Mississippi Valley Division,
Regional Planning and Environment Division South

Tangipahoa Parish, Louisiana Feasibility Study

Draft Tangipahoa Parish Integrated Feasibility Report and Environmental Assessment

June 2025

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Cover Page

Tangipahoa Parish, Louisiana

Draft Integrated Feasibility Report and Environmental Assessment

Location of Proposed Action: Tangipahoa Parish, Louisiana

Lead Agency: U.S. Army Corps of Engineers, St. Louis District

Cooperating Agencies: U.S. Fish and Wildlife Service; Choctaw Nation of Oklahoma

Abstract: The Tangipahoa Parish, Louisiana Feasibility Study (study) for flood damage reduction in Tangipahoa Parish, Louisiana (study area), is authorized by Title II. Section 201(a)(10) of the Water Resources Development Act of 2020. The study was authorized in accordance with the annual reports submitted to the Congress in 2019, pursuant to Section 7001 of the Water Resources Reform and Development Act of 2014 (33 U.S.C. 2282d). The study was funded by the Disaster Relief Supplemental Appropriations Act of 2022 (P.L. 117-43), Division B, Subdivision 1, Title IV as a high-priority study of projects in States with a major disaster declared due to Hurricane Ida pursuant to the Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C 5121 et seq.). The study area includes all of Tangipahoa Parish in southeastern Louisiana. The Draft Integrated Feasibility Report and Environmental Assessment contains, among other things, sections on plan formulation, analysis of potential environmental impacts and consequences, alternatives analysis, mitigation, and a description of the Tentatively Selected Plan (TSP or proposed action). The proposed action includes a nonstructural plan consisting of 1,006 residential elevations and 82 nonresidential floodproofing for eligible structures in Tangipahoa Parish of Louisiana. The TSP is estimated to produce nearly $384,439,405 in net benefits with a BCR of 1.37 (net national economic development benefits) and is consistent with USACE policies for protecting the environment and applicable environmental laws and regulations.

Date Comments must be Received by: 5 July 2025

Point of Contact for Additional Information:

U.S. Army Corps of Engineers
Attention: Chief, Environmental Branch
CEMVS–RPEDN, Room 3.200,
1222 Spruce Street, St. Louis, MO 63103
Email: tangipahoafs@usace.army.mil

Executive Summary

Introduction: The U.S. Army Corps of Engineers (USACE), Mississippi Valley Division (MVD), Regional Planning and Environment Division North (RPEDN), has prepared this Draft Integrated Feasibility Report and Environmental Assessment (DIFR-EA) for the Tangipahoa Parish Feasibility Study. The non-Federal sponsor is the State of Louisiana, acting by and through the Coastal Protection and Restoration Authority Board of Louisiana (CPRA). This feasibility study, funded through the Disaster Relief Supplemental Appropriations Act of 2022 (P.L. 117-43), Division B, Subdivision 1, Title IV is 100 percent federally funded up to $3,200,000. A Feasibility Cost Share Agreement was executed on November 4, 2022. This report includes input from the non-Federal sponsor, natural resource agencies, federally recognized Indian Tribes, and the public. The Tangipahoa Parish Feasibility Study is authorized to investigate Flood Risk Management (FRM) problems and solutions associated with riverine flooding. However, this study examines the coastal effects to identify problems associated with coastal surge and compound flooding. Riverine flooding was examined by itself as well as with coastal effects accounted for. This was done so the PDT could identify flooding from both riverine flooding and coastal surge for future consideration. The study included the riverine flooding effects from the Tangipahoa and Natalbany Rivers, and their tributaries, but did not address localized flooding in adjacent communities. Channels with discharges greater than 800 cfs for the 10% Annual Exceedance Probability (AEP) event (10 Year) flood event were included for consideration.

Additional resources were approved by the Assistant Secretary of the Army for Civil Works (ASA(CW)), in accordance with Section 1001 of WRRDA 2014, in April 2024 in order to complete the complex feasibility study due to the size and study area, compliance with Engineering Regulations (ERs), and the complexities of evaluating community risk factors. An additional $280,000 and eight months was allocated to complete critical tasks to inform the decision on the Tentatively Selected Plan (TSP).

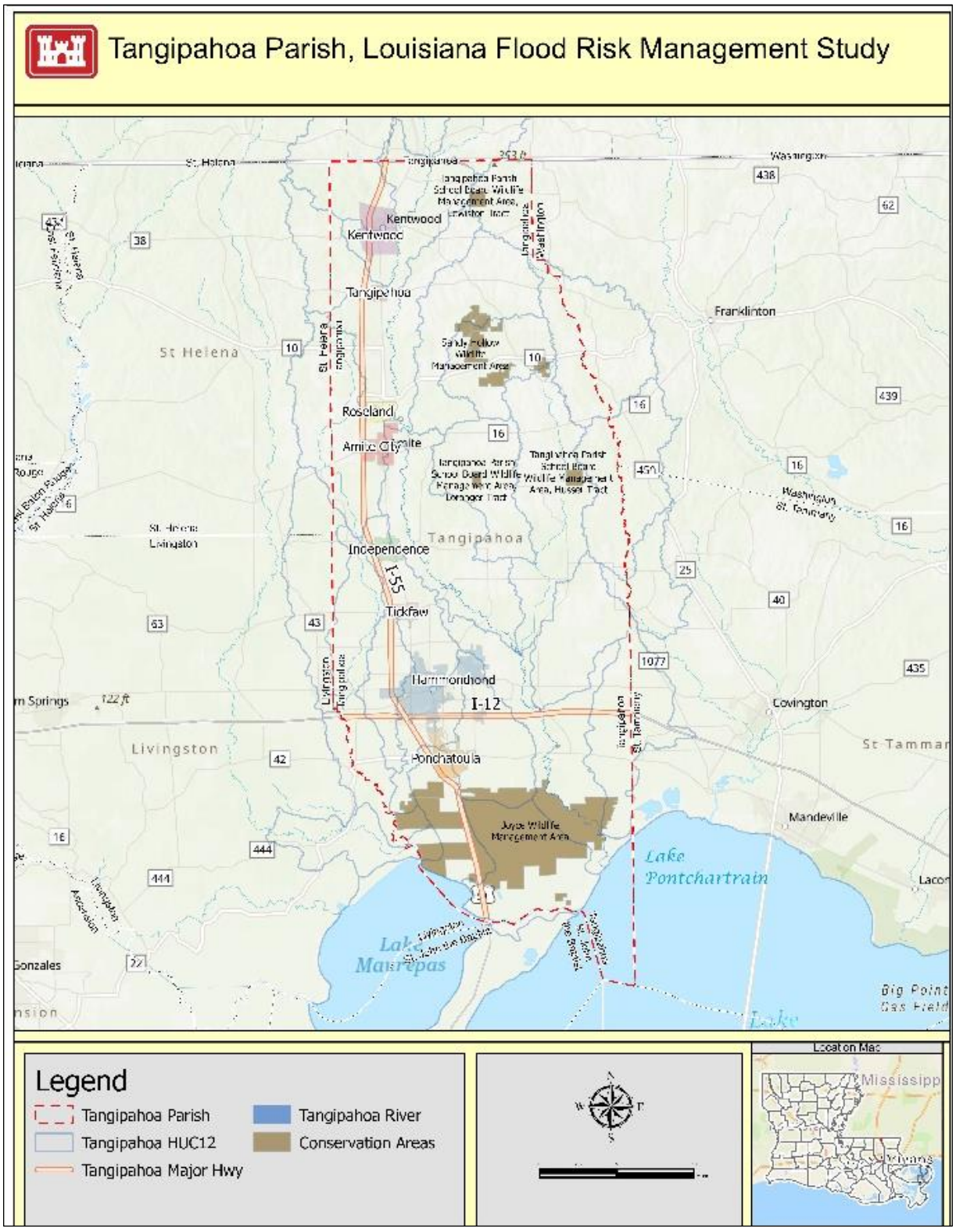

Figure ES-1. Tangipahoa Parish Feasibility Study Area

Study Area - The study area encompasses all of Tangipahoa Parish, which is approximately 823 square miles and located in southeastern Louisiana (see Figure ES-1). The Parish extends from the Mississippi State line in the north to Lake Pontchartrain and Lake Maurepas to the south and extends from the eastern boundary with Washington and St. Tammany Parishes and St. Helena and Livingston Parish boundaries in the west. The Tangipahoa River bisects vertically the Parish and the study area. Tangipahoa Parish is home to over 137,000 residents and 2,500 businesses. The most populated areas within the Parish include the cities of Hammond and Ponchatoula and the towns of Amite City (Parish seat), Independence, Kentwood, and Roseland. The Parish is uniquely located at the crossroads of two interstates, I-12 and I-55, which serve as national transportation corridors. The hydrology is complex, and communities experience repeated damages from flooding, including, but not limited to storm surge from coastal events, localized heavy rainfall, and riverine flooding.

Problems and Opportunities (Purpose and Need) - The communities within Tangipahoa Parish, Louisiana are continually impacted by widespread riverine flooding from heavy rainfall events often associated with hurricanes and tropical storms. Flooding poses risks to human life and flood damages to residential and commercial structures. Tangipahoa Parish has multiple sources of flooding (rainfall, riverine, coastal, interior/urban, and backwater); however, the scope of this study does not address coastal flooding from storm surge and waves, although coastal influences on river stages are reflected in the analyses.

Flood-related problems identified for the study include:

- Damage to structures (both residential and commercial) resulting from riverine flooding;
- High flood depths and velocities at structures and on roadways during a flooding event can pose a risk to human life safety and result in impacts to critical infrastructure;
- Risk to national transportation corridor and evacuation routes (I-55 / I-12 / US 190 / LA-445);
- Increased risk to historically significant structures;
- Sea level rise and subsidence may increase flood frequency in the future;
- Increase in development is occurring in areas where flooding occurs; and
- Degradation of natural flood protection:
    - 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.

Study opportunities related to these problems include:

- Public Safety - Enhance public education and awareness to flood risk.

- Community Resilience – Improve the communities' ability to prepare, mitigate, and recover from flood events.
- Recreation - Incorporate public recreational features incidental to proposed flood risk management alternatives.
- Ecosystem – Protect function of the ecosystem through development of flood risk management measures that are nature based.

Planning Objectives/ Constraints - Planning objectives represent desired positive changes to future conditions within the study area. All of the objectives focus on the 50-year period of analysis from 2033 to 2083. The overall goal of the study is to identify and potentially recommend actions to manage flood risk to public safety and human life and reduce economic damages caused by riverine flooding within Tangipahoa Parish, Louisiana, through approximately 2083 (the 50-year period of analysis). The planning objectives are as follows:

- Reduce the risk to public safety associated with riverine flood impacts to residential and nonresidential structures, evacuation routes, and access to critical infrastructure.
- Reduce economic loss due to flood damage to structures (i.e., businesses, residential, commercial, and public structures) from riverine flooding.
- Reduce life risk and economic impacts due to interruption of evacuation routes and a national transportation corridor, e.g., the I-12 and I-55.
- Increase community resiliency which is the sustained ability of a community to use available resources, before, during, and after significant rainfall and or coastal events.
- In conjunction with managing flood risk and reducing economic flood damages in the study area overall, incorporate the needs and considerations of all at--risk communities.

A planning constraint is a restriction that limits plan formulation or that formulation must work around. It is a statement of things the alternative plans avoid. The planning constraints for this study include the following:

- To the maximum extent practicable, avoid promoting development within the floodplain (in accordance with E.O. 11988), which contributes to increased life safety risk.
- Proposed projects must meet minimum flow (800 cubic feet per second for a 10 percent chance flood) and drainage area (1.5 square miles) requirements for inclusion in the plan formulation (ER 1165-2-21).

Additional considerations in the plan formulation process include the following:

- Avoid or minimize negative impacts to:
    - threatened and endangered (T&E) species and protected species and their critical habitats;

  - water quality;
  - cultural, historic, and Tribal-trust resources;
  - recreational areas in the Parish;
  - wildlife management areas, wetlands, and forests;

- Avoid locating project features on lands known to have hazardous, toxic, and radioactive waste (HTRW) and/or related concerns;
- Recognition that the Tangipahoa River is designated as a Louisiana Natural and Scenic River, which may require legislative changes to implement alternatives.
- Consistency with local floodplain management plans by not inducing flooding in other areas.

Planning Process and Alternatives Considered: This report describes how the project delivery team (PDT) followed the USACE's planning process, which included identifying problems and opportunities, inventorying, and forecasting conditions, identifying measures, creating alternatives, and continually reevaluating the measures within the alternatives and screening measures through the selection of the Final Array of Alternatives and TSP.

Initially a total of 59 site-specific management measures were identified and compiled from previous reports, Non-Federal Sponsor (NFS), stakeholders, the public, and recommendations from the PDT. These measures were based on the inventory of resources, and forecasting of significant resources that are relevant to the problems and opportunities under consideration. The measures were evaluated by the PDT using a screening process based on the planning objectives, existing data, professional judgment, avoiding constraints, and addressing the opportunities and problems within the study area.

After screening the initial measures, the PDT developed the Initial Array of 16 Alternatives with site-specific management measures. The Initial Array was developed by grouping measures based on hydrologic sub-basins for different areas into alternatives. The PDT then evaluated, screened, and compared measures within the geographic alternatives, including the No Action Alternative. All structural alternatives were screened out largely due to ineffectiveness or economic inefficiency, and the PDT identified the Final Array consisting of four nonstructural alternatives and the no action alternative. These alternatives were compared using a variety of comparison criteria resulting in the selection of a TSP.

All nonstructural plans employed the USACE "logical aggregation method" which according to USACE Planning Bulletin (PB) 2019-03, nonstructural analyses are to be conducted using the method. Rather than the individual structure, selected groups of structures are aggregated and become the unit of analysis, and each such group is a separable element that must be incrementally justified. Aggregation of structures was arranged based on several factors including but not limited to hydraulic and hydrologic characteristics, geographic location, and socioeconomic considerations, as well as the types of buildings in an area.

For evaluation purposes, the cost of elevating and floodproofing was used to determine the cost of the nonstructural plans since the study area is most often receiving damages

resulting from widespread, low-level flooding; raising and floodproofing were determined to be more cost effective than other nonstructural measures such as buyouts or relocations when assessing a grouping of aggregations. Additionally, the acquisition of structures was screened because the cost exceeded the damages reduced (benefits) and it was non-effective at meeting study objectives. Qualitative evaluation of the reuse of the floodplain in targeted areas determined that there would be minimal benefits to recreation and environmental restoration. See Appendix E Plan Formulation, Section 2.5 for detail on the methods of nonstructural plans developed to evaluate the acquisition and relocation of structures in the Parish.

Enhanced Risk Evaluation

Understanding risk is crucial for planning for natural hazards. Risk is characterized as a function of how likely a hazard (flooding) is and the potential harm it could cause (consequences)(See equation below).

$$Risk = Probability(Hazard)\ x\ Consequences$$

The Tangipahoa Feasibility Study team recognized that the consequences of a hazard aren't always fully captured by traditional economic analyses. Therefore, the PDT utilized FEMA's Community Risk Factor, part of their National Risk Index, to account for amplified impacts due to factors such as socioeconomics and community resilience. This factor highlights communities where a hazard will likely have more severe consequences.

Incorporating the Community Risk Factor into the risk equation; the risk equation now includes the probability of a hazard, the consequences of said hazard, and the increased severity of those consequences (See equation below).

$$Risk = Probability(Hazard)\ x\ Consequences(Community\ Risk\ Factor)$$

FEMA has developed a dataset which helps illustrate communities in the United States which are most at risk from natural hazards. A key component of this dataset is a scaling factor of risk values that better reflect the magnitude of the impacts a community may experience from those natural hazards. In other words, this factor helps describe the amplified consequences these communities may experience after a natural hazard. The Tangipahoa PDT incorporated risk from flooding in its entirety when evaluating plans, measures, and alternatives. To better explain this, an explanation of the risk equation is shown below.

The risk equation takes into account both the hazard and its corresponding probability and also the consequences of said hazard, including communities and their structures whose consequences are not fully reflected in the traditional National Economic Development dollars and cents.

The PDT focused on the entire risk equation when developing alternatives. That is, both the hazard and the consequences as well as the factors that amplify consequences for communities. For a community to be classified as having risk factors that result in amplified

consequences, the census tract in which it resides must have met a relatively high or very high threshold for the susceptibility to the adverse impacts of natural hazards according to FEMA's National Risk Index.

The Final Array of Alternatives is summarized below.

Plan 0: No Action Plan

The "No Action" Alternative is developed using existing conditions and forecasting data used to define the future without-project (FWOP) condition. The future without-project condition is the default baseline to which all other alternatives are compared. The without-project condition is the same as the NEPA "no action" condition and it assumes that no action would be taken to address the problem.

Plan 1: Nonstructural NED Plan Identification

Eligibility for nonstructural measures in Plan 1 relied on the optimization of the grouping of floodplain aggregations. For each reach, the group that received the highest Net NED benefits, was selected for inclusion in the plan. Plan 1 consists of floodproofing or elevating 597 structures. Of the total groupings of aggregations, 27 groups were optimized at the 10% AEP floodplain, 3 aggregation areas were optimized at the 4% AEP floodplain, and 2 were optimized at the 2% AEP floodplain.

Plan 3a: NED + Increment 1: 10% AEP Flood Frequency Comprehensive Increment

Plan 3a expands upon Plan 1 by including groups of structures experiencing similar flooding to groupings in Plan 1 at the 10% AEP even if those groupings don't maximize net NED benefits. Each group was evaluated based on flood hazard frequency and depth, critical and civic infrastructure, community risk factors, community cohesion, incremental net NED benefits, and how reducing flood risk would impact the day-to-day lives of residents, workers, and business owners. Plan 3a also will result in the reduction of flood insurance premiums for some structure owners. The PDT determined that the total marginal benefits of including groups beyond Plan 3a exceeded the total marginal cost. Plan 3a includes floodproofing or elevating 675 structures.

Plans 3b: NED + Increment 2: 4% AEP Flood Frequency Comprehensive Increment

Plan 3b expands upon Plan 3a by including groups of structures experiencing similar flooding to groupings in Plan 1 and Plan 3b at the 4%, or in some cases 2% AEP, even if those groupings don't maximize or even have positive net NED benefits. Some groups were included at the 10% AEP if comprehensive benefits were not enough to justify inclusion at a wider floodplain. Each group was evaluated based on flood hazard frequency and depth, critical and civic infrastructure, community risk factors, community cohesion, incremental net NED benefits, and how reducing flood risk would impact the day-to-day lives of residents, workers, and business owners. Plan 3b also will result in the reduction of flood insurance premiums for some structure owners. That being said, a balance between incremental net benefits, flood hazard and frequency, as well as community risk, and community cohesion

was sought while still ensuring that critical infrastructure was included. The result of this analysis was that on average, additional aggregations were included if the incremental net NED benefits were in excess of (more positive than) -$5,000 annually per structure. The team did not pick this number, but rather this is the result of weighing incremental net NED benefits against various other social effects benefits as well as flood hazard and frequency on an incremental basis. The PDT determined that the total marginal benefit of the additional groups included in Plan 3b equaled the total marginal cost of the additional groups. Plan 3b would include the elevation of 1006 residential structures and floodproofing of 82 nonresidential structures.

Plan 3c: NED + Increment 3: 2% AEP Flood Frequency Comprehensive Increment

Plan 3c continues to build upon the previous increments. All the previous benefits are still present and the extra benefits beyond the previous increment are focused on increased other social effects benefits and a wider floodplain. The PDT ensured that the additional groupings in Plan 3c experienced similar or greater levels of flooding at the 2% AEP when compared to areas previously justified. In developing plans, this plan was determined to have the highest benefits in the other social effects category given that it provides the most benefits for communities with community risk factors. This plan also improves community resiliency and cohesion more than the previous plans. However, it has the lowest net NED benefits of the four plans in the final array while still providing more NED benefits than costs. The PDT determined that the total marginal cost of the additional groups in Plan 3c exceeded the marginal total benefit Plan 3c includes elevating 1147 residential structures and floodproofing 87 nonresidential structures.

