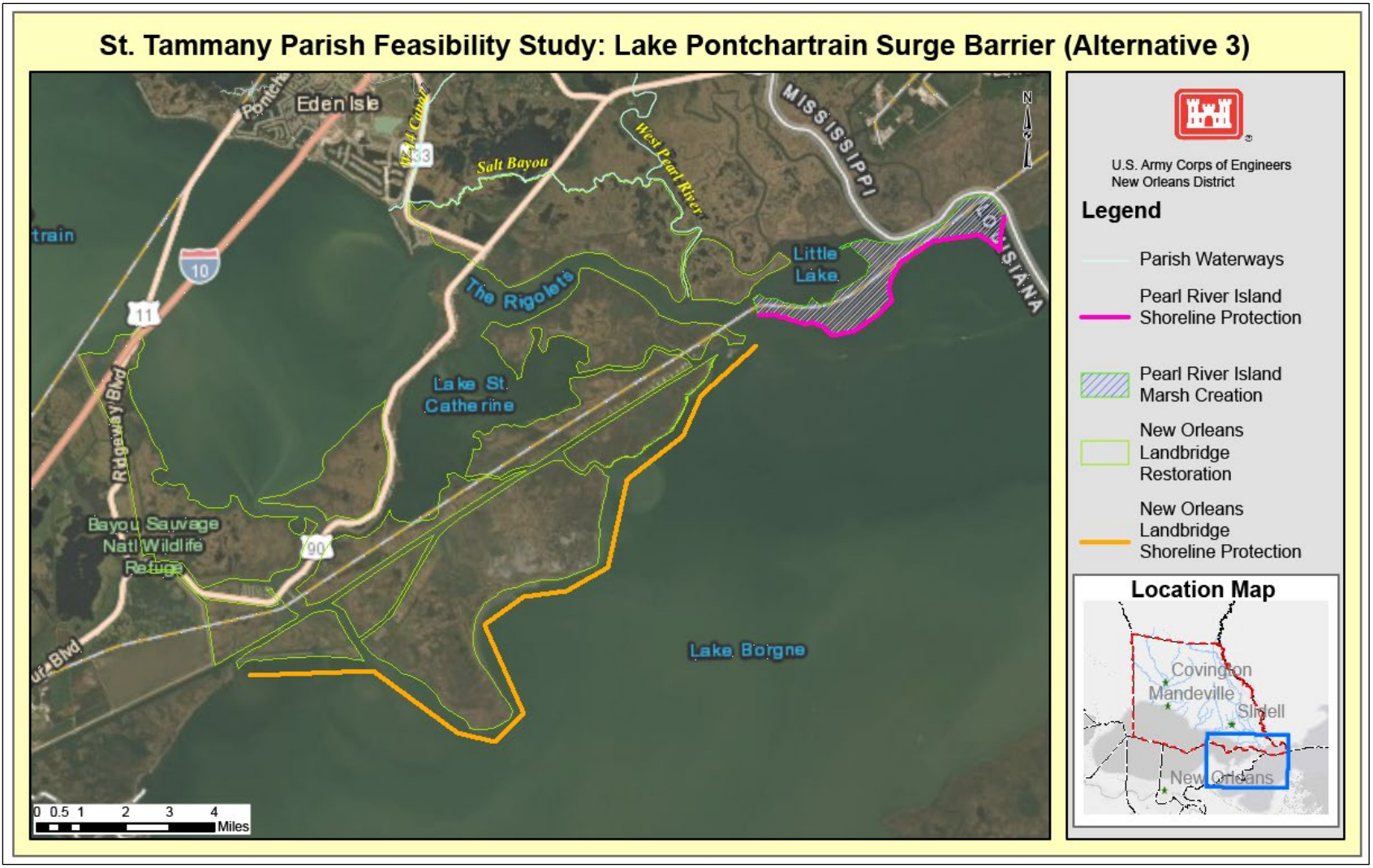


Figure B:2-3. Alternative 3 – Lake Pontchartrain Surge Barrier

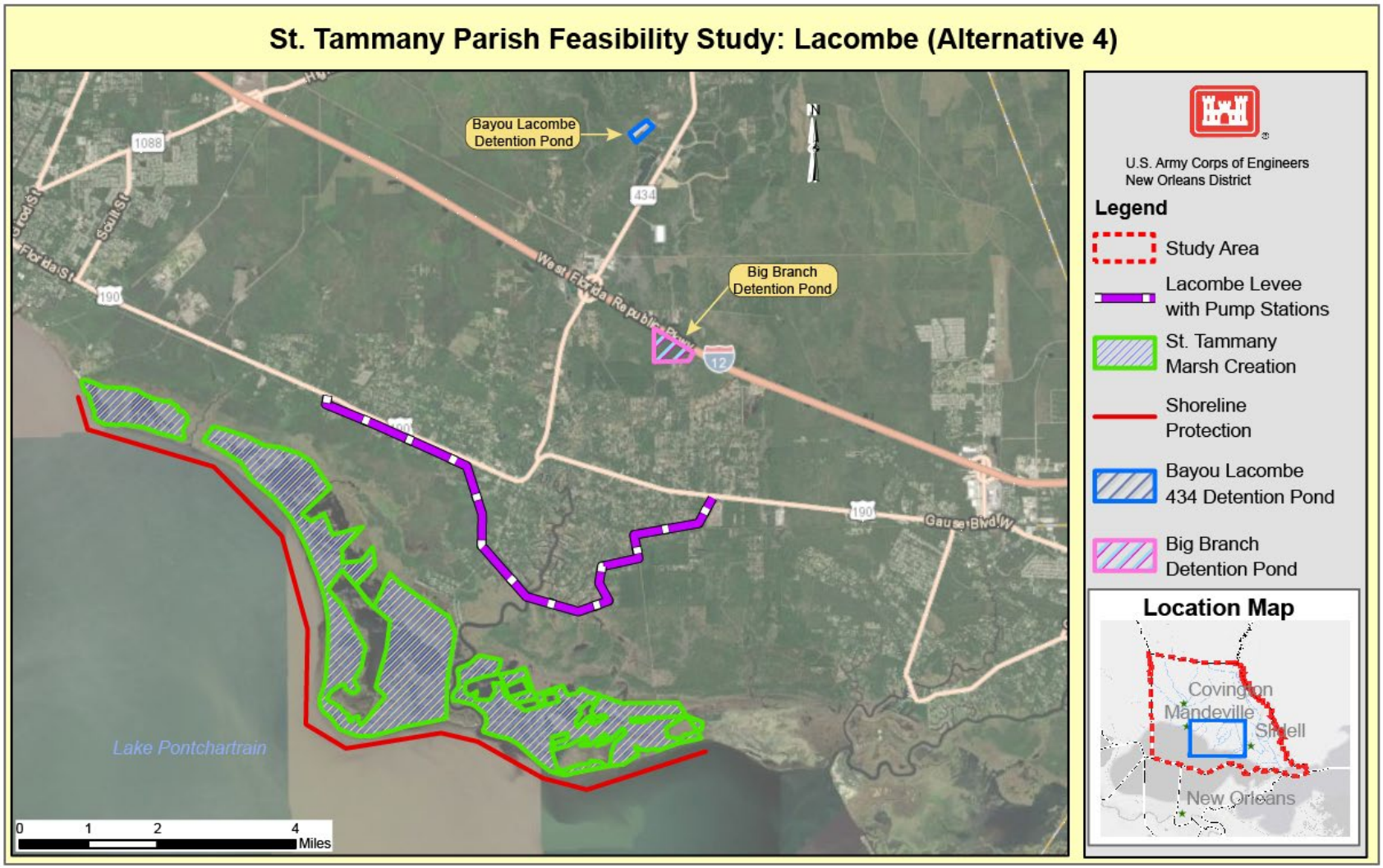


Figure B:2-4. Alternative 4 - Lacombe

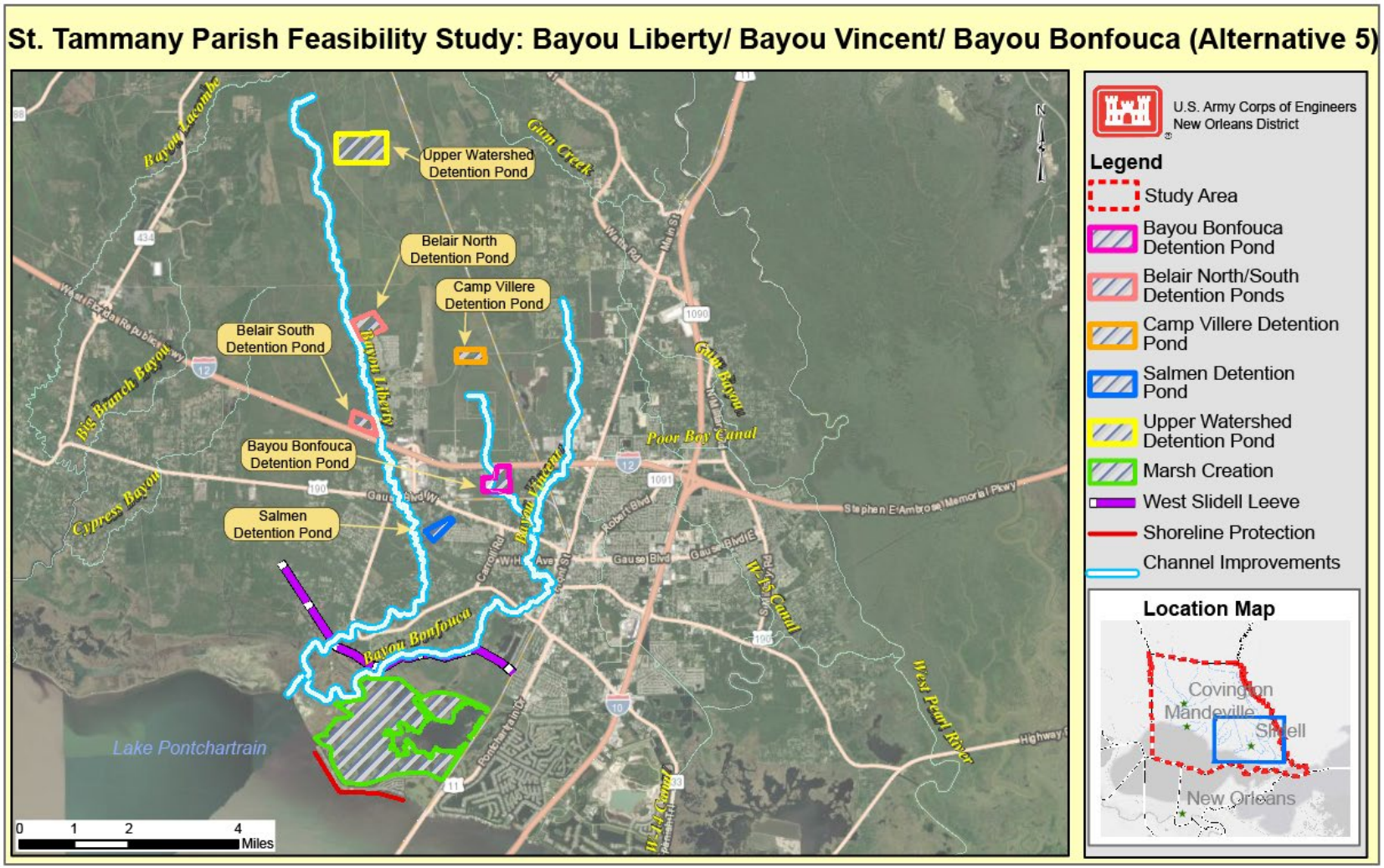


Figure B:2-5. Alternative 5 - Bayou Vincent/ Bayou Liberty/ Bayou Bonfouca

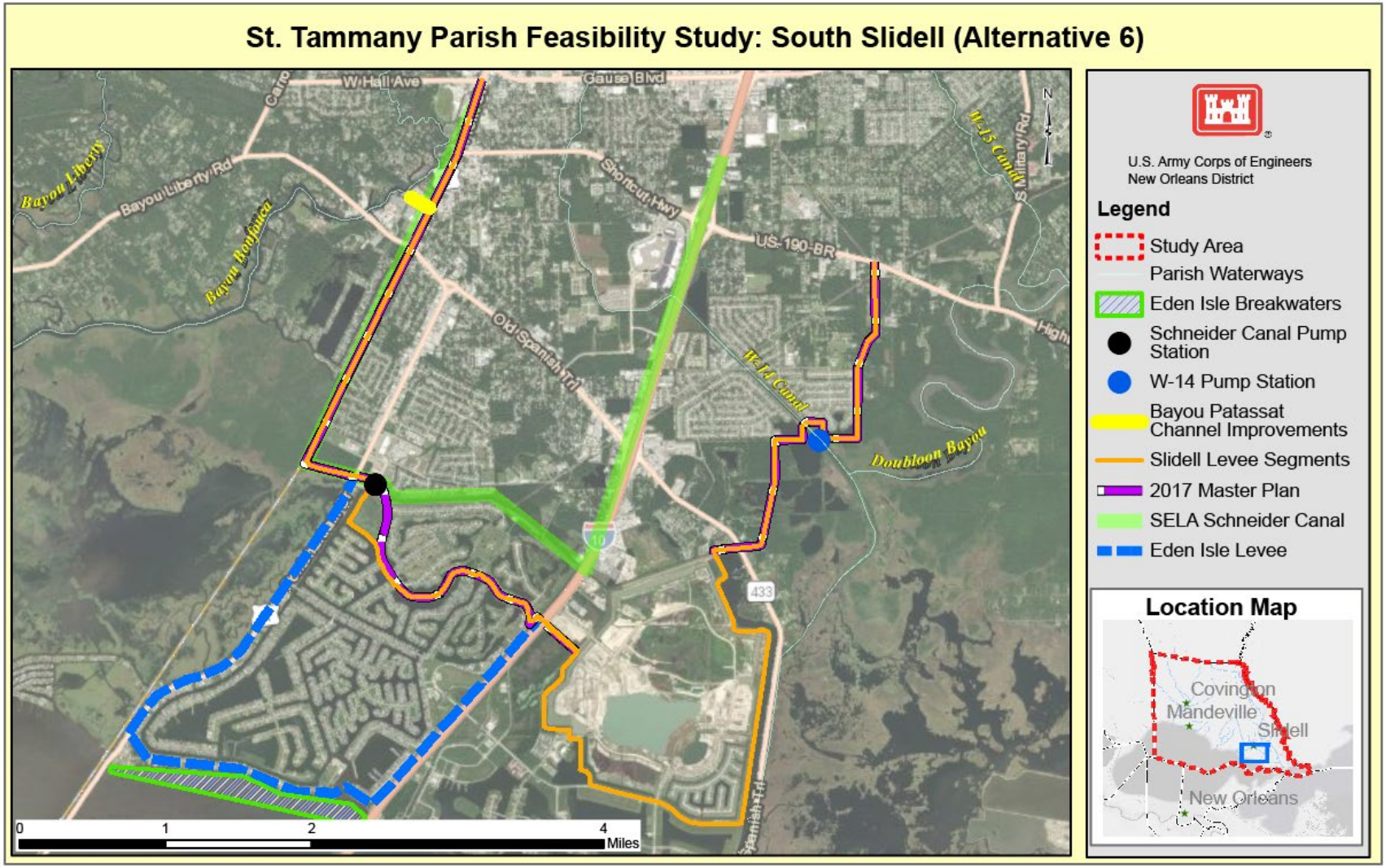


Figure B:2-6. Alternative 6 - South Slidell

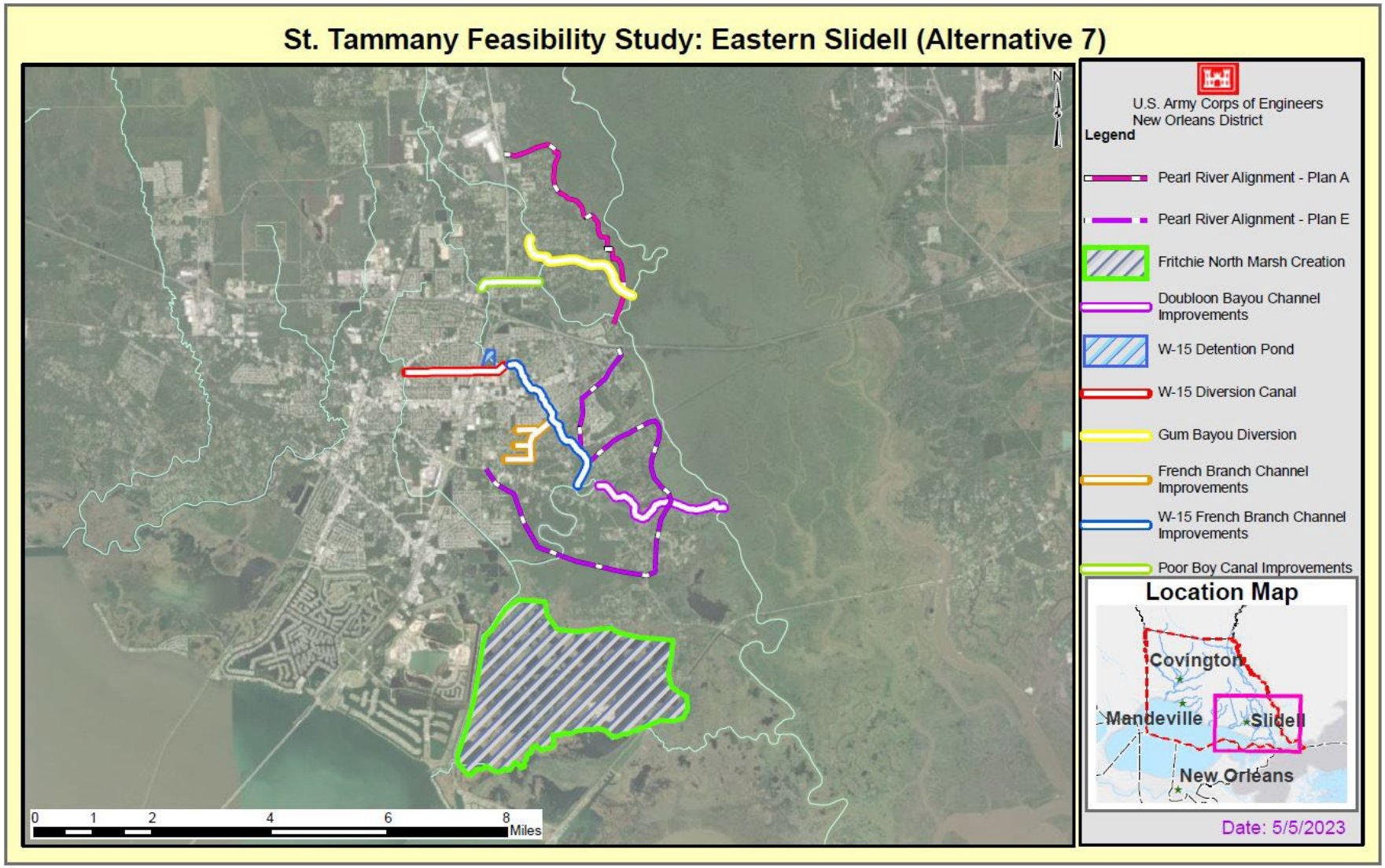


Figure B:2-7. Alternative 7 - Eastern Slidell

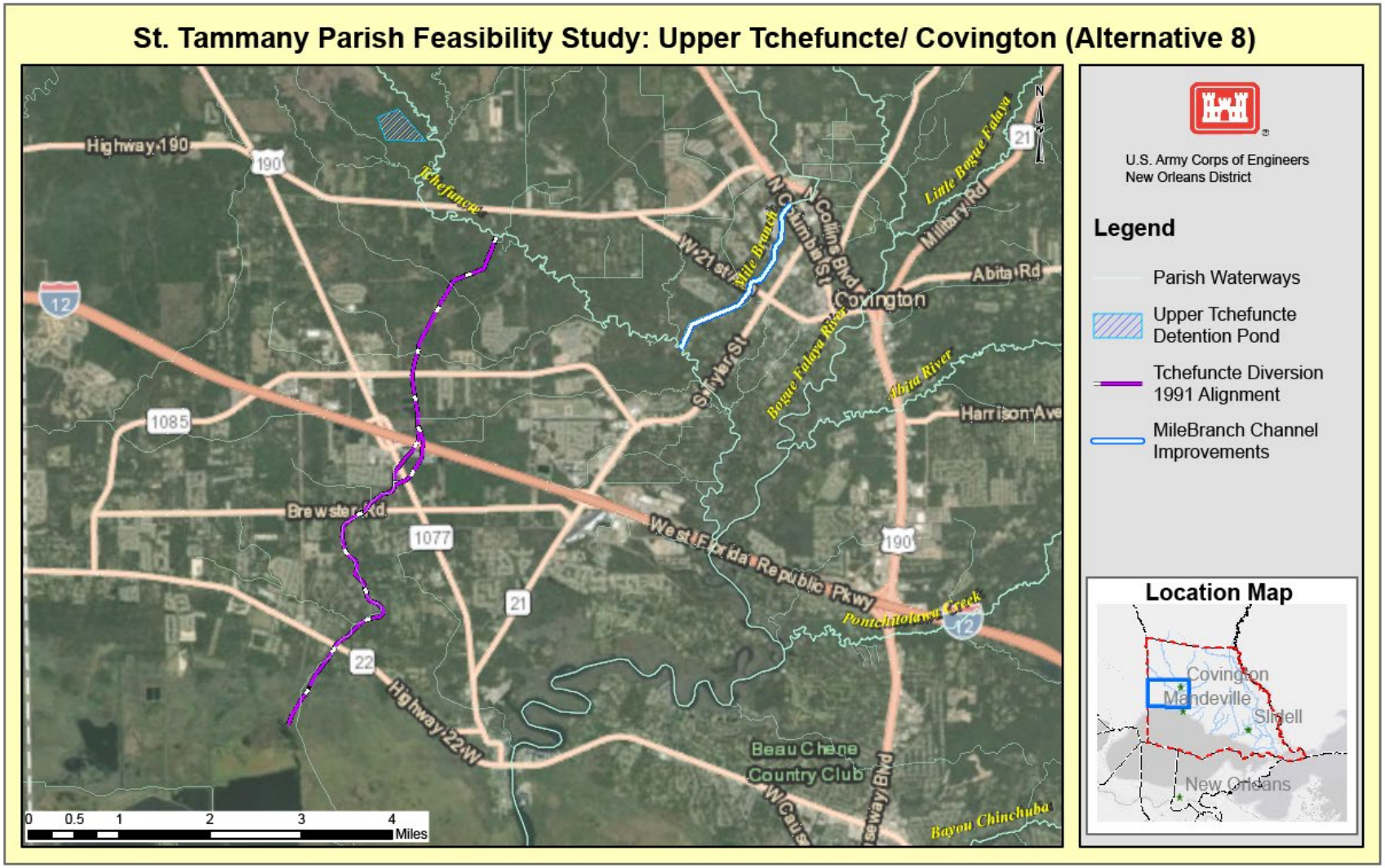


Figure B:2-8. Alternative 8 - Upper Tchefuncte/Covington

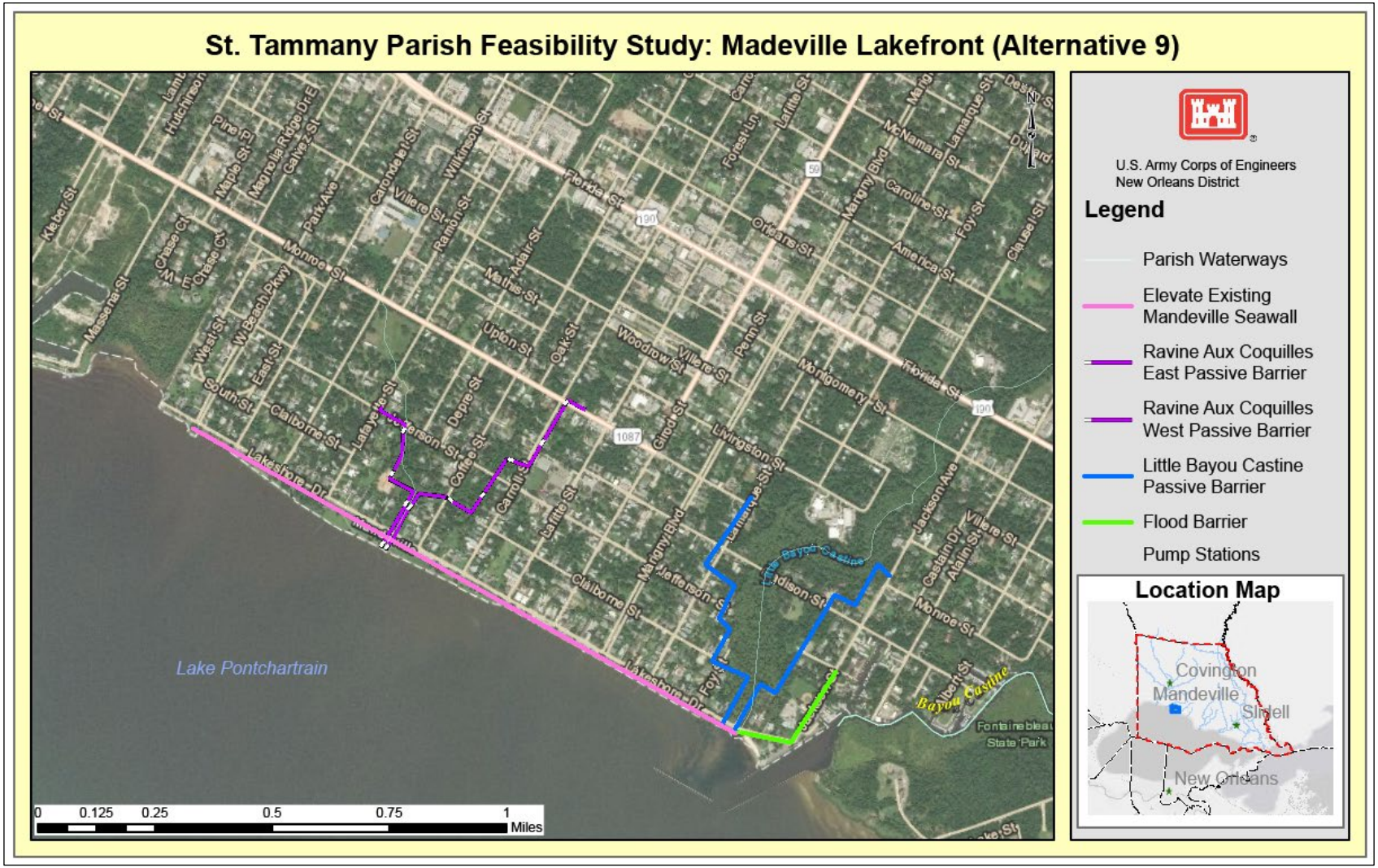


Figure B:2-9. Alternative 9 – Mandeville Lakefront

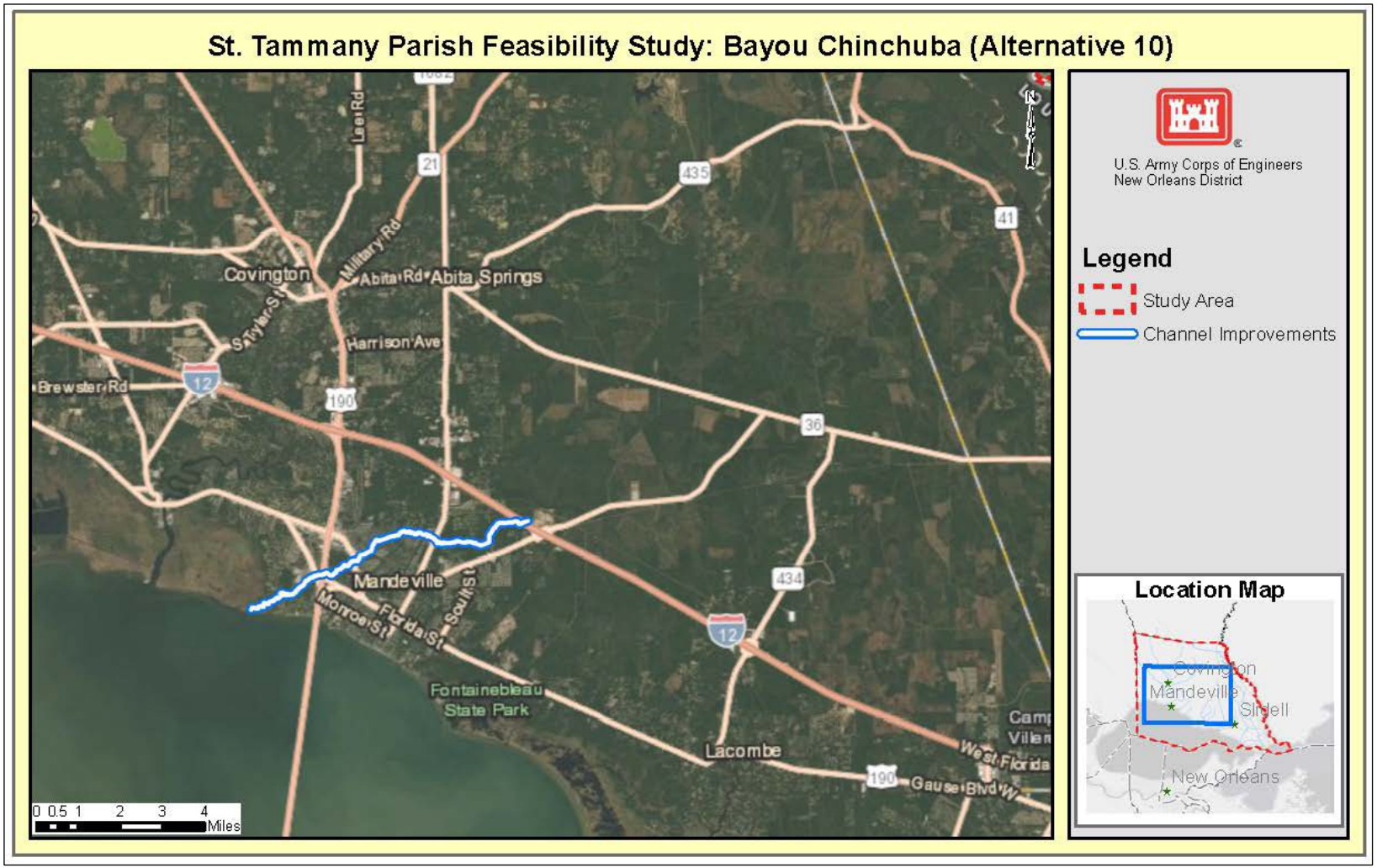


Figure B:2-10. Alternative 10 – Bayou Chinchuba

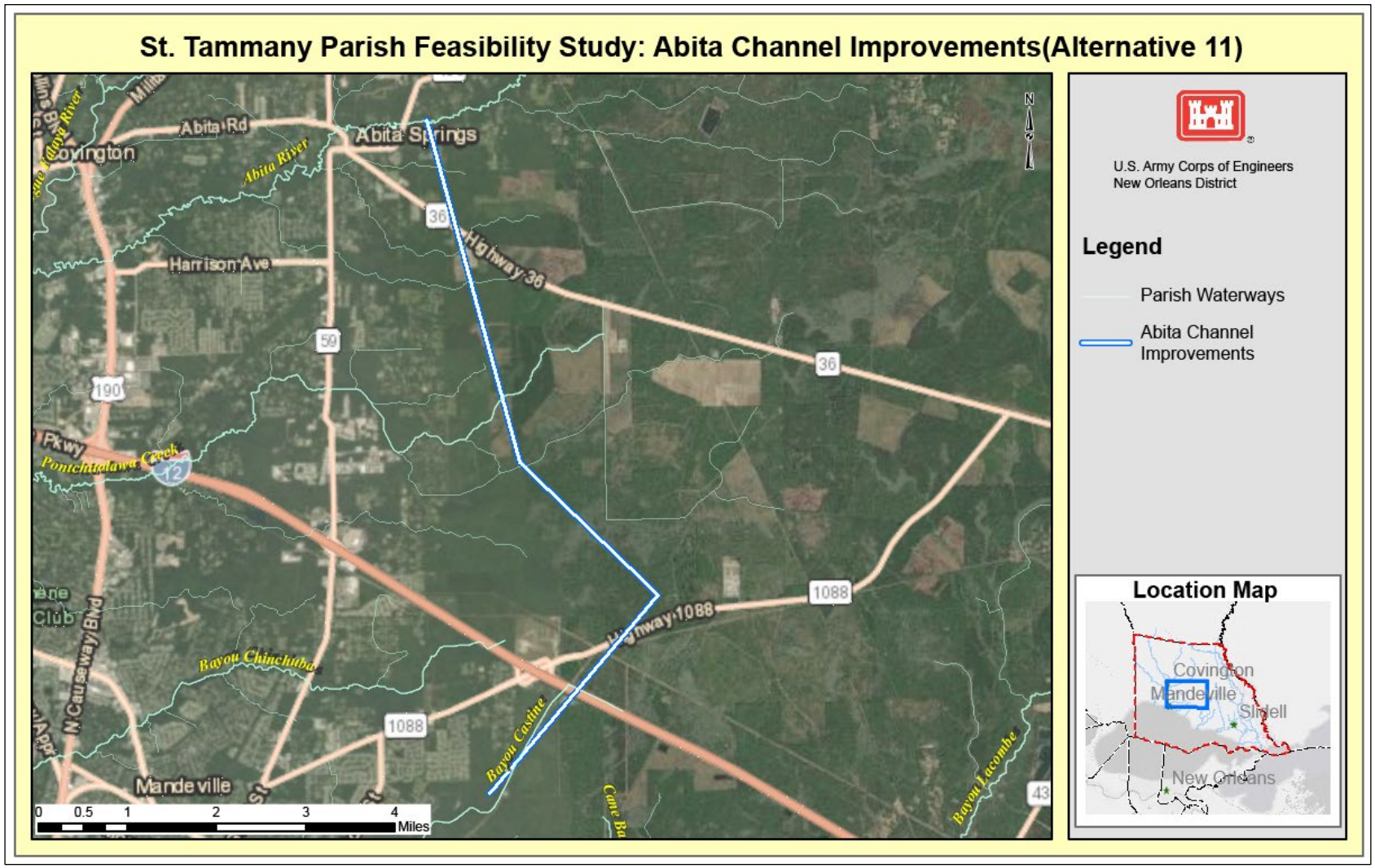


Figure B:2-11. Alternative 11 – Abita Channel Improvements

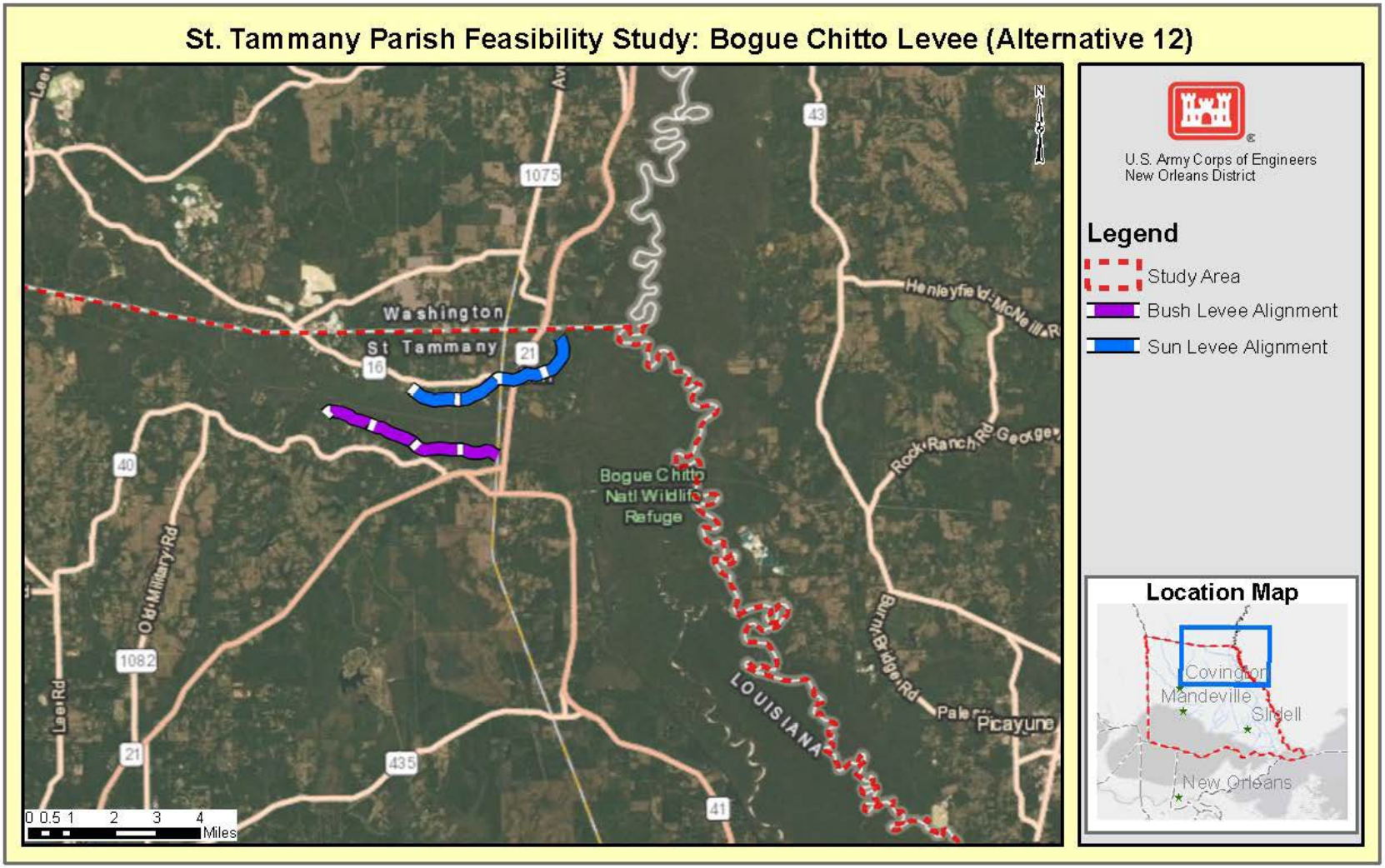


Figure B:2-12. Alternative 12 - Bogue Chitto Levee

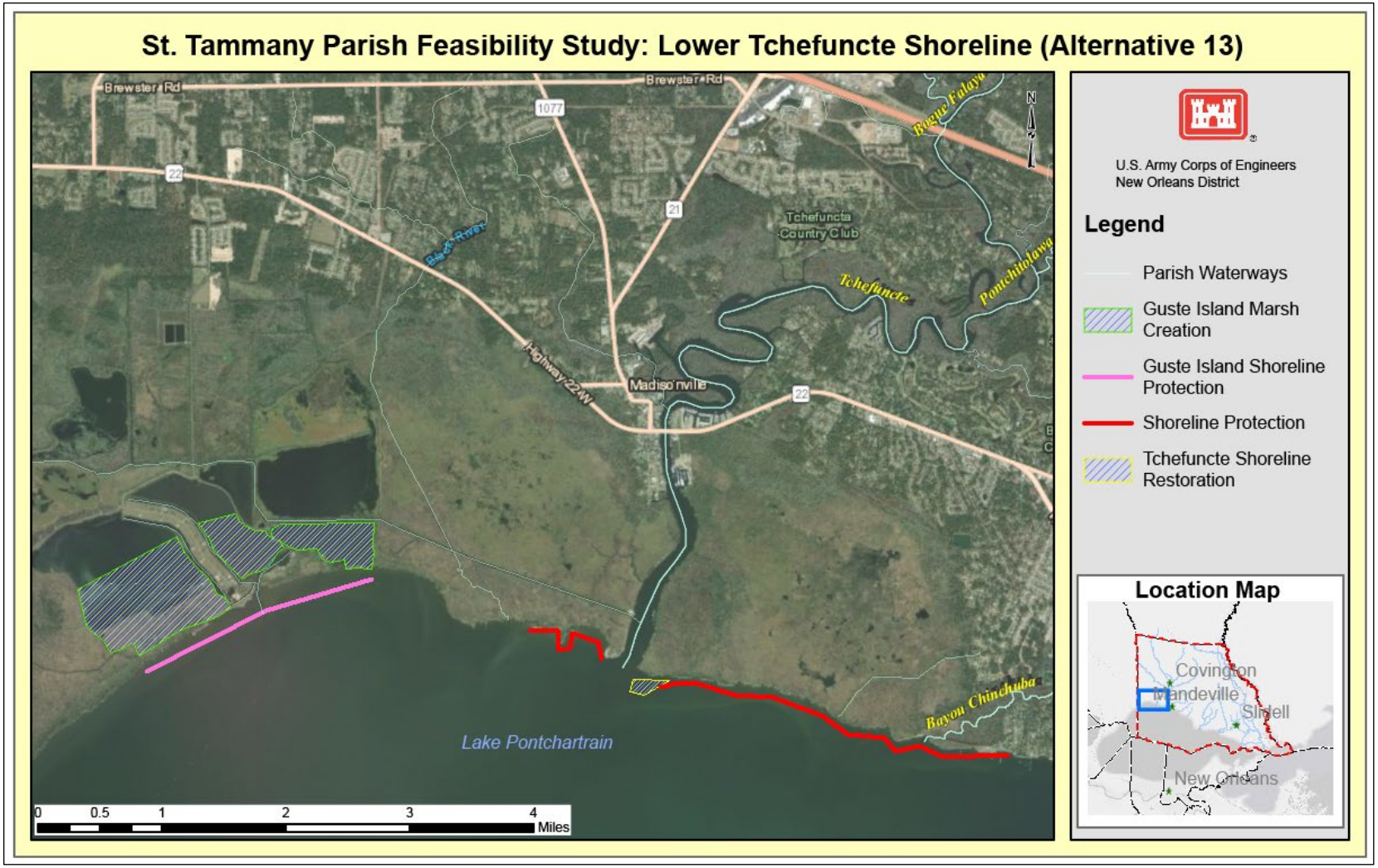


Figure B:2-13. Alternative 13 - Lower Tchefuncte Shoreline

The PDT evaluated each measure within the Initial Array of Alternatives separately to determine if the measure was justified in accordance with ER 1105-2-100 and WRDA 1986. Table B:2-2 presents the results of the screening process used to evaluate the Initial Array and develop a refined set of Alternatives; this next smaller set of Alternatives is called the Focused Array. Geographic areas that were screened from the structural alternatives continued to be evaluated for nonstructural measures throughout the process. The following criteria were used to screen the Initial Array of 13 Alternatives:

- Meets planning objectives.
- Meets USACE definition for FRM vs local storm drainage- ER-1165-2-21, with flows greater than 800 cfs.
- Scale-detention ponds can store at least 1,000-acre feet of water.
- Potential damages do not exceed implementation cost. For the initial economic analysis, the estimated annual damages (EAD) over the 50-year period of analysis were calculated using the Flood Damage Reduction Analysis (HEC-FDA) software based on preliminary existing condition H&H modeling at the subbasin level. The expected maximum cost of a project that could be implemented based on the estimated damages was calculated from the without project EAD. For the screening of the Initial Array, the PDT assumed it could capture 75 percent of benefits of an implemented measure or alternative. The PDT then compared the maximum cost supported estimate for each measure to cost estimates gathered from previous reports and previous similar projects. Criteria for justification requires a benefit cost ratio of <1.
- The proposed solutions are in line with, and do not contradict, the St. Tammany Master Plan and the Louisiana Coastal Protection and Restoration Authority Master Plan.
- Meets the four P&G criteria from the - https://planning.erdc.dren.mil/toolbox/library/Guidance/Planning%20Manual.pdf
    - Completeness - The extent to which the alternative plans provide and account for all necessary investments or other actions to ensure the realization of the planning objectives, including actions by other Federal and non-Federal entities.
    - Effectiveness - The extent to which the alternative plans contribute to achieve the planning objectives.
    - Efficiency - The extent to which an alternative plan is the most cost-effective means of achieving the planning objectives.
    - Acceptability - The extent to which the alternative plans are acceptable in terms of applicable laws, regulations and public policies.
- Avoids violating study constraints.

Table B:2-2. Initial Array of Alternatives

	Initial Array of Alternatives	Screening Notes
1	No Action	Moved forward to the Focused array.
2	Nonstructural	All measures moved forward to the Focused array: NS- 08, NS- 09, NS- 10 and NS- 11.
3	Lake Pontchartrain Surge Reduction	Measures moved forward to the Focused array: NB-024, NB-030 and NB- 031. **Screened Measures: S-039 and S-040.** **Structural measures including the weir and gates were removed from consideration based on the effectiveness of the measure reducing flood risk and the estimated implementation cost being higher than potential damages avoided.**
4	Lacombe	Measures moved forward to the Focused array: S-028, , NB-015 and NB-016. **Screened: S-026 and S-027.** **FRM Detention ponds were removed from this alternative. Potential damages avoided do not exceed implementation cost for the Lacombe detention ponds.** **Potential concerns were raised related to impacts to adjacent the Wildlife refuge from S-028; the PDT documented that the levee will be designed to avoid and minimize impacts.**
5	Bayou Liberty/ Bayou Vincent/Bayou Bonfouca	Measures moved forward to the Focused array: S-004, S-010, S-013, S-017, S-080, S-081, and NB-003. **Screened Measures: S-005, S-006, S-007, S-011, and S-012.** **Salmen Property Detention Pond was removed from consideration because it violated the recreation planning consideration. The estimated costs for the Belair North and South Detention Ponds exceeded the damages avoided. Additional information was obtained for the Camp Villere site and it was determined to not meet the Scale screening criteria.** **Channel improvements along Bayou Bonfouca were screened due to violating the project constraint related to HTRW.**
6	South Slidell	Measures moved forward to the Focused array: S-070, S-074, S-075, S076, S-077 and NB-33.
7	Eastern Slidell	Measures moved forward to the Focused array: S-060, S-061, S-069, S-071, S072, S-073, S-078, S-079, S-119 and NB-34
8	Upper Tchefuncte/ Covington	Measures moved forward to the Focused array: S-057, S-105, S-106 and S-121. **Screened Measures: S-101 bridge restriction was screened after further analysis did not show significant hydrology restrictions at the proposed location; action would not reduce flood damages.**
9	Mandeville Lakefront	Measures moved forward to the Focused array: S-046, S-047, S-048, S-118. **Screened Measures: NB-26 and NB-27. Shoreline protection and marsh creation were screened out due to effectiveness; these measures would not provide a measurable benefit beyond the surge reduction already received from the seawall.**