The measures in the Final Array of Alternative Plans were evaluated for economic benefits and then to the planning objectives and the formulation criteria as given and defined in the Principles and Guidelines (P&G) Section VI.1.6.2(c). The measures were subsequentially compared to the four Federal accounts (Table ES-1) to assess the potential effects of the final array of alternatives. This evaluation and screening inform the decision in selecting the TSP.

Table ES-1. P&G Four Federal Accounts Assessment

Four Accounts	Plan 1	Plan 3a	Plan 3b	Plan 3c
NED	Equiv. Annual Benefits: $23.37M	Equiv. Annual Benefits: $24.58M	Equiv. Annual Benefits: $30.74M	Equiv. Annual Benefits: $31.97M
NED	Net Annual Benefits: $10.54M	Net Annual Benefits: $10.41M	Net Annual Benefits: $8.63M	Net Annual Benefits: $7.24M
EQ	No significant impacts to the environment	No significant impacts to the environment	No significant impacts to the environment	No significant impacts to the environment
RED	Gross Regional Product: $552.52M	Gross Regional Product: $610.25M	Gross Regional Product: $952.58M	Gross Regional Product: $1,064Billion
RED	FTE Jobs: 5,964	FTE Jobs: 6,588	FTE Jobs: 10,283	FTE Jobs: 11,493
OSE	Overall minor positive benefits. For a detailed explanation of OSE criteria, reference Table 6-6	Both Minor & Moderate positive benefits. For a detailed explanation of OSE criteria, reference Table 6-6.	Both Moderate & significant positive benefits. For a detailed explanation of OSE criteria, reference Table 6-6.	Mainly significant positive benefits. For a detailed explanation of OSE criteria, reference Table 6-6.

Fiscal Year (FY) 2024 Interest: 2.75% and FY 2024 Price Level

Identifying the TSP

As seen in Table ES-2, the plan that maximizes NED benefits is Plan 1 and, according to USACE policy, the NED plan is selected for recommendation unless an exception is obtained from the ASA(CW). According to USACE Policy: ER 1105-2-103, Paragraph 4-5.a: "National Economic Development plan exception considerations. Departures from the NED plan may be considered to manage residual risk, particularly to manage residual life safety risks, or when overriding reasons to recommend another plan are revealed in the analysis of the alternatives. The departure from the NED plan may include uneconomic increments or negative net national economic benefits when non-monetary benefits result from the plan. Any departure from the NED plan requires an exemption from the ASA(CW) [with certain exceptions]." CEMVS is presently pursuing an exception to NED selection policy and has identified the TSP as Plan 3b: Nonstructural Plan: NED + Increment 2 because it provides flood risk reduction in terms of national economic development along with the added benefit of flood risk reduction to communities with significant community risk factors which amplify consequences as a result of a natural disaster, maximizing the OSE account (Table ES-2). This plan has also been identified as the Total Net Benefits Plan for this study. If the policy exception is not granted, the TSP will default to Plan 1: Nonstructural NED Plan.

ES-2 Summary of Costs and Benefits of the TSP (Plan 3b: Total Net Benefits Plan) and the NED Plan (Plan 1)

Item	Plan 1: NED Plan	Plan 3b: TSP
Equivalent Annual Benefits	$23.37M	$30.74M
Damage Category: Structure, Contents, Vehicles, and Debris Removal	Structures and Contents	Structures and Contents
Total First Costs	$346.32M	$597.09M
Interest During Construction	$1.17M	$2.02M
Annual Operations & Maintenance Costs	$TBD	$TBD
Total Annual Costs	$12.82M	$22.11M
B/C Ratio	1.82	1.39
Expected Annual Net Benefits	$10.54M	$8.62M

FY 24 Interest 2.75% and FY 2024 Price Level

Subject to project authorization, appropriation and availability of funding, full environmental compliance, and execution of a binding agreement with the NFS, construction is currently scheduled to begin in 2033. The schedule assumes that implementation of the Nonstructural Plan will occur over an approximate 10-year period with approximately 100 structures to be elevated and/or floodproofed each year after an 18-month PED phase. The project requires construction authorization and the appropriation of construction funds. A continuous funding stream is needed to complete this project within the anticipated timeline, which requires continuing appropriations from Congress and the State of Louisiana to fund the detailed design phase and fully fund construction contracts.

In order to be preliminarily eligible for inclusion for implementation, the following criteria must be met:

1. The structure must have a first-floor elevation at or below the applicable floodplain (which may be a 10%, 4%, 2% AEP year floodplain depending on the location of the structure), based on hydrologic conditions predicted to occur in 2033 (the beginning of the 50-year period of analysis) at a specific location.

2. The elevation or floodproofing measures proposed for the structure must be economically justified based on an aggregation or sub aggregation level that are anticipated to be avoided over the 50-year period of analysis (years 2033-2083) unless they have been identified eligible based on OSE criteria.

3. The structure must have a permanent foundation and be permanently immobilized and affixed or anchored to the ground, as required by applicable law, and must be legally classified as immoveable real property under state law. Notwithstanding the provisions of La. R.S. 9:1149.6, a manufactured, modular, or mobile homeowner and any subsequent owner of an immobilized manufactured, modular, or mobile home, may not de-immobilize the manufactured, modular, or mobile home in the future, by

detachment, removal, act of de-immobilization, or any other method. Manufactured, modular, and mobile homes that do not meet these requirements are not eligible for elevation. This criterion only applies to residential uses of manufactured, modular, and mobile homes.

Final Feasibility Design of the Tentatively Selected Plan:

Subsequent to the public release of this draft report, USACE will conduct additional engineering, economic, and environmental assessment of the TSP. The nonstructural plan will be optimized to present alternatives based on consideration of benefits as part of OSE, as well as the other three P&G accounts.

Residual Risk and Damages

The TSP will greatly reduce, but not eliminate future flood risk damages, and residual flood risk for structures would remain in the study area. The structures eligible for inclusion in the nonstructural plans were based on the combined riverine and coastal flood risk. While this is comprehensive, this does still leave structures with residual flood risk within the study area as nonstructural measures may not mitigate flood risk for very infrequent events (Appendix G). The residual risk, along with the potential consequences, will continue to be communicated to the NFS and will become a requirement of any communication and evacuation plan when this plan is implemented.

Significant Resources/Environmental Considerations: In accordance with Section 2045 of WRDA 2007, a meeting was conducted on 31 January 2023 with Federal, State, and local government agencies and Indian tribes to develop and implement a coordinated review process. Two public scoping meetings were conducted within the study area on 14 and 15 February 2023. Input received from public meetings assisted the PDT in refining the study's problems and opportunities, goals, objectives, potential measures, and alternative plans. On 01 February 2023, the CEMVS sent out letters to tribal, Federal, state, and local government entities inviting them to become a cooperating agency with USACE in preparation of the environmental compliance documentation. The U.S. Fish and Wildlife Service (USFWS) and the Choctaw Nation of Oklahoma (CNO) responded that they would like to be cooperating agencies and were invited to participate in the PDT meetings. Two additional scoping meetings were held on 13 and 14 September 2023 each with Facebook live streaming. Comments were accepted via written correspondence and emails. Approximately 130 non–USACE people attended the meetings in person and the Facebook live streaming had over 25 views. Scoping identified additional flooding areas of concern. Comments received were related to potential structural measures and areas of flooding concern. Feedback from the public scoping meeting resulted in the identification of one additional measure related to roadway flooding.

Resources evaluated within the study area identified through agency and public scoping include but are not limited to: migratory birds; T&E and protected species; wetlands; aquatic resources; water quality; air quality; cultural resources; socioeconomics; agricultural lands; Hazardous, Toxic and Radioactive Waste (HTRW); recreation; aesthetics; and noise. Direct, indirect, and cumulative effects of the Final Array of Alternatives are addressed in the

evaluation of the measures and alternatives. There are minimal environmental concerns anticipated with the TSP. Under a nonstructural TSP, the project is anticipated to result in the following:

1. No substantial adverse impacts on F&W species, wetlands, and other habitats.
2. No impacts identified on listed or endangered species.
3. No critical habitat located in study area.
4. No impacts to habitat identified for listed or endangered species.
5. No mitigation needs have been identified.
6. Not considered controversial.

Measures to address flood damages have been applied to all structures that meet eligibility criteria. No disproportionate effects have been identified at this time. The final array of alternatives included plans to ensure sufficient assessment of comprehensive benefits was completed.

The TSP is expected to result in negligible known impacts on historic properties as defined by Section 106 of the National Historic Preservation Act. Historic properties are defined as any “prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion on, the National Register of Historic Places, including artifacts, records, and material remains related to such a property or resource.” No buildings or structures that are currently on the National Register of Historic Places are affected by the TSP. Consultation is ongoing with the Federally Recognized Tribes with stated interest in the Parish along with the State Historic Preservation Office. A program--specific programmatic agreement (PA) is being drafted to address effects of non-structural measures on unrecorded historic properties. Consultation and coordination with resource agencies is on-going and would be concluded prior to signature of the Finding of No Significant Impact. The PA will undergo a 30-day public notice process prior to the Final Integrated Feasibility Report and Final Environmental Assessment.

Timeline: This DIFR/EA was available for a 45-day public review and comment period beginning 09 August 2024. The official closing date for comments was 23 September 2024, 45 days from the public review start date. All comments were mailed or emailed to:

U.S. Army Corps of Engineers
St. Louis District (CEMVS), Room 3.200
Attention: Chief, Environmental Branch
1222 Spruce Street, St. Louis, MO 63103
Email: tangipahoafs@usace.army.mil

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SECTION 1
Introduction

The United States Army Corps of Engineers (USACE), Mississippi Valley Division (MVD), St. Louis District (CEMVS), Regional Planning and Environment Division North (RPEDN), prepared this Draft Integrated Feasibility Report and Environmental Assessment (DIFR-EA) (collectively the "report") for the Tangipahoa Parish, Louisiana Feasibility Study under a work agreement with USACE New Orleans District (CEMVN). This report documents the technical and other analyses conducted by the Project Delivery Team (PDT) to identify and evaluate Flood Risk Management (FRM) solutions to flooding in Tangipahoa Parish, Louisiana. The PDT undertook this study and analyses to confirm a Federal interest in the project, identify and evaluate an array of alternative plans, and make a recommendation for action or inaction. The purpose of the Tangipahoa Parish study is to investigate flood risk solutions to reduce the risk of flood damages caused by riverine flooding in the Tangipahoa Parish.

The results of the study are presented in this decision document, which is a Draft integrated Feasibility Report and National Environmental Policy Act of 1969 (NEPA) Environmental Assessment document (DIFR/EA), in accordance with the USACE Planning Guidance Notebook (1105-2-100); ER 1105-2-103 "Policy for Conducting Civil Works Planning Studies" dated 7 December 2023; ER 1105-2-101 "Risk Assessment for Flood Risk Management Studies" dated 15 July 2019; NEPA, and all other applicable laws, regulations and policies. The study followed the specific, measurable, attainable, risk-informed, timely (SMART) planning process. The DIFR-EA also documents the Six Step plan formulation process (Figure 1-1) and recommends a Tentatively Selected Plan (TSP), or Proposed Action, supported by the Non-Federal Sponsor (NFS) for implementation. The selection of the TSP as described herein, is based on consideration of the associated economic benefits, environmental and social impacts, costs, and residual risk. The USACE planning process is also detailed in Appendix E - Plan Formulation. This DIFR/EA was released for concurrent public, agency technical review, and policy review in August 2024 and was available for a 45-day public review and comment period starting on 09 August 2024.

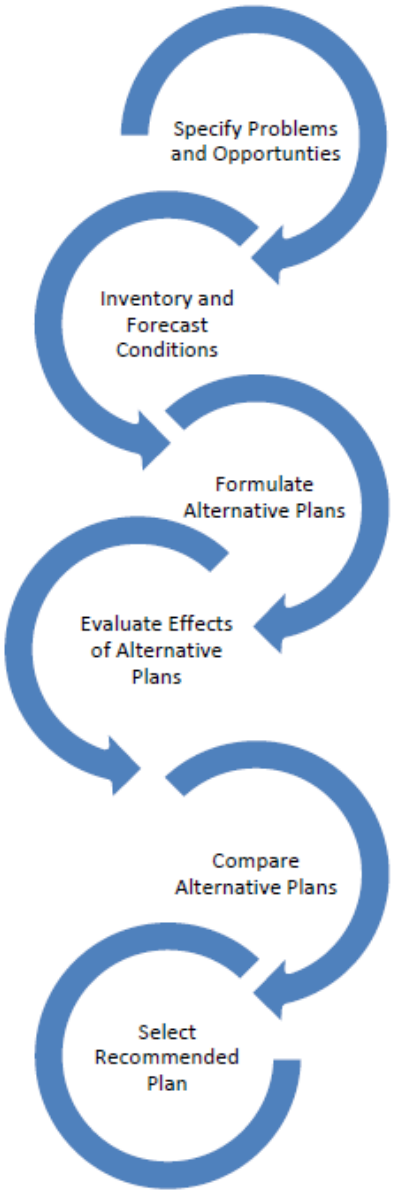


Figure 1-1. USACE Planning Process

This multi-disciplinary PDT includes professionals with expertise that matches the water resources problem identified in this study and acquired the information necessary to make a recommendation to reduce flood risk within Tangipahoa Parish. The feasibility process also coordinated with, and integrated input from, the USACE vertical team, which includes MVD, or Major Subordinate Command (MSC), and Headquarters USACE (HQUSACE). The DFIR-EA reflects the collaboration of the NFS, stakeholders, natural resource agencies, federally recognized Indian Tribes, and the public. The NFS is the State of Louisiana, acting by and through, the Coastal Protection and Restoration Authority of Louisiana Board (CPRAB).

1.1 STUDY SCOPE

The study is authorized to investigate Flood Risk Management (FRM) problems and solutions. The study includes analysis of impacts caused by coastal flooding (storm surge and waves) and overlapping or compounded risk of riverine and coastal flooding. The study included the flooding effects from the Tangipahoa and Natalbany Rivers, and their tributaries, but did not address localized flooding in adjacent communities. Channels with discharges greater than 800 cfs for the 10% Annual Exceedance Probability (AEP) event (10 Year) flood event were included for consideration.

The study area experiences flood risk from two primary sources: coastal storm surge with waves and heavy rainfall. The majority of the Parish flooding can be attributed to heavy rainfall that causes its rivers to overflow their banks This study refers to this type of flooding as riverine flooding. Coastal storm surge flooding dominates the lower portion of the parish south of Louisiana Highway 22.

The FRM study authority dictates that only riverine flooding be examined in the application of the structural, non-structural, and nature based measures. However, the study analysis includes the coastal effects within the study area in order to identify problems associated with coastal surge and compound flooding and understand the comprehensive flood risk. Riverine flooding was examined alone and in combination with coastal effects to identify the distinct flooding effects from both riverine flooding and coastal surge for future consideration.

1.2 STUDY AUTHORITY

This study is authorized by Title II. Section 201(a)(10) of the Water Resources Development Act of 2020 (WRDA) the study is authorized in accordance with the annual reports submitted to the Congress in 2019, pursuant to Section 7001 of the Water Resources Reform and Development Act (WRRDA) of 2014 (33 U.S.C. 2282d). The study was funded by the Disaster Relief Supplemental Appropriations Act of 2022 (DRSAA 22), (P.L. 117-43), Division B, Subdivision 1, Title IV, as a high-priority study of projects in States with a major disaster declared due to Hurricane Ida pursuant to the Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C 5121 et seq).

Notwithstanding Section 105(a) of the WRDA of 1986 (33 U.S.C. 22 I 5(a)), which specifies the cost-sharing requirements generally applicable to feasibility studies, DRSAA 22 authorizes the Government to conduct the study at full Federal expense, to the extent that appropriations provided under the Investigations heading of the DRSAA 22 are available and used for such purpose. The Policy Guidance Memorandum on Implementation of Supplemental Appropriations of the DRSAA of 22 dated 25 April 2022, states that a new Feasibility Cost Share Agreement (FCSA) or an amendment to the existing FCSA is required to address use of DRSAA 22 Investigations funds at full Federal expense. The FCSA was fully executed by all parties on 04 November 2022.

Generally, feasibility studies funded by DRSAA 2022 are conducted for not more than $3 million and are completed within 36 months, consistent with Section 1001 of WRRDA 2014. If a cost exemption is approved for a study, those additional costs may be funded from

remaining supplemental investigations funds. On April 26, 2024, the Assistant Secretary of the Army (Civil Works) (ASACW) approved an exemption request in the amount of $280,000 and an additional 8 months.

1.3 NON-FEDERAL SPONSOR

The NFS is the State of Louisiana, acting by and through, the Coastal Protection and Restoration Authority Board of Louisiana (CPRA). The feasibility study is 100 percent federally funded. The FCSA for this study was executed on 04 November 2022.

1.4 STUDY AREA

The study area encompasses all of Tangipahoa Parish, which is approximately 823 square miles, located in southeastern Louisiana (Figure 1-2). Tangipahoa Parish is home to approximately 137,000 residents and 2,500 businesses. The parish is uniquely located at the crossroads of two Interstates, I-55, and I-12, which serve as national transportation corridors. The Parish extends from the Mississippi State line in the north to Lake Pontchartrain and Lake Maurepas to the south and extends from the eastern boundary with Washington and St. Tammany Parishes to the St. Helena and Livingston Parish boundaries in the west.

The Tangipahoa River vertically bisects the Parish and the study area. The parish is predominantly rural with an economic base comprised of truck, dairy, fish farms and timber industry. The most populated areas within the Parish include the cities of Hammond and Ponchatoula and the towns of Amite City (Parish seat), Independence, Kentwood, and Roseland. Interstates 55 and 12 serve as national transportation corridors and evacuation routes for the greater Metropolitan New Orleans, LA area. Tangipahoa Parish is one of the fastest-growing parishes in Louisiana. The term “study area” and “Tangipahoa Parish” are used interchangeably throughout this document.

The study area includes 30 hydrologic sub-basins, as defined by the United States Geological Survey (USGS), 12- digit hydrologic unit delineations (HUC12). Within the 30 sub-basins, 18 sub-basins have documented flooding, from storm surge or riverine flooding causing repetitive flood loss damages. These 18 sub-basins are identified (bold) in Table 1-1 and shown on Figure 1-2. In cases where a sub-basin overlaps the neighboring parish, the entire sub-basin watershed was included in hydrology and hydraulic (H&H) analysis, however, the flood risk resolutions were developed only for areas within Parish boundary. Additionally, of the 30 hydrologic sub-basins, 21 of them had structures located within them which met our non-structural criteria.

The study area includes the Joyce Wildlife Management Area, Tangipahoa School Board Wildlife Management Area (Loranger Tract, Husser Tract, and Lewiston Tract), and the Sandy Hollow Wildlife Management Area.

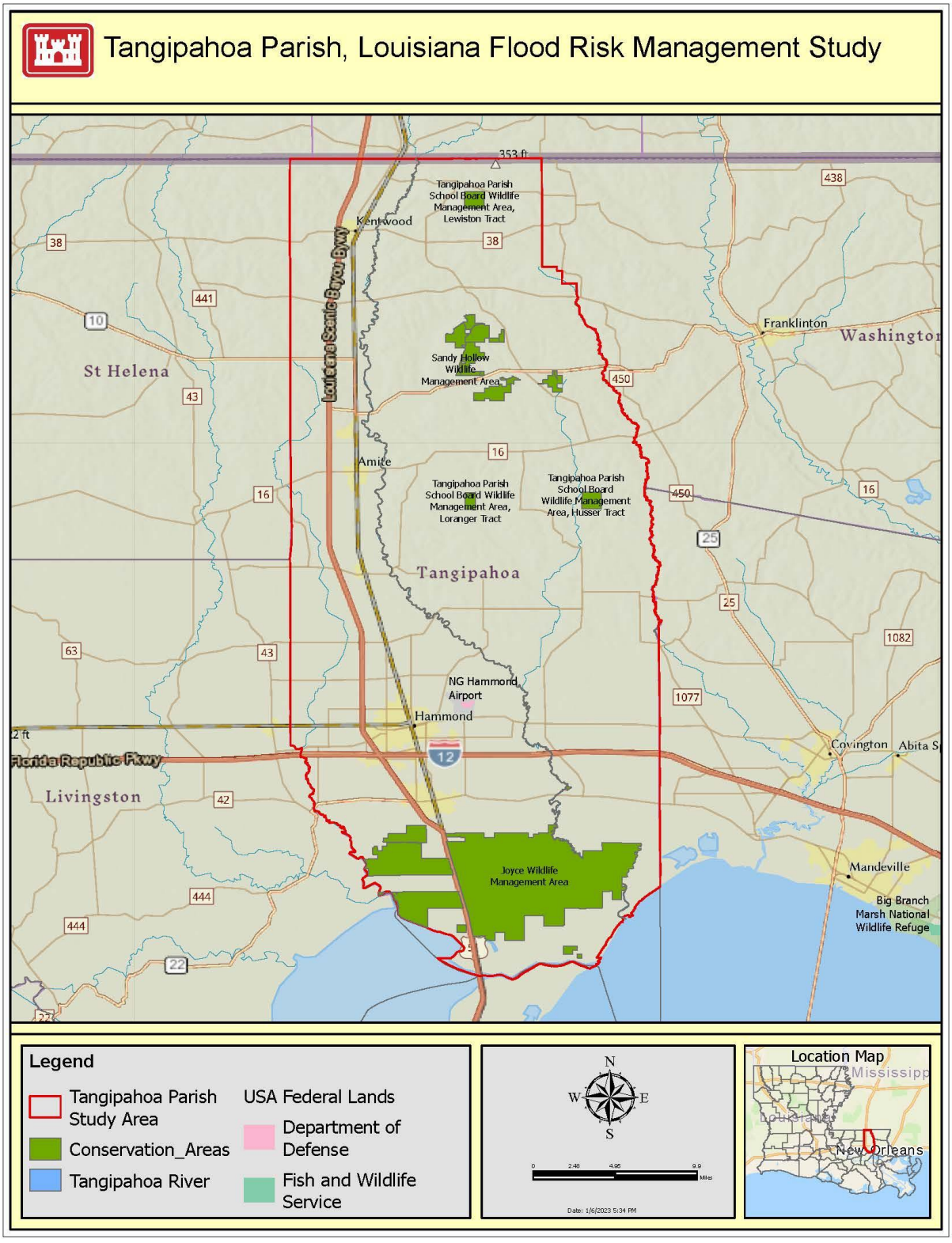
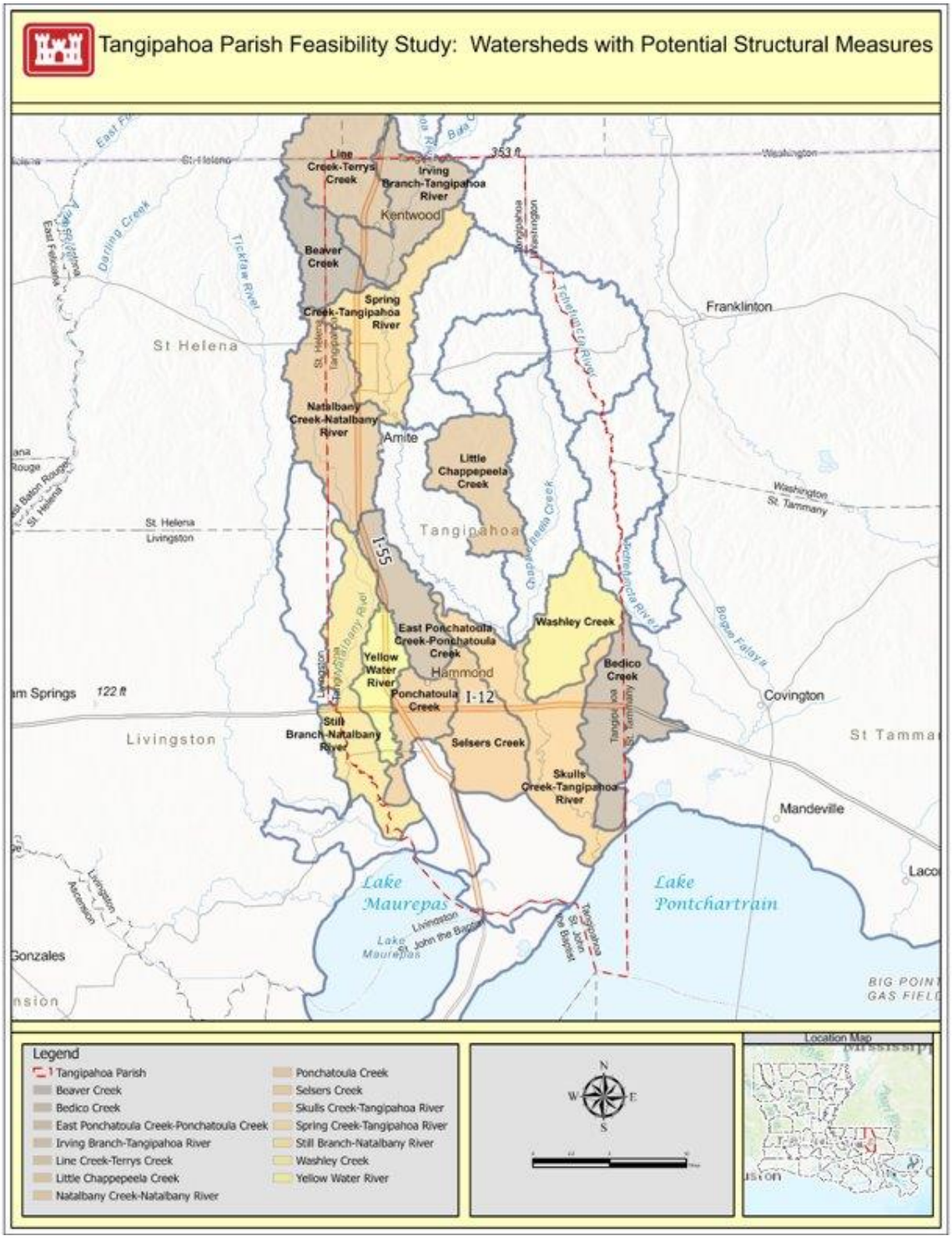


Figure 1-2. Tangipahoa Parish, Louisiana Feasibility Study Area

Table 1-1: Tangipahoa Parish, Louisiana Feasibility Study Hydrologic Sub Basins

Number	Sub-Basin	Type of Flooding	Number	*Sub-Basin*	Type of Flooding
1	**Anderson Canal**	Coastal	16	**Lower Bala Chitto Creek**	Riverine
2	**Beaver Creek**	Riverine	17	**Natalbany Creek-Natalbany River**	Riverine
3	**Bedico Creek**	Coastal/Riverine	18	**North Pass-Pass Manchac**	Coastal
4	**Big Creek**	Riverine	19	**Ponchatoula Creek**	Coastal/Riverine
5	**Black River**	Coastal	20	**Savannah Branch-Tchefuncte River**	Riverine
6	**Bull Branch-Tchefuncte River**	Riverine	21	**Selsers Creek**	Coastal/Riverine
7	**Chappepeela Creek**	Riverine	22	**Skulls Creek-Tangipahoa River**	Coastal/Riverine
8	**East Fork Big Creek**	Riverine	23	**Snell Branch-Silver Creek**	Riverine
9	**East Ponchatoula Creek-Ponchatoula Creek**	Riverine	24	**Spring Creek-Tangipahoa River**	Riverine
10	**Gorman Creek-Tchefuncte River**	Riverine	25	**Still Branch-Natalbany River**	Coastal/Riverine
11	**Irving Branch-Tangipahoa River**	Riverine	26	**Sweetwater Creek-Tangipahoa River**	Riverine
12	**Killian Bayou-Tickfaw River**	Coastal	27	**Taylor Branch-Little Natalbany River**	Riverine
13	**Line Creek-Terrys Creek**	Riverine	28	**Town of Osyka-Tangipahoa River**	Riverine
14	**Little Chappepeela Creek**	Riverine	29	**Washley Creek**	Riverine
15	**Little Silver Creek-Silver Springs Creek**	Riverine	30	**Yellow Water River**	Riverine



Note: The U.S. Geological Survey Watershed Boundary Dataset (WBDHU12) (November 2019) is included to delineate the hydrologic sub basins. The highlighted WBDHU 12 sub-basins are documented areas of frequent flooding and repetitive loss.

Figure 1-3. Sub-basins with Documented Flooding

1.5 PRIOR REPORTS, EXISTING WATER PROJECTS, AND ONGOING PROGRAMS

The study area is a large region with a number of studies and reports on water resources development for the Parish being prepared by USACE, and other Federal, state, Parish, and local agencies. The PDT collected existing information and relevant portions of existing data was used in the planning process, including the development of problems, opportunities, management measures and alternatives for the study. Previous Federal and non-Federal studies have established a reasonable database for this report. Information from the documents listed in Table 1-2 were considered the most significant to identifying problems and formulating plans. Studies and reports were also reviewed to ensure consistency between the plan formulation under this study and other existing plans and reports for the study area.

Table 1-2. List of Relevant Prior Reports, Existing Water Projects, and Ongoing Programs

Year	Study/Report/Environmental Document Title	Document Type	Importance to Current Study
1975	USACE. Draft Composite Environmental Statement, Continued Maintenance Amite River; Bayou Manchac; Tickfaw, Natalbany, Ponchatoula, Blood Rivers; Tangipahoa River; Tchefuncte and Bogue Falia Rivers; Bayou Bonfouca and Pass Manchac, Lake Pontchartrain Basin, Louisiana	Technical Report	Data Source, Structural Measures, FWOP Conditions
1991	USACE. Tangipahoa, Tchefuncte and Tickfaw Rivers Reconnaissance Report	Reconnaissance Report	Structural Measures
1998	Coast 2050 Region 1 Strategy	Technical Report	Consistency
2006	Comprehensive Habitat Management Plan for the Lake Pontchartrain Basin	Management Plan	Data Source
2007	Louisiana Speaks Regional Plan LA	Community Plan	Consistency
2009	USACE Louisiana Coastal Protection and Restoration (LACPR) Final Technical Report	Technical Report	Structural Measures
2011	Hammond Comprehensive Master Plan	Master Plan	Data Source/Consistency
2011	Lake Pontchartrain Basin Foundation Northshore: Recommendations for Restoration and Conservation Report	Conservation Report	Nonstructural Measures
2012	Northshore Hurricane/Food Protection/Restoration Plan by G.E.C. Inc for St. Tammany and Tangipahoa Parish, CPRA Sponsor (PO-0074)	Restoration Plan	Data Source/Consistency/Structural Measures//Nonstructural Measures/FWOP Conditions
2016	Flood Loss Outreach & Awareness	Management	Data Source

Year	Study/Report/Environmental Document Title	Document Type	Importance to Current Study
	Taskforce (FLOAT) Lake Pontchartrain, Louisiana Area Floodplain and Stormwater Management Program	Plan	
2016	Reducing Coastal Risk with a Lake Pontchartrain Surge Barrier	Technical Report	Data Source/Structural Measures/FWOP Conditions
2016	USGS Federal Emergency Management Agency (FEMA) Characterization of Peak Streamflow and Flood Inundation of Selected Areas in Louisiana, Texas, Arkansas, and Mississippi from Flood of March 2016	Technical Report	Data Source/FWOP Conditions
2016	Louisiana Economic Development – The Economic Impact of the August 2016 Floods on the State of Louisiana	Technical Report	Data Source / Measures / FWOP Conditions
2016	Preliminary Dredging Study: Bar Channel to the Mouth of the Tangipahoa River, Tangipahoa Paris, Louisiana (Prepared by Elos Environmental for Tangipahoa Parish Government)	Technical Report	Data Source / Measures / FWOP Conditions
2017	CPRA- Louisiana's Comprehensive Master Plan for a Sustainable Coast	Master Plan	Data Source/Consistency/Structural Measures//Nonstructural Measures/FWOP Conditions
2018	Integrated Draft Feasibility and Environmental Impact Statement Pearl River Basin, Mississippi; Hinds and Rankin Counties, MS	EIS	Data Source/Consistency
2019	Coastal Wetlands Planning, Protection and Restoration Act	Master Plan	Data Source/Nonstructural Measures/FWOP Conditions
2020	Tangipahoa Hazard Mitigation Plan Update 2020	Mitigation Plan	Data Source/Consistency
2020	City of Hammond, LA FIRM Reconnaissance Study Summary	Reconnaissance Report	Data Source
2020	USACE, MVN Silver Jackets Study – Tangipahoa Watershed Analysis	Technical Report	Data Source / Structural Measures / Nonstructural Measures
2023	Tangipahoa Parish Code of Ordinances	Local Code	Consistency
2023	CPRA- Louisiana's Comprehensive Master Plan for a Sustainable Coast	Master Plan	Data Source/Consistency/Structural Measures//Nonstructural Measures/FWOP Conditions
2024	Tangipahoa Parish Comprehensive Master Plan	Master Plan	Data Source / Consistency/ Structural Measures / Nonstructural Measures /

Year	Study/Report/Environmental Document Title	Document Type	Importance to Current Study
			FWOP Conditions

Existing Flood Risk Reduction Features: There are no federal levees or dams located in Tangipahoa Parish. Minimal structural flood risk reduction features are present throughout the Parish. The only structural levee present in the Parish is the Yellow Water River Levee System which is a small (0.6 mile), private agricultural levee (Figure 1-4) located approximately 2 miles west of Ponchatoula, LA.

Figure 1-4. Yellow Water River Levee System located at the confluence of the Yellow Water River and Ponchatoula Creek.

Ongoing Programs and Projects

Louisiana Watershed Initiative (LWI): In 2018, in response to the statewide flood events of 2016, the state launched the Louisiana Watershed Initiative, a watershed-based approach to reducing flood risk in Louisiana. It is designed to coordinate and align various state and federal programs, and coordinate policies and decision making among local jurisdictions

within a watershed. The State of Louisiana is in the process of developing a comprehensive State Watershed Plan.

The LWI has continued to develop guidance and planning documents to develop a more holistic approach to watershed management across the state. The Operational Guidance for State Agencies was developed to increase policy and programmatic alignment among state agencies in advance of the State Watershed Plan. Currently, the Initial State Watershed Plan provides the framework for the development of regional watershed management plans. Detailed watershed information and planning will reside within the regional plans, which will be incorporated into the state plan.

The PDT coordinated with the LWI through the NFS to ensure coordination regarding the Watershed Initiative activities in Tangipahoa Parish. To date, there have been no products developed from the initiative that could be incorporated into this study, and no projects are currently identified in Tangipahoa Parish, but the PDT will continue coordination efforts as the study and the LWI progress. If new data becomes timely available, it would be incorporated into the DIFR-EA. The PDT is in coordination with the NFS regarding allocation and implementation of nonstructural projects and how this work supplements the efforts of this study.

Several programs provide funding to the study area for floodplain-related activities, as provided in Table 1-2. Louisiana Governor's Office of Homeland Security and Emergency Preparedness (GOSHEP) coordinates funds from grants for Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance (FMA), Pre-Disaster Mitigation Program (PDM). Office of Community Development (OCD) coordinates funds from the Community Development Block Grant Mitigation (CDBG-MIT). Statewide support (CAPP-SSSE) funds are coordinated by the Analysis Team of LA Watershed Initiative, GOSHEP, and LADOTD. The PDT is also coordinating with other governmental entities on flood risk reduction studies in the Parish. Information on LWI ongoing programs and funding stream can be found at https://watershed.la.gov/.

Coastal Protection and Restoration Authority Board: Following Hurricanes Katrina and Rita in 2005, the Louisiana legislature created the CPRAB and tasked it with coordinating the local, state, and Federal efforts to achieve comprehensive coastal protection and restoration. To accomplish these goals, CPRAB was charged with developing a coastal master plan (http://coastal.la.gov/). The Louisiana's Comprehensive Master Plan for a Sustainable Coast, updated in 2023, sets forth a path to create a more sustainable coastal Louisiana landscape and identifies protection and restoration goals for reducing coastal flood risk, promoting sustainable ecosystems by harnessing natural processes, providing habitats to support a variety of commercial and recreational activities, sustain unique cultural heritage of coastal Louisiana, and support for regional and national business and industry. The 2023 Master Plan recommends a diversity of projects to build land and reduce flood risk to balance short-term needs with long-term goals. The PDT has been in contact with the CPRAB Master Plan team to ensure coordination and consistency between this study and the 2023 Master Plan.

Only one candidate project is located in Tangipahoa Parish and was not selected for the 2023 Master Plan. The Manchac Wetland Restoration and Maurepas Landbridge (ID# 312) was a candidate project for the creation of marsh within a footprint of approximately 25,000 acres in the Manchac Landbridge Area including restoration of approximately 46,000 feet of historic ridge along Eastern Lake Maurepas.

Tangipahoa Watershed Analysis: In 2020, the Louisiana Silver Jackets Teams completed a project to evaluate and recommend flood risk reduction alternatives to aid in flood prevention, specifically along the Tangipahoa River. The PDT utilized this report as part of the study.

The Tangipahoa Parish Government (TPG) has a history of projects related to addressing flooding issues throughout the Parish that have the potential to further reduce flood risk in the study area. There are ongoing and proposed mitigation actions and projects related to local plans & regulations, structure and infrastructure projects (detention basins), natural system protection, and education and awareness programs. Throughout the study, the PDT coordinated with the TPG to capture existing and ongoing projects and assess whether proposed projects met the scope or sizeable scale to be included in the H&H modeling. Additional information regarding what was included in study modeling can be found in Appendix B – Hydrology and Hydraulics.

Per the 2024 Tangipahoa Parish Comprehensive Master Plan, the Parish does not have a substantial amount of engineered flood infrastructure, however it does include 12 low – risk dams, a constitutionally enabled Levee board that is inactive, and a gravity drainage system with a consolidated drainage district (District No. 1) operating in the southern portion of the Parish. The low risk dams support wastewater treatment for towns or are privately owned for recreational or fish ponds in the Parish.

SECTION 2
Problems and Opportunities
(Purpose and Need)

2.1 PURPOSE AND NEED*

The federal objective of water and related land resources project planning is to contribute to the National Economic Development (NED) consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable Executive Orders, and other Federal planning requirements. The purpose of this study with Integrated EA is to analyze alternatives to reduce flood risk as a result of riverine flooding within the Tangipahoa Parish, Louisiana study area. The study evaluates and compares the benefits, costs, and impacts (positive or negative) of alternatives including the No Action Alternative, including the identification and analysis of benefits and their likelihood across a full array of benefit categories. Appendix G Economics and Social Considerations, Section 5.2, Risk Analysis, of includes a probabilistic display of benefits and long-term assurances. The study identified whether a National Economic Development (NED) plan exists to economic damages due to the flood risk within the study area. A life safety risk analysis was conducted to determine if there is risk to human life safety during flood events. The study identified and analyzed benefits across a full array of benefit categories and also considered if comprehensive benefits related to Other Social Effects (OSE) warrant additional action above and beyond the NED plan. Among other things, OSE incorporates the needs and consideration of all at risk communities. The integrated report includes assessment of the environmental effects of a reasonable range of potential alternatives or actions designed by USACE, including the No Action Alternative, prior to decision making.

2.2 PROBLEM IDENTIFICATION

Step 1 of the Six-Step USACE planning process (Figure 1-1) focused 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 then was 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. Through Step 1 of the planning process, the PDT identified FRM types of flood damages experienced in the study area. FRM seeks to reduce flood risks by managing the floodwaters to reduce the probability of flooding and/or by managing the floodplains to reduce the consequences of flooding.

2.2.1 Project History

The communities within Tangipahoa Parish, Louisiana are continually impacted by widespread riverine flooding from heavy rainfall events often associated with hurricanes and tropical storms. The Tangipahoa Parish has multiple sources of flooding (rainfall, riverine,

coastal, interior/urban, and backwater); however, the scope of this study does not address coastal flooding from storm surge and waves, although coastal influences on river stages are reflected in the analyses. The effects from tropical hurricanes (flooding and wind) were determined to be the most prevalent and the most frequent hazard to the Parish. Thirteen of the twenty-one presidential disaster declarations Tangipahoa Parish has received resulted from tropical hurricanes, of which, five declarations were as result of flooding (Tangipahoa Parish Hazard Mitigation Plan 2020).