10	Bayou Chinchuba	Not carried forward to the Focused array. **Screened Measures: S-045** **After further coordination the St. Tammany Parish Government informed that a detention pond was constructed in 2012 and they reported that there has not been continued documented flooding issues.**
11	Abita Channel Improvements	Measures moved forward to the Focused array: S-001. Estimated to contribute ~21-32% of the total flow where the Tchefuncte, Bogue Falaya and Abita Rivers meet.
12	Bogue Chitto Levee	Not carried forward to the Focused array. **Screened Measures: S-019 and S-020.** **Avoided damages are less than the implementation cost for a structural feature.**
13	Lower Tchefuncte Shoreline	Not carried forward to the Focused array. **Screened Measure: NB 41, NB 42, and NB 44.** **This alternative was estimated to have limited coastal storm risk reduction. Storm surge was documented to go around and over the marsh and shoreline, and in this particular case, also up the Tchefuncte River.**

Three Alternatives (10, 12 and 13), in the Initial Array of 13 Alternatives were screened and removed from consideration. Alternative 10 was screened due to limited opportunities for improvement based on recently constructed projects. Alternative 12, which proposed levees to reduce risk from riverine flooding from the Bogue Chitto River, was screened because the estimated damages avoided were lower than the estimated implementation cost. The nature-based measures in Alternative 13 were screened due to the limited CSRM risk reduction benefits.

During the evaluation of the Initial Array of Alternatives, some of the management measures within alternatives were determined not to be justified. In those cases, the measures that were not justified were removed from the alternatives that moved forward to the Focused Array to reflect only the management measures that were justified (Table B:2-2).

The following measures within alternatives were screened (see Table B:2-2 for justification for each): Alternative 3 Structural Measure, Alternative 4 Detention Ponds, and in Alternative 5, Detention Ponds at the Salmen, Belair North, Belair South, and Villere sites and channel improvements along Bayou Bonfouca. Alternative 9 was modified to no longer include nature-based measures. A total of 18 measures were screened from the Initial Array of Alternatives. Nonstructural alternatives were still considered and moved forward in the subbasins and areas where these structural and nature-based measure were screened.

2.1.1 Lake Pontchartrain Storm Surge Evaluation

The study considered a few options to reduce storm surge from entering Lake Pontchartrain. These storm surge reduction measures include gate structures at the main passes, including the Rigolets, and marsh creation and shoreline protection. The gate structures were screened from consideration based on effectiveness. The estimated cost to construct the gate barrier exceeded estimated damages avoided to the study area. For this evaluation,

the PDT was only able to try to justify the project by avoiding damages in the study area. Previous studies had looked at benefits to multiple parishes and areas. Also, the potential mitigation costs for environmental impacts and flooding impacts to the State of Mississippi has not yet been incorporated into the cost estimate.

Marsh creation and shoreline protection features were also screened due the lack of efficiency in reducing storm surge impacts. Previous studies and research conducted in the study area were used by the PDT to determine how much water levels would be expected to be reduced based on the potential increases in marsh creation acreage and shoreline protection. The PDT's analysis showed that the expected costs of such features outweighed the storm surge reduction benefits. Additionally, the marsh creation features were expected to have high Operation Maintenance Repair Replacement & Rehabilitation costs with respect to maintaining marsh at certain elevations to reduce only a minimal amount of surge.

2.2 FOCUSED ARRAY OF ALTERNATIVES

Additional details on the Focused Array of Alternatives, which were the alternatives that remained after screening the Initial Array, are included below. The Focused Array included 11 alternatives, made up of 43 measures and is illustrated in Table B:2-3. Maps depicting the Focused Array are presented in Figures B:2-14 through B:2-23. A summary of the screening of the Focused Array to determine the Final Array of Alternatives can be found in Table B:2-4.

Table B:2-3. Focused Array of Alternatives (Bolded superscript denotes subbasins with expected flood risk reduction)

	Alternative Name	**Management Measures**								
	Focused Array	Detention ponds (FRM)	Channel / restriction improve (FRM/CSRM)	Diversion channel (FRM)	Pump stations (FRM/CSRM)	Levee, floodwall, seawall (FRM/CSRM)	Floodgates (CSRM)	Shoreline protection breakwater (CSRM)	Marsh creation (CSRM)	Non structural (FRM/CSRM)
1	No Action Parishwide									
2	Nonstructural Parishwide									NS-008, NS-009, NS-010, NS-011
3	Lake Pontchartrain Surge Reduction 1, 2, 8, 18, 22, 23, 25, 30, 35							NB-024, NB-031	NB-024, NB-030	NS-008, NS-009, NS-010, NS-011

4	Lacombe 18				S-028,	S-028,	S-028, S-	NB-016	NB-015	NS-008, NS-009, NS-010, NS-011
5	Bayou Liberty/Bayou Vincent/Bayou Bonfouca 1 & 35	S-004, S-13	S-010, S-017, S-080		S-81,	S-81,	S-081	NB-003	NB-003	NS-008, NS-009, NS-010, NS-011
6	South Slidell 1 & 23				S-74, S-075, S-076, S-077	S-70, S-075, S-076	S-70, S-075, S-076	NB-33		NS-008, NS-009, NS-010, NS-011
7	Eastern Slidell 1, 13, 17, 23	S-078	S-069, S-071, S-073, S-119	S-072, S-079	S-060, S-061	S-060, S-061	S-060, S-061		NB-34	NS-008, NS-009, NS-010, NS-011
8	Upper Tchefuncte/Covington 2, 10, 31	S-106	S-057, S-101, S-121	S-105						NS-008, NS-009, NS-010, NS-011
9	Mandeville Lakefront 8				S-048	S-046, S-118,	S-047			NS-008, NS-009, NS-010, NS-011
11	Abita Channel Improvements 2, 24, 31			S-001						NS-008, NS-009, NS-010, NS-011

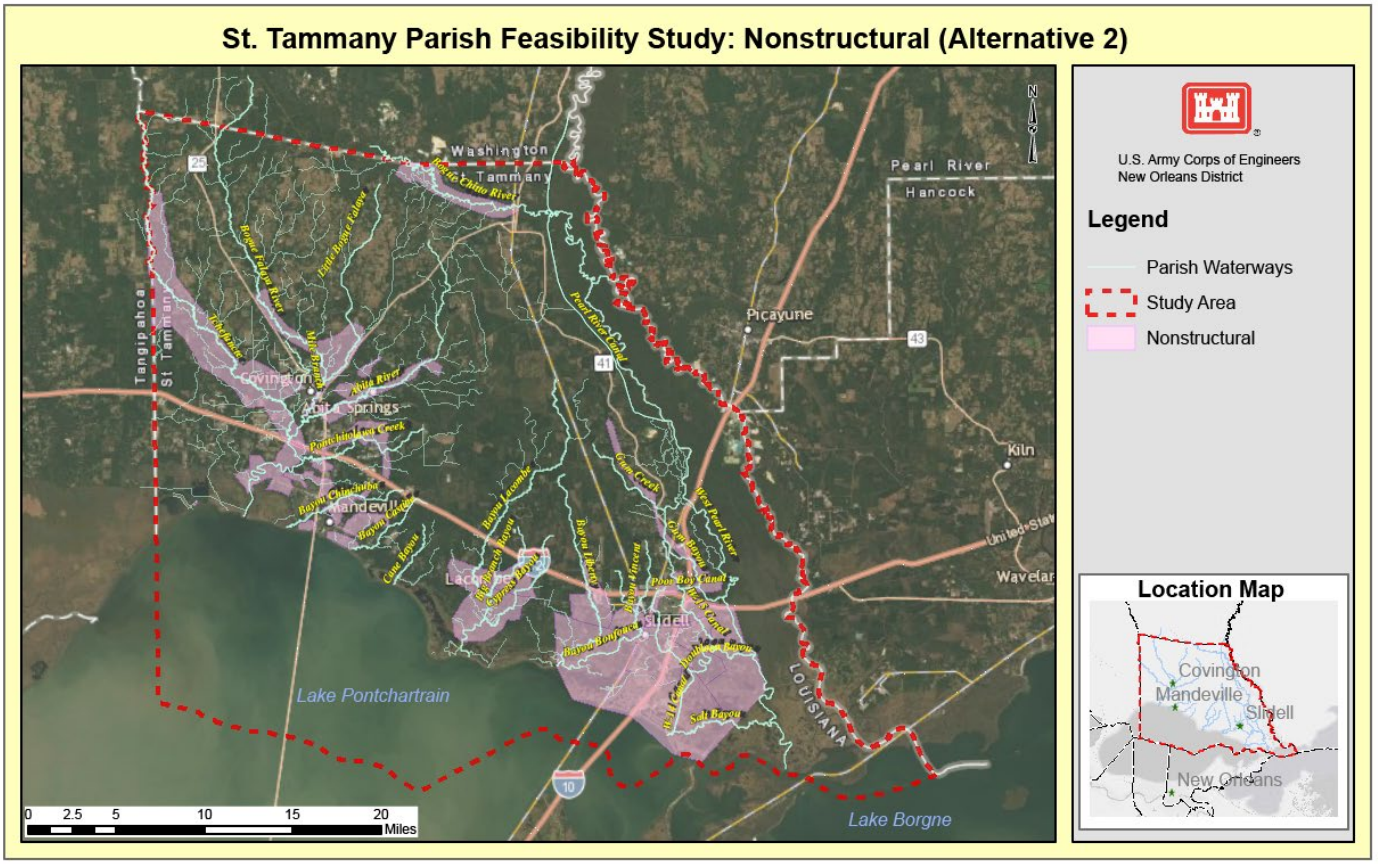


Figure B:2-14. Alternative 2 - Nonstructural

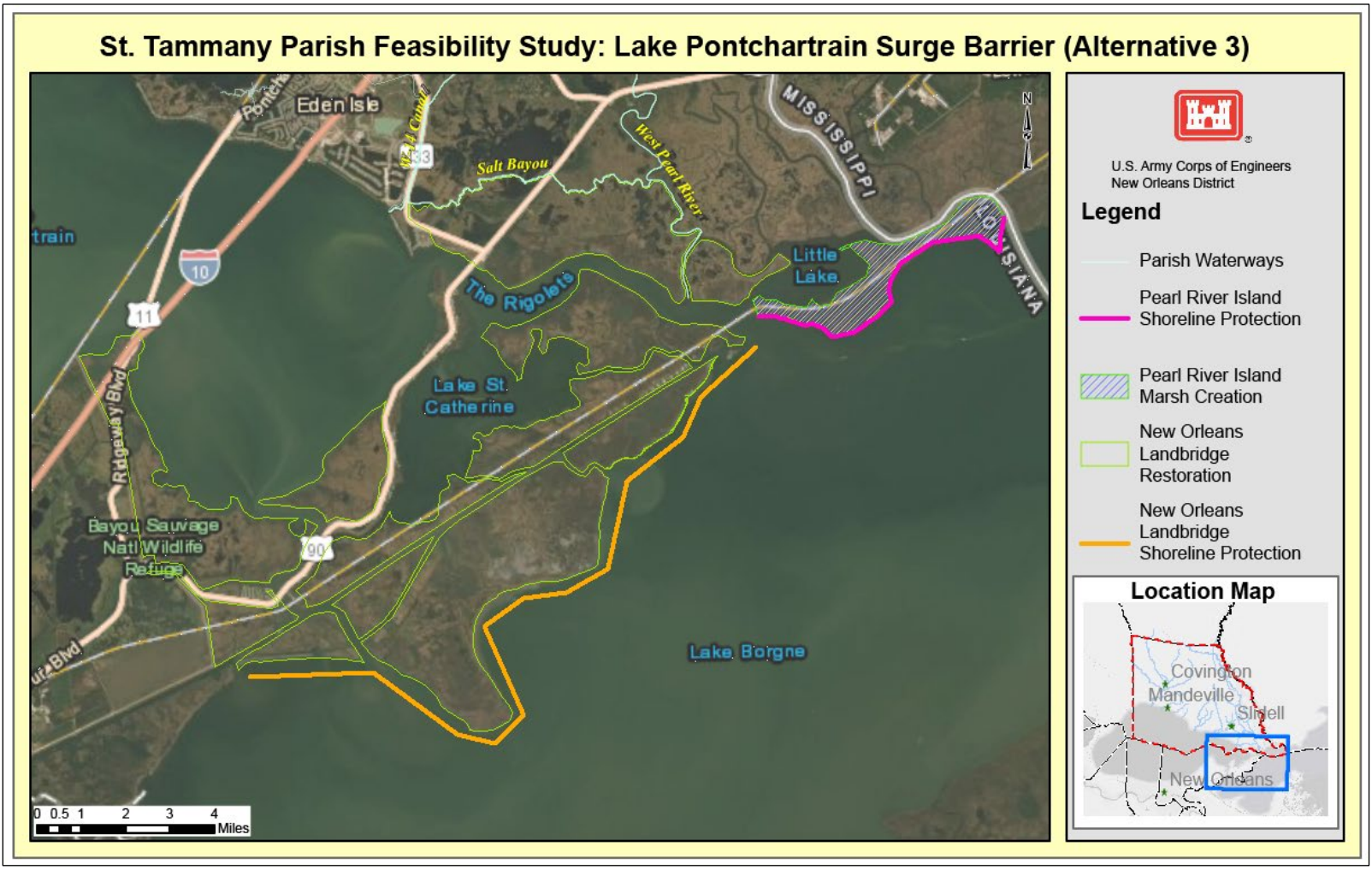


Figure B:2-15. Alternative 3 - Lake Pontchartrain Surge Barrier

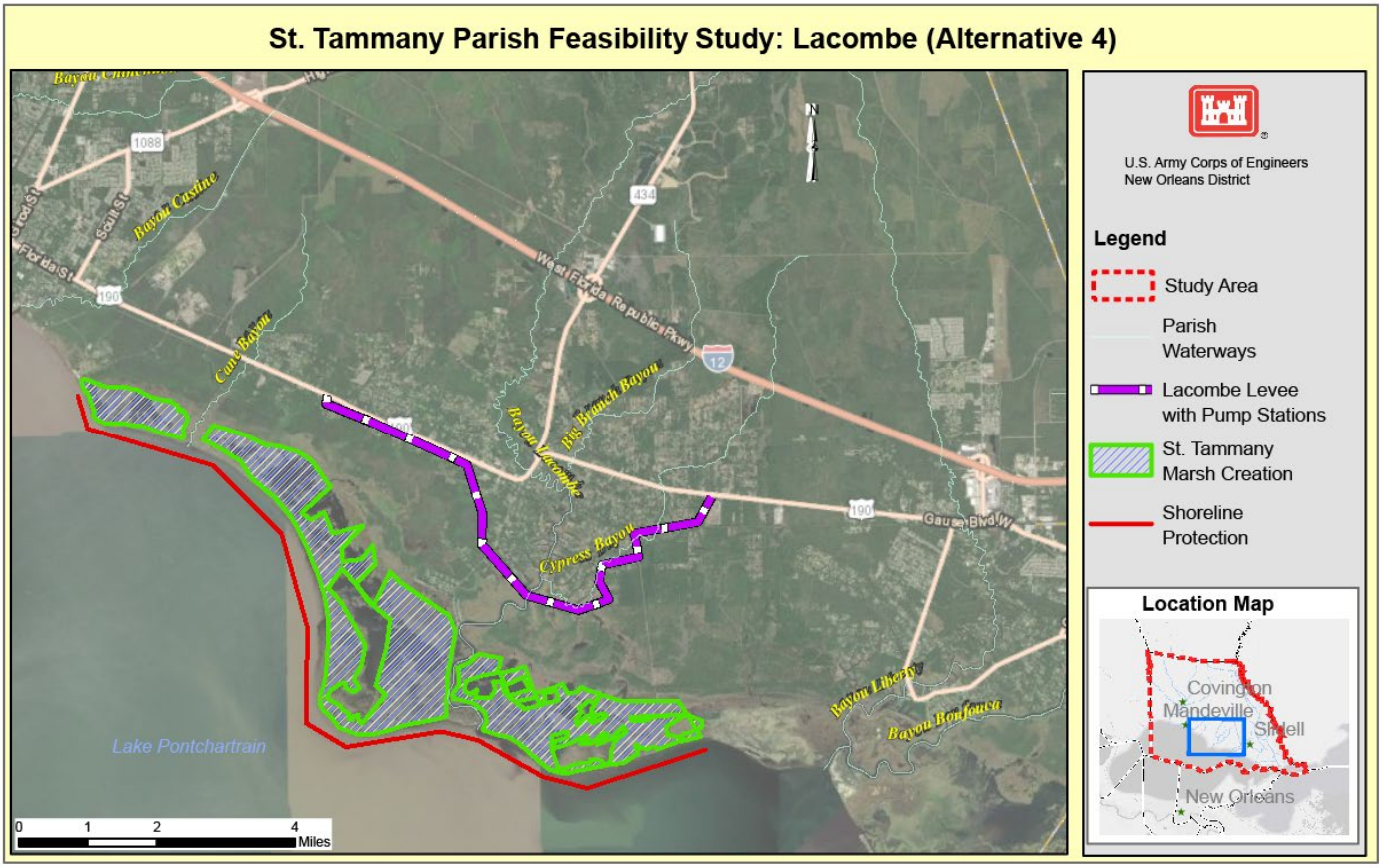


Figure B:2-16. Alternative 4 - Lacombe

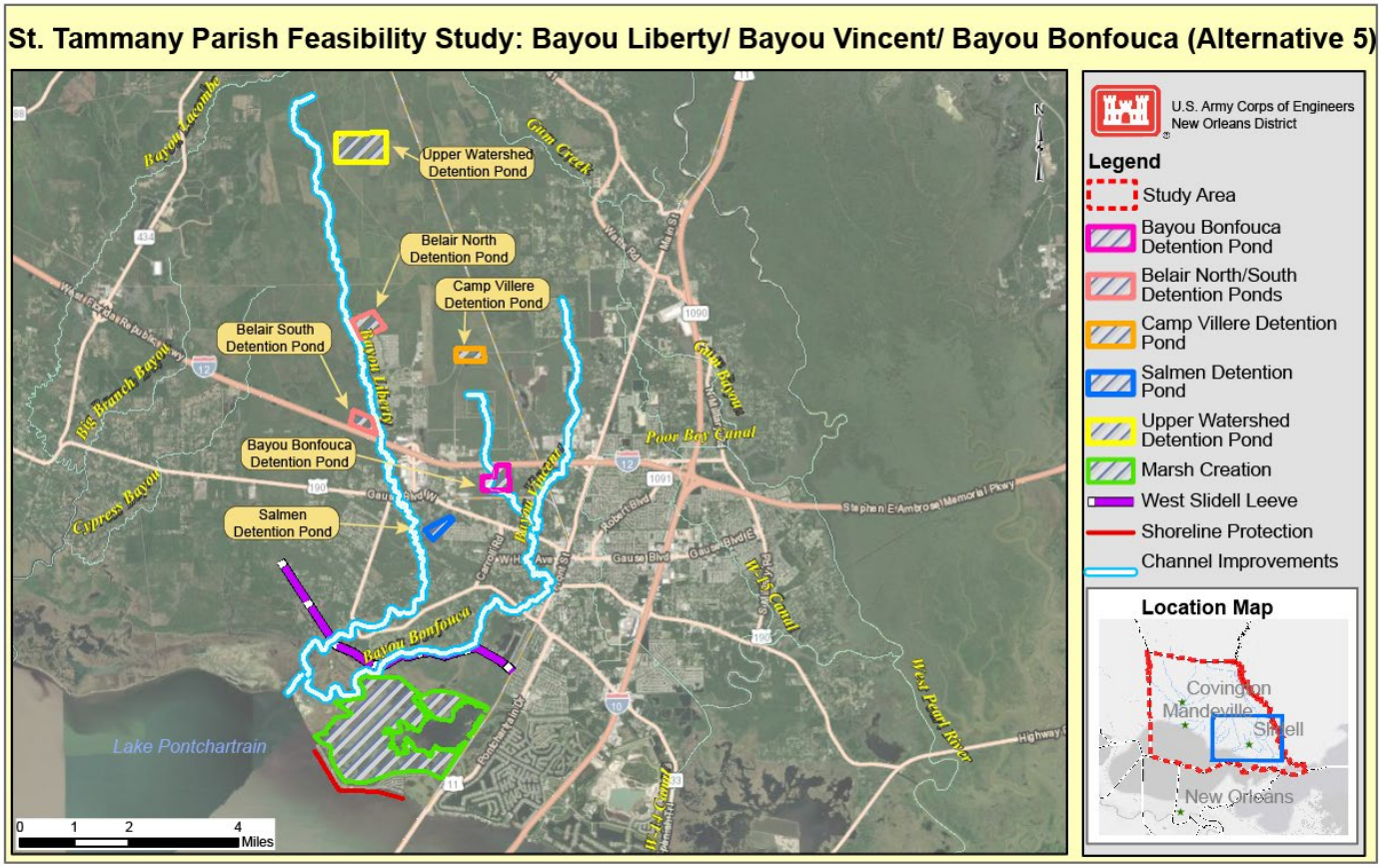


Figure B:2-17. Alternative 5 - Bayou Liberty/ Bayou Vincent/ Bayou Bonfouca

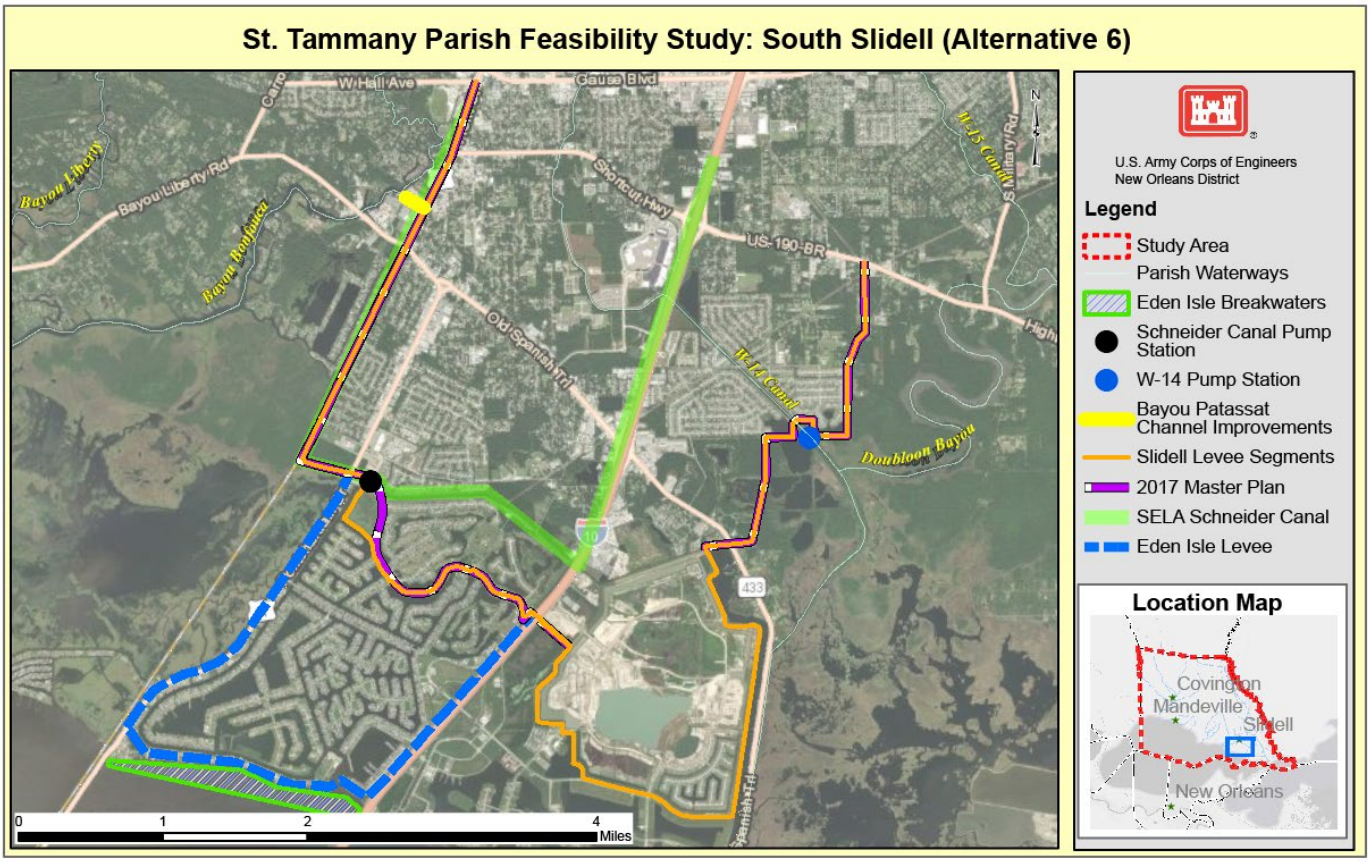


Figure B:2-18. Alternative 6 - South Slidell

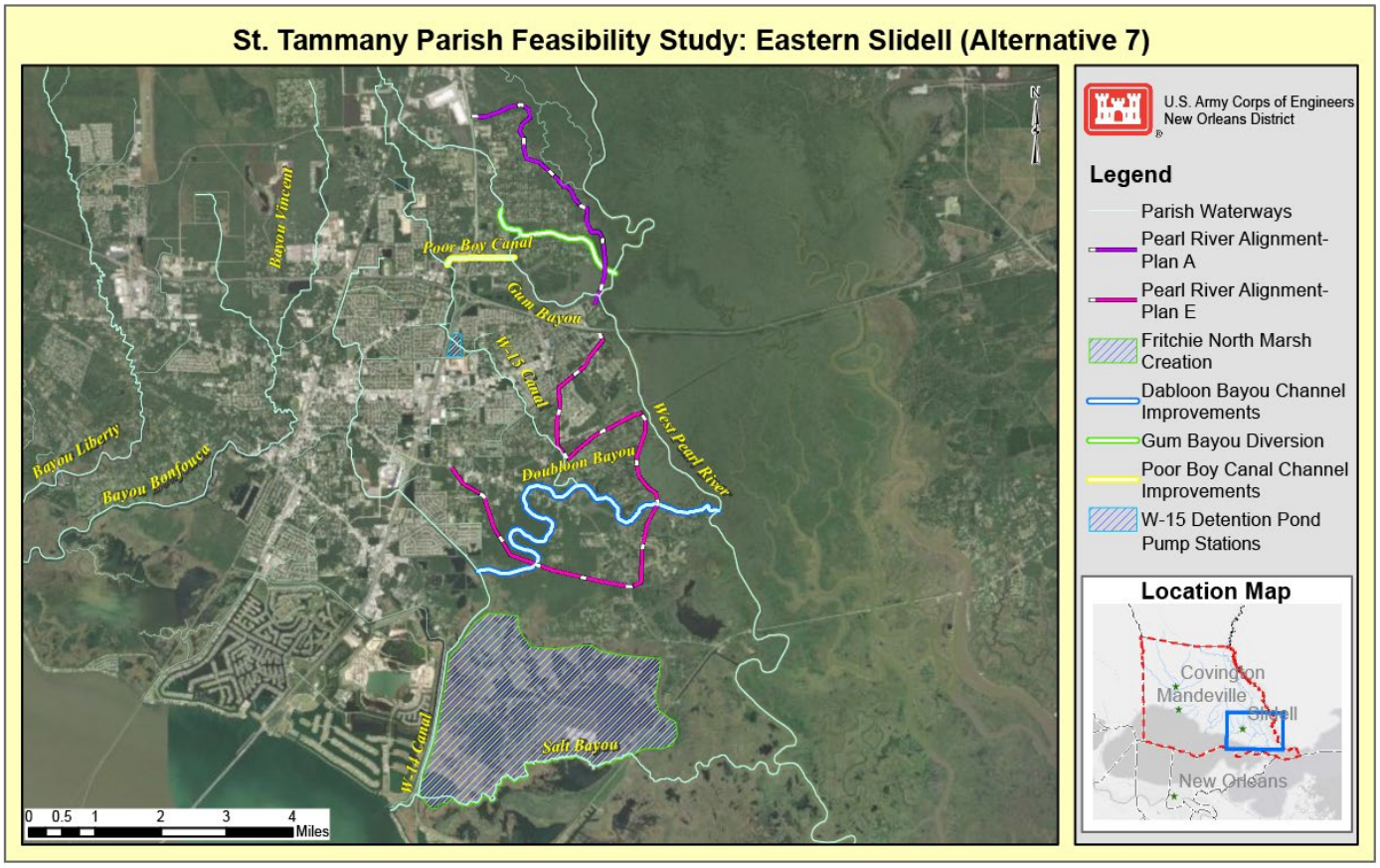


Figure B:2-19. Alternative 7 - Eastern Slidell

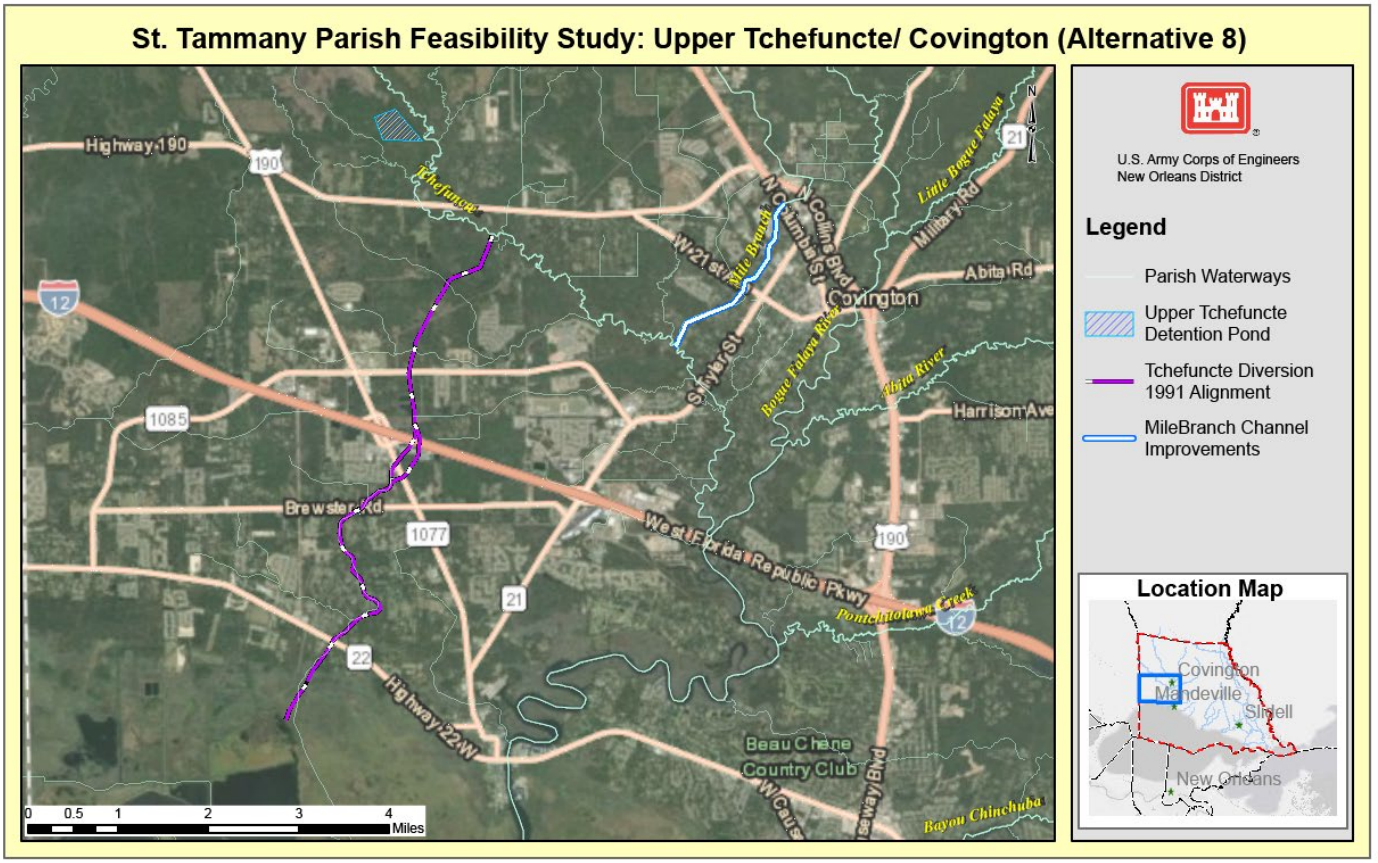


Figure B:2-20. Alternative 8 - Upper Tchefuncte/ Covington

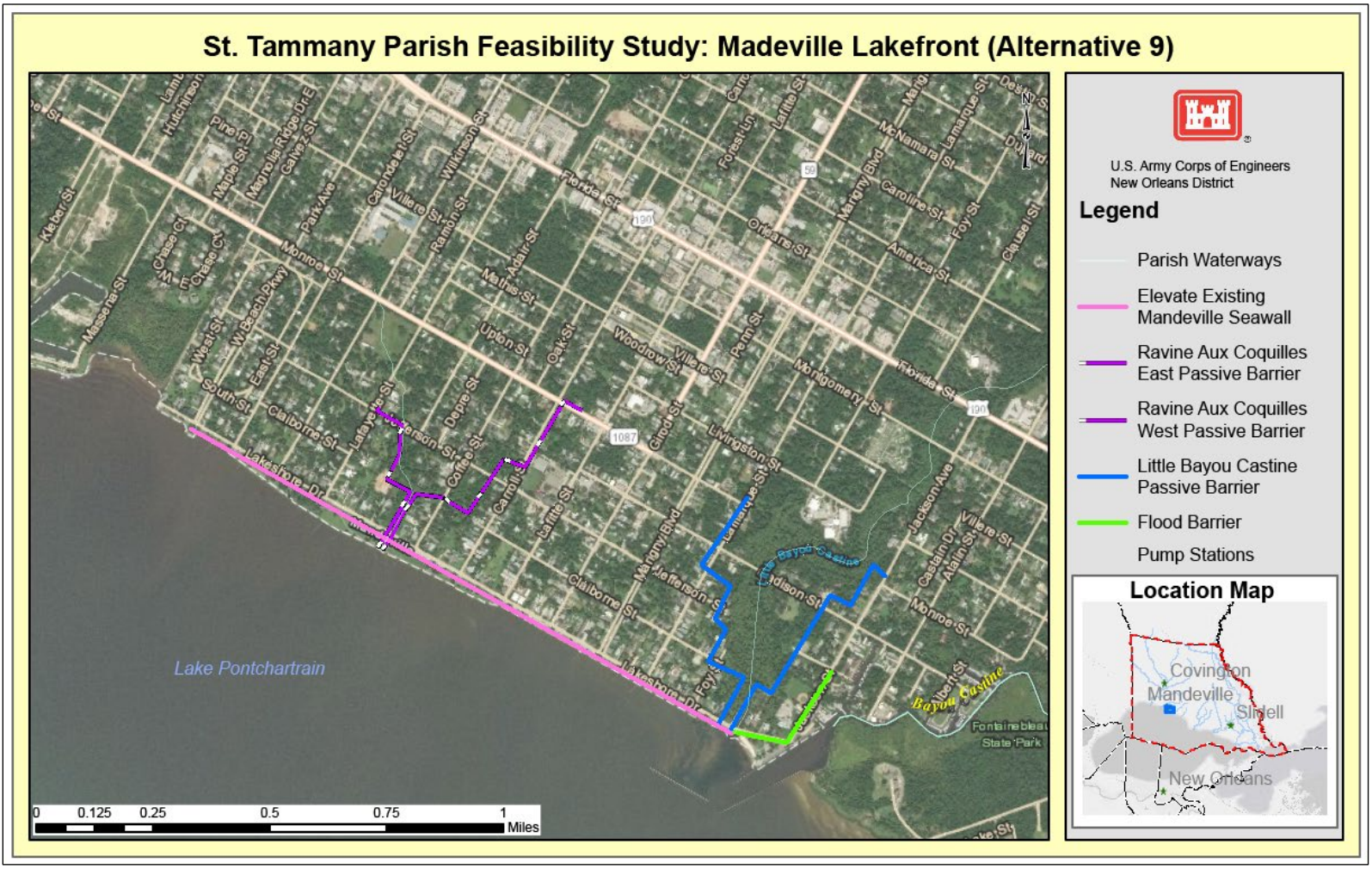


Figure B:2-21. Alternative 9 - Mandeville Lakefront

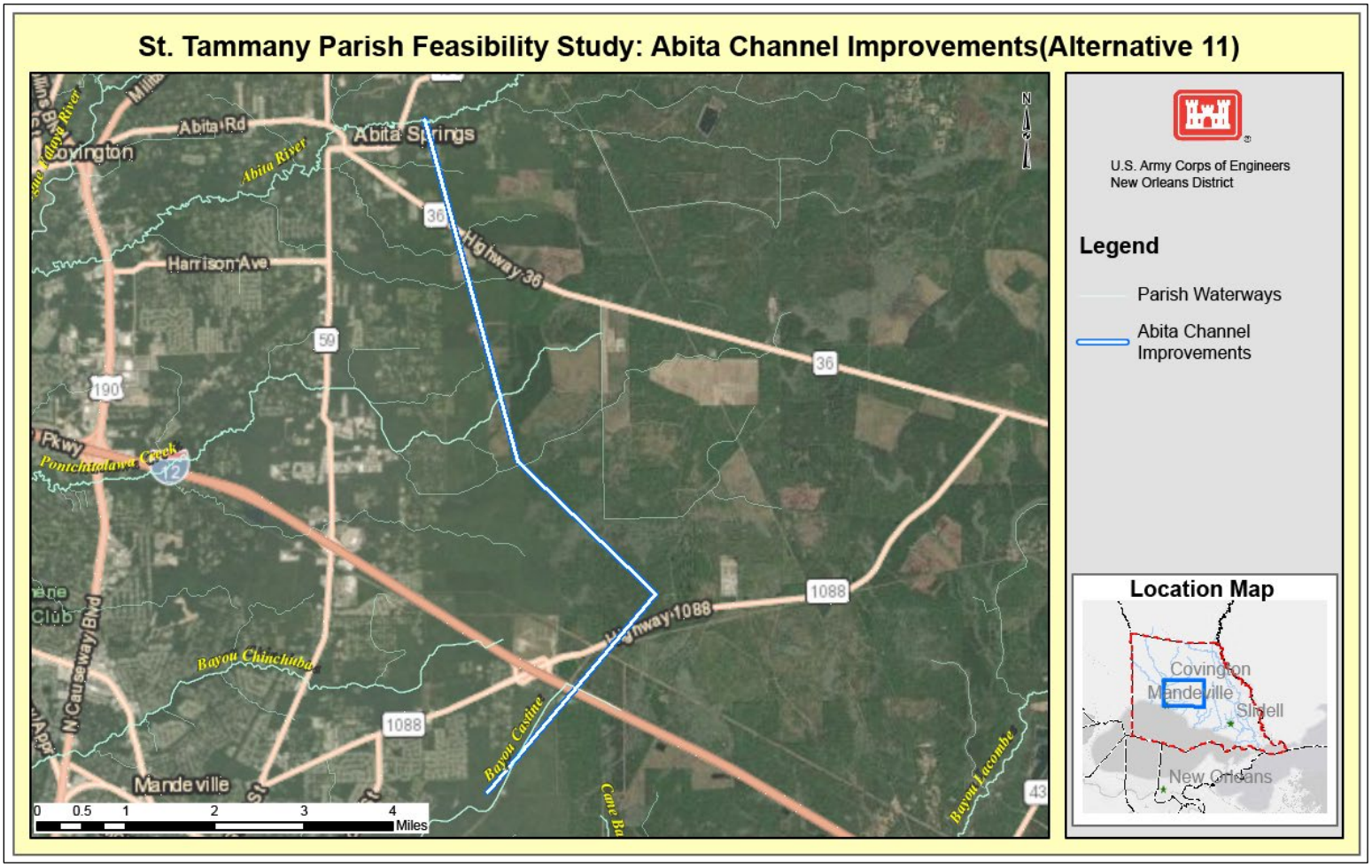


Figure B:2-22. Alternative 11 - Abita Channel Improvements

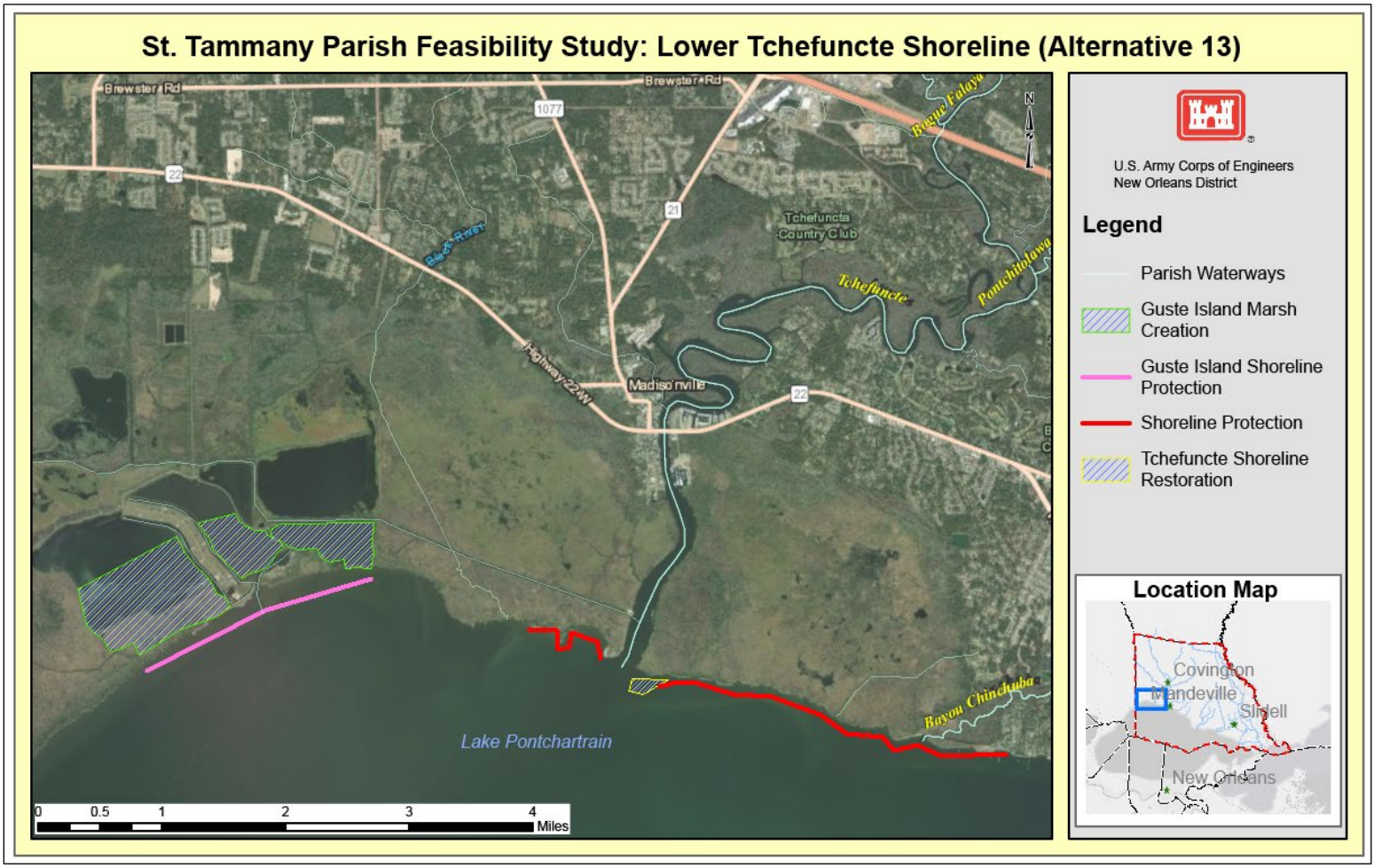


Figure B:2-23. Alternative 13 - Lower Tchefuncte Shoreline

The Focused Array of Alternatives was evaluated to further narrow down the alternatives and measures that would undergo a full evaluation, including modeling and preliminary design to identify the Final Array. To provide the additional information and data to screen the Focused Array, the PDT undertook the following actions:

- Rough order of magnitude (ROM) cost estimates were developed for the Focused Array. The screening for the Initial Array used cost estimates from previous studies and reports and those costs were updated and or escalated costs to provide a more recent cost estimate. Cost estimates for compensatory mitigation resulting from for direct impacts to marsh and BLH habitat were also estimated and included in the total revised costs for the Focused Array of Alternatives.
- Potential benefit and inducement areas (subsections) for each remaining structural measure were delineated. These areas identify where potential flood risk reduction or inducement might occur with the implementation of the measure within the alternative. These approximate benefit areas represented rough estimation of potential flood risk reduction and were used to identify structures that would likely benefit from implementation of each measure. Both reduction and inducement estimates were formulated using a combination of existing model documentation and best engineering judgement. Literature sources and prior studies estimated benefits were also used. Below is a summary of assumptions applied to the delineated areas for calculating preliminary benefits when estimated with the lowering or reduction of water surface elevation (WSE) from prior studies were not available. It should be noted that any WSE lowering given in a range resulted in a median value, which was applied during the economic analysis.

    - Shoreline Protection: Range of water surface elevation (WSE) reduction due to shoreline protection is 0-0.5 foot.
    - Marsh Creation: Range of surge attenuation rates from measured data is approximately 3 feet per 14,000 feet - 200,000 feet.
    - CSRM Levees or Floodwalls: All structures in benefit area predicted to be protected up to the 100-year storm surge event.
    - FRM Levees or Floodwalls: Reduce damages by 90 percent for rainfall/riverine flood damages for events up to and including the 200 year. No reductions assumed for more extreme events (500 year).
    - Detention Pond: 0.3-2 feet reduction in the 10-year profile.
    - Channel Improvements: Range of estimated WSE reduction is 0.1 foot-0.9 foot for 10-year event and can be applied to other frequencies.
    - Diversion Channel: No damage reduction up to and including the 25-year rainfall event. 50-year and less-frequent events, water levels would equal the 25-year event.

- The Expected Annual Damages values for the structures within the potential benefit areas were calculated to estimate the maximum potential benefits that could accrue to each measure within an alternative. The EAD totals were then converted to a maximum cost supported by dividing by the capital recovery factor.

The maximum cost supported estimates were then further refined by developing an estimated flood lowering for each of the measures and using that value to adjust the potential maximum cost supported for each measure within an alternative.

- The PDT then compared the maximum cost supported estimate for each measure to the ROM cost estimates to screen out measures and alternatives that would likely not be economically justified.
- Nature based measures were also further evaluated. Research was conducted using published literature to determine the potential range of surge attenuation rates estimated to be reduced in the study area based on the acreage of marsh creation and shoreline protection proposed in the area. The potential lowering of WSE were calculated for both marsh creation and shoreline protection using these statistics:
    - Marsh Creation: WSE reduction of approximately 3 feet per 200,000 feet to 3 feet per 14,000 feet. (Wamsley, T.V. 2010)
    - Shoreline Protection: WSE reduction of 0 feet-0.5 foot of reduction within the extents of the benefit area. (Naryan, S. 2017)

The analysis of the Nature Based (NB) measures showed that the expected costs outweighed the storm surge reduction benefits. Additionally, to maximize benefits, the marsh creation feature was expected to have high OMRR&R costs to maintain the design elevation required to attenuate surge effectively.

*Table B:2-4. Summary of Focused Array Screening**

	Focused Array of Alternatives	Screening Notes
1	No Action	MF to the Final array
2	Nonstructural	MF: NS- 08, NS- 09, NS- 10 and NS- 11.
3	Lake Pontchartrain Surge Reduction	Screened Alternative. Screened Measures: NB-24, NB-30, NB-31. The creation and shoreline protection measure were screened due to the low efficiency with which they would be able to reduce storm surge impacts. The marsh creation was also expected to have high O&M costs in order to maintain the marsh at a certain elevation over time due to subsidence and sea level rise.
4	Lacombe	MF: S-028, S-120. The Lacombe levee was moved forward to the Final array. Screened Measures: NB-15, NB-16. The nature-based shoreline protection and marsh creation measures were screened due to effectiveness in reducing flood damages.
5	Bayou Liberty/ Bayou Vincent/Bayou Bonfouca	MF: S-004, S-010, S-080, S-081. Screened Measures: S-13, S-17. The Upper Watershed Detention Pond

		and Bayou Vincent Channel improvements were screened based on the estimated implementation costs exceeding the potential damages avoided. Screened Measures: NB-03. The marsh creation and shoreline protection were screened based on the low efficiency with which they would be able to reduce storm surge impacts.
6	South Slidell	MF: S-070, S-074, S-075, S-076 and S-077. Screened Measures: NB-33. The shoreline protection nature-based measures were screened based on the low efficiency with which they would be able to reduce storm surge impacts.