Figure 2-1 shows the paths of 21 tropical events that have occurred with direct paths within the study area since 1855, and 83 storms within a 60-mile radius of the Parish (NOAA 2024). Table 2-1 provides a summary of the disaster declarations and the natural event that caused flooding within Tangipahoa Parish. From January 1978 through September 2023, FEMA repetitive flood loss claims have resulted in in over $61 million paid through approximately 1,300 claims for Tangipahoa Parish.

The most recent flood events that caused major disruptions, damages, and economic impacts to the Parish included the 2016 Louisiana flooding and Hurricane Ida in 2021. In August 2016, the President issued a disaster declaration in Tangipahoa Parish and adjoining parishes due to impacts from “The Great Flood of 2016”. The flood was responsible directly and indirectly for 13 deaths across all parishes (Louisiana Department of Health, 2023) and the rescue of at least 19,000 people (Louisiana National Guard Public Affairs Office, 2016). Tangipahoa Parish experienced historic flooding to thousands of homes and businesses and impacts to the National transportation corridors, I-12 and I-55. The flooding negatively impacted approximately 1,500 businesses and estimated 17,000 employees, which resulted in $17.4 million in lost labor productivity (Louisiana Economic Development 2016). Most recently, in 2021, Hurricane Ida damaged over 48,000 residential structures in southeastern Louisiana, causing $1.45 billion in damages. The event brought catastrophic flooding damages throughout southeastern Louisiana and brought both localized flooding and riverine flooding throughout the Parish.

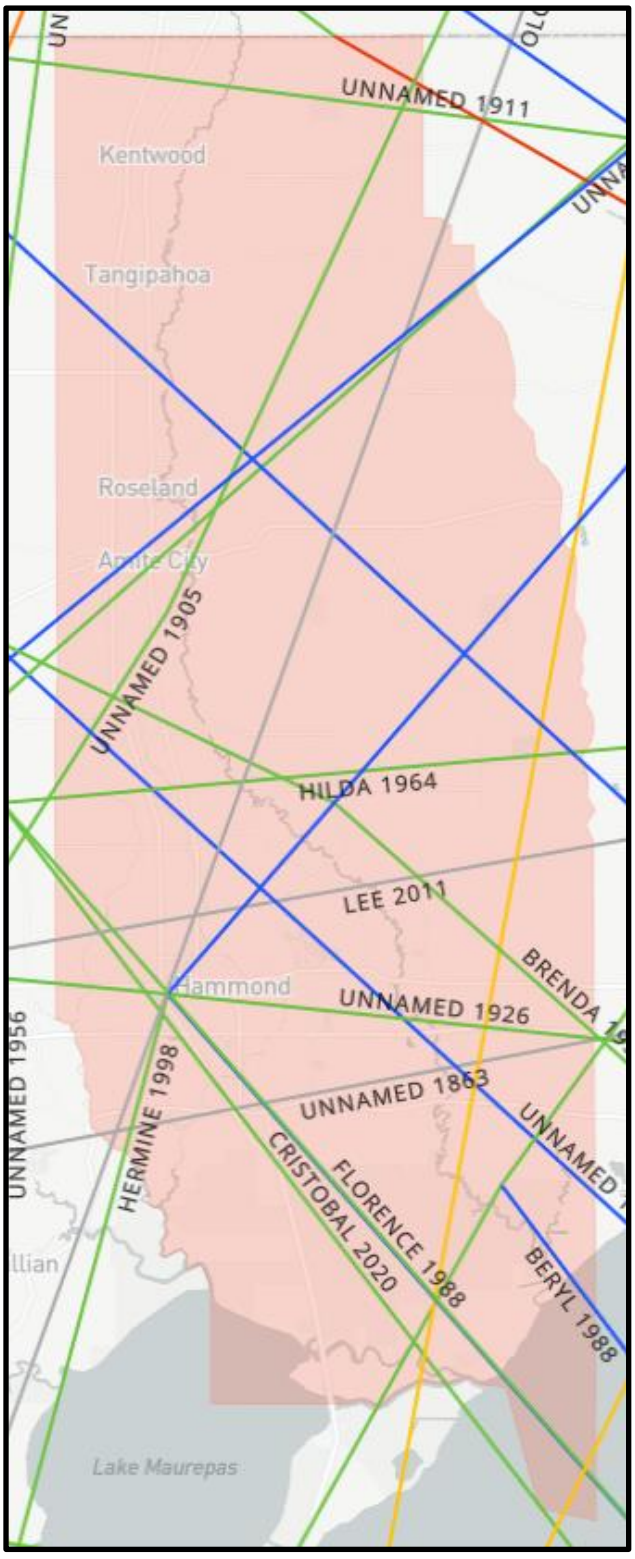


Figure 2-1 Hurricane and Tropical Storm Paths

Table 2-1: Summary of Major Disaster Declaration events, Tangipahoa Parish

DATE	TITLE OF FEMA DECLARATION (EVENT)	DATE	TITLE OF FEMA DECLARATION (EVENT)
Sep 1965	Hurricane Betsy	June 2001	Tropical Storm Allison
April 1973	Severe Storms and Flooding	September 2002	Tropical Storm Isadore
February 1977	Drought and Freezing	October 2002	Hurricane Lili
May 1978	Severe Storms and Flooding	September 2001	Hurricane Ivan
April 1983	Severe Storms and Flooding	August 2005	Hurricane Katrina
November 1985	Hurricane Juan	September 2005	Hurricane Rita
June 1989	Tropical Storm Allison	September 2008	Hurricane Gustav
August 1992	Hurricane Andrew	August 2012	Hurricane Isaac
February 1993	Severe Storms and Flooding	March 2016	Severe Storms and Flooding
May 1995	Rainstorm and Flooding	August 2016	Severe Storms and Flooding
September 1998	Hurricane Georges	September 2021	Hurricane Ida

Source: Federal Emergency Management Agency (FEMA) website, July 2024

Table 2-2: FEMA Repetitive Loss Flood NFIP Claims in Tangipahoa Parish from January 1978 through September 2023

LOCATION	NUMBER OF CLAIMS	TOTAL PAYMENTS
Tangipahoa, unincorporated	2,679	$113,012,613
Amite, City of	20	$770,910
Hammond, City of	332	$3,728,435
Independence, Town of	25	$933,829
Kentwood, Town of	3	$100,055
Ponchatoula, City of	551	$2,655,845
Roseland, Town of	4	$17,629
Tangipahoa, Village of	20	$422,261
Tickfaw	27	$422,261
Total	**3,172**	**$121,874,060**

Source: Federal Emergency Management Agency (FEMA)

Figure 2-2 below shows the areas with repetitive loss from both coastal and riverine sources.

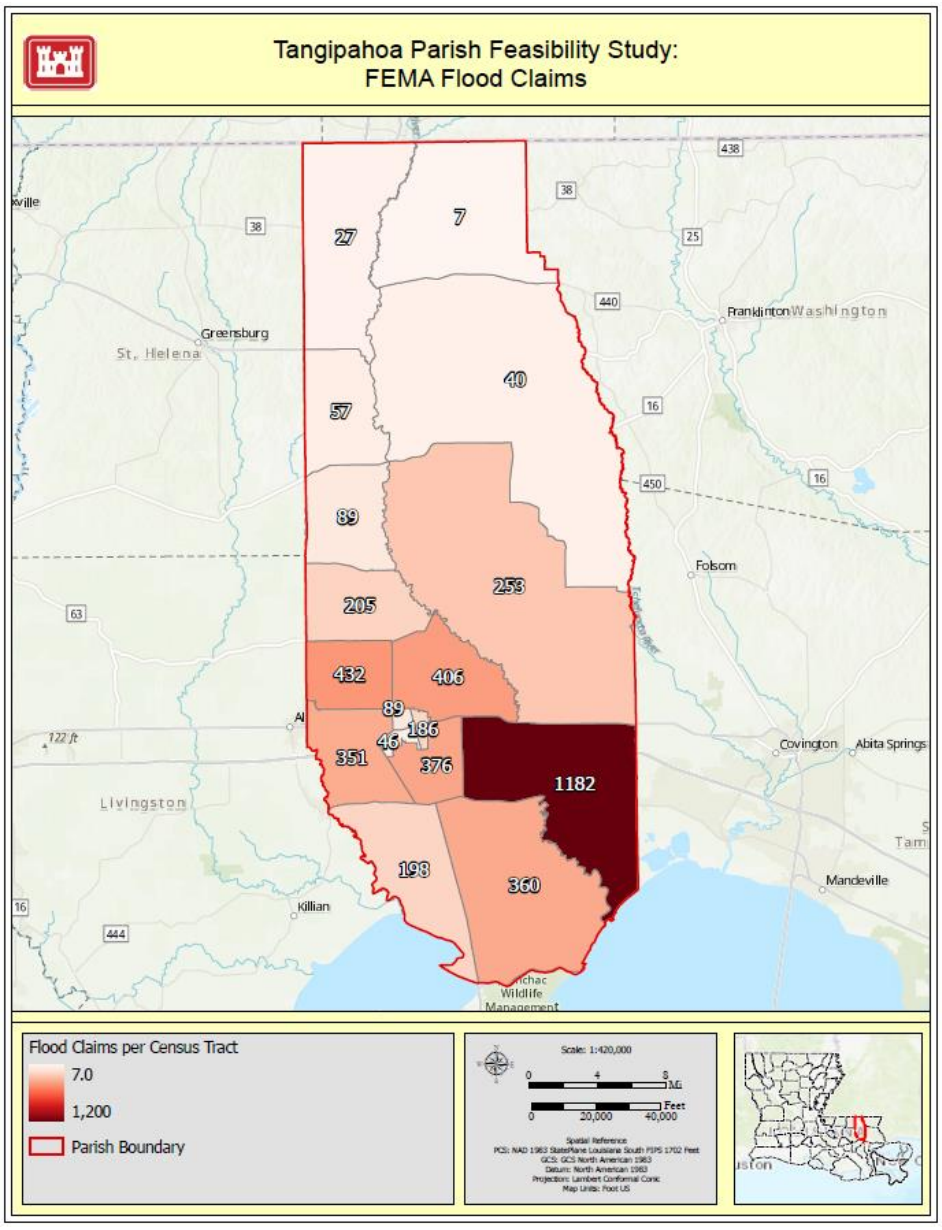


Figure 2-2: Number of FEMA Flood Claims throughout Tangipahoa Parish

2.2.2 Public, Stakeholder and Resource Agency Coordination

Early and continued NEPA coordination with the public, NFS, stakeholders, Federal and State agencies, and Federally-recognized Tribes was conducted. Public scoping and

continued coordination are an essential part of the study development and planning process and ensure an accurate scope development. This coordination helps in determining the appropriate level of documentation and analysis needed, developing and refining the study purpose, goals, objectives, constraints, the range of alternatives to consider, impacts to resources, possible mitigation measures, and opportunities for environmental enhancement as well as in identifying the NEPA and permit requirements of other agencies.

Stakeholder and public engagement was performed through public meetings, social media, and study website. USACE hosted general scoping meetings within 90 days of the start of the study, per Water Resources Reform and Development Act (WRRDA) 2014. A public website dedicated to the study and to request feedback was established in January 2023: (https://www.mvn.usace.army.mil/About/Tangipahoa-Parish-Feasibility-Study/). The points at which public, stakeholder and agency input was gained to inform the study process are summarized below:

- On 31 January 2023, a virtual stakeholder meeting was conducted by CEMVS in accordance with Section 2045 of WRDA 2007 to develop and implement a coordinated study review process with Federal, State, and local government agencies and Indian tribes in the develop of this water resources development project.
- On 01 February 2023, CEMVS sent out letters to tribal, Federal, state, and local government entities inviting them to become a cooperating agency with USACE in preparation of the environmental compliance documentation. The cooperating agencies for this study are the USFWS and the Choctaw Nation of Oklahoma.
- In February 2023, during the early phases of project planning, CEMVS held two public information meetings within 90 days after the commencement of the study: (1) 15 February 2023, at the Hammond Police Union Hall, and (2) 16 February 2023, at the Kentwood First Baptist Church.
- In September 2023, two additional public meetings were held after the Alternatives Milestone Meeting (AMM) to gather public input on the problems, opportunities, objectives, constraints, and alternative formulation: (1) 13 September 2023, at the Amite Community Center and (2) 14 September 2023, at the Hammond Tangipahoa Parish Government Building. These meetings included expanded outreach to communities within the Parish. Feedback from residents affected by flooding is critical to the process.
- There is ongoing coordination between the CEMVS, CEMVN, CPRA, and key stakeholders, such as the Tangipahoa Parish Government, U.S Fish and Wildlife Service (USFWS), Choctaw Nation of Oklahoma, other local municipalities, and others that have expressed interest in the project. Bi-weekly meetings are held between the PDT, NFS, and official cooperating resource agencies. Ongoing meetings with key stakeholders will continue to ensure that they are informed of the study progress.

This draft report is being provided to the public and stakeholders for review and comment on the analysis of the alternative plans and the selection of the TSP. The input and feedback

received during this review period will be incorporated into the final report. This DIFR and DEA is available for public review beginning 5 June 2025. The official closing date for comments is 30 days from the date on which the report has been made publicly available. Comments should be mailed or emailed to:

U.S. Army Corps of Engineers
Attention: Chief, Environmental Branch
CEMVS–RPEDN, Room 3.200,
1222 Spruce Street, St. Louis, MO 63103
Email: tangipahoafs@usace.army.mil

Table 2-3 shows the typical NEPA reporting requirements and where they are located in the DIFR/EA.

Table 2-3. NEPA Information in the DIFR/EA

NEPA Sections	Location in this Document
Cover Sheet	Cover Page
Abstract	Executive Summary
Table of Contents	Table of Contents
Purpose and Need for Action	Section 2
Alternatives Including Proposed Action	Section 4
Affected Environment	Section 3
Environmental Consequences	Section 5
List of Preparers	Section 10
Public Involvement	Section 9
Environmental Compliance	Section 8
List of Report Recipients	Section 9
Index	Listed in References
Appendices	Listed in the Table of Contents

2.2.3 Problems to be addressed by this study

The primary problem in the study area is the flood risk from the Tangipahoa and Natalbany Rivers and their tributaries to human life and flood damages to residential and nonresidential structures. The study also examines the coastal flooding effects to identify problems associated with coastal surge and compound flooding. Critical infrastructure in the parish includes numerous hospitals, schools, and local government facilities. Interstates I-12 and I-55 connect the parish with the state of Mississippi, and the cities of Baton Rouge and New Orleans, serving as a major transportation corridor through Louisiana. I-55 connects the City

of Hammond with I-12 that directly leads into the greater New Orleans area (Jefferson Parish). Problems are based on the need of evaluating flood risk management in the Tangipahoa Parish and are the drivers for developing the planning goal and objectives.

The flood-related problems identified within the study area include:

- Damage to structures (both residential and commercial) resulting from riverine flooding;
- High flood depths and velocities at structures and on roadways during a flooding event can pose a risk to human life safety and result in impacts to critical infrastructure;
- Risk to national transportation corridor and evacuation routes (I-55 / I-12 / US 190 / LA-445), as well as damage to government facilities, schools, fire stations, wastewater treatment plant;
- Increased risk to historically significant structures;
- Increase in urban development in areas where flooding occurs;
- Degradation of natural flood protection:
    - 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.

2.3 OPPORTUNITIES

The following opportunities were identified to address the recognized problems include:

- Manage flood risk by leveraging the following efforts:
    - Enhance public education and awareness of floodplain management;
    - Improve flood warnings for preparation and evacuation;
    - Improve roadway systems to maintain emergency response vehicles access during flooding events.

- Community Resiliency – Improve the communities' ability to prepare for, mitigate, and recover from flood events.
- Recreation - Afford access to public recreation features incidental to proposed flood risk management alternatives;
- Natural Resources - Protect the function and increase the resiliency of the ecosystem to reduce flood damages.

2.4 GOALS AND OBJECTIVES*

The federal objective of water and related land resources project planning is to contribute to the National Economic Development (NED) consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable Executive Orders, and

other Federal planning requirements. Planning objectives represent desired positive changes to future conditions. The study will evaluate and compare the benefits, costs, and impacts (positive or negative) of alternatives including the No Action Alternative, including the identification and analysis of benefits across a full array of benefit categories.

Within the scope of the study, the primary goal is to reduce the severity of flood risk, including flood damages and risk to public health and safety, to residents, businesses, and critical infrastructure in Tangipahoa Parish. See Appendix E - Plan Formulation for additional information regarding the linkages between the documented problems, opportunities, and identified study objectives.

All of the objectives focus on problems and opportunities within the study area and within the 50-year period of analysis from 2033 to 2083. The planning objectives for the study area include the following:

- Objective 1: Reduce the risk to public safety associated with riverine flood impacts to residential and nonresidential structures, evacuation routes, and access to critical infrastructure.
- Objective 2: Reduce economic loss due to flood damage to structures (i.e., businesses, residential, commercial, and public structures) from riverine flooding.
- Objective 3: Reduce interruption of national transportation corridors, e.g., the I-12 and I-55.
- Objective 4: Increase community resiliency which is the sustained ability of a community to use available resources, before, during, and after riverine flooding events and/or coastal events.
- Objective 5: In conjunction with reducing flood risk and economic flood damages in the study area, incorporate the needs and considerations of all at risk communities.

Throughout the DIFR-EA, flood events are referred to by their AEP, which is the probability the level of flooding may be realized or exceeded in any given year. Table 2-4 shows descriptions for flood events by AEP. For example, the term 1% AEP, or 100 Year flood event, refers to a level rainfall, riverine, or storm surge driven flooding (or combination thereof) that has a 1% chance of experiencing each year. Different combinations of size, intensity, and track of rainfall and coastal storm could result in a 1% probability of a coastal surge and/or riverine flooding event.

Table 2-4. Comparison of AEP and Return Period Terminology

AEP	Return Period*
20%	5-year
10%	10-year
4%	25-year
2%	50-year
1%	100-year
0.5%	200-year
0.2%	500-year
0.1%	1000-year

*Note: Return Period is a term that can be misleading, is often misunderstood, and is no longer used by USACE (see ER 1110-2-1450).

2.5 PLANNING CONSTRAINTS AND CONSIDERATIONS

Constraints

A planning constraint is a restriction that limits plan formulation or that formulation must work around. Plans should be formulated to meet study objectives and avoid violating the constraints. These are outlined below, along with a list of additional considerations that, while not constraints, may influence the study process.

The criteria below are considered constraints when formulating management measures:

- To the maximum extent practicable, avoid promoting development within the floodplain (in accordance with E.O. 11988), which contributes to increased life safety risk.
- Proposed measures are limited to those that address problems associated with a minimum flow (800 cubic feet per second for a 10 percent AEP flood) and drainage area (1.5 square miles) requirements (ER 1165-2-21).

Additional considerations identified for plan formulation that would not require the removal of an alternative plan from consideration, but need to be assessed as part of the plan formulation process included:

- Avoid or minimize negative impacts to:
    - threatened and endangered (T&E) species and protected species and their critical habitats;
    - water quality;
    - cultural, historic, and Tribal-trust resources;
    - recreational areas in the Parish;
    - wildlife management areas, wetlands, and forests;
- Avoid locating project features on lands known to have hazardous, toxic, and radioactive waste (HTRW) and/or related concerns;

- Recognition that the Tangipahoa River is designated as a Louisiana Natural and Scenic River, which may require legislative changes to implement alternatives.
- Consistency with local floodplain management plans by avoiding or minimizing inducing flooding in other areas.

SECTION 3
Inventory and Forecast Conditions

3.1 PERIOD OF ANALYSIS

In accordance with ER 1105-2-103, the period of analysis shall be the same for each alternative plan. The period of analysis shall be the time from when benefits begin to be accrued for the project plus a period not to exceed 50-years. The period of analysis for this study is 2033-2083 which is the time period used to consider the benefits and impacts of an action. The time it takes to conduct the study and complete initial design is not part of the period of analysis. For this study, it was assumed that the study would not be completed until 2026 and the design and initial construction activities would not be completed until 2033 (base year).