7	Eastern Slidell	MF: S-060, S-069, S-072, S-073, and S-119. Screened Measures: S 061 The Pearl River Levee Alignment E was screened based on the estimated Implementation costs exceeding the potential damages avoided. Screened Measures: S-071, S-078, S-079, and S-115. W-15 Detention Pond, Diversion Canal, French Branch Channel Improvements, and the W-15 Detention Pond were removed from consideration since they are under construction by the STPG. Screened Measures. NB-34 The marsh creation nature-based measure was screened based on the low efficiency with which it would be able to reduce storm surge impacts.
8	Upper Tchefuncte/ Covington	MF: S-057, S-106 and S-121. Screened Measures: S-101 and S-105. Detention Pond and Diversion measure were screened based on the estimated Implementation costs exceeding the potential damages avoided.
9	Mandeville Lakefront	MF: S-046, S-047, S-048 and S-118.
11	Abita Channel Improvements	Screened Alternative Screened Measures: S-101. The estimated Implementation costs exceed the potential damages avoided.

*This tables presents the screening of the Focused array of alternatives to the Final array of alternatives. Please note previously screened measures and alternatives during the Initial array screening are not duplicated here.

There were two alternatives and 18 additional measures that were screened from the Focused Array to the Final Array. All nature-based measures were screened out based on the estimated low efficiency with which they would be able to reduce storm surge impacts. Additionally, measures related to the W-15 in Alternative 7 were removed due to progress made by the St. Tammany Parish Government regarding their construction. Additional measures screened from the alternatives due to the implementation costs exceeding estimated benefits included: Alternative 4 detention pond; Alternative 5 Bayou Liberty detention pond, and channel improvements along Bayou Vincent; and a detention pond and the diversions from the Tchefuncte and Abita south to Lake Pontchartrain to reduce riverine flooding from Alternative 8 and 11. Nonstructural alternatives were moved forward in the subbasins and areas where structural and nature based measure were screened.

2.3 FINAL ARRAY OF ALTERNATIVES

The Final Array of Alternatives carried forward for H&H modeling, preliminary engineering and design, development of full cost estimates, and environmental and resource analysis, included eight alternatives made up of 27 measures:

- Alternative 1: No Action Alternative
- Alternative 2: Nonstructural (NS-008, NS-009, NS-010, NS-011)
- Alternative 4: Lacombe
  - 4a Lacombe Levee (S-028)
  - 4a.1 Lacombe Levee Short (S-028)
  - 4b Lacombe Levee Combined with West Slidell Levee (S-120)
- Alternative 5: Bayou Liberty/Bayou Vincent/Bayou Bonfouca
  - West Slidell Levee (S-081)
  - Bayou Bonfouca Detention Pond (S-004)
  - Bayou Liberty Channel Improvements (S-010)
  - Bayou Patassat Channel Improvements- Clearing and Snagging (S-080)
- Alternative 6: South Slidell
  - 6a South Slidell Levee and Floodwall System (S-074, S-075, S-076, S-077)
  - 6b South Slidell Levee and Floodwall System with Eden Isle (S-070, S-074, S-075, S-076, S- 077)
  - 6c South Slidell and West Slidell Levee and Floodwall System (S-074, S-075, S-076, S-077, S-081) It should be noted that Alternative 6a and the West Slidell Levee from Alternative 5 (S-081) were combined to form Alternative 6c during evaluation of the Final array as it was found the combined alternative provided the highest net benefits.
- Alternative 7: Eastern Slidell
  - Pearl River Levee (S-060)
  - Doubloon Bayou Channel Improvements-Dredging (S-069)
  - Poor Boy Canal Channel Improvements- Dredging (S-073)
  - Gum Bayou Diversion- Channel Improvements (S-072)
- Alternative 8: Upper Tchefuncte/Covington
  - Mile Branch Channel Improvements (S-057)
  - Lateral A Channel Improvements (S-121)
- Alternative 9: Mandeville Lakefront
  - 9a Mandeville Lakefront-Seawall Passive Drainage (S-046, S-047, S-118)
  - 9b Mandeville Lakefront-Seawall and Pump Stations (S-046, S-048, S-118)
  - 9c Mandeville Lakefront-18 ft (S-046, S-048, S-118, S-122)

This included the 25 measures remaining from the Focused Array, plus additional measures that were developed during the iterative process as new information became available. New measures included in the Final Array include, S-120 and S-122 (Table B:2-5). S-120 Lacombe Levee Combined with West Slidell Levee was added as a potential variation to have a complete levee system from Slidell to Lacombe and measure S-122 Mandeville Lakefront-18 ft was added to evaluate a 100-year level of protection in Mandeville after the

7.3 ft system proposed being evaluated at the request of local stakeholders under Alternative 9 (S-046, S-047 and S-048) was shown to have limited flood reduction benefits.

Figure B:2-24 presents an overview of the Final Array of Alternatives. Maps depicting the Final Array of Alternatives are presented in Figure B:2-25 to Figure B:2-30. Refer to Appendix D: Engineering for detailed descriptions of the Final Array, including measures specific to each alternative.

Screening, evaluation, and comparison of the Final Array to determine the Draft TSP is provided in Section 4 of the Main Report.

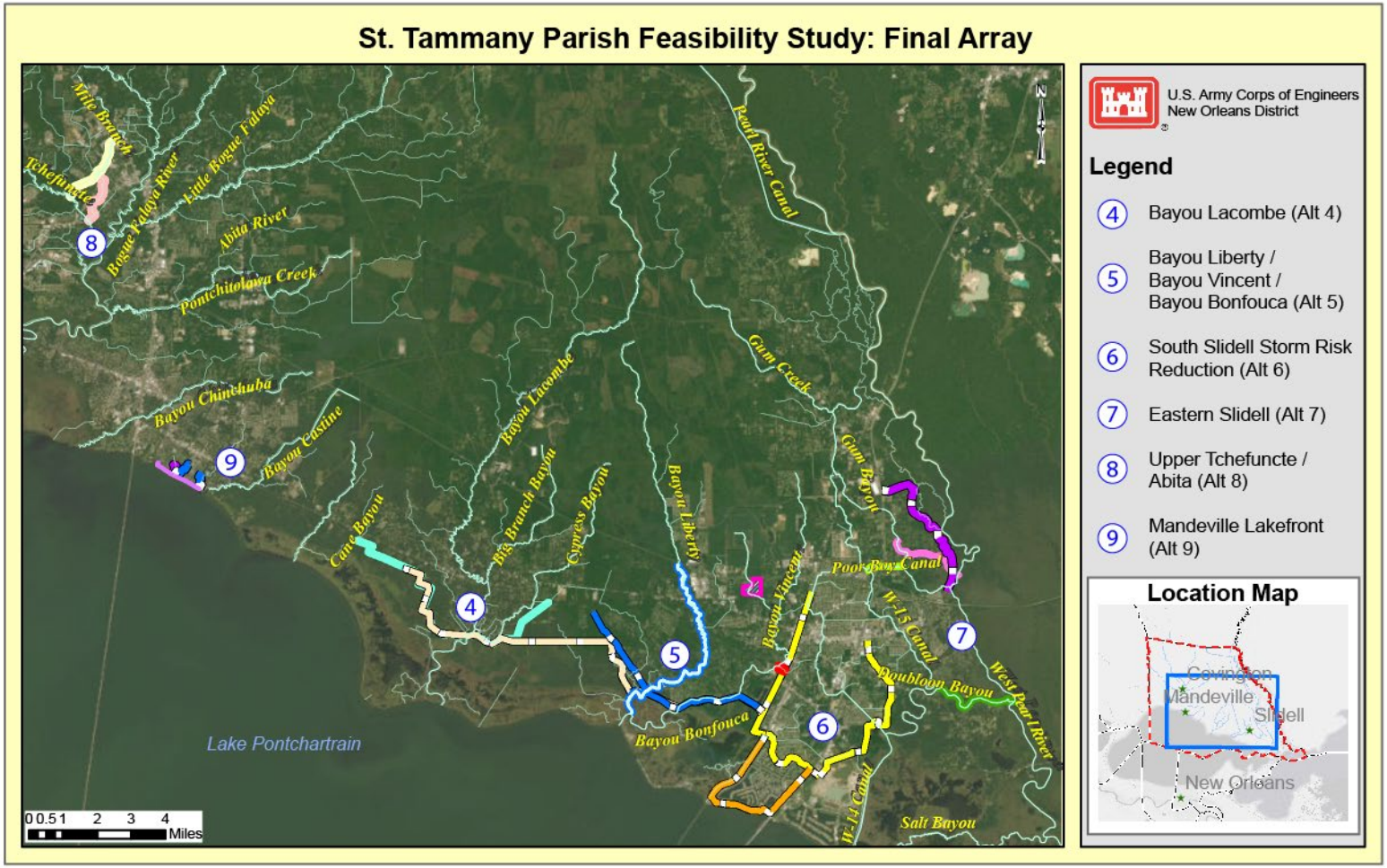


Figure B:2-24. Final Array of Alternatives

Table B:2-5. Final Array of Alternatives (Bolded superscript denotes subbasins with expected flood risk reduction)

	Alternative Name	**Measures**							
	Final Array	Detention ponds (FRM)	Channel improvements (FRM/CSRM)	Pump stations (FRM/CSRM)	Levee, floodwall, seawall (FRM/CSRM)	Flood gates (CSRM)	Shoreline protection breakwaters (CSRM)	Marsh creation (CSRM)	Nonstructural (FRM/CSRM)
1	No Action								
2	Nonstructural 1, 2, 5, 6, 8, 10, 13, 14, 17, 22, 23, 24, 26, 30, 31, 35, 36								NS-008, NS-009, NS-010, NS-011
4	4a Lacombe 18			S-028	S-028	S-028			NS-008, NS-009, NS-010, NS-011
	4a.1 Lacombe Levee Short 18			S-028S	S-028S	S-028S			NS-008, NS-009, NS-010, NS-011
	4.b Lacombe Levee Combined with West Slidell Levee 18			S-120	S-120	S-120			NS-008, NS-009, NS-010, NS-011
5	Bayou Liberty/ Bayou Vincent/ Bayou Bonfouca 1 & 35	S-004	S-010, S-080	S-81, S-120	S-81, S-120	S-81, S-120			NS-008, NS-009, NS-010, NS-011
6	6a South Slidell 1 & 23			S-074, S-075, S-077	S-075, S-076	S-075, S-076			NS-008, NS-009, NS-010, NS-011
	6b South Slidell with Eden Isle 1 & 23			S-74, S-075, S-077	S-70, S-075, S-076	S-70, S-075, S-076			NS-008, NS-009, NS-010, NS-011
	6c South Slidell with West Slidell* 1 & 23			S-74, S-075, S-076, S-077, S-81	S-075, S-076, S-81	S-075, S-076, S-81			NS-008, NS-009, NS-010, NS-011

7	Eastern Slidell 1, 13, 17, 23		S-069, S-072 S-073	S-060	S-060	S-060			NS-008, NS-009, NS-010, NS-011
8	Upper Tchefuncte/Covington 2, 10, 31		S-057, S-121						NS-008, NS-009, NS-010, NS-011
9	9a. Mandeville Lakefront-Seawall Passive Drainage 8				S-046, S-118,	S-047			NS-008, NS-009, NS-010, NS-011
	9b. Mandeville Lakefront-Seawall and Pump Stations 8			S-048	S-046, S-118,				NS-008, NS-009, NS-010, NS-011
	9c. Mandeville Lakefront-18 ft 8			S-048	S-046, S-118, S-122				NS-008, NS-009, NS-010, NS-011