3.2 GENERAL SETTING

In Step 2 of the Six Step USACE Planning Process (Figure 1-1), the PDT documented the existing conditions relevant to the identified problems by looking at historic trends and potential changes to the existing conditions, and forecasting what would likely happen in the future if no federal action was taken. The data from the inventory and forecasting was used to define the future without-project (FWOP) condition or the “No Action” Alternative. The future without-project condition is the default baseline to which all other alternatives are compared. The without-project condition is the same as the NEPA “no action” condition and it assumes that no action would be taken to address the problem.

This section contains a description of relevant resources that could be impacted by implementation of any Proposed Action. The relevant resources described are those recognized by laws, executive orders, regulations, and other standards of national, state, or regional agencies and organizations; technical or scientific agencies, groups, or individuals; and the general public. Relevance based on institutional recognition means that the importance of an environmental resource is acknowledged in the laws, adopted plans, and other policy statements of public agencies, federally recognized tribes, and private groups. Relevance based on public recognition means that some segment of the general public recognizes the importance of an environmental resource. Relevance based on technical recognition means that the importance of an environmental resource is based on scientific or technical knowledge or judgment of critical resource characteristics. Table 3-1 provides a summary of the institutional, technical, and public importance of these resources.

Table 3-1. Summary of Institutional, Technical and Public Importance of Resources.

Resource	Institutionally Important	Technically Important	Publicly Important
Wetlands	Clean Water Act of 1977,	They provide necessary	The high value the public

Resource	Institutionally Important	Technically Important	Publicly Important
	as amended; Executive Order 11990 of 1977, Protection of Wetlands; Coastal Zone Management Act of 1972, as amended; and the Estuary Protection Act of 1968., EO 11988, and Fish and Wildlife Coordination Act.	habitat for various species of plants, fish, and wildlife; they serve as ground water recharge areas; they provide storage areas for storm and flood waters; they serve as natural water filtration areas; they provide protection from wave action, erosion, and storm damage; and they provide various consumptive and non-consumptive recreational opportunities.	places on the functions and values that wetlands provide. Environmental organizations and the public support the preservation of these areas.
Uplands (including scrub shrub)	Food Security Act of 1985, as amended; the Farmland Protection Policy Act of 1981; and the Fish and Wildlife Coordination Act of 1958, as amended.	They provide habitat for both open and forest-dwelling wildlife, and the provision or potential for provision of forest products and human and livestock food products.	The high value the public places on their present value or potential for future economic value.
Prime and Unique Farmlands	Farmland Protection Policy Act, Food Act of 1981	State and Federal agencies recognize the value of farmland for the production of food, feed, and forage. Public places a high value on food and feed production.	Public places a high value on food and feed production.
Wildlife	Fish and Wildlife Coordination Act of 1958, as amended and the Migratory Bird Treaty Act of 1918	They are a critical element of many valuable aquatic and terrestrial habitats; they are an indicator of the health of various aquatic and terrestrial habitats; and many species are important commercial resources.	The high priority that the public places on their esthetic, recreational, and commercial value.
Threatened and Endangered Species	The Endangered Species Act of 1973, as amended; the Marine Mammal Protection Act of 1972; and the Bald Eagle Protection Act of 1940.	USACE, USFWS, NMFS, NRCS, EPA, LDWF, and LDNR cooperate to protect these species. The status of such species provides an indication of the overall health of an ecosystem.	The public supports the preservation of rare or declining species and their habitats.
Aquatic / Fisheries Resources	Fish and Wildlife Coordination Act of 1958, as amended; Clean Water Act of 1977, as amended; Coastal Zone Management Act of 1972, as amended; and the Estuary Protection	They are a critical element of many valuable freshwater and marine habitats; they are an indicator of the health of the various freshwater and marine habitats; and many species are important commercial resources. USACE, USFWS,	The high priority that the public places on their esthetic, recreational, and commercial value. Environmental organizations and the public support the preservation of fishery

Resource	Institutionally Important	Technically Important	Publicly Important
	Act of 1968.	NMFS, NRCS, EPA, and State DNR and wildlife/fishery offices recognize value of fisheries.	resources.
Essential Fish Habitat (EFH)	Magnuson-Stevens Fishery Conservation and Management Act of 1996, Public Law 104-297	Federal and state agencies recognize the value of EFH. The Act states, EFH is "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity."	Public places a high value on seafood and the recreational and commercial opportunities EFH provides.
Air Quality	Clean Air Act of 1963, Louisiana Environmental Quality Act of 1983.	State and Federal agencies recognize the status of ambient air quality in relation to the NAAQS.	Virtually all citizens express a desire for clean air. The EPA must promote an environment for all Americans free from noise that jeopardizes their health and welfare.
Noise and Vibration	USACE ER 1105-2-100, and National Environmental Policy Act of 1969, Noise Control Act of 1972, Quiet Communities Act of 1978	Unwanted noise has an adverse effect on human beings and their environment, including land, structures, and domestic animals and can also disturb natural wildlife and ecological systems.	The EPA must promote an environment for all Americans free from noise that jeopardizes their health and welfare.
Water Quality	Clean Water Act of 1977, Fish and Wildlife Coordination Act, Coastal Zone Mgt Act of 1972, and Louisiana State & Local Coastal Resources Act of 1978	USACE, USFWS, NMFS, NRCS, EPA, LDFW and State DNR recognize value of good water quality and the national and state standards established to assess water quality.	Environmental organizations and the public support the preservation of water quality and the desire for clean drinking water.
Socioeconomics	River and Harbor Flood Control Act of 1970 (PL 91-611), USACE ER 1105-2-100, and National Environmental Policy Act of 1969.	When an environmental document is prepared and economic or social and natural or physical environmental effects are interrelated, then the environmental document will discuss all of these effects on the human environment.	Government programs, policies and projects can cause potentially significant changes in many features of the socioeconomic environment. Social concerns and items affecting area economy are of significant interest to community.
Cultural Resources	National Historic Preservation Act of 1966, as amended; the Native American Graves	State and Federal agencies document and protect sites. Their association or linkage to past events, to historically	Preservation groups and private individuals support protection and enhancement of historical

Resource	Institutionally Important	Technically Important	Publicly Important
	Protection and Repatriation Act of 1990; and the Archeological Resources Protection Act of 1979	important persons, and to design and construction values; and for their ability to yield important information about prehistory and history.	resources.
Aesthetics	USACE ER 1105-2-100, and National Environmental Policy Act of 1969, the Coastal Barrier Resources Act of 1990, Louisiana's National and Scenic Rivers Act of 1988, and the National and Local Scenic Byway Program.	Visual accessibility to unique combinations of geological, botanical, and cultural features that may be an asset to a Study Area. State and Federal agencies recognize the value of beaches and shore dunes.	Environmental organizations and the public support the preservation of natural pleasing vistas.
Recreation Resources	Federal Water Project Recreation Act of 1965 as amended, and Land and Water Conservation Fund Act of 1965 as amended	Provide high economic value of the local, state, and national economies.	Public makes high demands on recreational areas. There is a high value that the public places on fishing, hunting, and boating, as measured by the large number of fishing and hunting licenses sold in Louisiana; and the large per-capita number of recreational boat registrations in Louisiana.

3.3 HYDROLOGY AND HYDRAULICS

Tangipahoa Parish has multiple waterways which include the Tangipahoa River, Natalbany River, Yellow Water River, Chappepeela Creek, Big Creek, Bedico Creek, Ponchatoula Creek, and Selser's Creek, to name a few. These waterways eventually drain into Lakes Pontchartrain and Maurepas in southeast Louisiana. Tangipahoa Parish is comprised of 8 major watersheds and 30 hydrologic subbasins as defined by the USGS 12-digit hydrologic unit delineations. Figure 3-1 illustrates the subbasins within the study area. The area is hydraulically complex and experiences repeated damages from various types of flood events, including, but not limited to storm surge and riverine.

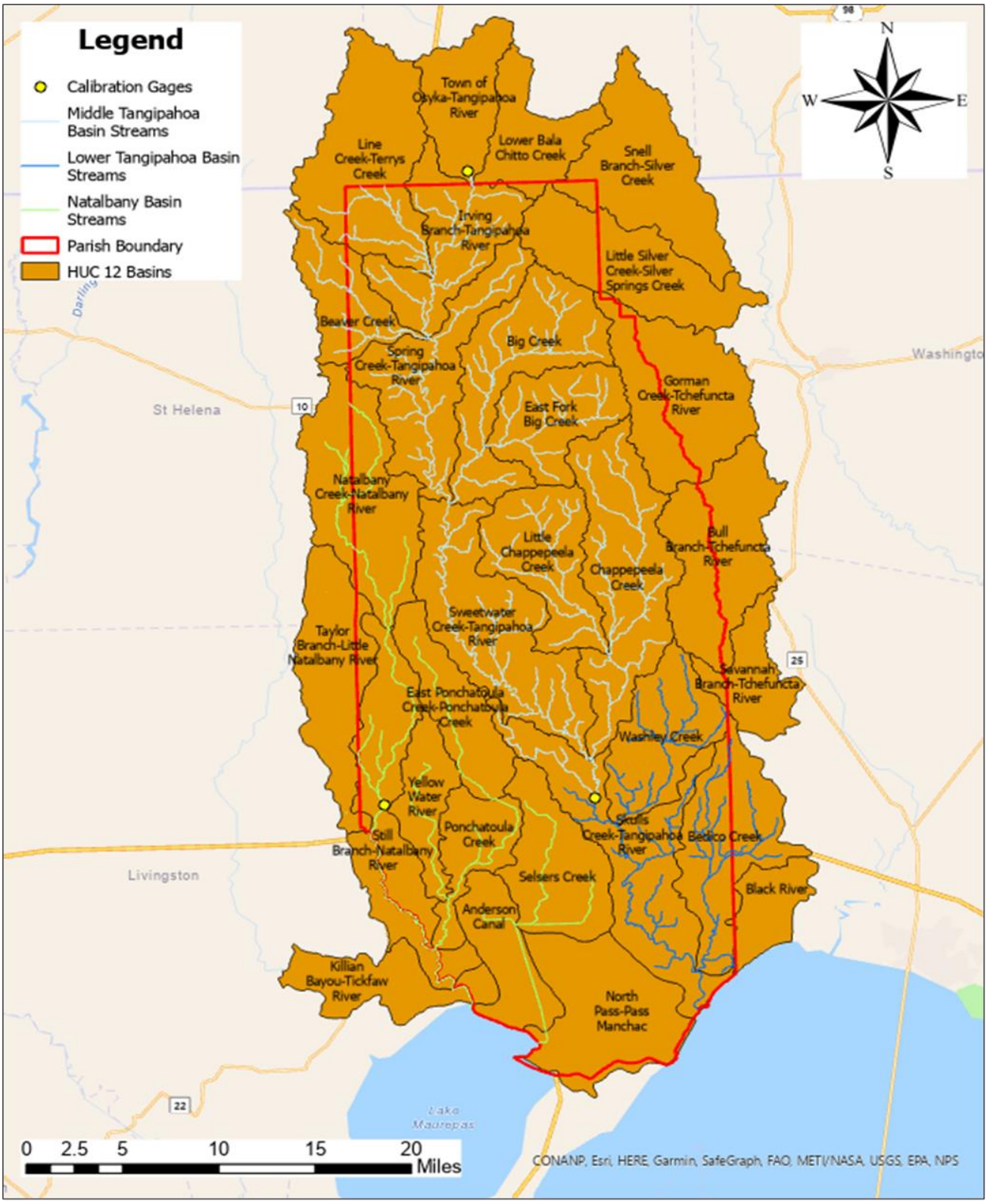


Figure 3-1. Tangipahoa Parish Watersheds

The study area experiences flood risk from two primary sources: coastal storm surge with waves and heavy rainfall. The majority of the Parish flooding can be attributed to heavy rainfall that causes its rivers to overflow their banks This study refers to this type of flooding as riverine flooding. Coastal storm surge flooding dominates the lower portion of the parish south of Louisiana Highway 22.

FRM study authority dictates that only riverine flooding be examined in the application of the structural, non-structural, and nature based measures. However, this report still examines the coastal effects to identify problems associated with coastal surge and compound flooding. Riverine flooding was examined by itself as well as with coastal effects accounted for. This was done so the PDT could identify flooding from both riverine flooding and coastal surge for future consideration.

Tangipahoa River Watershed

The Tangipahoa River originates northwest of McComb in southwest Mississippi and runs south 122 miles through Lake Tangipahoa in Percy Quin State Park before passing into southeast Louisiana. There it flows through the entirety of the Tangipahoa Parish until its mouth opens into the northwest region of Lake Pontchartrain.

The Tangipahoa River basin is an 800 square mile watershed that accounts for approximately 60% of the Parish drainage area. Chappepeela and Big Creek are two of the larger tributaries to the Tangipahoa River. The Tangipahoa River is designated as a Louisiana state Natural and Scenic Stream (Louisiana RS 56:1847) from the Louisiana-Mississippi state line to its junction with Interstate 12 crossing.

Natalbany River Watershed

The Natalbany River originates northwest of Amite, LA and runs south 79.5 miles. It joins the Tickfaw River which empties into Lake Maurepas. The Natalbany River basin is a 220 square mile watershed that accounts for approximately 20% of the Parish drainage area. Ponchatoula Creek and Little Natalbany Creek are two of the larger tributaries to the Natalbany River.

Selser's Creek Watershed

Selser's Creek originates east of Hammond, LA and west of Robert, LA. It runs south approximately 15 miles and empties into Lake Maurepas. The Selser's Creek basin is a 50 square mile watershed that accounts for approximately 8% of the Parish drainage area.

3.3.1 Hydrologic Modeling

Hydrology was analyzed using the Hydrologic Engineering Center's Hydrologic Modeling System (HEC-HMS) software package. HEC-HMS is designed to simulate the complete hydrologic process of watershed systems. The purpose of using HEC-HMS is to produce local inflow into the hydraulic models that compute water surface levels. The Tangipahoa

Parish was subdivided into four HEC-HMS projects. The models were calibrated at the observed gages in the parish. The gages were located at Osyka, MS and Robert, LA on the Tangipahoa River as well as Baptist, LA on the Natalbany River. Discharges were computed and checked against a Bulletin 17c analysis of the gage period of record data. The HEC-HMS computed frequency design discharges at the observed gages are shown in Table 3-2.

Table 3-2. HEC-HMS Frequency Design Discharges

Annual Exceedance Probability (%)	Tangipahoa River near Osyka, MS (cfs)	Tangipahoa River near Robert, LA (cfs)	Natalbany River near Baptist, LA (cfs)
50	7,000	35,500	4,750
20	11,400	47,300	6,525
10	14,900	56,100	7,809
4	19,700	69,200	9,653
2	24,700	77,900	11,258
1	30,300	93,100	12,919
0.5	36,000	104,900	14,297
0.2	43,700	123,600	16,815

For detailed information on the hydrologic analysis performed in this study see Appendix B - Hydrologic & Hydraulics, Section 3.

3.3.2 Hydraulic Modeling

The hydraulics was analyzed using the Hydrologic Engineering Center's River Analysis System (HEC-RAS) software package. HEC-RAS uses one and two-dimensional unsteady flow simulations to compute and illustrate water surface levels on a river system. The purpose of using HEC-RAS is to compute discharges and water surface levels for the frequency design storm events.

The Tangipahoa Parish was subdivided into three HEC-RAS projects. The models were calibrated at the same observed gages as was done with the HEC-HMS models. With the inflows computed by HEC-HMS water surface levels during the design frequency events were computed. The water surface elevation grids created using HEC-RAS were used in the HEC-FDA economic analysis of the parish. The extents of the inundation for the

selected design frequency events are located in Annex D in Appendix B – Hydrologic and Hydraulics.

3.3.3 Coastal Surge Analysis

The 2017 CPRA dataset of existing coastal storm conditions was used to develop storm surge and wave parameters at specific frequencies. Using a MATLAB script, storm surge, significant wave height and wave period were extracted from the 2017 CPRA Master Plan ADCIRC dataset. This data set is based on the modeling results of 152 JPM-OS synthetic storms. The storms cover a range of hypothetical tracks, forward speeds, intensities, and sizes. The JPM-OS synthetic storms are basically an extension of the limited observed record.

The synthetic storms are parametrically similar to actual storms in the record. All 152 storms must be simulated to estimate storm surge statistics. ADCIRC, which computes storm surge water surface elevations, is coupled with SWAN (Simulating WAves Nearshore) to compute significant wave height and peak wave period. The couple of ADCIRC and SWAN yields frequency surge levels that are forced by both wind velocities and atmospheric pressure. For storm surge inundation, the MATLAB code was written to do a 3D interpolation on the CPRA ADCIRC dataset. The MATLAB function scattered Interpolant develops a 3D surface of the variables return period, sea level rise, and surge. The water surface levels produced from the ADCIRC results were used as HEC-RAS coastal boundary conditions.

3.3.4 Compound Flooding

Compound flooding is a concern at the boundaries of the storm surge influence and the riverine flood influence. The interaction and coincidence of the two regimes impact peak water levels in this zone. To understand the likelihood of coincident flood events between the lakes and the rivers, the degree of stage independence was examined. Based on the magnitude of the lag times, the river and storm surge peak stage occurrence are assumed to be relatively independent. The one caveat is that the lake levels do appear to be elevated during river peak stages which could affect compound flooding risk. Since this adds to uncertainty, a sensitivity analysis of river flood coincidence with lake surge was performed. This analysis included the range of the actual conditional exceedance frequency profiles. To capture the difference in the upper and lower bounds of dependent frequency profiles in the zone of compound flooding, the 1% AEP and 10% AEP storm events were examined. Plots of the computed profiles for 1% AEP event for rivers and creeks in the Lower Tangipahoa is shown in Figure 3-2.

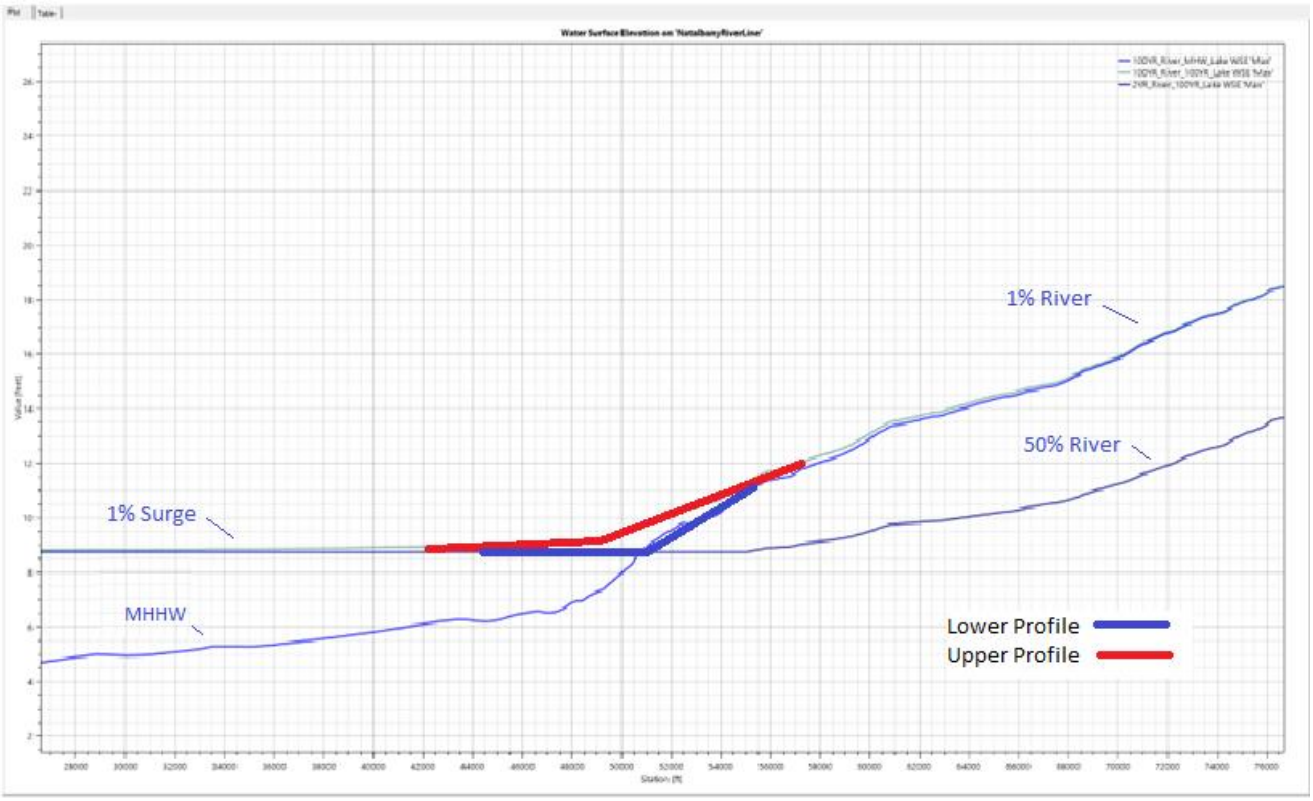


Figure 3-2. Lower Tangipahoa River Coincident Frequency Profiles – 1% AEP Event

The upper profile in the plots have the 1% AEP river event coincident with a 1% AEP lake surge event. The lower lines that join in the area of compound flooding are the 1% AEP river event coincident with the Mean Higher High Water (MHHW - the average height of the highest tides recorded at a tide station on a daily basis) level on the lake and 1% AEP lake surge event coincident with the 50% AEP river flood event. Falling within this triangle of profiles will be the actual 1% AEP river profile. To clarify, the actual profile within this compound flooding zone would be computed through a more complex coincident frequency analysis.

Through flood peak timing analysis of select storm events it was determined that river and lake levels during storm events are relatively independent. Therefore, a simpler approach is warranted to capture coincident river stages to lake surge stage. The approach that the PDT determined acceptable is that the design frequency event river flow will be coincident with the MHHW level for riverine flooding. The design frequency storm surge level will be coincident with a normal river flow (50% AEP event).

The risk for error in relying on the river profile computed from a merger of the 1% AEP river profile tying into MHHW and the 1% AEP lake level tying into a 50% AEP river event is low. Also, because the economic analysis shows total damage cost differences of less than 2.3% for additional damage within the analyzed range of profiles, the overall risk associated with

this approach to computing frequency water surface elevations in the areas of compound flooding is acceptable. The compound flooding analysis is discussed in detail in Section 4.6 in Appendix B – Hydrology and Hydraulics.

3.4 SOCIOECONOMICS

The socioeconomics can be characterized by inventory of structures, trends in population, number of households, employment, and income. Historically, damages from storm surge and riverine flood events have adversely impacted business and industrial activity, agricultural activity, and local employment and income, which then led to commensurate negative impacts to property values and the tax base upon which state and municipal government revenues rely.

3.4.1 Structures

An inventory of residential and nonresidential structures was developed by CEMVS using the National Structure Inventory (NSI) 2022 for the study area. The inventory consists of approximately 50,000 structures with 90 percent categorized as residential and 10 percent categorized as non-residential. Figure 3-3 shows the National Structure Inventory and the study area boundary.

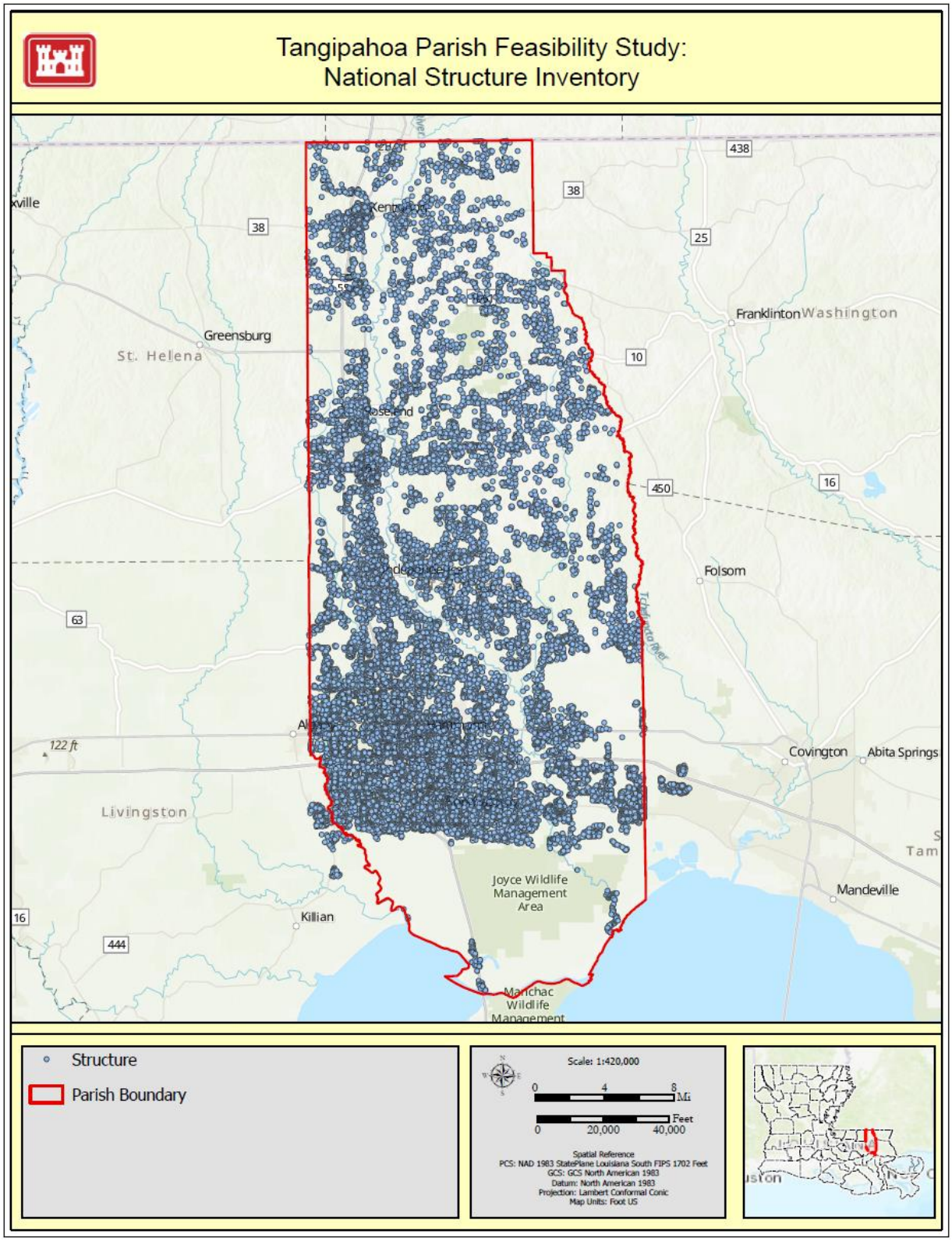


Figure 3-3. 2022 National Structure Inventory

3.4.2 Population, Number of Households, and Employment

Tables 3-3 and 3-4 display the population, number of households, and the employment (number of jobs) for the years 2000, 2010, 2020, and projections for 2025 and 2045.

Table 3-3. Population of Tangipahoa Parish (2000-2045)

Parish	2000	2010	2020	2025	2045
Tangipahoa	121,425	135,217	131,780	133,060	134,820

Table 3-4. Households in Tangipahoa Parish (2000-2045)

Parish	2000	2010	2020	2025	2045
Tangipahoa	43,228	49,915	52,430	54,150	57,660

3.4.3 Income

Table 3-5 shows the actual and projected per capita personal income levels for Tangipahoa Parish from 2000 to 2030.

Table 3-5. *Per Capita Income ($) in Tangipahoa Parish (2010 - 2030)*

Parish	2010	2021	2025	2030
Tangipahoa	33,424	47,748	49,847	59,380

3.4.4 FEMA Flood Claims

The FEMA flood repetitive loss statistics for Tangipahoa Parish from January 1978-September 2023 totaled of 3,172 insured claims, totaling approximately $121.9 Million. According to the 2016 Flood Loss Outreach and Awareness Taskforce (FLOAT) report, 9 percent of the properties in Tangipahoa Parish have flood insurance. Recent disasters and predicted future events will continue to negatively impact the region without some form of flood risk management solution. The PDT developed FRM management measures to reduce the risk of flood damages for residential and commercial structures, vehicles, and major transportation routes and activities vital to the economy of the region and nation.

3.4.5 Other Social Effects

In accordance with the USACE Institute for Water Resources (IWR) handbook in Applying Other Social Effects (OSE) in Alternatives Analysis (USACE, 2013), the CEMVS identified multiple factors to describe and quantify the social impact in the study area. These social factors include:

3.4.5.1 *Community Risk Factors*

Understanding the potential consequences of flood events requires a detailed assessment of community characteristics. This study considered socioeconomic factors, household characteristics, and housing/transportation conditions within the study area to identify attributes that could amplify the impact of a flood – meaning factors that would likely worsen the consequences experienced by residents. Each community facing flood hazards was carefully examined, and the specific needs of those communities were incorporated to determine overall risk.

To systematically evaluate these community risk factors, we utilized the Federal Emergency Management Agency's (FEMA) National Risk Index, specifically the Community Risk Factors component (see Table 3.6). This index allowed us to assess how various characteristics could amplify the consequences of a flood event.

Table 3.6: FEMA National Risk Index- Community Risk Factors

Consequence Enhancing Category	Individual Risk Indicator
Socioeconomic Status	Below 150% Poverty
Socioeconomic Status	Unemployed
Socioeconomic Status	Housing Cost Burden
Socioeconomic Status	No High School Diploma
Socioeconomic Status	No Health Insurance
Household Characteristics	Aged 65 & Over
Household Characteristics	Aged 17 & Younger
Household Characteristics	Civilian with a Disability
Household Characteristics	Single-Parent Households
Household Characteristics	English Language Proficiency
Housing Type and Transportation	Multi-Unit Structures
Housing Type and Transportation	Mobile Homes
Housing Type and Transportation	Crowding
Housing Type and Transportation	No Vehicle
Housing Type and Transportation	Group Quarters

Tangipahoa Parish demonstrates a significant level of risk from natural disasters, ranking in the 96th percentile according to the FEMA National Risk Index. This indicates that Tangipahoa experiences a greater level of risk than 96% of all other counties and parishes in the United States. This heightened risk is driven, in part, by the factors detailed below.

Socioeconomic Status & Impact: This category encompasses indicators related to income, poverty, employment, and educational attainment. Communities with lower incomes and higher unemployment rates often possess fewer resources for disaster preparedness, making it harder to protect property and livelihoods. Damage to homes and infrastructure represents a greater financial hardship for these populations, and they may face increased costs associated with injury or healthcare needs following a flood.

Household Characteristics & Impact: The presence of populations requiring additional support – including children under 18, seniors aged 65 and over, individuals with disabilities, and single-parent households – significantly impacts a community's ability to respond to and recover from a flood. These groups are often more reliant on external assistance for basic needs like financial aid, transportation, medical care, and help with daily living activities during and after a disaster (Flanagan, Gregory, Hallisey, Heitgerd, & Lewis, 2011). Language barriers, as indicated by limited English language proficiency, can also hinder access to critical information and resources.

Housing Type & Transportation & Impact: The type and quality of housing, along with access to reliable transportation, play a crucial role in determining a community's resilience. Structures like mobile homes and multi-unit buildings are often more susceptible to damage from flooding and severe weather. Crowded living conditions can impede safe evacuation routes, leading to congestion and increased risk. Limited access to vehicles restricts a population's ability to evacuate proactively or to access essential services and safe shelter in the aftermath of a flood.

Taken together, these risk factor categories, and their associated indicators provide a comprehensive overview of the potential challenges facing Tangipahoa Parish residents in responding to future flood events. A more detailed exploration of the broader economic and social considerations related to these risks can be found in Appendix G: Economic and Social Considerations.

3.4.5.2 *Health & Safety*

According to 09-R-4 (IWR) personal and group safety is a basic human need. Any conditions that are perceived to affect personal health and safety implicate personal stress and dissatisfaction. Areas that are prone to flooding, such as the Tangipahoa study area, have an increased risk of adverse effects on health and safety. See Section 3.4.7 for Life Safety Assessment.

3.4.5.3 *Critical Infrastructure*

Critical infrastructure includes hospitals, emergency services such as EMT, fire stations, and police stations. Flooding impacts to critical infrastructure pose a risk to the health and safety

within the study area at the time of inundation via the inability to access individuals in need of assistance. Figure 3-4 represents critical infrastructure situated within the Tangipahoa study area.

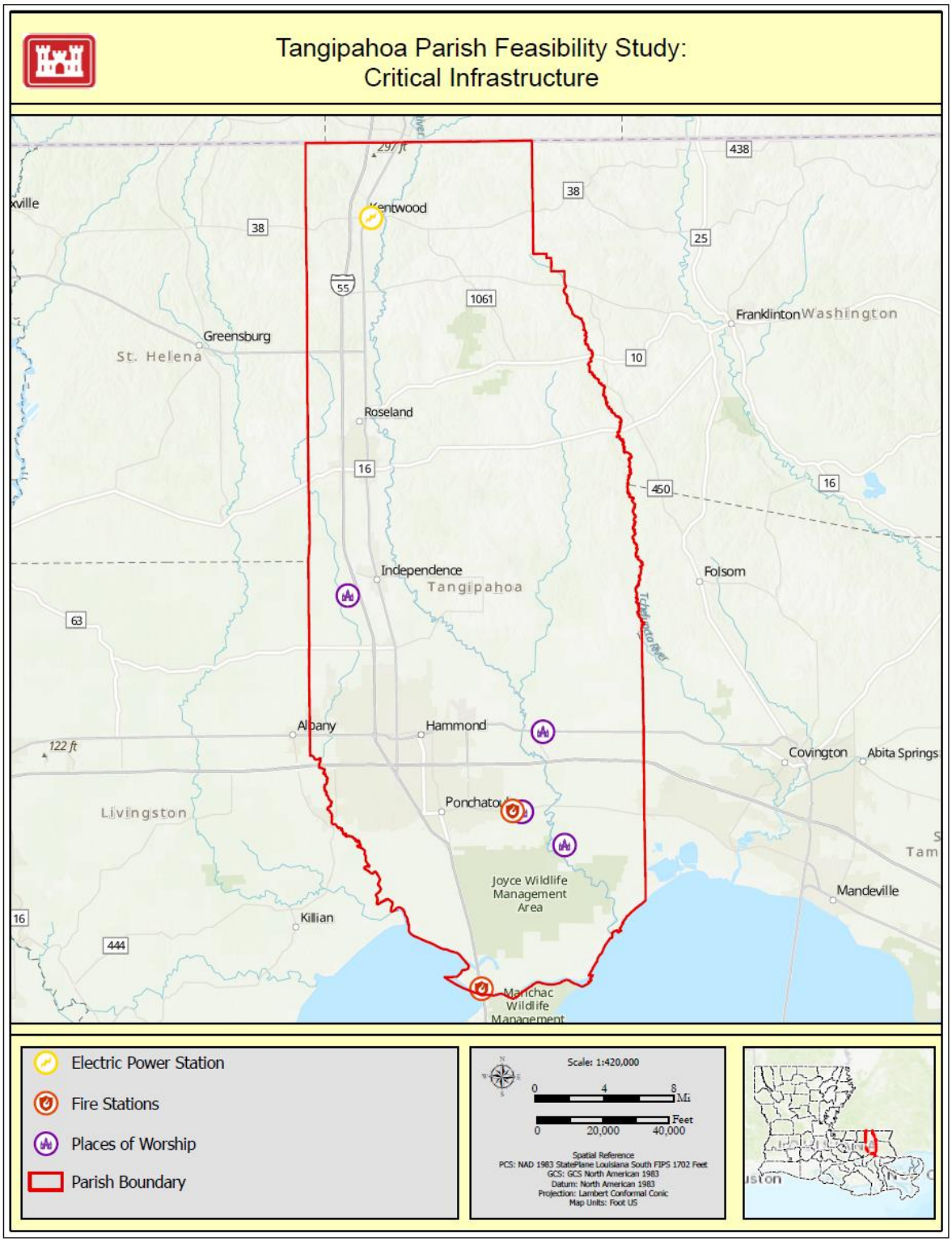


Figure 3-4: Critical and Civic Infrastructure

3.4.5.4 *Economic Vitality*

Economic vitality refers to the quality of life of the affected population. This is influenced by the economy's ability to provide a good standard of living. Employment activity indicates how efficiently a community can respond to hazardous events and is an overall indicator for economic health. Table 3-7 shows the top 10 industries employment within the Tangipahoa study area.

Table 3-7: Employment by Industry in Tangipahoa Parish

Top 10 Industries In Tangipahoa	Employment Numbers
Junior colleges, colleges, universities, and professional schools	5,190
Employment and payroll of local govt, non-education	2,942
Employment and payroll of local govt, education	2,776
Full-service restaurants	2,029
Employment and payroll of state govt, education	1,872
Limited-service restaurants	1,917
Other real estate	1,694
Retail - General merchandise stores	1,464
All other food and drinking places	1,300
Scientific research and development services	1,493

3.4.5.5 *Social Connectedness*

Social Connectedness refers to social networks where community members interact. Strong social connectedness supports meaning and structure to one's life. In addition to social connectedness, identity of an individual or a community provides a sense of self as a member of a group, distinct from other groups. Appendix G: Figure 7-2 shows a map of physically located civic infrastructure, which includes places of worship, community centers, and parks. In addition to community services that occupy physical space and are affected by inundation, there are community projects and activities that are supported by state and local government, including recreation activities for children and adults, as well as events in support of music and culture within the region. These activities are likely also impacted by inundation in the existing condition via inundation on roadways and recovery delays.

Community cohesion is based on the characteristics that keep the members of the group together long enough to establish meaningful interactions, common institutions, and agreed upon ways of behavior. These characteristics include race, education, income, ethnicity, religion, language, and mutual economic and social benefits. The study area is comprised of communities with a long history and long-established public and social institutions, including places of worship and schools.

3.4.5.6 *Participation*

Participation refers to the ability of a community to influence social outcomes. In water resource planning, teams partake in conversations with stakeholders to better understand how a community is impacted by current conditions as well as how they could be affected by future outcomes, which includes the public. Public involvement in the study process is essential in evaluation of plans. Outreach efforts focused on community-based organizations that serve residents in the study area and included calls to two hundred twenty-four churches as well as coordination and delivery of project summaries to six libraries, two community centers, eight Head Start child centers, four senior centers, and three nonprofit organizations in advance of public meetings in September 2023 at Amite City and Hammond, LA. These organizations were notified again of the draft report release date and scheduled public meetings in August 2024 at Hammond and Ponchatoula, LA to offer additional opportunities for public input and involvement. Libraries in the Parish agreed to make the public meeting presentation available to patrons interested in learning more about the project and how to provide feedback on flood hazard in the Parish. More information on the meetings is provided in Appendix D.

3.4.6 Economic Damages – Existing Condition (Base Year 2033)

Table 3-8 below shows the economic damages for a given AEP event reflective of the base year (2033) hydraulics and hydrology. Additional structure inventory refinement post-draft report is likely to decrease the expected damage at a given AEP event.

Table 3-8. Existing Conditions Structure Damage Without Project by Probability Event (2024 Price Level; $1000s) (Base Year 2033)

Annual Exceedance Probability (AEP) Event	Total Damage Base Year - 2033
50% (2 yr.)	$58
20% (5 yr.)	$58
10% (10 yr.)	$152,551
4% (25 yr.)	$248,318
2% (50 yr.)	$342,586
1% (100 yr.)	$440,030
0.5% (200 yr.)	$562,216
0.2% (500 yr.)	$779,313

3.4.7 Life-Safety Risk

High flood depths and velocities at structures and on roadways during a flooding event can pose a risk to human life safety. Life loss modeling software such as HEC-LifeSim can be used to estimate potential life loss from flood hazards. For the purposes of this study, life safety risk was evaluated using assumptions from the HEC-LifeSim software.