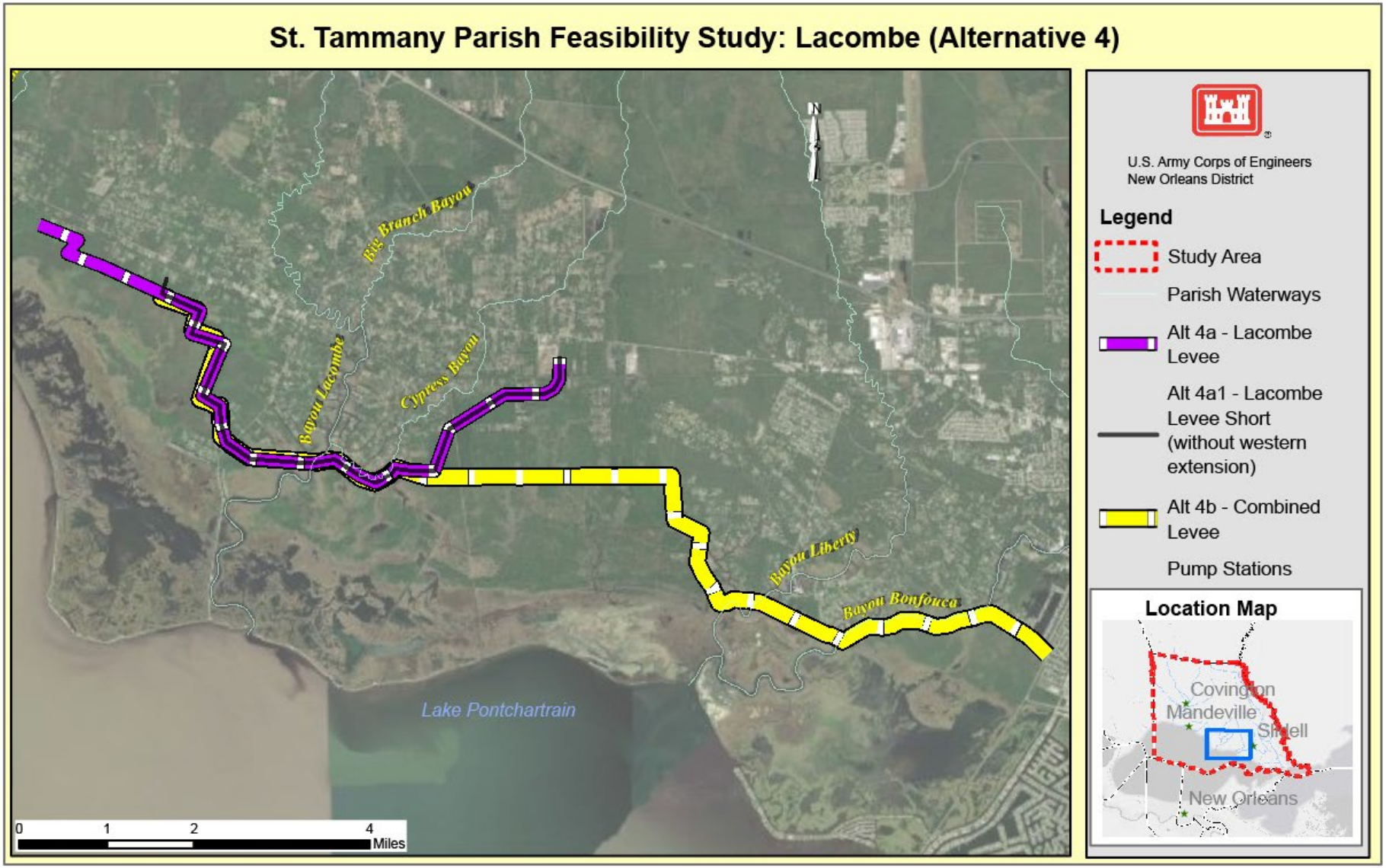


Figure B:2-25. Alternative 4 - Lacombe

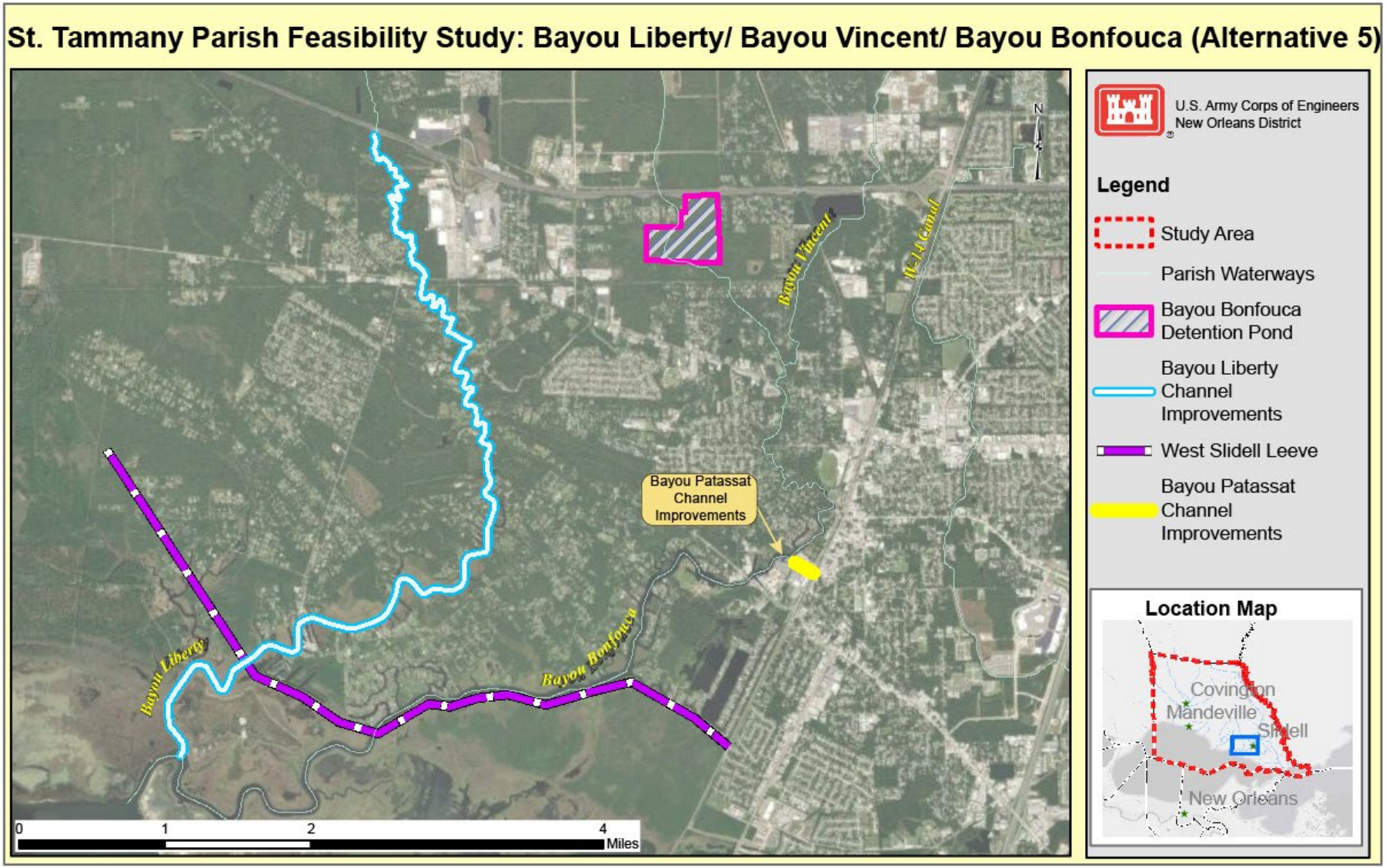


Figure B:2-26. Alternative 5 - Bayou Liberty/ Bayou Vincent/ Bayou Bonfouca

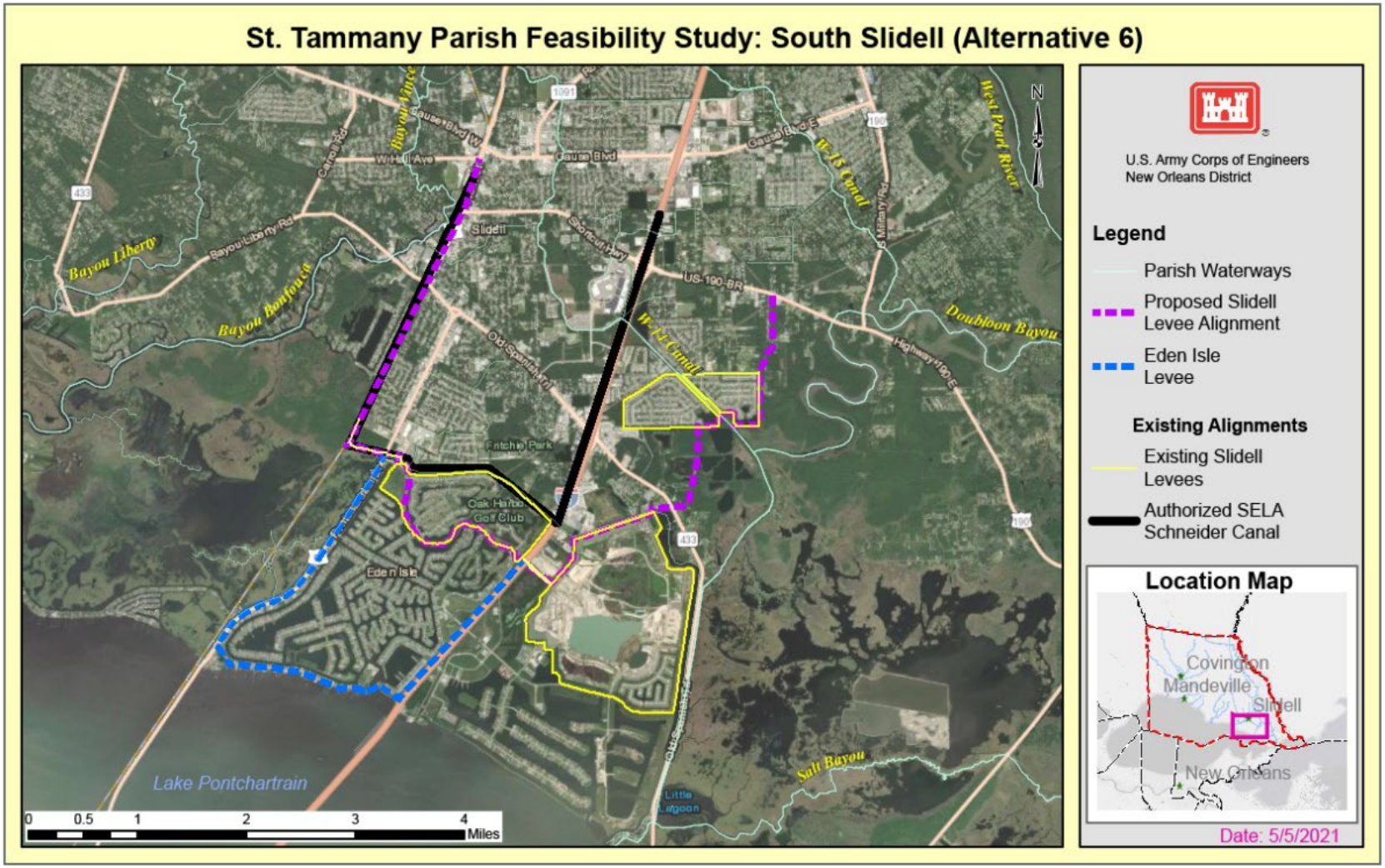


Figure B:2-27. Alternative 6 - South Slidell

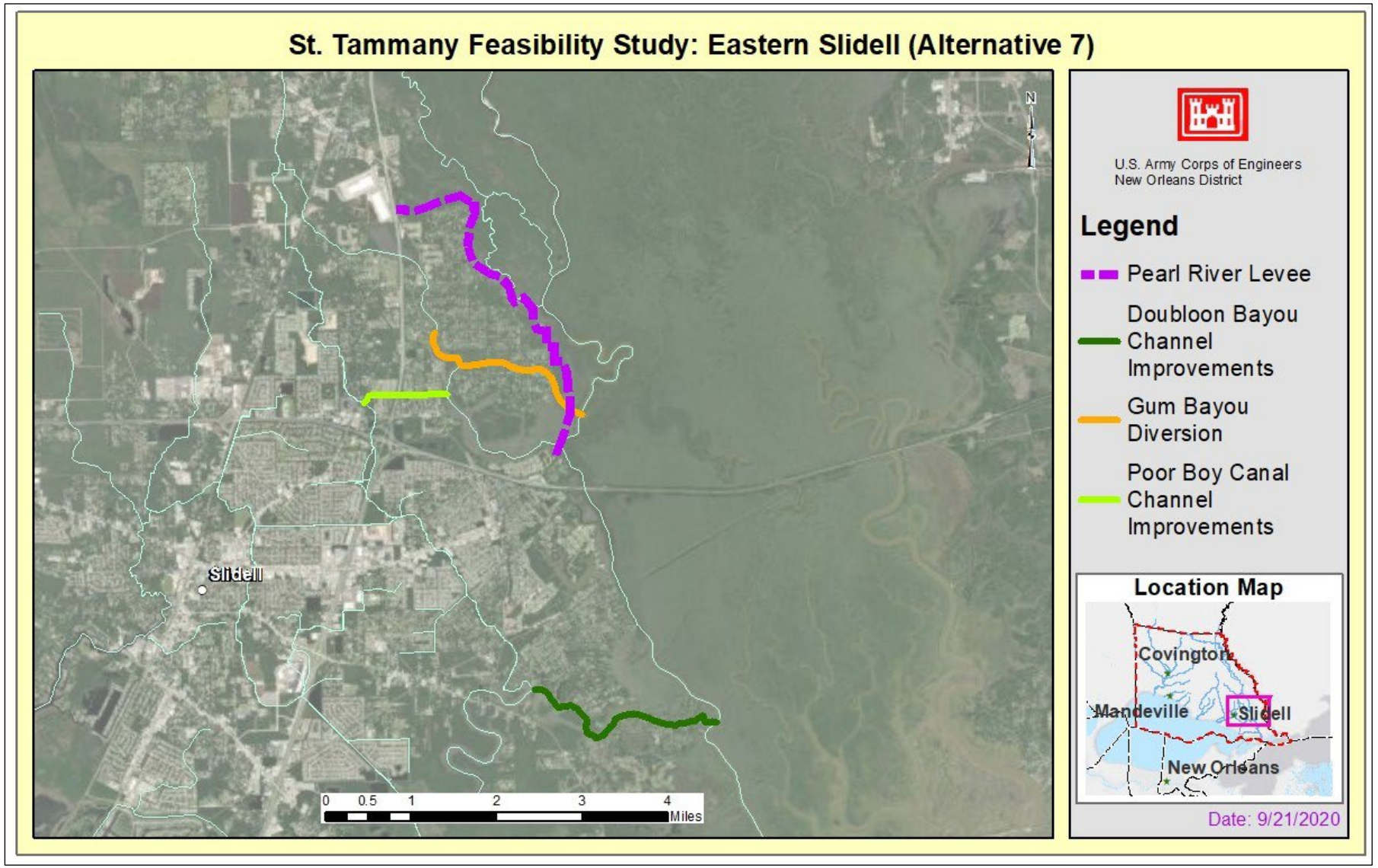


Figure B:2-28. Alternative 7 - Eastern Slidell

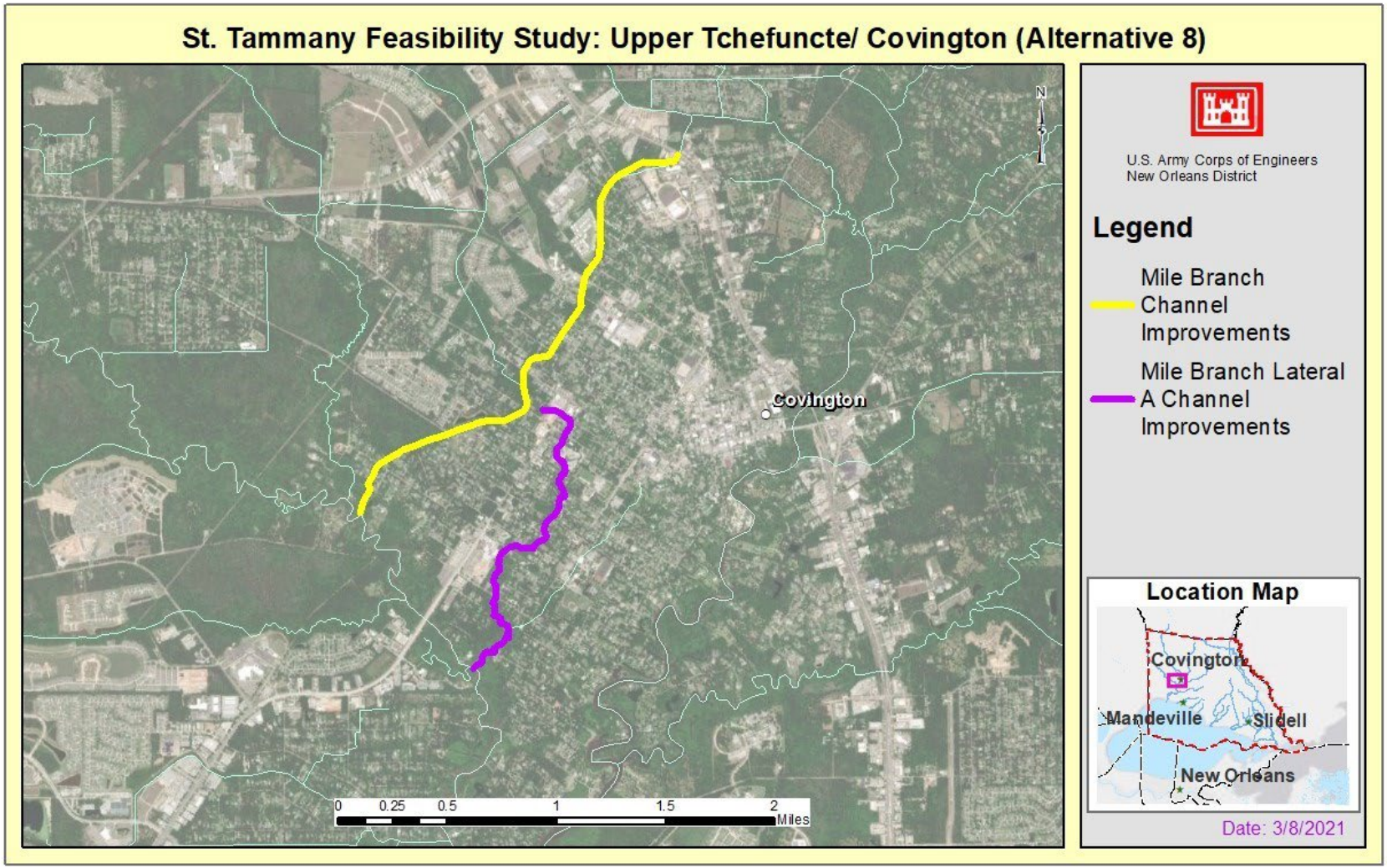


Figure B:2-29. Alternative 8 - Upper Tchefuncte/Covington

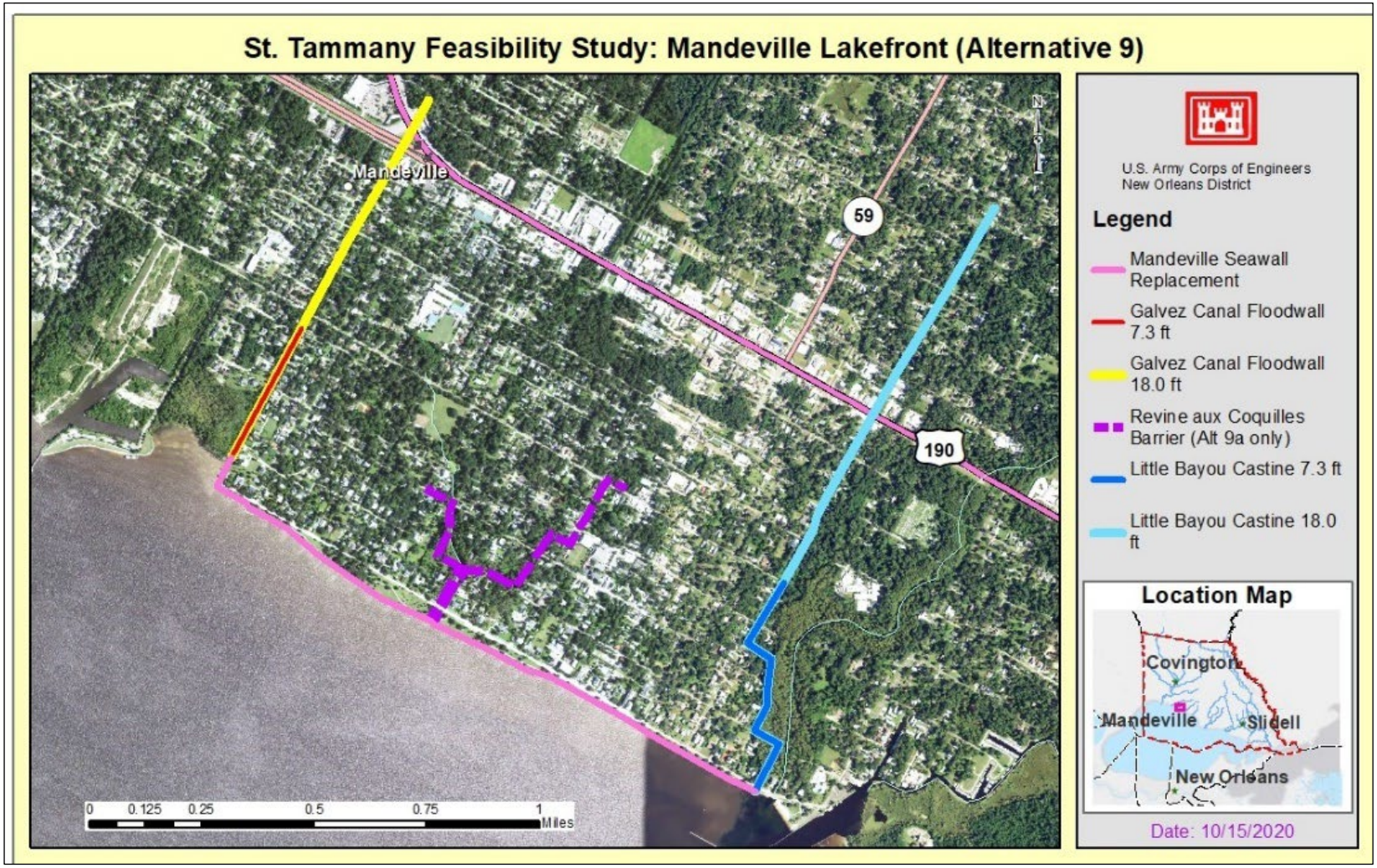


Figure B:2-30. Alternative 9 - Mandeville Lakefront

2.4 FURTHER INVESTIGATION AND REEVALUATION OF FRM/CSRM MEASURES FOR THE EDEN ISLE COMMUNITY IN SLIDELL, LA.

The Final Array of Alternatives included Alternative 6b, which consisted of CSRM measures that would provide flood risk reduction to the Eden Isle community in Slidell, Louisiana. Alternative 6b included, but was not limited to, a series of levees, floodwalls, pump stations and floodgates along the eastern, southern and western boundaries of the Eden Isle community. However, the final economic and cost-benefit analysis conducted by USACE demonstrated that Alternative 6b was not the most cost-effective alternative for a structural protection. Therefore, the Draft TSP did not incorporate the structural measures (S-070) of Alternative 6b but does include nonstructural measures (from Alternative 2) that would protect approximately 400 homes and businesses within Eden Isle.

Subsequent to the selection of the Draft TSP but prior to the public release in 2021, the NFS requested that USACE investigate additional FRM and CSRM measures for the Eden Isle community. The PDT coordinated with the NFS, the STPG, the St. Tammany Levee, Drainage Conservation District (STLDCD) and other stakeholders to discuss and develop additional measures. A total of 14 structural measures (variations of levee and floodwall segments) were reevaluated by USACE. The USACE reevaluation included Alternative 6b, Measure S-070 (with its three floodwall components) and 11 new structural measures. See Table B: 2-6.

The significant distinguishing factors between the variations in the 14 structural measures included differences in the costs of construction, real estate acquisition challenges, environmental resource impacts, constructability concerns, Louisiana Department of Transportation & Development and other requirements for the I-10 crossing features, and general safety concerns.

During USACE's supplemental reevaluation of the 14 structural measures (S-070 from Alternative 6b and S-123-S-133), a new measure (S-132) was identified as a viable alignment for the western segment of Eden Isle. USACE determined that Measure S-132 was cost effective and efficient, and had (potential) lower construction costs and real estate impacts when compared to the original western segment in Measure S-070 from Alternative 6b. Measure S-132 would provide additional benefits to reduce damages to the Norfolk Southern Railroad, which passes through Slidell, Louisiana, but had potential impacts related to environmental that would need to be avoided, reduced, mitigated and/or minimized.

USACE conducted a sensitivity analysis to determine if the estimated change in benefits, impacts and/or costs associated with a refined alignment at Eden Isle, including the new western segment (comparing S-070 and S-132), would result in the selection of a different TSP. Taking into consideration the existing conditions and the required USACE design criteria, the sensitivity analysis showed that the estimated change in benefits, impacts and/or costs associated with any of the reevaluated structural measures (including the new Measure S-132) were not significant enough to result in the selection of a different

TSP. Consequently, the TSP originally identified by USACE remained the National Economic Development (NED) Plan. Although the Draft TSP does not include structural protection for the Eden Isle community, the nonstructural portion of the Draft TSP includes approximately 400 homes and businesses within Eden Isle.

If the local stakeholders and the NFS want alternative actions to the NED Plan, a locally preferred plan (LPP) can be developed. An LPP would include changes to plan component(s) to address local interests. A LPP would be evaluated in the same way as the NED Plan was analyzed, including a full environmental assessment to identify the impacts as required by NEPA. A LPP has to be approved by the Assistant Secretary of the Army for Civil Works (ASA(CW)). The LPP components can be presented to Congress by USACE as alternatives to the study findings. If the LPP is smaller in scale and cost than the NED Plan, the Federal cost share would be 65 percent of total project costs, as long as the LPP changes are consistent with the objectives of the study. An LPP that costs more than the NED Plan is eligible for ASA(CW) consideration if the following conditions are met: (a) The LPP must produce as many or more benefits as the NED Plan; (b) The NFS must pay all increased costs of the LPP over the NED Plan. The Federal cost share of a higher-cost LPP is established as 65 percent of the NED Plan for flood/coastal risk management on projects. The NFS has not expressed the desire to pursue a LPP at this time.

Table B:2-6. Reevaluation of Eden Isle Measures. Measures in bold were part of the Final Array of Alternatives

Measure ID	Measure Type	Measure	Location/Segment	Source
NS-08	**Nonstructural**	**Buyouts**	**Parish wide**	**Final Array**
NS-09	**Nonstructural**	**Flood proofing**	**Parish wide**	**Final Array**
NS-10	**Nonstructural**	**Relocations**	**Parish wide**	**Final Array**
NS-11	**Nonstructural**	**Structure Raising**	**Parish wide**	**Final Array**
S-070	**Floodwall**	**Floodwall West 1-10**	**Slidell, Eden Isle, Eastern**	**Final Array (STPG)**
	Floodwall	**Floodwall T-Wall Median Lakeview Dr**	**Slidell, Eden Isle, Southern**	**Final Array (STPG)**
	Floodwall	**Highway 11 Floodwall**	**Slidell, Eden Isle, Western**	**Final Array (STPG)**
S-123	Levee	Levee West of I-10	Slidell, Eden Isle, Eastern	St Tammany Parish
S-124	Levee	Levee East of I-10	Slidell, Eden Isle, Eastern	St Tammany Parish
S-125	Floodwall	I-10 Median	Slidell, Eden Isle, Eastern	St Tammany Parish
S-126	Floodwall	Floodwall East of I-10	Slidell, Eden Isle, Eastern	PDT
S-127	Floodwall	Eastern Lakefront Floodwall	Slidell, Eden Isle, Eastern	PDT

S-128	Surge Barrier	Levee Berm North Lakeview Drive	Slidell, Eden Isle, Southern	St Tammany Parish
S-129	Seawall	Lake Surge Barrier	Slidell, Eden Isle, Southern	St Tammany Parish
S-130	Floodwall	Eden Isle Seawall with Backfill	Slidell, Eden Isle, Southern	PDT
S-131	Levee	Highway 11 T-wall Median	Slidell, Eden Isle, Western	St Tammany Parish
S-132	Levee	Levee West of Railroad to Lake	Slidell, Eden Isle, Western	St Tammany Parish
S-133	Levee	Levee East of Hwy 11	Slidell, Eden Isle, Western	St Tammany Parish

2.5 SUMMARY OF REVIEW COMMENTS ON THE DRAFT TSP

The notice of availability for the DIFR-EIS was published in the Federal Register on 11 June 2021, initiating the 45-day public review period for the study. The comment period closed on Monday, 26 July 2021. Two virtual public meetings were scheduled in June 2021. Approximately 725 people were reached during the first meeting on 28 June 2021 and approximately 746 people were reached during the second meeting on 29 June 2021.

In addition to the public review period, the USACE also conducted concurrent agency technical review (ATR), independent external peer review (IEPR), Mississippi Valley Division and USACE – Headquarters policy review. CEMVN received approximately 300 comments on the DIFR-EIS. The PDT received the IEPR report of 20 comments on 13 August 2021. The comments received were related to insufficient NEPA compliance, Future with project modeling, and assumption on 100% participation rate for the nonstructural plan as participation is voluntary. followed the same categories discussed below. The comments are broken into the following main categories:

1. NFS and Federal Agency comments
2. Public Comments
3. Nonstructural (NS) Plan
4. Hydraulic & Hydrology (H&H) Modeling
5. NEPA Process
6. Cost Analysis

2.5.1 NFS and Federal Agency Comments

Agency comments expressed concerns over the levee alignment in Big Branch Wildlife Refuge and avoiding and minimizing impacts to wetlands. Additional engineering information (such as cross sections and plan views), future with project (FWP) modeling, and operations guidelines were also requested. With no applicable wetland value assessment (WVA)

model, the agencies are unable to determine mitigation costs for the Draft TSP and request additional time to complete the field work necessary for completion of the WVA. With anticipated changes to the Draft TSP, the United States Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) requested a second release of the DIFR-EIS for review. The NFS expressed concerns with the alignment which they are currently working on and the costs associated with the alignments. Coordination with the NFS is ongoing to address their concerns. The NFS remains in support of the project.

2.5.2 Public Comments

Many of the comments received from the general public were related to concerns for induced flooding, the nonstructural plan, inadequate or insufficient H&H modeling, and the Draft TSP alignment. The public questioned the alignment along the Military Road and Old Spanish Trail areas. The residents of the communities in and around Military Road criticized the lack of inclusion of their community within the levee alignment and they requested reconsideration of the levee alignment. Eden Isle residents, in Eastern Slidell, expressed concerns regarding the lack of protection the Draft TSP provided to Eden Isle. Comments received highlighted the previous work by the State/Parish regarding possible benefits of the Rigolets Barrier measure that was screened out due to the cost outweighing the benefits.

Additional information was requested regarding the implementation of the nonstructural plan such as which homes would be raised and the cost burden of elevations. In addition, concern was expressed for induced flooding impacts to structures outside of the structural protection.

A recurring theme in the comments was in regard to localized flooding, floodplain development and permitting. Many comments received described areas prone to flooding and the effects of flooding caused by Hurricane Katrina as well other rain events. Many individuals commented on real estate development within the parish floodplain and critiqued the permitting process.

2.5.3 Nonstructural Plan

There has been significant public concern over structures that are currently included in the nonstructural component of the Draft TSP. In addition, there are concerns over homes and communities that are not captured in the nonstructural plan. Some residents want to be included in the plan, and feel they have justification for inclusion based on their current home elevation. Some of these concerns could not be addressed without surveys of properties, which is usually a part of pre-construction engineering and design.

The aggregation of homes in the Draft TSP was based on a floodplain analysis across the entire study area. The USACE Planning Center of Expertise, ATR, and IEPR reviewers expressed significant concerns and requested further sub-aggregation of the nonstructural plan looking at smaller groups of structures in the study area to be completed in feasibility level of design.

2.5.4 Hydrologic & Hydraulic Modeling

Many of the reviewers (ATR, IEPR, USACE Planning Center of Expertise, and the public) commented on the modeling approach and also the ADCIRC modeling that had not been completed at the release of the DIFR-EIS. A common trend among many of the comments is a critique of the hydraulic modeling used by the USACE to determine inducements. Some comments specifically contrasted differences between the modeling used by the NFS, USACE, and FEMA. There was a suggestion for more H&H modeling to provide information on the potential optimization of the levee. The PDT is modeling FWP to assist in addressing these concerns. Section 4.2.1 in the main report discusses the H&H analysis that was completed at the time of the DIFR-EIS.

2.5.5 NEPA Process

During the NEPA process, CEMVN received specific questions regarding the period of review and how to access materials related to the study. CEMVN also received questions about whether the PDT was using any input from the state and local governments and agencies in developing the Draft TSP.

2.5.6 Cost Analysis

The ATR review contained comments regarding the study's cost analysis and how it was performed. One ATR reviewer noted the level of contingencies that were used for the ROM cost. The contingency development for all measures and alternatives was based on the Abbreviated Risk Analysis software. The analysis developed a contingency for the alternatives and measures with a contingency range from 41 percent to 56 percent. The analysis identified levels for scope growth, acquisition strategy, construction elements, specialty construction, design and quantities, cost assumptions and external project risks. The ATR reviewer stated that the key cost risk driver identified is construction elements, specialty construction, and technical design with risk level of 4 or 5. The PDT will re-evaluate the key cost risks when completing the cost schedule risk analysis during the Feasibility Level Design stage.

2.6 SUMMARY OF REVIEW COMMENTS ON THE OPTIMIZED TSP

Due to the significance of the comments received on the initial DIFR-EIS, the TSP was optimized to incorporate additional modeling and evaluation that was performed. Wetland value assessments and Habitat Evaluation Procedures were conducted. Anticipated impacts resulting from the implementation of the proposed plan were further developed including identification of mitigation sites and development of the mitigation plan.

The RDIFR-EIS containing the Optimized TSP was released for a second public comment period beginning 21 July 2023 and ending 6 Sep 2023. The NOA for the second 45-day public comment period was published in the Federal Register (Vol 88 No. 86) on 21 July 2023. Public hearings were held on 15 August and 16 August, 2023 in Slidell and Covington, LA respectively. The release was coordinated with appropriate Congressional, Federal,

tribal, state, and local interests, as well as environmental groups and other interested parties.

The Optimized TSP garnered a good deal of attention with the submission of approximately 212 emails and 17 comment cards constituting 767 comments from individual citizens, non-government organizations, city, parish, state, and federal agencies. There were submissions of 4 different form letters with many commenters modifying the standard form letter with their own specific comments. If the same form letter was submitted without changes by multiple respondents, then the comments within the letter was counted as a single comment submitted by the number of individuals that submitted that form letter. If the form letter was modified from the standard format then it counted as a separate comment. Of the 767 comments received, a majority of the individuals expressed opposition to the plan or were skeptical of risk reduction limits of the plan. The top reoccurring themes were plan formulation and support for another alternative, social effects from increased taxes, insurance, emergency services, induced flooding or risk of increased height of flooding for those outside the system. The lack of support was generally in regard to being excluded from the proposed levee system and concerns for increases to their taxes, home and flood insurance.

2.6.1 Peer Review

The final ATR review was completed on December 20, 2023, and the PDT received and addressed twenty-one comments. The final ATR certification was received on January 19, 2024. Cost certification was received by the Cost Engineering Center of Expertise on December 19, 2023.

2.6.2 Policy and Legal Compliance Review

The FIFR-EIS underwent a Policy and Legal Compliance Review completed by the Mississippi Valley Division on September 6, 2023. Twenty-nine comments were received and addressed by the PDT. Comments received were related to the Real Estate Plan, Environmental mitigation, and the economics analysis.

2.7 DRAFT TSP SELECTION (2021)

Based on evaluations described in the Main Report (Sections 4.2.1 - 4.2.10 and summarized in Section 4.2.11 and Table 4-13), the independent, combinable, cost-effective measures with a benefit to cost ratio (BCR) value greater than 1, were moved forward for inclusion as part of the comprehensive combined structural and nonstructural plan identified as the Draft TSP. Subsequent to the release of the DIFR-EIS, the PDT conducted additional engineering, economic, and environmental investigations on the individual features of the Draft TSP. The information gathered by the PDT through these additional investigations, together with the consideration of comments received from the NFS, ATR, the public, stakeholders, and the resource agencies, the PDT refined the Draft TSP into the Optimized TSP, which is described in Section 4.5 of the main report Based on the public, ATR, and policy comments

from the July 2023 review, the proposed plan, known as the Optimized TSP, was refined again. Section 6 of the Main Report provides additional detail on the Recommended Plan.

Draft TSP (2021)

- For FRM, the two justified measures, Bayou Patassat Channel Improvements (clearing and snagging) (S-080) and the Mile Branch Channel Improvements (S-050), were separable and combinable and both moved forward for the Draft TSP.
- For CSRM, the West Slidell Levee, South Slidell Levee, South Slidell Levee with Eden Isle and the Combined South Slidell and West Slidell Levee all had a positive BCR, but these measures were not all separable and could not all be selected. The West Slidell (S-081) and South Slidell (S-075, S-076) levee combination provided the greatest net benefits for this area and was the only alternative moved forward for CSRM.
- The nonstructural measures (NS- 08, NS-09, NS-10, NS-11) that address structures in the 0–50-year floodplain (2 percent AEP) in areas not benefited by the structural measures were also moved forward.

The below Figures show each of the measures in the Draft TSP.

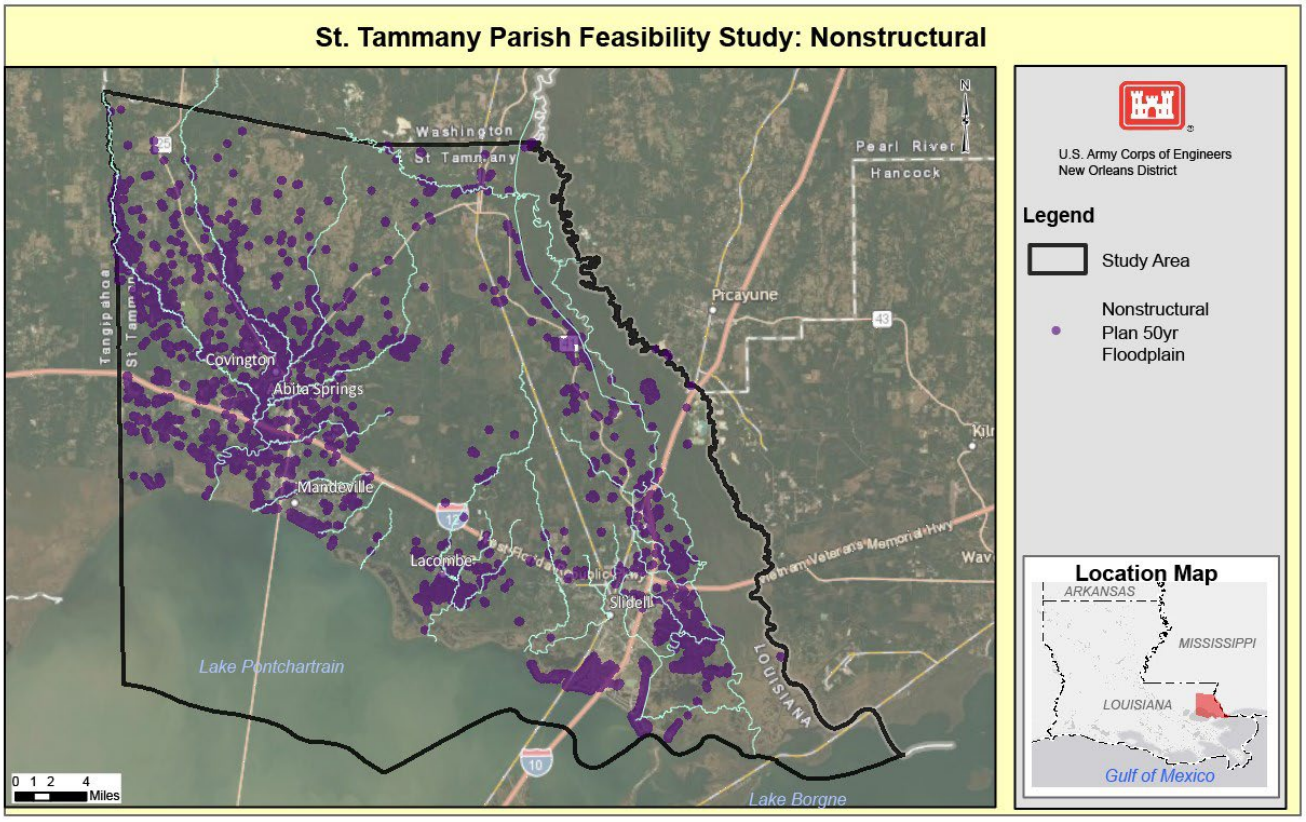


Figure B:2-31. Draft TSP Nonstructural Component

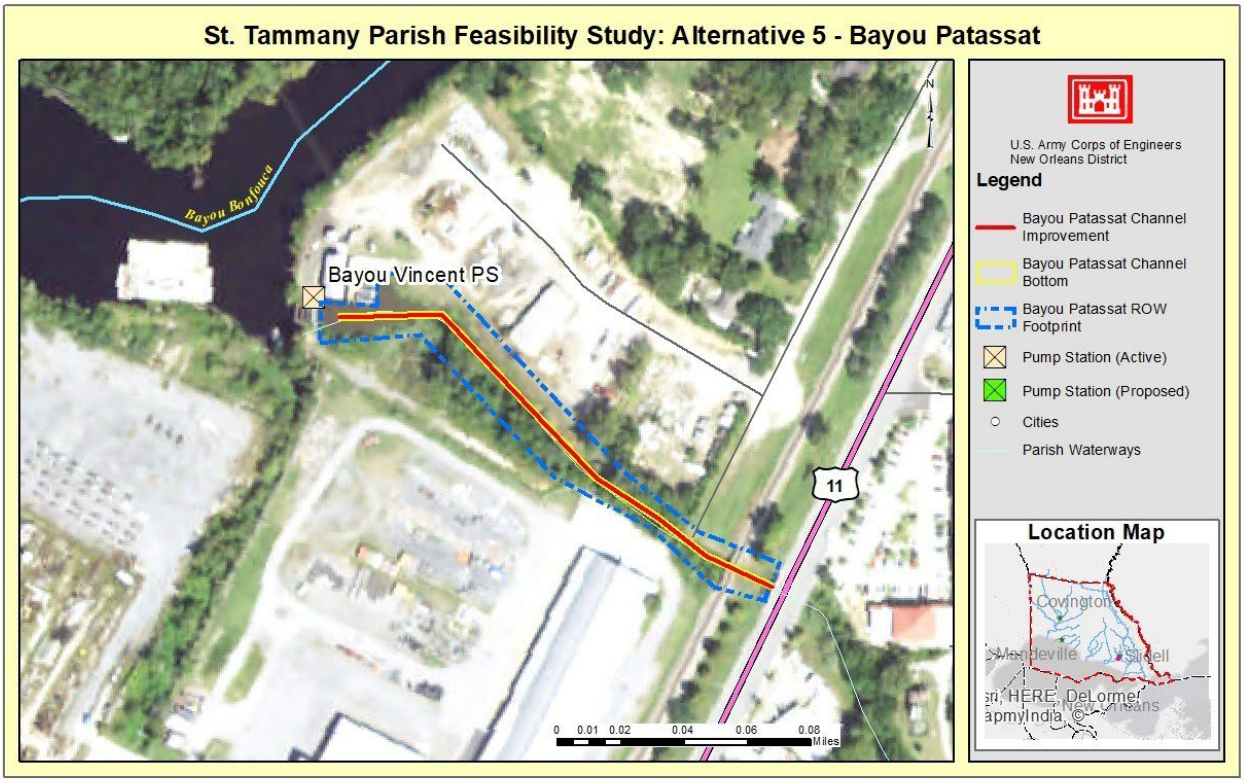


Figure B:2-32. Draft TSP FRM feature-Bayou Patassat Channel Improvements (Alternative 5)

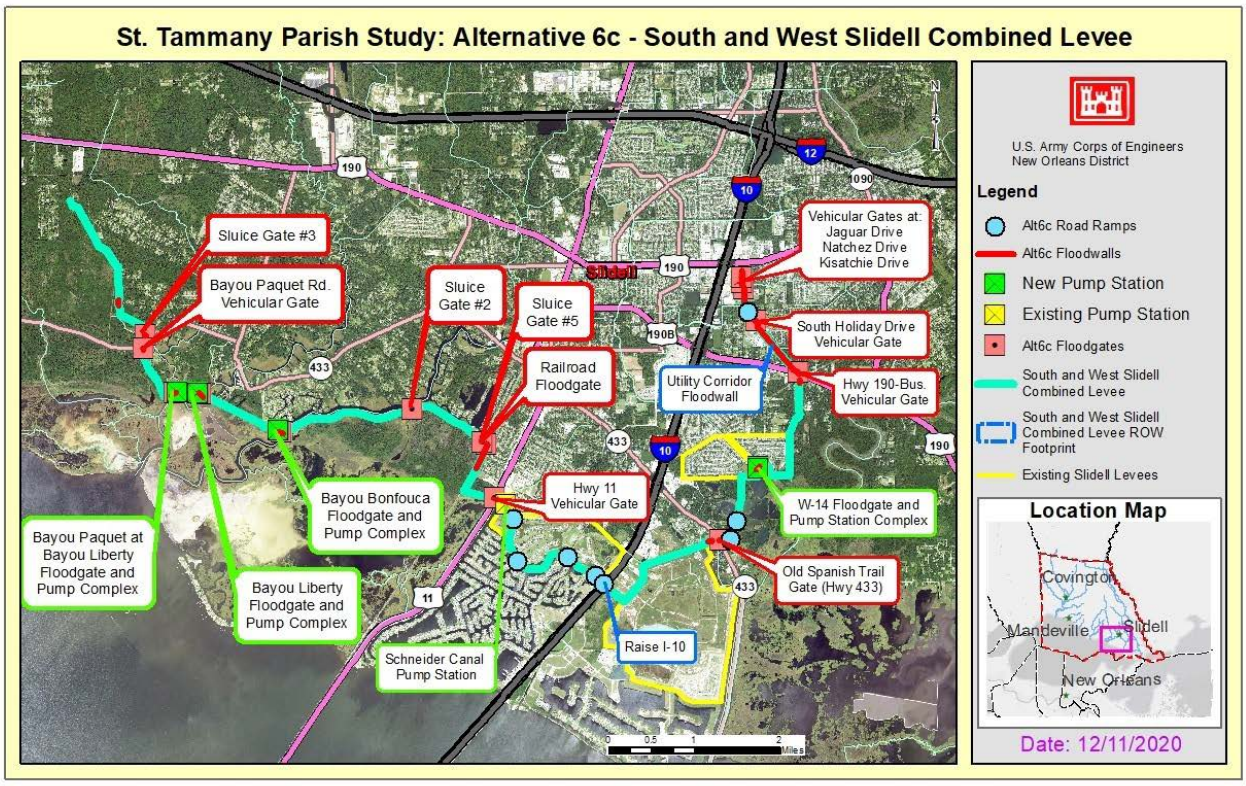


Figure B:2-33. Draft TSP CSRM Feature- South and West Slidell Combined Levee (Alternative 6c)

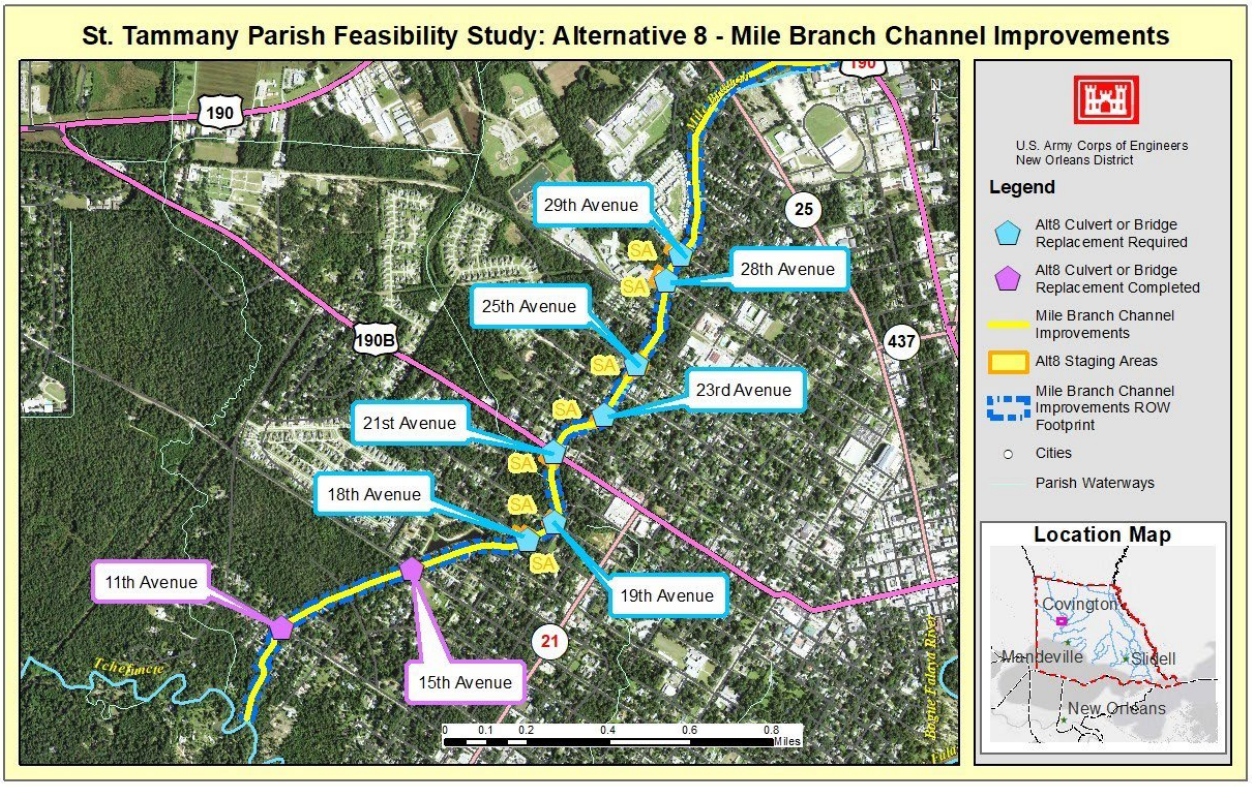


Figure B:2-34. Draft TSP FRM Measure-Mile Branch Channel Improvements (Alternative 8)

2.8 STUDY EXEMPTION GRANTED BY ASA(CW) TO EXCEED- 3 YEAR BASE STUDY PERIOD AND $3M FEDERAL STUDY COST; STUDY CLASSIFIED AS "MEGA" STUDY

Section 1001 of the Water Resources Reform and Development Act of 2014 (WRRDA 2014) (Public Law 113-121), as amended, provides that, to the extent practicable, U.S. Army Corps of Engineers (USACE) final feasibility reports will be completed in three years and will have a maximum federal cost of $3 million and that USACE districts, divisions and headquarters review will be concurrent. In calculating the duration of the feasibility study, the study is initiated when the Feasibility Cost Sharing Agreement (FCSA) is executed or, for those feasibility studies for which a FCSA is not required, when federal funding is allocated to initiate the study, and ends with the signing of the decision document (e.g., Chiefs Report or Director's Report) or another document as appropriate.

Section 1001 of WRRDA 2014, as amended by Section 1330(b) of the Water Resources Development Act of 2018, further provides that if a study will not be completed within three years, the Assistant Secretary of the Army for Civil Works (ASA(CW)) may approve a total of up to seven additional years to complete the study, as long as the study duration does not exceed ten years total. Exemptions to the three-year

base study period may be requested in any increment, up to the seven-year limit as mandated in Section 1330(b) of WRDA 2018. If the study is not completed as of the last day of the approved timeline, the study is deauthorized. MEMORANDUM FOR COMMANDING GENERAL, U.S. ARMY CORPS OF ENGINEERS, dated March 8, 2019, SUBJECT: Implementation Guidance for Section 1001 of the Water Resources Reform and Development Act of 2014, Vertical Integration and Acceleration of Studies as amended by Section 1330(b) of the Water Resources Development Act of 2018. The Deputy Commanding General Civil Works and Emergency Operations (DCG-CEO) is authorized to approve an increase of the total study cost, including approving an increase of the federal cost from $1.5 million federal to up to $3 million federal.

The CEMVN transmitted a Request for an Exemption to the 3-year study duration and for the approval of a federal study cost in excess of $3 million on October 15, 2021. A copy of the Exemption Request package is included in this Appendix as Annex 1. The basis for the Exemption Request was that the study is not scheduled to be completed within the three-year timeframe, which was to end on 13 January 2023 and that additional time and funding was needed to finish tasks related to feasibility level design, National Environmental Policy Act (NEPA) compliance, and coordination with federal partner agencies. Several factors, described below, demonstrate why this study cannot be completed under the current schedule or cost parameters. The primary WRRDA 2014 factor in consideration of the exception is the type, size, location, scope, and overall cost of the project. This study is attempting to address flood risk in coastal Louisiana. The study area comprises 1,124 square miles, over 250,000 residents, and in excess of 2,500 businesses. Formulation included explicit investigations into each of the 36 hydrologic subbasins across St. Tammany Parish. Further, the recommended plan contains a mixture of both structural and nonstructural measures aimed at reducing risk of riverine and coastal flood damage mechanisms that require feasibility level design.

The Exemption Request stated that the PDT had received extensive feedback during the concurrent review period that requires additional analyses to be performed. Public concerns centered around the themes of expected environmental impacts and mitigation costs, economic benefits and efficiency of measures, future with project hydraulic modeling, and resiliency related to future sea level change. Furthermore, the Exemption Request stated after the agency decision milestone, the U.S. Fish and Wildlife Service requested the study schedule be extended by six months to provide more time to complete their coordination with the PDT. While significant action by another federal agency is not expected during construction, the levee-floodwall system is partially situated on national refuge lands. Outstanding detailed analyses include threatened and endangered species impacts, essential fish habitat assessment, a functional assessment of wetland habitat impacts, and the use of habitat evaluation procedures to inform a compensatory mitigation plan.

Finally, the Exemption Request noted that there were NEPA Environmental Impact Statement (EIS) time limit considerations. The Request stated that an additional eighteen months was needed to complete the EIS. Under the Council on Environmental Quality's July 2020 Final Rule on implementation of updated NEPA regulations, EISs are to be completed within two years of the Notice of Intent (NOI). The NOI was published 19 June 2020, prior to when the new NEPA policy went into effect (14 September 2020). Thus, the NEPA two-year time limit

for an EIS would not apply, but it is nonetheless relevant for consideration as a factor contributing to the need for this exception.

The Policy and Legal Compliance Review Team members concurred with the Exemption Request, and the Chief of Planning and Policy received endorsement of the exception request from the Senior Leader Panel on 25 January 2022.

On April 4, 2022, the Assistant Secretary of the Army, Civil Works, approved the Exemption Request submitted by the New Orleans District for an exemption from the feasibility study cost and schedule requirements (3-year study duration and $3 million federal study cost) of Section 1001 of WRRDA 2014 for this Study. This action increased the total Study time from 36 months to 52 months and increased the Federal study funds by $1.77 million from a total of $3 million to a total of $4.77 million. Since the Exemption Request was approved, the study is now classified as a Mega Study and is subject to oversight by HQUSACE and any related project management practices.