Risk to human life safety during a major flooding event in the Tangipahoa study area was evaluated using stability criteria assumptions from the LifeSim technical manual, 2033 without project H&H depth and velocity grids, and the Tangipahoa structure inventory. Stability criteria refers to the possibility of either vehicles or people being swept off of either the road or their feet by flood waters. It was determined that while there are areas of the Parish which may result in depths, velocities, or the combination therein to present the possibility of sweeping vehicles off of the road, there also exists alternative routes which are not inundated by flood events. Additionally, there were no communities or groups of homes which are completely cut off in the event of a flood from emergency services as alternative routes are available. Stability criteria on structures will be evaluated post-TSP with 2083 hydraulic depth and velocity grids.

A life safety assessment was completed for the study area that included existing conditions and evaluated using depths, velocities, frequency, and duration of flooding on roadways and on structures. There were no depth and/or velocity threshold results that exceeded structure stability. An assumption in this structure stability analysis was that, unless otherwise identified, a structure was assumed to have a wood-anchored frame. For the roadway life-risk analysis, the low clearance, minimum threshold stability threshold function was used as shown in Figure 3-5 below.

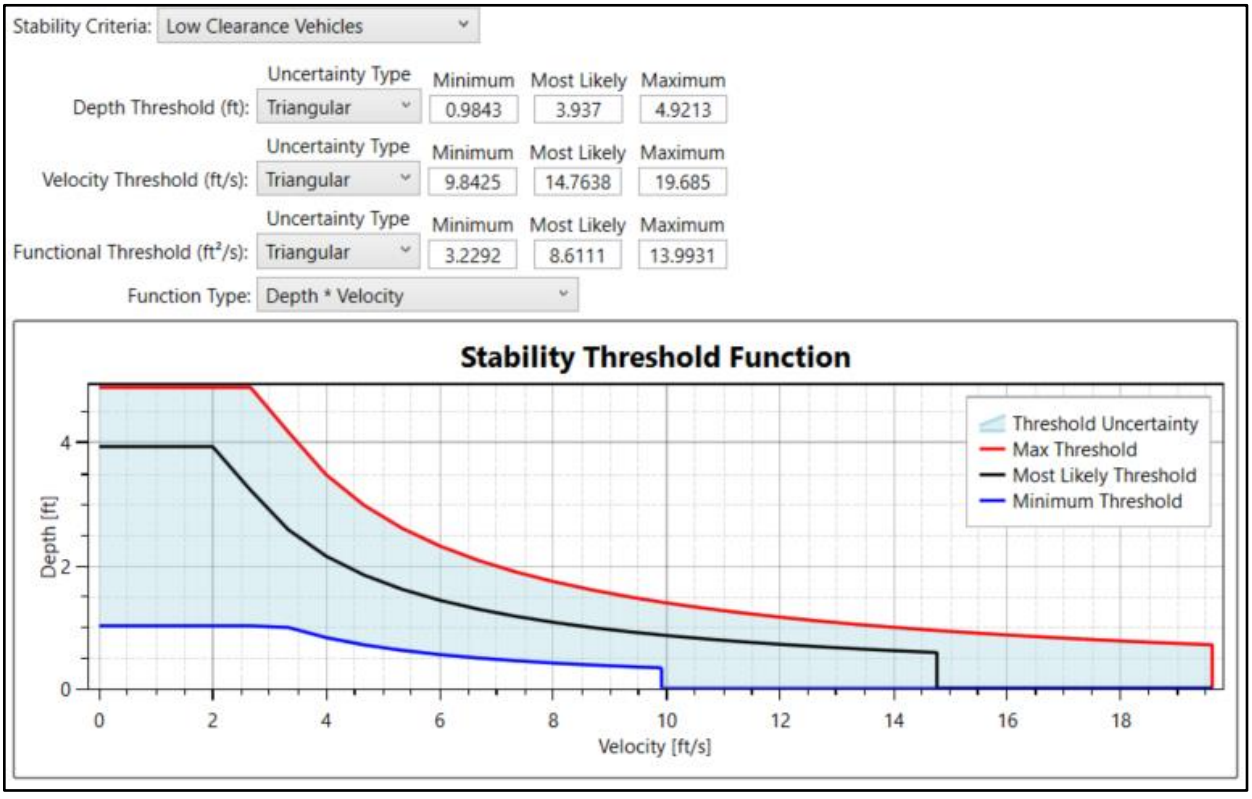


Figure 3-5: Low Clearance Vehicle Minimum Stability Threshold

Using this conservative approach, there were depth and/or velocity thresholds exceeded for vehicle stability on three small segments of roadways identified. Those stability thresholds were exceeded at relatively infrequent events, had short flood duration, and had short re-route options available, resulting in the conclusion that life safety risk on roads in the existing condition is low. No structural measures, including roadway elevations, were deemed appropriate for addressing the low life safety risk due to prohibitive cost and/or ineffective reduction in incremental life safety risk. Additionally, the NFS and the Parish government provided locations of interest where life safety risk may be a concern. Those locations were evaluated as described above and were determined to have low life safety risk. Stability criteria on structures will be evaluated post-TSP with 2083 hydraulic depth and velocity grids.

Additionally, because each of the plans in the final array is exclusively nonstructural, depth of flooding is the only physical characteristic being altered which will impact life safety. As the depth on the structure decreases (due to nonstructural elevation), the ability to withstand additional velocity increases. This means that a structure is more likely to remain stable following the implementation of elevation. With that being said, it is not expected that structures will experience combinations of depths and velocities high enough to cause structure stability issues in the existing condition. Section 5.2, Risk Analysis, of the Economics Appendix has more information regarding risk analysis including but not limited to long-term assurance, residual risks, and variability of benefits.

3.5 PHYSICAL ENVIRONMENT

3.5.1 Land Use

The study area consists of the entire parish including but not limited to, the communities of Hammond, Ponchatoula, Amite City, Independence, Kentwood, Roseland, Tangipahoa, and Tickfaw. The Tangipahoa and Natalbany River have the biggest flooding impacts to communities in the southern portion of the parish. Critical infrastructure in the parish includes numerous hospitals, schools, and local government facilities. Interstates I-12 and I-55 connect the parish with the state of Mississippi, and the cities of Baton Rouge and New Orleans, serving as a major transportation corridor through Louisiana. Interstate 55 connects the City of Hammond with I-10 that directly leads into the greater New Orleans area (Jefferson Parish).

Tangipahoa Parish consists of three primary ecoregions, including Inland Swamp, Gulf Coast Flatwoods, and Southern Pine Plains and Hills (Daigle, et al., 2006). The Inland Swamp ecoregion is part of the Mississippi Alluvial Plain, which is a broad, flat alluvial plain intermixed with terraces, swales, and levees from the Louisiana coastline up the Mississippi River to the Ohio-Mississippi River confluence. The Inland Swamp ecoregion marks the transition between fresh-water swamps and marshes to the north, and brackish and saline marshes to the south near the Louisiana coastline. A transition to the Gulf Coast Flatwoods ecoregion occurs near state route 22 in the parish and extends north to the confluence of the Tangipahoa and Chappepeela River confluence. On the western half of the parish the flatwoods ecoregion extends up to Amite City. The Gulf Coast Flatwoods region consists of

relatively level terraces of alluvial and deltaic deposits of sand and clay. This region was historically longleaf pine flatwoods and savannas and is now largely converted to mixed forest and pine plantations, urban, pastures, or crops. The northern half of the Parish is primarily Southern Pine Plains and Hills. This portion historically consisted of longleaf pine woodlands and mixed loblolly pine-hardwood forests. This ecoregion now consists primarily of pasture, mixed forest, and slash or loblolly pine plantations. River corridors such as the Tangipahoa River are lined with bottomland forest species. Overall, the top three major land use types by area in the Parish are pine forest/plantation, woody wetlands, and pastureland (Table 3-9).

Table 3-9. Tangipahoa Parish Land Use Cover (mi2) by Category and Year 2001-2021.

Land Cover Categories	2001	2006	2016	2021	Percent Change 2001-2021
Developed, High Intensity	2.4	2.8	3.6	3.9	64%
Developed, Medium Intensity	7.2	8.4	11.5	12.8	77%
Developed, Low Intensity	24.1	24.7	26.2	26.8	12%
Developed, Open Space	49.2	48.8	48.4	47.9	-3%
Cultivated Crops	1.3	1.3	1.3	1.3	4%
Pasture/Hay	159.5	148.8	135.7	135.7	-15%
Grassland	22.3	33.8	25.5	16.2	-28%
Deciduous Forest	0.7	0.6	0.7	0.7	7%
Evergreen Forest	186.7	185.3	211.6	232.8	25%
Mixed Forest	7.5	7.0	6.6	7.9	6%
Scrub/Shrub	62.0	61.7	52.5	36.2	-42%
Woody Wetland	223.3	210.8	224.1	223.8	0%
Emergent Herbaceous Wetland	40.8	53.3	38.8	38.9	-5%
Barren Land	3.2	3.2	3.3	5.2	65%
Open Water	53.9	53.6	54.4	53.8	0%

Source: USGS National Land Cover Database 2001, 2006, 2016, 2021

3.5.2 Geomorphic and Physiographic Setting

Multiple waterways run through the parish, with major rivers and streams including but not limited to the Tangipahoa River, Yellow Water River, Natalbany River, and Ponchatoula Creek. Each of these serves an important role in sediment transport from the upper portions of the parish into Lake Maurepas and Lake Pontchartrain, enriching the estuary with nutrients in a manner that is highly favorable to numerous species. Benthic communities throughout Lake Pontchartrain are directly impacted by geochemical changes that are associated with nutrient exchange between the marshes that separate Lake Pontchartrain and oceanic water near the Louisiana coastline.

3.5.3 Climate, Weather Patterns, and Changing Hydrologic Conditions

The 2024 USACE Climate Adaptation Plan update reflects climate preparedness and resilience actions in the Climate and Natural Resources Priority Agenda and recommendations from the State, Local, and Tribal Leaders Task Force for Climate Preparedness and Resilience. The Climate Adaptation Plan is designed to evaluate the most significant risks related to changes in climate, and vulnerabilities in, agency operations and mission in both the short and long term, while also addressing how USACE would address vulnerabilities.

ER 1100-2-8162 and EP 1100-2-1 provide guidance for incorporating direct and indirect physical effects of projected future relative sea level rise (RSLR) across the project life cycle in managing, planning, engineering, designing, constructing, operating, and maintaining USACE projects and systems of projects. Potential relative sea level change must be considered in every USACE coastal activity as far inland as the extent of estimated tidal influence. See Appendix B and Appendix I for more details on RSLR and inland hydrologic change analysis for the study.

Temperatures in Southeast Louisiana have increased approximately 0.1 degrees Fahrenheit over the past century (USEPA, 2016). Climate patterns in Louisiana are forecasted to see continued warming of temperature, and a corresponding increase in severe flooding events and droughts. Increasing sea temperatures are expected to result in the increased likelihood of more intense tropical storm events, as well as accelerating land loss and decline of coastal marsh (USEPA, 2016).

The study area is humid, reflecting the subtropical nature typical for the region, and heavily influenced by the amount of water surface in the immediate area and the proximity to oceanic waters. Prevailing winds from the oceanic waters in the region reduce extreme summer heat, shorten the duration of infrequent winter polar air masses, and provide abundant rain in all seasons. Available data from the National Climatic Data Center show seasonal averages in Tangipahoa Parish, including both temperature and precipitation, are included in Table 3-10.

Table 3-10. Hammond Station, Tangipahoa LA Average Temperature and Precipitation. Variable Averages (1981-2010)

Month	J	F	M	A	M	J	J	A	S	O	N	D	Annual
Temperature (°F)	50.0	53.5	59.4	66.2	73.9	79.7	81.6	81.7	77.5	67.6	58.6	51.8	66.7
Precipitation (Inches)	5.70	5.40	5.38	4.74	4.82	6.07	6.22	5.57	4.64	3.99	4.46	4.73	64.6

Source: National Climatic Data Center, NOAA

Projections of storm frequencies from the 2017 Master Plan anticipate increased frequencies for hurricanes and decreased frequencies for tropical storms. Table 3-11 presents the average annual number of North Atlantic Basin tropical storms and major hurricanes (see Master Plan Tropical Storm Intensity and Frequency attachment, (CPRA, 2017)).

Table 3-11. North Atlantic Basin Tropical Storms and Major Hurricanes based on the Plausible Range of Future Tropical Storm Frequency

Storm Event	1981-2010 Average	Projected Average for 2015-2065	Range of Frequency change (2015-2065)
All tropical storms	12.1	8.8 to 12.6	-28%
Major Hurricanes	2.7	3.1 to 8.6	+13% and +83%

3.5.4 Water Quality

The dominant bodies of water in Tangipahoa Parish are the Tangipahoa River, Natalbany River, and Chappepeela Creek. Numerous rivers and streams cross the study area, and its hydrology is greatly affected in the lower basin because the elevation is around sea level.

Water quality in the main channels of the study area is influenced by decentralized treatments systems, construction, and changes in land use (development). In addition, atmospheric deposition of mercury impairs several streams and rivers within the parish.

Ten rivers and streams (some with multiple segments), Lake Maurepas, and Lake Pontchartrain are listed as impaired for one or more designated uses in the Final 2022 Integrated Report of Water Quality in Louisiana (LDEQ, 2022).

See Appendix D, for a complete list of 305(b) impaired waterbodies in the study area from the LDEQ.

Most of the segments are impaired for Fish and Wildlife Propagation due to elevated mercury (Hg) levels and therefore fish consumption advisories are in place. Additionally, some rivers are impaired for primary (e.g., swimming) or secondary (boating, wading, etc.) contact recreation due to low DO, elevated nutrients (e.g., nitrates, total phosphorus, etc.), or elevated fecal coliform levels related to decentralized treatment systems (e.g. septic tanks), residential districts, or from additional unknown sources.

3.5.5 Hazardous, Toxic, and Radioactive Waste

An initial assessment is required for all USACE Civil Works projects to facilitate early identification and appropriate consideration of potential HTRW concerns. USACE HTRW policy is to avoid the construction of Civil Works projects in HTRW-contaminated areas where practicable.

Initial assessments were conducted for the footprints of the TSP (including the proposed borrow sites) in accordance with ER 1165-2-132 – HTRW Guidance for Civil Works Projects (USACE, 1992), and the American Society for Testing and Materials (ASTM) E 1527-21, Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process (ASTM, 2022). The purpose of a Phase I ESA (initial assessment) is to identify the range of contaminants (i.e. Recognized Environmental Conditions, RECs) within the scope of the U.S. Environmental Protection Agency's (EPA) Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and petroleum products. The term REC means the presence of hazardous substances or petroleum products in, on, or at the subject property due to a release, a likely release, or that pose a material threat of a future release to the environment. A de minimis condition is not considered a REC.

During the feasibility phase, an initial assessment was performed on proposed structural measures, however, those measures have been screened out due to non-HTRW issues as explained in the feasibility report. An initial assessment of nonstructural measures was conducted for the current DIFR-EA and no potential HTRW concerns were identified. The study area was reviewed using current aerial imagery and environmental databases published by US EPA Region 6 and the Louisiana Department of Environmental Quality. The proposed action would include an individual HTRW assessment per structure, should that structure go through the process of being floodproofed. These HTRW assessments will follow the methods outlined by ASTM E1527-21, which may include additional records review, physical site visit, and communications with persons knowledgeable of the proposed nonstructural measure when practicable. Since nonstructural measures will largely be occurring at residential properties the most likely HTRW concerns will be with asbestos and lead-based paint in or on building materials. These materials are excluded under ASTM E1527-21, unless they have been released or are likely to be released into the environment. If during the HTRW assessment, a REC is identified, it would be incumbent upon the property owner to address the REC in order to be considered part of the program.

3.5.6 Air Quality

The Clean Air Act Amendment of 1990 directed the EPA to establish National Ambient Air Quality Standards (NAAQS) for the following six criteria pollutants considered harmful to public health and the environment:

- carbon monoxide (CO),
- nitrogen dioxide (NO2),
- ozone (O3),

- sulfur oxides (commonly measured as sulfur dioxide [SO2]),
- lead (Pb),
- particulate matter no greater than 2.5 micrometers (µm) in diameter (PM2.5),
- particulate matter no greater than 10 µm in diameter (PM10).

The EPA classifies air quality by air quality control region (AQCR) according to whether the region meets primary and secondary air quality standards. An AQCR or portion of an AQCR may be classified as attainment, nonattainment, or unclassified. A classification of attainment indicates that air quality for one or more criteria air pollutants within the region is within NAAQS values. A nonattainment classification indicates that regional air quality for one or more criteria air pollutants is not within NAAQS values. A classification of unclassified indicates that air quality within the region cannot be classified (generally because of lack of data). A region designated as unclassified is treated as an attainment region. The study area is located in the southern Louisiana AQCR.

The EPA Green Book Nonattainment Areas for Criteria Pollutants (Green Book) maintains a list of all areas within the United States that are currently designated nonattainment areas with respect to one or more criteria air pollutants. Nonattainment areas are discussed by county or metropolitan statistical area (MSA). MSAs are geographic locations, characterized by a large population nucleus, that are comprised of adjacent communities with a high degree of social and economic integration. MSAs are generally composed of multiple counties. Based on review of the Green Book, the parish is currently designated as being in attainment for all NAAQS.

Evaluation of the emissions anticipated under the with and without project conditions was conducted to evaluate potential impacts to air quality. A detailed description on the methodology used to assess emissions is provided in Appendix D (Table 3-12).

Table 3-12. Total anticipated emissions under the future without project conditions over the 50-year period of analysis.

Emission Type:	**CO_2**	**CH_4**	**N_2O**	**CO_2e**
Plan 1: No Action	16,759	0.7	0.1	16,820

3.6 NATURAL ENVIRONMENT

The natural environment includes areas that have not been developed to support human uses and includes terrestrial and aquatic wildlife, their habitats, and the ecological quality of the current systems.

3.6.1 Wetlands Resources

The Louisiana coastal plain accounts for 90 percent of the total coastal marsh loss in the nation (Coastal Wetlands Conservation and Restoration Task Force, 2004). Couvillion

(2011) analyses shows that coastal Louisiana has undergone a net change in land area of about -1,883 square miles of wetlands from 1932 to 2010. An estimated 182 square miles have been lost in the Pontchartrain basin from 1932 to 2016, which includes the study area (Couvillion, Beck, Schoolmaster, & Fischer, 2017) and other land in the region.

The major factors that influence the type of wetland community in the study area are elevation, hydrology, salinity, and soil type. Elevation is critical to the type of wetland occurring in an area, and small elevation changes can result in major shifts in community type (Conner, Gosselink, & Parrondo, 1981). Freshwater habitats generally have salinities less than 0.5 parts per thousand (ppt), salinities in intermediate marsh range between 0.5-5.0 ppt, brackish marsh has salinities of 5-18 ppt, and saline marsh salinities vary between 18-30 ppt.

A variety of wetland types comprised of unique plant communities can be found within the study area. Further discussion on specific wetland plant community types that are anticipated to be the most relevant to the project due to their prevalence and distribution within the parish are discussed in the following subsections.

3.6.2 Bottomland Hardwoods

The bottomland hardwood (BLH) forest communities are found primarily along river basins throughout Louisiana. In the study area, the plant community primarily occurs along floodplains of the Tangipahoa and Natalbany Rivers. Bottomland hardwood forest is maintained by a natural hydrologic regime that creates alternating conditions of wet and dry periods as rivers overtop their bank periodically during high flows. During overbank flows, water spreads across the floodplain depositing nutrients and sediments which supports high primary production rates and species diversity. A range of bottomland hardwood forest types occur and include several bottomland species of oak (*Quercus spp.*), Water Hickory (*Carya aquatica*), hackberry (*Celtis laevigata*), American Elm (*Ulmus americana*) and Green Ash (*Fraxinus pennsylvanica*), Sweet Gum (*Liquidambar styraciflua*), and Red Maple (*Acer rubrum*). Additional tree species that tolerate periodic flooding occur in these communities. In addition, high densities of vines and shrubs are often supported.