Section 3

Local Flood Policies and Management

There are a variety of activities that are being conducted at the state, parish and/or municipality level to reduce and or mitigate flood risk. While the Recommended Plan (RP) provides a suite of measures to reduce FRM and CSRM risk in the study area, the plan would not solve all of flooding problems within the study area. Due to the large scale, complexity, and multiple sources of flooding in the study area, risk reduction would require multiple management strategies at numerous levels. This section provides a brief summary of the flood reduction or mitigation policies and activities in place within the study area that were considered during the plan formulation process, including: comprehensive planning, hazard mitigation planning, zoning and land use, local ordinances and the National Flood Insurance Program (NFIP), Community Rating System (CRS) participation and coastal zone management.

In accordance with Section 402 of WRDA 1986, as amended (33 U.S.C. 701b-12), the NFS shall prepare a floodplain management plan for the project within one year after the effective date of this agreement and shall implement such plan no later than one year after completion of construction of the project. The NFS may execute agreements with other non-Federal entities to ensure such preparation and implementation. The plan shall be designed to reduce the impacts of future flood events in the project area, including but not limited to, addressing those measures to be undertaken by non-Federal interests to preserve the level of flood risk reduction provided by such work. The NFS shall provide an information copy of the plan to the government.

Table B:3-1 Summary of Flood Management Planning Efforts and Policies Applicable to the

Study Area

Planning Efforts		
CPRA	2012, 2017 and 2023 Louisiana Coastal Master Plan	Include protection and restoration goals of reducing coastal flood risk, promoting sustainable ecosystems, providing habitats for a variety of commercial and recreational activities coast wide, strengthening communities, and supporting regionally and nationally important business and industry. https://coastal.la.gov/our-plan/2017-coastal-master-plan/
St Tammany Parish	Coastal Master Plan	Holistic watershed approach to address water quality, riverine flooding, and coastal erosion. http://www.stpgov.org/files/Departments/Grants/STP-Coastal-Mast-Plan-2017-BLUE-PLAN4.pdf
St Tammany Parish	New Directions 2025 – St. Tammany Parish Comprehensive Plan (2003)	Addresses community facilities, critical and sensitive areas, economic development, essential community design, housing, land use, natural hazards, transportation, and implementation. http://www.stpgov.org/new-directions-2025
St Tammany Parish	Storm Water Management Plan (2017)	St. Tammany Parish Stormwater Management Plan (SWMP)
City of Covington	Flood Response Plan-2018	https://thewaterinstitute.org/assets/docs/reports/Covington-Flood-Response-Plan-29-Oct-2018.pdf
City of Slidell	Master Plan	
Hazard Mitigation Plans-Hazard mitigation plans are multi-disciplinary risk reduction plans required by the FEMA for states and parishes to receive mitigation grants. These local mitigation plans form the foundation for communities' comprehensive and long-term strategies to reduce disaster losses. They also create a framework for risk-based decision making to protect health and safety, reduce damage to property, and minimize disruptions to the economy and governmental operations from future disasters. (CPRA 2017)		
State Hazard Mitigation Plan (SHMP).	Louisiana SHMP	Produced by LA Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP) produces the SHMP and analyzes a range of climatological, geological, and human-influenced hazards, and assesses the relative risk they pose at the parish level based on past events. Hazards incorporated in the SHMP include: coastal erosion, dam failure, drought, earthquake, extreme heat, flooding, levee failure, saltwater intrusion, sea level rise, sinkholes, storm surge, subsidence, thunderstorms (hail, high wind, and lighting), tornadoes, tropical cyclones, wildfires, and winter weather.
St Tammany Parish	St. Tammany Parish Hazard Mitigation Plan, updated in 2020	Comprehensive plan for disaster relief in St. Tammany Parish. This plan is multi-jurisdictional and includes the following jurisdictions: Unincorporated St. Tammany Parish, Town of Abita Springs, City of Covington, Village of Folsom, Town of Madisonville, City of Mandeville, Town of Pearl River, City of Slidell, and Village of Sun. This plan provides the process, identifies natural hazards and risks within the parish and identifies the parish's hazard mitigation, which is done to make the parish less vulnerable and more disaster resilient.

Regulatory Tools- Zoning, subdivision regulations, unified development codes, infrastructures standards and building codes, ordinances and other regulations are key tools that can help communities reduce their flood risk. These types of statutory rules are the conduits through which plans and policies are implemented and achieve on the ground results (CRPA 2017).		
St Tammany Parish	Building Codes	St. Tammany Parish has a published building code, which is available online through the Permits and Regulatory Department of the parish government as a separate document and as Appendix D of the Code of Ordinances. The building code applies to the unincorporated portions of the parish. and operates within the context of the State of Louisiana Uniform Construction Code, which requires the enforcement of the current editions of the Family of International Building Codes. Division 5 (Provisions for Flood Hazard Reduction) of the Parish Code of Ordinances stipulates that the first floor of new or substantially improved residential, commercial, and industrial structures must be above the base flood elevation. (GEC 2012)
St Tammany Parish	Unified Development Code (including Subdivision Ordinances),	Subdivision ordinances, much like zoning, offer a tool for shaping future and on-going development. Essentially these are ordinances that offer ability and flexibility to developers to allow them, through design and location, keep development within a subdivision isolated to those areas that have lower hazard exposure. These ordinances can also help ensure features like wetlands and greenways that can provide mitigation services through water retention for example, are maintained, enhanced, and perhaps even created. (Peacock et al 2009). St. Tammany has an officially adopted Uniform Development Code – Volume 1 (Zoning), which is available online through the Planning Department of the parish government and identifies the various zoning districts (residential, commercial, industrial, medical, public facilities, etc.). Officially adopted zoning maps are available online at the parish, regional, and ward level. The Unified Development Code continues to evolve with new classifications being added and the requirements for existing classifications modified. (GEC 2012) St. Tammany Parish Code of Ordinances
Town of Abita Springs	Codes and Ordinances	https://library.municode.com/la/abita_springs/codes/code_of_ordinances
Village of Folsom	Code and Ordinances	https://www.codepublishing.com/CA/Folsom/
Town of Madisonville	Codes and Ordinances	https://library.municode.com/la/madisonville/codes/code_of_ordinances
City of Mandeville	Codes and Ordinances	https://library.municode.com/la/mandeville/codes/code_of_ordinances
City of Covington	Codes and Ordinances	https://library.municode.com/la/covington/codes/code_of_ordinances
Town of Pearl River	Code and Ordinances	https://library.municode.com/la/pearl_river/codes/code_of_ordinances
City of Slidell	Codes and	https://library.municode.com/la/slidell/codes/code_of_ordinances

	Ordinances	
NFIP- aims to reduce the impact of flood damages on communities through increased access to affordable flood insurance in exchange for community adoption of floodplain management standards and regulations. In order to provide communities with opportunities to reduce flood insurance costs in exchange for additional flood risk reduction actions and more stringent ordinances, NFIP also encourages participation in CRS. Communities that enroll in CRS receive additional reductions in flood insurance premiums for implementing activities supporting four main goals: 1) increasing access to information about flood risk and risk reduction options, 2) improving floodplain mapping and regulatory standards, 3) promoting flood damage reduction activities, and 4) promoting flood preparedness plans (CPRA 2017).		
St Tammany Parish		CRS Score 7
Covington		CRS Score 10
Mandeville		CRS Score 7
Slidell		CRS Score 7
DFIRM-While flood damage prevention ordinances that meet or exceed the minimum standards of NFIP are currently in place, not all communities have updated Digital Flood Insurance Rate Maps (DFIRMs) with final effective BFEs. As the parish and communities adopt the latest DFIRMs and Base Flood Elevation(BFE)s, new work will be required periodically to assure that the latest land elevations, benchmarks, storm surge modeling, and other relevant information about Louisiana's dynamic coast are incorporated (CPRA 2017). FEMA's flood insurance study for St. Tammany Parish covers Slidell, Covington, Mandeville, Madisonville, Abita Springs, Pearl River, Folsom, Sun, and the unincorporated areas and includes flooding from Lake Pontchartrain, with revisions completed in April 2008. (GEC 2012)		
FEMA available flood hazard data as of 11-30-2020 (FEMA)		Location of Data
ABITA SPRINGS, TOWN OF	Effective FIRM 5/17/1988	https://msc.fema.gov/portal/availabilitySearch?addcommunity=220199
COVINGTON, CITY OF	Effective FIRM 11/19/1980	https://msc.fema.gov/portal/availabilitySearch?addcommunity=220200
FOLSOM, VILLAGE OF	Effective FIRM 3/16/1982	https://msc.fema.gov/portal/availabilitySearch?addcommunity=220285
MADISONVILLE, TOWN OF	Effective FIRM 3/16/1983	https://msc.fema.gov/portal/availabilitySearch?addcommunity=220201
MANDEVILLE, CITY OF	Effective FIRM 5/16/2012	https://msc.fema.gov/portal/availabilitySearch?addcommunity=220202
PEARL RIVER, TOWN OF	Effective FIRM 5/4/1988	https://msc.fema.gov/portal/availabilitySearch?addcommunity=220203
SLIDELL, CITY OF	Effective FIRM 4/21/1999	https://msc.fema.gov/portal/availabilitySearch?addcommunity=220204
ST. TAMMANY PARISH*	Effective FIRM 4/21/1999	https://msc.fema.gov/portal/availabilitySearch?addcommunity=225205
SUN, VILLAGE OF	Effective FIRM 7/1/2013	https://msc.fema.gov/portal/availabilitySearch?addcommunity=220205

ABITA SPRINGS, TOWN OF	Preliminary 4/4/2008. Revised on 4/30/2008	FEMA MIP
COVINGTON, CITY OF	Preliminary 4/4/2008. Revised on 4/30/2008	FEMA MIP
FOLSOM, VILLAGE OF	Preliminary 4/4/2008. Revised on 4/30/2008	FEMA MIP
MADISONVILLE, TOWN OF	Preliminary 4/4/2008. Revised on 4/30/2008	FEMA MIP
PEARL RIVER, TOWN OF	Preliminary 4/4/2008. Revised on 4/30/2008	FEMA MIP
SLIDELL, CITY OF	Preliminary 4/4/2008. Revised on 4/30/2008	FEMA MIP
ST. TAMMANY PARISH	Preliminary 4/4/2008. Revised on 4/30/2008	FEMA MIP
SUN, VILLAGE OF	Preliminary 4/4/2008. Revised on 4/30/2008	FEMA MIP
Coastal Zone Management Program-CZMP attempts to "balance conservation and resources, . resolve user conflicts, encourage coastal zone recreational values, and determine the future course of coastal development and conservation" (DNR, 2015, p. II-2). While the Program typically pertain to projects that have "direct and significant impacts on coastal waters," it also refers directly to minimizing the risk due to flood and storm hazards (CPRA 2017)		
State of Louisiana	Louisiana Coastal Resources Program (CRP). http://www.dnr.louisiana.gov/index.cfm/page/85	

Section 4
Borrow Site Investigations

4.1 INTRODUCTION

The term “borrow” is used in the fields of construction and engineering to describe material that is dug in one location for use at another location. The term borrow material is used to describe soil or sediment taken from a site for use in structure construction, such as sandy sediment dredged and pumped to restore an eroded beach, or clay taken to build a levee or dike. The term borrow pit is used to describe the site remaining after borrow material has been removed (EM 1110-2-5026).

The intent of this initial investigation was to provide a level of detail sufficient to support the TSP decision, demonstrate that there are sufficient available options for borrow for the RP and provide NEPA clearance on selected potential borrow sites, STP-5, STP-6, STP-9, MS-1, and MS-2. These sites are detailed further in Table B:4-1 and shown on Figure B:4-1. The only measure of the RP that require borrow material are West and South Slidell levees and floodwalls which would require approximately 7,239,000 million cubic yards of suitable clay fill (See Section 6 of the main report and Appendix D for additional details regarding the RP for borrow).

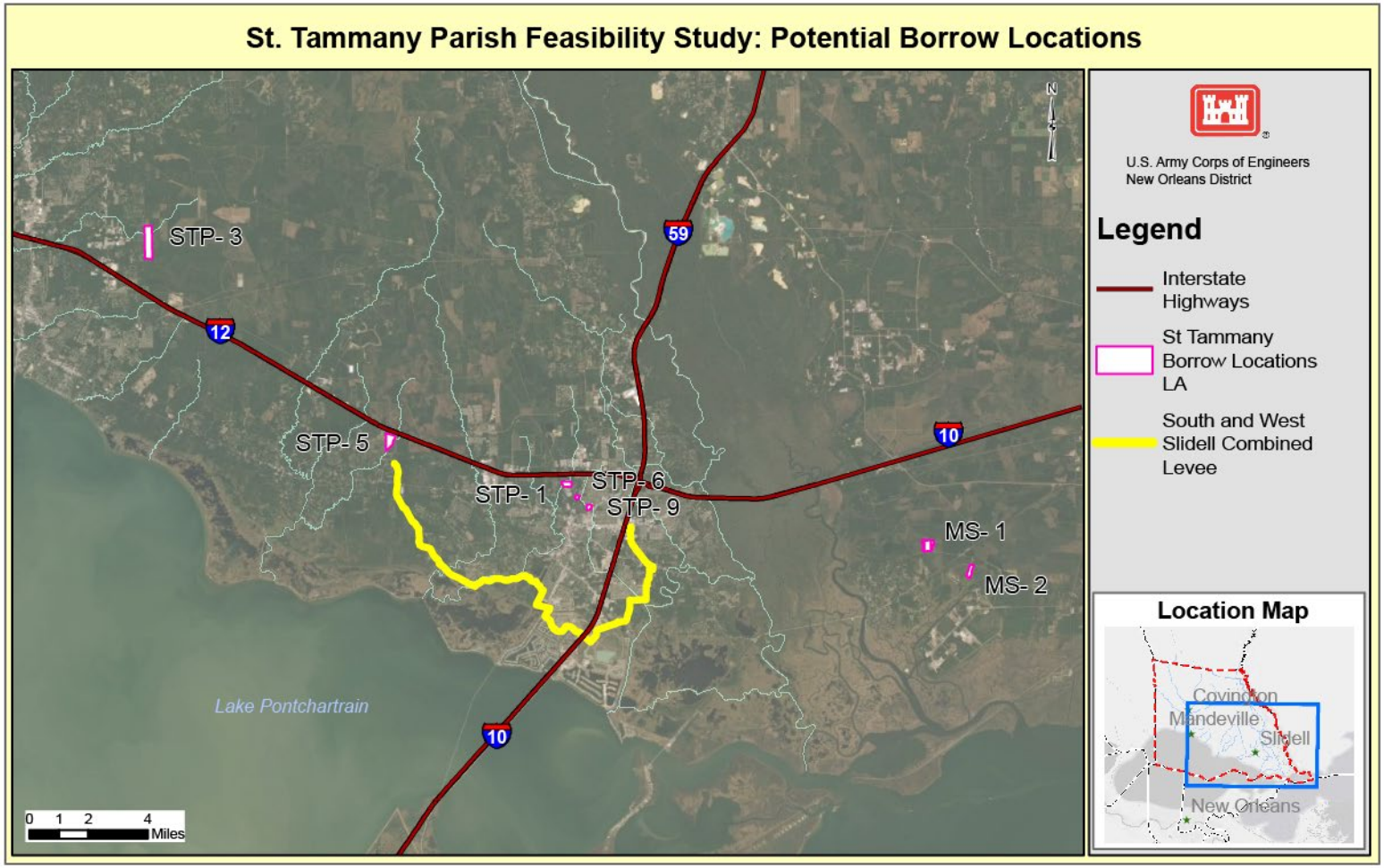


Figure B:4-1. Map of borrow sites. Sites STP-5, STP-6, STP-9, MS-1 and MS-2 retained for further consideration.

4.2 REFERENCES FOR THE ACQUISITION OF BORROW MATERIAL

The following regulations and authorities pertain to the acquisition of borrow material:

- EM 1110-2-1913, Chapter 4, Borrow Areas.
- MVD SOP 2009-01, Real Estate: Acquisition of Borrow Material.
- EO 11990, Protection of Wetlands.
- ER 200-2-2, Environmental Quality, Procedures for Implementing NEPA.
- ER 405-1-12, Section 12-9, Determining the Appropriate Interest to Acquire.
- ER 405-1-12, Section 12-10, Determining the Appropriate Estate.
- ER 405-1-12, Section 12-16, Real Estate Plan.
- ER 405-1-12, Section 12-18, Baseline Cost Estimate for Real Estate.
- ER 405-1-12, Section 12-29, LER and Relocations Required Relocations for Cost Shared Projects.
- ER 405-1-12, Section 12-34, Government Acquisition of LER and Performance of Relocations on Behalf of Nonfederal Sponsors.
- ER 1105-2-100, Planning Guidance Notebook, Appendix C, Environmental Evaluation and Compliance.
- ER 1165-2-132, Hazardous, Toxic and Radioactive Waste (HTRW) Guidance for Civil Work Projects.

4.3 IDENTIFICATION OF POTENTIAL BORROW SITES

The PDT identified and ranked potential borrow sources in terms of the location, suitability and land use that best avoids and minimizes adverse environmental impacts from the excavation site and the haul route. Throughout the process, the PDT coordinated with STPG, the NFS, stakeholders to identify potential borrow sources. In addition to identification of new borrow sites, the PDT investigated previous sites that were identified during the Hurricane and Storm Damage Risk Reduction System (HSDRRS) borrow evaluation process https://www.mvn.usace.army.mil/Missions/Environmental/NEPA-Compliance-Documents/HSDRRS-Projects/) since some have readily available borrow materials and available site data. These sites may need additional investigations and their NEPA clearance updated prior to usage. Furthermore, the PDT used landowner parcel data, aerial maps, National Wetland Inventory datasets, United States Department of Agriculture (USDA) soil maps (https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm) existing geology and geotechnical information to identify sites within St. Tammany Parish and nearby Hancock County, Mississippi with potentially suitable soil characteristics and suitable land characteristics. Through the investigation, a total of 34 sites were identified. Table B:4-1 further details the screening and evaluation process and identifies the five sites the PDT moved forward.

Factors considered by the PDT in identifying and evaluating potential borrow sites:

1. **Environmentally sensitive areas**, including wetlands, BLH forest, were deemed critical areas to be avoided whenever practicable and possible.
2. **Section 404 of the Clean Water Act** regulates impacts to waters of the U.S., which could include streams, rivers, some lakes/ponds, and wetlands. Avoid and minimize impacts to "waters of the United States" and/or wetlands.
3. **Haul distances** should be minimized to reduce costs associated with material transportation; therefore, sites were identified near the levee and floodwall system. Sites with suitable material and using the shortest possible access routes (i.e., shortest haul distance less than 15 miles) near Slidell, LA were identified. Distance from the work site was considered during the screening of borrow sites. Borrow sites must be accessible by equipment required to excavate and transport material to project location. (i.e. Excavators, dozers, scrapers, tractors and pans, over the road or off-road dump trucks).
4. **HTRW**. Soils exhibiting hazardous waste characteristics (40 CFR 261.21-261.24), even if naturally occurring, are not eligible as borrow material. Generally, soil with concentrations exceeding toxicity characteristic leaching procedure (TCLP) levels specified in 40 CFR 261.24 or significantly exceeding background levels are unsuitable as borrow material.
5. **Suitability of material**. The PDT used USDA soil survey data (https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm) and available engineering, geology and geotechnical information during this initial investigation to identify suitable clay sites.

    - Available geology and geotechnical information for Sites STP 1 thru 5: See Appendix D of the St. Tammany Parish Louisiana, DIFR for a preliminary geologic analysis of the five potential sites in St. Tammany Parish (STP 1-5 from Table 1).
    - Available geology and geotechnical information for Sites MS-1 and MS-2: Individual Environmental Report (IER) 19 and IER 23 are incorporated by reference for the completed analysis of the HSDRRS approved Pearlington Dirt site (MS-1) and IER 31 for the geology and geotechnical information on the Port Bienville site (MS-2) in Hancock, Mississippi.
    - New Orleans District > Missions > Environmental > NEPA Compliance Documents > HSDRRS Projects (army.mil)

6. **Land uses** were evaluated in terms of borrow source locations that have the greatest ability to avoid and minimize environmental impacts. For example, areas to be avoided are those with BLH and wetlands. Preferred land uses include but are not limited to previously cleared land and prior-converted cropland.
7. **Parcel Data**. The PDT used landowner parcel data as a tool to identify potentially suitable clay sites that were in public ownership within St. Tammany Parish.
8. **Quantity**. Availability of sufficient quantities of suitable material were estimated for the identified sites. It was assumed that 10-15 feet of usable material could be found in these sites.

4.4 SUMMARY

The evaluation of borrow sites led to the identification of three sites in St. Tammany Parish and two sites in Hancock County, Mississippi as potential borrow sources (See Figure B:4-2 to B:4-6). These sites include land cleared of vegetation and previously investigated HSDRRS borrow sources. Environmental resource assessments were performed on five sites (ST-5, ST-6, ST-9, MS-1 and MS-2) to determine if significant impacts to potentially affected resources in the potential borrow areas. The borrow sites have been previously investigated and partially or fully cleared for Cultural Resources. See IER 19, 23 and 31 for sites MS-1 and MS-2 and SHPO report #'s 22-3725, 22-5346 and 22-3151 for the St Tammany sites. For additional information regarding environmental resource borrow evaluation see Section 5 of the RDIFR-DEIS. These five potential borrow site options contain approximately 27.3 million cubic yards of borrow where only approximately7 million cubic yards is estimated to be needed for construction of the RP and follows environmental operating principles to reduce impacts. The potentially affected resources included wetlands, uplands, prime and unique farmland, fisheries, wildlife, T&E species, cultural resources, recreational resources, noise, and aesthetics. The five borrow sites avoid impacts to wetlands and are not expected to require compensatory mitigation. A Phase I ESA will be conducted by the CEMVN on the proposed borrow sites. Any additional potential borrow sites will require supplemental environmental evaluations in accordance with the NEPA.

The final borrow sources will be selected prior to acquisition and may include borrow material from all sites, from just one of the identified sites or a combination of sites depending on the suitability of the sites. The necessary right of entry and onsite surveys to get the additional information needed for site selection including geologic profiles, borings, and Cone Penetration Test would be obtained.

Transportation routes and mechanisms for the delivery of borrow material have been examined and can be achieved using highways including Interstate-10, Highway 190, Highway 433 and Highway 11. Sensitive areas such as schools and hospital would be avoided. These actions are expected to avoid and minimize transportation, noise and socioeconomic impacts. Staging areas and haul roads would be contained within the borrow site and construction footprints.

The final borrow site(s) design would include slopes, depths, drainage, environmental design considerations. Best management practices would be developed and would address the installation of signage, construction fencing and gates, and erosion control. A stormwater pollution prevention plan (SWPPP) would be prepared in accordance with EPA and state regulations. The SWPPP will outline temporary erosion control measures, such as silt fences, retention ponds, and dikes. The construction contract will include permanent erosion control measures, such as turfing and placement of riprap or filter material.

Table B:4-1. Potential Borrow Site Identification for the St. Tammany Parish Feasibility Study. Bolded highlighted sites were moved forward.

Site #	Site Name	Location	Estimated Borrow Pit Acreage	Estimated Fill Volume (cubic yards)	Screening/Notes	Source	Haul Distance (Approximate distance in miles)
STP-1	Ben Thomas	Slidell, LA	34	861,867	Screened- Adjacent to Ski Lake Task Force Guardian pit that was used and filled as pond, risk -potential impacts to BLH.	STPG HSDRRS	3.5
	Levis	Slidell, LA	51	1,282,470	Screened-North section developed for borrow; residential development is south section	Approved IER-31 (2010)	2.5
STP-3	Maritime	Mandeville, LA	176	4,384,100	Screened- potential impacts to BLH, if determined to be needed to meet fill requirements the site would need mitigation	STPG HSDRRS	12
	Murphy TFG	Pearl River, LA	194.055	4,832,480	Screened- potential impacts to BLH, approval declined during HSDRRS process	STPG HSDRRS	9
	Ski Lake TFG	Slidell, LA	56	1,416,790	Screened-Developed; retention pond on site	STPG HSDRRS	3.5
	Tammany Holding Company	Slidell, LA	332	8,291,880	Screened-Developed; retention pond on site	Approved IER-29 (2008)	1
	Site 1- Tax Free Nature Conservancy	St. Tammany Parish	0.001	0	Screened- Available quantity	PDT-NRCS Soil layer and public property	22
	Site 2- Tax Free	St. Tammany Parish	803	0	Screened-Environmental Impacts Within Big Branch Marsh National Wildlife Refuge (BBMNWR); available quantity	PDT-NRCS Soil layer and public property	1.5
	Site 3- Tax Free	St. Tammany Parish	0.009	0	Screened-Available quantity/too small	PDT-NRCS Soil layer and public	3
	Site 4- Tax Free	St. Tammany Parish	100	2,509,671	Screened-Environmental Impacts Within (BBMNWR)	PDT-NRCS Soil layer and public property	5.5
	Site 5- Tax Free	St. Tammany Parish	33	825,360	Screened-Environmental Impacts Within (BBMNWR)	PDT-NRCS Soil layer and public	5

	Site 6- Tax Free	St. Tammany Parish	1.7	42,603	Screened- Available quantity/ too small	PDT-NRCS Soil layer and public	3
	Site 7- Tax Free	St. Tammany Parish	1.6	39,416	Screened- Available quantity/ too small	PDT-NRCS Soil layer and public	3
	Site 8- Tax Free 3101E Causeway	Mandeville, LA	1.5	38,072	Screened- Available quantity/ too small	PDT-NRCS Soil layer and public property	14
	Site 9 - Tax Free	St. Tammany Parish	1.4	34,237	Screened- Available quantity/ too small	PDT-NRCS Soil layer and public	3
	Site 10- Tax Free Nature Conservancy	Lacombe, LA	367	9,144,798	Screened-Wetland Impacts	PDT-NRCS Soil layer and public property	20
	Site 11- Tax Free	Mandeville, LA	0.041	1,020	Screened- Available quantity/ too small	PDT-NRCS Soil layer and public	14.5
	Site 12- Tax Free	Mandeville, LA	3.4	84,585	Screened-Environmental Impacts BLH and on Scenic River (Bayou Chinchuba)	PDT-NRCS Soil layer and public	14.5
	Site 13- Tax Free-Weldon Park	Mandeville, LA	12.4	309,606	Screened-Environmental Impacts BLH and on Scenic River (Bayou Chinchuba)	PDT-NRCS Soil layer and public property	14.5
	Site 14- Tax Free-1923 Jefferson Street	Mandeville, LA	19.7	490,330	Screened-Environmental Impacts BLH and on Scenic River (Bayou Chinchuba)	PDT-NRCS Soil layer and public property	14.5
	Site 15- Tax Free	St. Tammany Parish	8.8	218,821	Screened-Environmental Impacts Within (BBMNWR)	PDT-NRCS Soil layer and public	5.5
	Site 16- Tax Free	St. Tammany Parish	8.7	216,306	Screened-Environmental Impacts Within (BBMNWR)	PDT-NRCS Soil layer and public	5
	Site 17- Tax Free	Mandeville, LA	0.24	5,976.00	Screened- Available quantity/ too small	PDT-NRCS Soil layer and public	11.5
	Site 18- Tax Free 3010 Causeway Approach	Mandeville, LA	5.8	143,349	Screened-environmental impacts	PDT-NRCS Soil layer and public property	12
	Site 19- Tax Free	St. Tammany Parish	1.2	29,357	Screened- Available quantity/ too small	PDT-NRCS Soil layer and public	0.1
	Site 20- Tax Free – St Tammany Mitigation	St. Tammany Parish	88	2,180,916	Screened- Not available for use; mitigation bank	PDT-NRCS Soil layer and public property	14

	Site 21- Tax Free	St. Tammany Parish	1.7	41,433	Screened- Available quantity/ too small	PDT-NRCS Soil layer and public property	1.5
	Site 22- Tax Free	St. Tammany Parish	38.4	956,259	Screened-Impacts BLH, Bayou Castine and Fontainebleau State Park	PDT-NRCS Soil layer and public property	10
	Site 23- Tax Free	Mandeville, LA	1.0	24,775	Screened- Available quantity/ too small	PDT-NRCS Soil layer and public property	10.5
	Site 24- Tax Free	Mandeville, LA	1.3	33,366	Screened- Available quantity/ too small	PDT-NRCS Soil layer and public	11
STP-5	**Cleared Site 5**	**Lacombe, LA**	**73**	**1,817,700**	**Carried Forward- barren, land with no vegetation, existing retention pond- potential to increasing the retention capacity at this site-beneficial location, falls within defined soil/environmental parameters, and already has a similar land use**	**PDT identified based on previously cleared lands and available soil data**	**2**
STP-6	**Cleared Site 6**	**Slidell, LA**	**10**	**249,000**	**Carried Forward, cleared barren land with no vegetation**	**PDT identified based on previously cleared lands and available soil data**	**3.5**
STP-9	**Cleared Site 9**	**Slidell, LA**	**17**	**423,3 00**	**Carried Forward, previously cleared land with no vegetation**	**PDT-cleared lands**	**3**
MS-1	**Pearlington**	**Hancock County, MS**	**326**	**8,000,000**	**Carried forward- 3 potential sites at location (2 approved). Potential commercial site. Remaining borrow available at each needs to be determined. Pearlington Phase 3 site has wetlands but wetland areas would be avoided**	**HSDRRS IER 19 and IER 23 (2008)**	**9.5**
MS-2	**Port Bienville**	**Hancock County, MS**	**677**	**16,857,300**	**Carried Forward- HSDDRS approved site- Potential commercial site previously planted in pine for commercial harvesting, mixture of overgrown pine habitat and cleared areas. Remaining borrow available needs to be determined, potential commercial site**	**HSDRRS IER 31 (2010)**	**11**

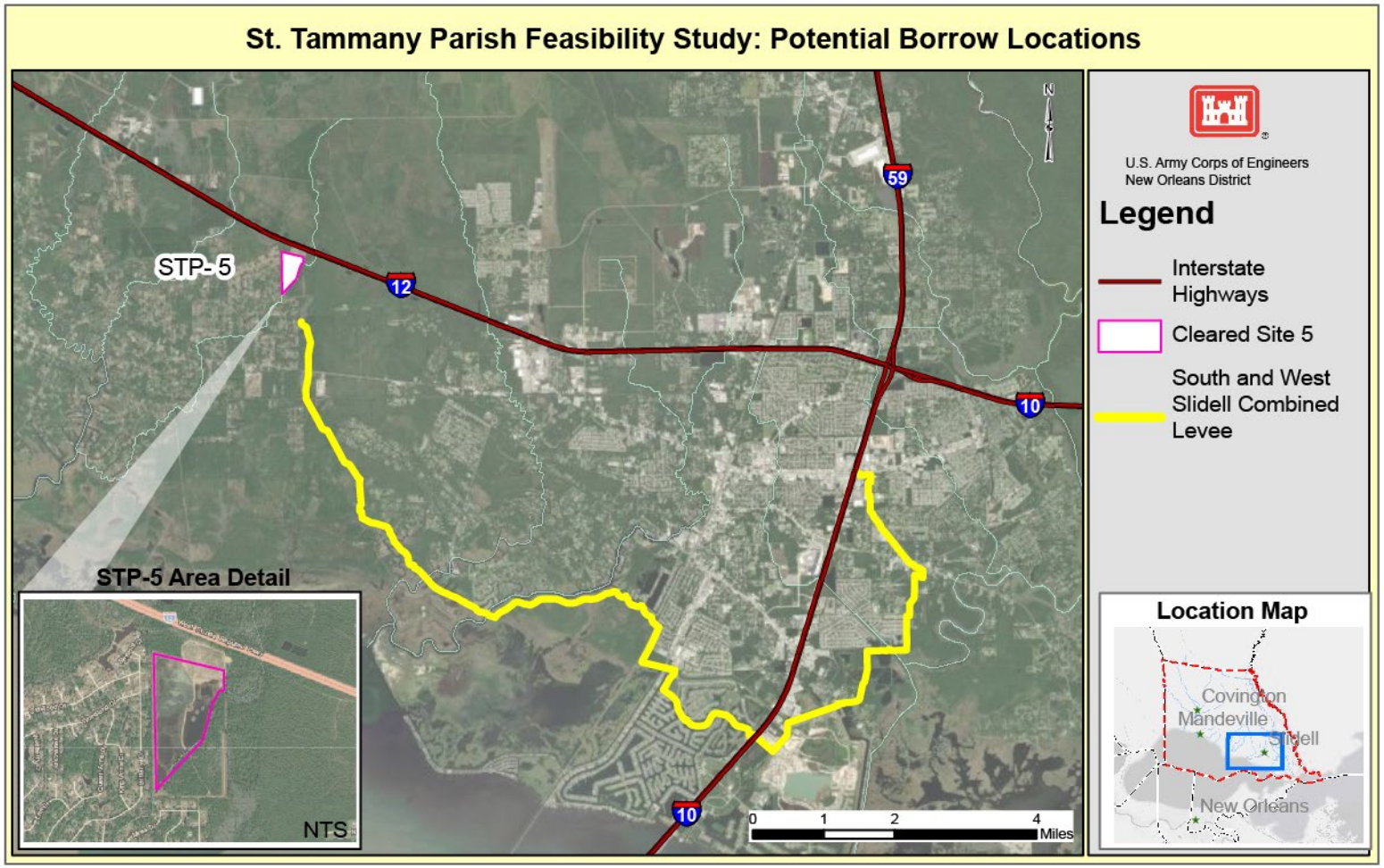


Figure B:4-2. Borrow Site STP - 5

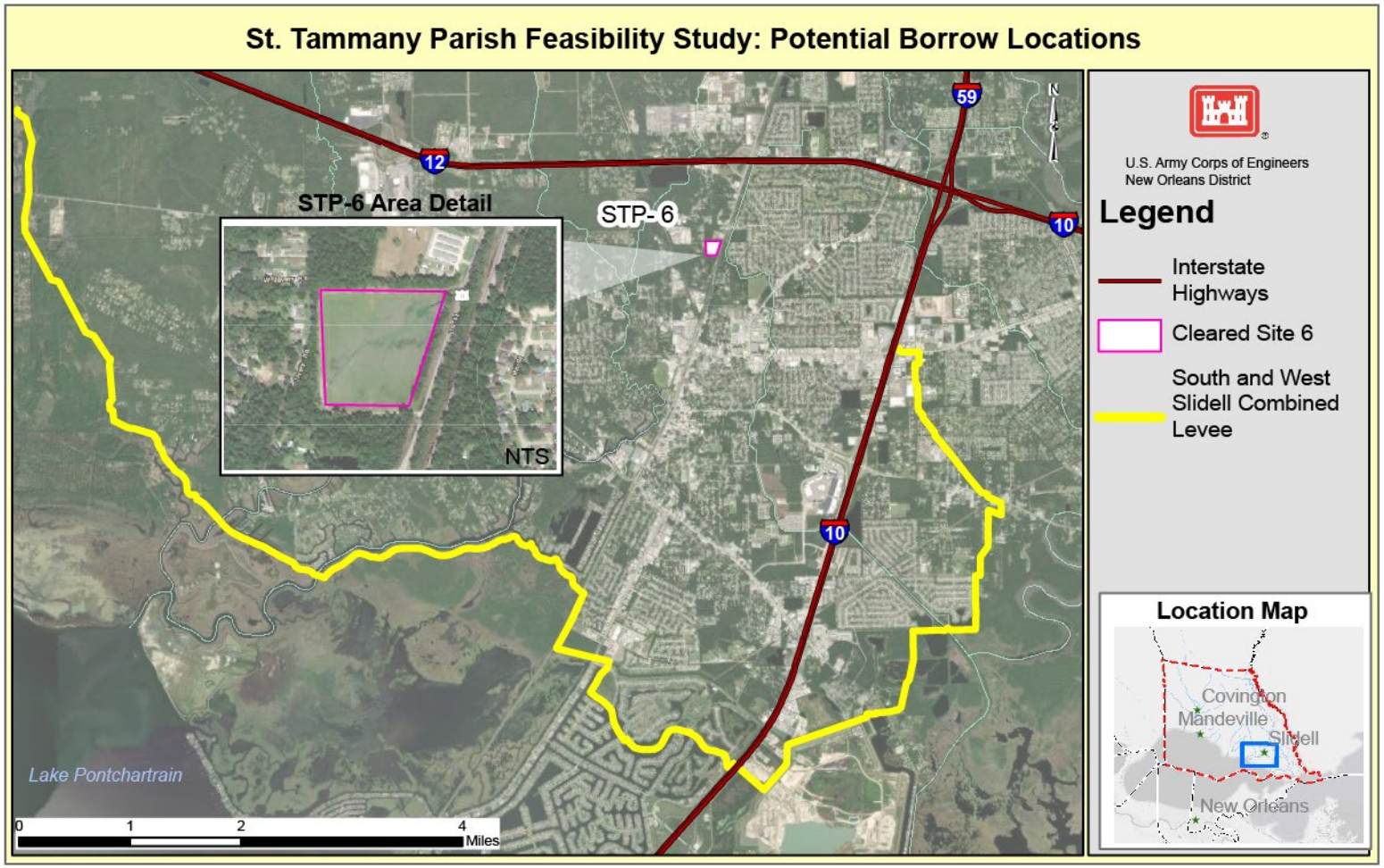


Figure B:4-3. Borrow Site STP-6

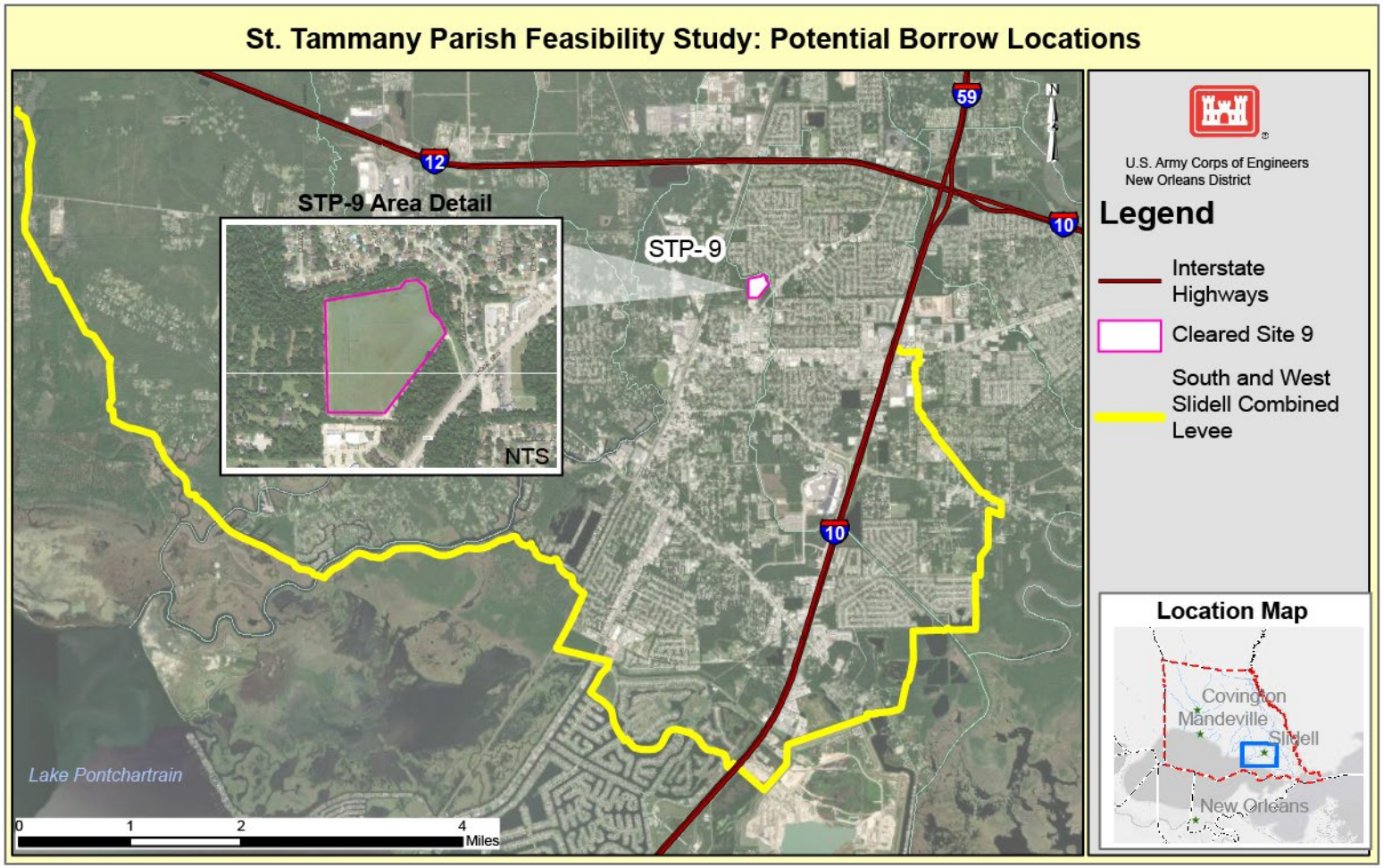


Figure B:4-4. Borrow Site STP-9

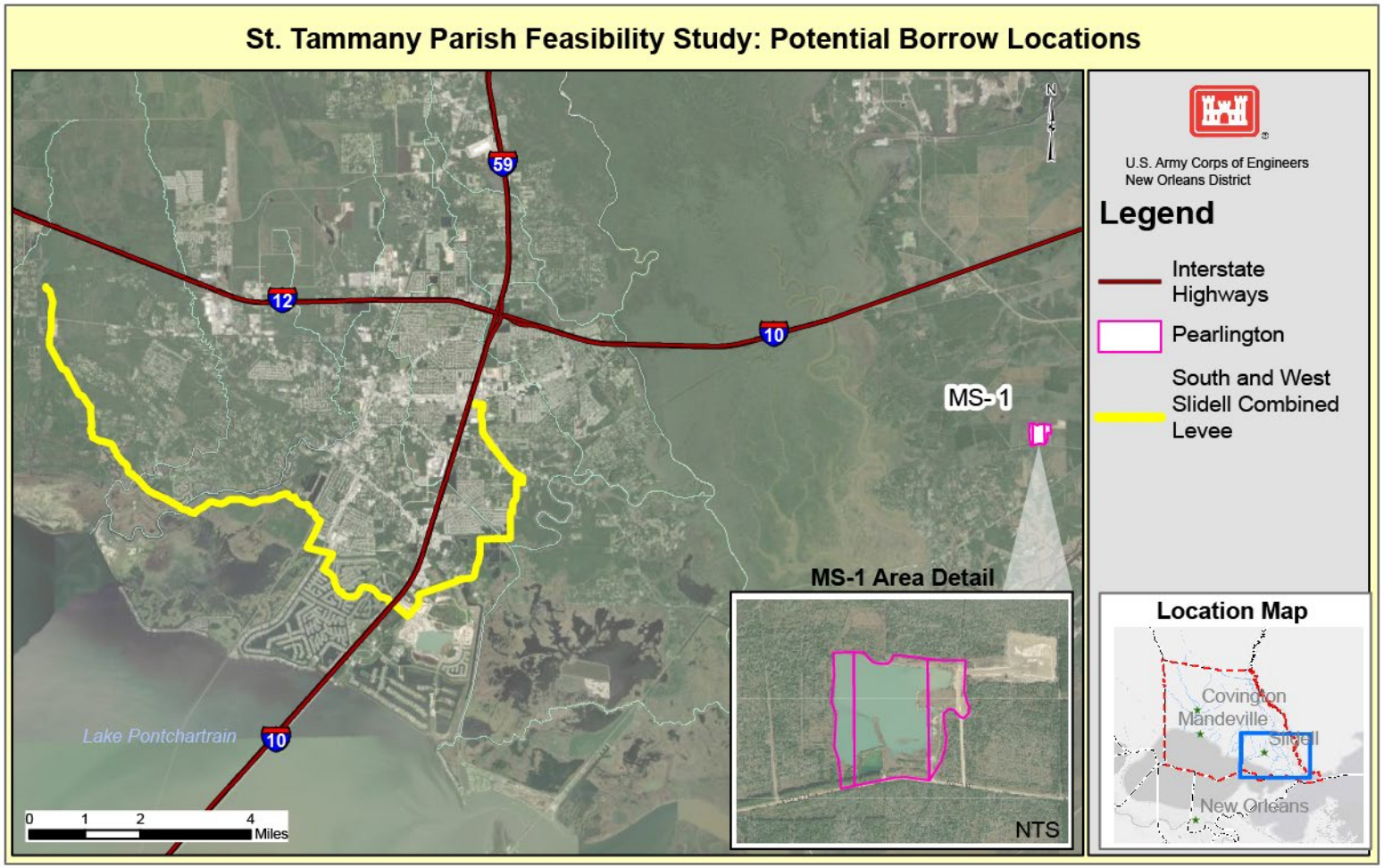


Figure B:4-5. Borrow Site MS-1

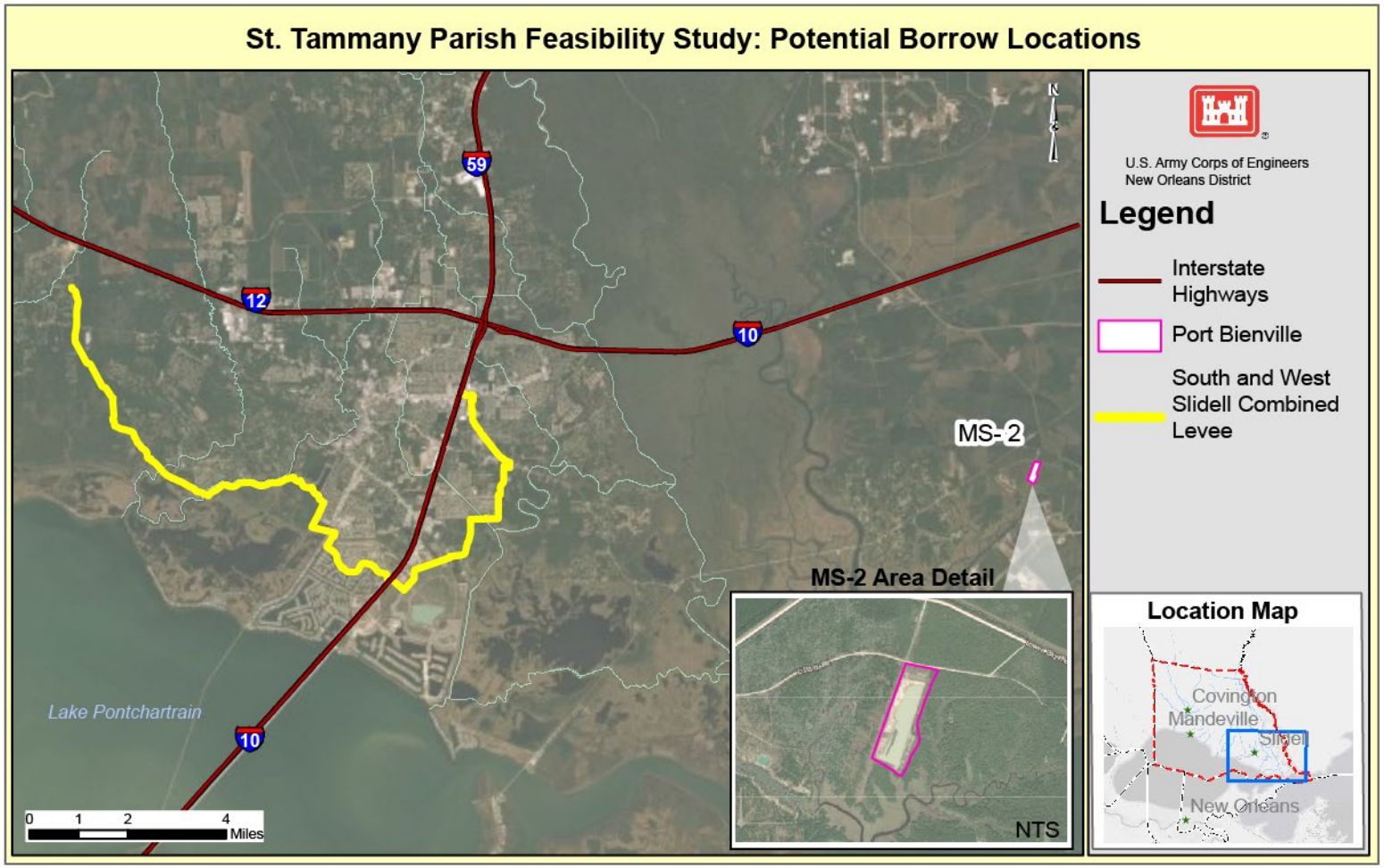


Figure B:4-6. Borrow Site MS-2

References

Coastal Protection and Restoration Authority (2017). *2017 Coastal Master Plan: Attachment E1: Flood Risk and Resilience Program Policy Recommendations*. Version Final. (pp. 1-41). Baton Rouge, Louisiana: Coastal Protection and Restoration Authority.

Individual Environmental Report #19 Pre-Approved Contractor Furnished Borrow Material Jefferson, Orleans, St. Bernard, Iberville, and Plaquemines Parishes, Louisiana, and Hancock County, Mississippi

Individual Environmental Report # 23 Pre-Approved Contractor Furnished Borrow Material # 2 St. Bernard, St. Charles, Plaquemines Parishes, Louisiana, and Hancock County, Mississippi.

Kuttruff, L. Carl, Lea Taylor Gabour, Malcolm K. Shuman, and Phillip K. Taylor. 2011 Phase I Cultural Resources Survey of 156.41 Acres (63.30 Hectares) on Cypress Bayou, St. Tammany Parish, Louisiana. Prepared for Department of Engineering, St. Tammany Parish. On file at the Louisiana Department of Culture, Recreation, and Tourism, Baton Rouge, Louisiana. Report No. 22-3725.

Louisiana Floodplain Management Desk Reference prepared for FEMA and the Louisiana Department of Transportation and Development. 2008.

http://floods.dotd.la.gov/lafloods/documents/2008_Desk_Ref.pdf

Moreno, Meredith, Emily Crowe, Nathanael Heller, and William P. Athens 2012 Phase I Cultural Resources Survey and Archeological Inventory of the Proposed W-14 Drainage Canal Detention Ponds, St. Tammany Parish, Louisiana. Prepared for USACE. On file at the Louisiana Department of Culture, Recreation, and Tourism, Baton Rouge, Louisiana. Report No. 22-3151.

Pumphrey, E. and H. L. Richardson Seacat 2007. A Phase I Cultural Resource Assessment of 424 Acres near Pearlington, Hancock County, Mississippi. Report prepared for R. Scott Higginbotham, Soil Tech Consultants, Inc., Ridgeland, MS by Center for Archaeological Studies, University of South Alabama, Mobile, AL.

St. Tammany Parish Multi- Jurisdictional Hazard Mitigation Plan Update. 2020. Prepared by Stephenson Disaster Management Institute for St. Tammany Parish and Incorporated Jurisdictions.

Status and Trends of Coastal Hazard Exposure and Mitigation Policies for the Texas Coast: The Mitigation Policy Mosaic of Coastal Texas. 2009. Walter Gillis Peacock, Jung Eun Kang, Yi-Sz Lin, Himanshu Grover, Rahmawati Husein, and Gabriel R. Burns. A Report

Prepared for the Texas General Land Office and The National Oceanic and Atmospheric Administration Under GLO Contract No. 09-045-000-3362.

USACE 2012 Supplemental Environmental Assessment Southeast Louisiana (SELA) Urban Flood Control Project W-14 Drainage Canal, Slidell Area, St. Tammany Parish, Louisiana. SEA# 409A.

List of Acronyms and Abbreviations

ACHP	Advisory Council on Historic Preservation
ADM	Agency Decision Milestone
ATR	Agency Technical Review
ASA(CW)	Assistant Secretary of the Army for Civil Works
BCR	Benefit to Cost Ratio
BFE	Base Flood Elevation
BLH	Bottomland Hardwood
BOEMRE	Bureau of Ocean Energy Management, Regulation, and Enforcement
CAR	Coordination Act Report
CEMVN	New Orleans District
CFS	Cubic Feet Per Second
CIAP	Coastal Impact Assistance Program
CPRA	Coastal Protection and Restoration Authority
CRS	Community Rating System
CSRM	Coastal Storm Risk Management
CWPPRA	Coastal Wetlands Planning, Protection and Restoration Act
DCG-CEO	Deputy Commanding General Civil Works & Emergency Operations
DEIS	Draft Environmental Impact Statement
DIFR	Draft Integrated Feasibility Report
EAD	Estimated Annual Damages
EFH	Essential Fish Habitat
EO	Executive Order
ER	Engineer Regulation

ESA	Endangered Species Act
FCSA	Feasibility Cost Sharing Agreement
FEMA	Federal Emergency Management Agency
FRM	Flood Risk Management
FWOP	Future Without Project
FWP	Future With Project
GOHSEP	Governor's Office of Homeland Security and Emergency Preparedness
HSDRRS	Hurricane and Storm Damage Risk Reduction System
HTRW	Hazardous, Toxic and Radioactive Waste
IER	Individual Environmental Report
IEPR	Independent External Peer Review
LPP	Locally Preferred Plan
MF	Moved Forward
NB	Nature Based
NED	National Economic Development
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NFS	Non-Federal Sponsor
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NRCS	National Resources Conservation Service
NS	Nonstructural
O&M	Operation & Maintenance
PA	Programmatic Agreement
PDT	Project Delivery Team
P&G	Principles and Guidelines
PPA	Project Partnership Agreement

RSLR	Relative Sea Level Rise
ROM	Rough Order of Magnitude
S	Structural
SELA	Southeast Louisiana Urban Flood Control Damage Reduction Project
SHMP	State Hazard Mitigation Plan
SHPO	State Historic Preservation Officer
STPG	St Tammany Parish Government
SWPPP	Stormwater Pollution Prevention Plan
T&E	Threatened and Endangered
TCLP	toxicity characteristic leaching procedure
THPO	Tribal Historic Preservation Office
TSP	Tentatively Selected Plan
USDA	United States Department of Agriculture
USFWS	Unites States Fish and Wildlife Survey
USGS	United States Geological Survey
WBDHU12	U.S. Geological Survey Watershed Boundary Dataset (WBDHU12)
USACE	United States Army Corps of Engineers
USACE O&M	United States Army Corps of Engineers Operation and Maintenance Program
WRDA	Water Resources Development Act
WSE	Water Surface Elevation
WVA	Wetland Value Assessment