3.6.3 Swamps

Bald Cypress-Tupelo is the dominant swamp plant community type and is located primarily in the Mississippi Alluvial Valley Ecoregion at the southern extent of the Parish. This once extensive plant community type has been degraded as a result of old-growth stand harvest in the early 1900s (Conner & Toliver, 1990), as well as changes in hydrology and salinity levels related to freshwater input from primary rivers in the area.

Cypress-Tupelo Swamps occurs in areas too wet for other wetland forest community types and occur adjacent to the freshwater marsh and intermediate marsh along the shore of Lake Pontchartrain. This wetland type provides valuable habitat for a wide diversity of organisms, including birds, mammals, reptiles, amphibians, invertebrates, and plants (Semlitsch & Bodie, 1998) as well as nutrient cycling and storage (Craft & Casey, 2000).

3.6.4 Marsh

Freshwater marsh is generally found along the northern most extent of coastal marshes and is located primarily along the shoreline of Lake Pontchartrain and Lake Maurepas in the study area. Salinities are usually less than 2 parts per thousand (ppt) and average 0.5-1 ppt. In general, freshwater marsh forms in the zone where periodic high-water periods kill woody plants and periodic low water periods allow establishment of herbaceous species. Sediment inputs from drainage basin rivers build new marsh areas while subsidence counteracts these processes. Overall, freshwater marsh has potential to support the greatest plant diversity among marsh types. Species commonly found in freshwater marshes include Arrowhead (*Sagittaria sp.*), spikerushes (*Eleocharis sp.*), cordgrasses (*Spartina sp*.), cutgrass (*Leersia sp*.), and others. A unique type of freshwater marsh that occurs throughout the Louisiana Mississippi River delta plain is floating marsh which occurs when mats of emergent vegetation, dead decomposing material, and mineral sediments separate from the substrate layer and fluctuate vertically with changes in water levels. This floating condition results in reduced or no sheet flow and changes the water exchange between the marsh and adjacent open water areas compared to marshes with plants directly rooted into the substrate (Swarzenski, Swenson, Sasser, & Gosselink, 1991).

Freshwater marshes provide important nursery habitat for juvenile stages of marine species such as Atlantic croaker, red drum, southern flounder, sea trout, blackdrum, and others. Fresh marshes also provide habitat for largemouth bass, warmouth, black crappie, blue catfish, bowfin, and gar.

Intermediate marsh is a unique type of wetland marsh found in Louisiana with water salinity values that are typically between freshwater and brackish wetlands. In the study area, it can be found along the extreme southern boundary of the Parish in a narrow band between Lake Pontchartrain (estuarine) and Lake Maurepas and freshwater marshes. Due to periodic pulses of saline water from tropical storm surge events, irregular tidal fluctuations, and periodic pulses of freshwater from watershed, salinity levels fluctuate in this type of marsh. The resulting plant community is comprised of species that tolerate these changing conditions and include species such as wire grass (*Spartina patens*), three-cornered grass (*Schoenoplectus robustus*), and others. Intermediate marsh supports a high diversity of species, provides important nursery habitat for larval marine organisms, and is important for overwintering waterfowl.

3.6.5 Upland Forest Resources

Longleaf pine communities were once extensive in the southeast United States, covering approximately 90 million acres, but has since been reduced by approximately 97% and further degraded by logging, land use change, conversion to loblolly pine plantations, fire exclusion, and lack of regeneration (Sui, Fan, Crosby, & Fan, 2015). In southeastern Louisiana, Longleaf pine forest has declined by more than 90% and historically occurred on upland terrace deposits. The southern half of the terraces consisted of flat slopes with a shallow water table which supported Longleaf Pine flatwoods. Presently, Longleaf pine resources in Tangipahoa Parish are limited to upland locations and can support unique,

diverse plant and animal communities (Keddy, Smith, Campbell, Clark, & Montz, 2006). Longleaf pine communities are characterized by an open canopy, open midstory, and a ground layer with a high percentage of herbaceous vegetation. Many of the plants and animals' characteristic of this community are fire disturbance dependent species that require periodic fires to maintain suitable structural conditions. In the absence of periodic fire disturbance longleaf pine midstory increases, ground layer vegetation decreases and thins, and it eventually converts to a mixed forest of hardwoods and pines.

Most of the remaining upland forest resources in the parish consist of mixed pine/hardwood forest and pine plantations with a different species composition than historical forest communities. Many of the forests have more dense understories due to changes in fire disturbance patterns and establishment of invasive species. In addition, forest structure has changed due to widespread harvest of old-growth pine. Overall, forests in the parish have become increasingly fragmented as forest resources are converted to other land uses such as residential and commercial development, pasture, or agriculture.

3.6.6 Prime and Unique Farmlands

The Farmland Protection Policy Act of 1981 (FPPA) was enacted to minimize the extent that Federal programs contribute to unnecessary and irreversible conversion of farmland to non-agricultural uses, and to assure that Federal programs are administered in a manner that, to the extent practicable, would be compatible with state, unit of local government, and private programs and policies to protect farmland.

A review of prime and unique farmland in the Proposed Action footprints and borrow sources was conducted by CEMVS using the web soil survey service provided by the Natural Resource Conservation Service (NRCS), and the results can be found in Appendix D. Forty percent of the lands within the Parish are prime and unique farmlands.

Prime and unique farmlands are designated by the U.S. Department of Agriculture (USDA) based on an identification of soil types. The identification of these soil types often has a correlation with the economic value of a given piece of property due to its potential for agricultural use. Within the parish, agricultural lands are generally found on terraces and higher elevation upland areas.

3.6.7 Aquatic Resources

Primary fresh and intermediate water bodies in the parish of importance for this study include: Lake Pontchartrain, Lake Maurepas, Stinking Bayou, T Bayou, Jim Reed Bayou, Middle Bayou, Owl Bayou, Black Bayou, Rice Bayou, Mays Bayou, Tangipahoa River, Yellow Water River, and Natalbany River. Average water depths of the lakes and bayous are relatively shallow (see Appendix D Tables 1-14, 15 and 16 for a list of fish, mussels, and aquatic species of conservation concern).

The fresh and low-salinity waters of the study area (ex. streams, rivers and freshwater marsh), support many commercially and recreationally important fishes and shellfishes. Freshwater sport fishes include largemouth bass (*Micropterus salmoides*), black crappie

(*Pomoxis nigromaculatus*), white crappie (*Pomoxis annularis*), bluegill (*Lepomis macrochirus*), redear sunfish (*Lepomis microlophus*), warmouth (*Lepomis gulosus*), channel catfish (*Ictalurus punctatus*) and blue catfish (*Ictalurus furcatus*). Blue catfish, channel catfish, yellow bullhead (*Ameiurus natalis*), freshwater drum (*Aplodinotus grunniens*), bowfin (*Amia calva*), common carp (*Cyprinus carpio*), buffaloes (*Ictiobus* spp.), and gars (*Lepisosteidae* spp.) are the primary freshwater fishes of commercial importance.

The low-to-moderate salinity waters and marshes in the far southern extent of the study area provide habitat for many estuarine-dependent fishes and shellfishes. Some species are permanent residents while others only occur in these habitats during early developmental periods (i.e. nursery habitat) before moving to more saline waters as they mature. Examples of species in the study area that have this developmental requirement include southern flounder (*Paralichthys lethostigma*), sand seatrout (*Cynoscion arenarius*), Atlantic croaker (*Micropogon undulatus*), black drum (*Pogonias cromis*), red drum (*Sciaenops ocellata*), striped mullet (*Mugil cephalus*), Gulf menhaden (*Brevoortia patronus*), blue crab (*Callinectes sapidus*) and white shrimp (*Litopenaeus setiferus*). Study area streams, surface runoff, and tidal action contribute decaying plant material (detritus) from study area wetlands into the adjacent estuarine waters to supports high finfish and shellfish productivity.

3.6.8 Essential Fish Habitat

Essential Fish Habitat (EFH) is described as all types of aquatic habitat that are necessary for federally managed marine fish and invertebrate species to provide shelter, feed, grow, and breed. Areas are identified by the National Marine Fisheries Service (NMFS) and local fishery management councils as required by the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA).

Essential Fish Habitat (EFH) zones occur within the Tangipahoa Parish at Lake Pontchartrain, Lake Maurepas, the lower Tangipahoa River, lower Natalbany River, Pass Manchac, North Pass, and channels along the I-55 corridor. Together these zones connect to the northern Gulf EFH zones that are needed by a range of federally managed species. Typically, these zones overlap with areas where individual life-stages of specific federally managed species are common, abundant, or highly abundant. In estuarine areas, EFH is defined as all estuarine waters and substrates (mud, sand, shell, rock, and associated biological communities), including the subtidal vegetation (submerged aquatic vegetation and algae) and adjacent intertidal vegetation (marshes and mangroves).

3.6.9 Wildlife

Wetlands and non-wetland forests provide valuable habitat for a variety of migratory game and non-game birds, mammals, amphibians, and reptiles (see Appendix D Table 1-17 for a list of fish and wildlife that occur in the study area.)

Extensive land use change from historic habitat conditions has occurred within the parish. Old-growth pine savannas and flatwoods have largely been converted to mixed forest and pine plantations, rangeland, and lines of trees. Freshwater marsh and forested swamp is

most prevalent at the southern extent of the parish within the Louisiana coastal zone located south of county road 22. Bottomland forest and shrub wetlands can be found along rivers in the parish and other waterways. This network of riparian vegetation provides cover and connectivity between habitat types. Due to the highly altered landscape consisting mostly of habitat fragments, wildlife that are limited to specific habitat types are less abundant and more susceptible to additional habitat loss and degradation.

Freshwater wetlands in the parish provide valuable habitat for migratory and resident waterfowl. The coastal marshes and forested wetlands of the Lake Pontchartrain Basin have been identified as key waterfowl wintering area. The Gulf Coast is one of the most important waterfowl areas in North America, providing both wintering and migration habitat for duck and goose populations that use both Central and Mississippi Flyways. Overall, the Mississippi Alluvial Valley (MAV) region is utilized as a major migration corridor for more than 40 percent of the waterfowl that breed in North America.

Many neotropical migrants and other migratory landbirds depend on the remaining forest resources that occur in forested wetlands and along riparian areas throughout the parish for stopover, breeding, and/or overwintering habitat (List provided in Appendix D). At least 107 species of land birds breed in the MAV region, with 70 of those depending upon bottomland hardwood forests for most or all of their life cycle. Many species of neotropical migrant songbirds are currently experiencing significant population decline. Some of these species are dependent on large, contiguous patches of forest to successfully reproduce.

Three state Wildlife Management Areas (WMA), including (Joyce WMA, Sandy Hollow, and Tangipahoa Parish School Board WMA) are found within Tangipahoa Parish whose primary purpose is the conservation of wildlife and fisheries resources. Joyce WMA, comprised of cypress-tupelo swamp, shrub-marsh, and freshwater marsh provides habit for a range of species including Bald Eagles, Osprey, neotropical migrant birds, migratory and resident waterfowl, deer rabbit, squirrel, amphibians, and reptiles. Sandy Hollow and Tangipahoa School Board WMAs consist of tracts in more upland areas with pine and mixed hardwood forests managed for upland game species, deer, and turkey.

3.6.10 Threatened, Endangered and Protected Species

To aid the CEMVS in complying with proactive consultation responsibilities under the Endangered Species Act (ESA), the USFWS provided a planning aid letter list of threatened and endangered (T&E) species and their critical habitats within the study area in a letter dated 28 June 2024. Species addressed as being of concern are:

Table 3-13. USFWS IPAC species list for Tangipahoa Parish

Common Name	Scientific Name	Status	Habitat
Northern Long-eared Bat	*Myotis septentrionalis*	Endangered	Overwinters in caves and mines and spends the remainder of the year in forested habitats. Roosts under bark or in cracks/crevices of live or dead trees.

Common Name	Scientific Name	Status	Habitat
Tricolored Bat	*Perimyotis subflavens*	Proposed Endangered	Overwinters in caves, abandoned mines, and road-associated culverts in the southern U.S. Summer habitat is forested habitats. Roosts in trees, among leaves of live or recently dead deciduous hardwood trees typically, although they may use Spanish moss, pine trees, and occasionally human structures.
West Indian Manatee	*Trichechus manatus*	Threatened	Marine brackish and freshwater systems in SE coastal areas. Feed on vegetation in aquatic grass beds. Concentrated around Florida waters most of year, but individuals travel hundreds of miles and can occur up the Atlantic Coast as well as along aquatic habitats accessible from the Gulf of America.
Red-cockaded Woodpecker	*Picoides borealis*	Endangered	Utilizes old growth southern pine forests with open understory maintained with fire.
Alligator Snapping Turtle	*Macrochelys temminckii*	Proposed Threatened	Typically found in deeper water with structure in freshwater lakes, bayous, rivers, canals, and oxbows. Shallow water and nest site locations on land are also needed to complete life-cycle Cypress-tupelo swamps
Gopher Tortoise	*Gopherus polyphemus*	Threatened	Utilizes open canopy savannas, flatwoods, and pine communities on well-drained sandy soils with abundant, low-growing vegetation and sunny areas for basking.
Ringed Map Turtle	*Graptemys oculifera*	Threatened	Typically large rivers and streams within Pearl River watershed with current, abundant coarse woody debris for basking, sandbars for nesting, and wide enough channel to allow light penetration.
Pearl River Map Turtle	*Graptemys pearlensis*	Threatened	Occurs primarily in small to medium-sized permanent streams with a sand and mud substrate, deep pools, and suitable basking sites. Nests in sandy banks or on sand bars.
Gulf Sturgeon	*Acipenser oxyrinchus desotoi*	Threatened	Adult fish undergo anadromous migrations spending several months in the Gulf of America before migrating in spring to spawn in freshwater. Juveniles spend approximately 2 years in freshwater rivers before beginning migrations.
Monarch Butterfly	*Danaus plexippus*	Candidate	Overwinters in Mexico. Migrates across much of North America in spring and occurs in a wide variety of habitats with adequate

Common Name	Scientific Name	Status	Habitat
			nectar-producing plants. Dependent on milkweed species as host plant for young to develop.
Louisiana Quillwort	*Isoetes louisianensis*	Endangered	Grows on sand and gravel bars other sandy substrate in shallow, blackwater streams in riparian woodland, pine flatwoods, and upland pine forests.

Northern Long-eared Bat

Northern long-eared bats can be found in mixed pine/hardwood forest with intermittent streams. Northern long-eared bats roost alone or in small colonies underneath bark or in cavities or crevices of both live trees and snags (dead trees). During the winter, northern long-eared bats can be found hibernating in caves and abandoned mines, although none have been documented using caves in Louisiana. Northern long-eared bats emerge at dusk to fly through the understory of forested hillsides and ridges to feed on moths, flies, leafhoppers, caddis flies and beetles, which they catch using echolocation. This bat can also feed by gleaning insects from the surface of vegetation and still waterbodies. The species has undergone high levels of mortality throughout much of its range due to white-nose syndrome (WNS). WNS is a fungal disease that can be spread among caves and other places bats hibernate through interactions among bats or via contaminated clothes, shoes, and equipment used by humans that visit caves.

Tricolored Bat

The Tricolored Bat was identified as a proposed endangered species in September of 2022, but it is not yet listed. While no Endangered Species Act Section (ESA) 7 requirements apply to proposed species, agencies are encouraged to take advantage of any opportunity they may have to conserve such species. Tricolored bats were formerly called eastern pipistrelle. Tricolored bats are usually found roosting singly, only sometimes in pairs or clusters of up to a dozen individuals. In winter, tricolored bats hibernate in caves, mines, and in some parts of its range, road culverts. They prefer caves that are humid and warm. In summer, they leave their hibernation caves and roost in trees, primarily among the leaves. They forage for insects high in the air along forest edge and along the boundary of streams or open bodies of water. Tricolored Bats mate during spring, fall, and sometimes in the winter. Maternity colonies begin forming in mid-April and females bear 1 to 2 pups by late May to mid-July. Similar to the northern long-eared bat, the primary cause of decline is white-nose syndrome.

West Indian manatee

The West Indian manatee is one of the largest coastal mammals in North America, occurring in marine, brackish, and freshwater systems throughout its range from southeastern U.S. through the Gulf of America to Brazil. This species undergoes seasonal migrations throughout much of its range to warmer waters above 68°F every winter. They are known to occur in Lake Pontchartrain and signage warning the public of their presence is posted by

the LDWF at many boat launches in the region. Some of the primary threats to manatees include watercraft collisions, access to suitable areas with warm enough waters during the winter, entrapment or crushing in water control structures that lack proper protective measures or procedures to minimize risk, water quality induced conditions (e.g., red tide), entanglement, poaching, and vandalism. In 2017, the manatee was reclassified from endangered to threatened in response to population increases. Manatees are also protected under the Marine Mammal Protection Act, which prohibits the take (i.e., harass, hunt, capture, or kill) of all marine mammals.

Red-cockaded woodpecker

The red-cockaded woodpecker is a federally listed endangered bird species that prefers mature open pine forest throughout the southeast (including longleaf, loblolly, slash, and shortleaf pine) with a sparse mid-story. It is a territorial, nonmigratory species that sometimes displays cooperative breeding behavior (Walters, Doerr, & Carter, 1988). It is dependent on pine trees of sufficient diameter, which are typically a minimum of 65 years old, to excavate nesting cavities. Numerous cavities are excavated by a group of red-cockaded woodpeckers (breeding pair, several non-breeding helpers, and current year young) in clusters of living trees with heart fungus, which makes the wood softer for excavation. Frequent excavation of resin wells may be performed to reduce predation pressure from rat snakes (*Pantherophis sp*.). The original cause of population decline was due to near loss of mature, open pine habitat. The species now displays a patchy distribution throughout much of its range. As a result, many populations are more vulnerable to hurricanes and major storm events, southern pine beetle infestations which can prematurely kill potentially suitable nest trees, degradation of habitat through invasive species spread, loss of adequate fire-disturbance which maintains key structural habitat requirements, and others. It is anticipated that this species is more of a concern toward the northern border of the parish, where uplands are more common and there is less development.

Alligator Snapping Turtle

The alligator snapping turtle is currently proposed for federally threatened species status. Habitat generally includes large rivers and major tributaries, but also occurs in a range of bayous, canals, swamps, lakes, and ponds. Within these bodies of water, alligator snapping turtle tend to select areas with structure such as tree roots, submerged trees, logs, etc., and may also select for areas with more canopy cover (Howey & Dinkelacker, 2009). There is a shift in use of habitat in waterbodies from deeper water in late summer through mid-winter to shallower water in early summer. Young hatchlings are associated with shallower water areas. Alligator snapping turtles reach reproductive age in 11-21 years for males and 13-21 years for females. Reproductive females can lay up to one clutch of eggs per year with an average of approximately 24 eggs in Louisiana (Dobie, 1971). Number of eggs per clutch may vary with age and size, with larger, more mature females producing more eggs than smaller, younger reproductive females. Poor foraging success in some years may decrease the total number of years that eggs are produced. Nesting in Louisiana is typically between May and July. In general, nest sites occur within 2.5 and 200 m from the nearest waterbody. Predation rates on active nests have been reported to occur at high rates and therefore limit

reproductive output. Alligator snapping turtles are opportunistic predators and foragers which include primarily fish, but also include crayfish, mollusks, smaller turtles, insects, nutria, snakes, birds, and vegetation (Ernst & Lovich, 2009). In the project area, the species would primarily occur along the Tangipahoa and Natalbany Rivers but likely also occurs in swamps and marshes in the southern portion of the parish. The species may occur in other locations where habitat is suitable as well.

Gopher tortoise

The gopher tortoise is an upland species that is federally listed as threatened. The species range is found through the Southeastern Atlantic and Gulf Coastal Plains from South Carolina west to eastern Louisiana and south through peninsular Florida. The species typically inhabits pine savannas, pine flatwoods, mixed hardwood-pine woodlands, dry prairies, and disturbed plant communities (roadside, rights-of-way, forest edges, fencerows, and clearing) with an open canopy, diverse herbaceous vegetation, soils that are suitable for building underground burrows for nesting (average 6-10 feet deep and 12-25 feet long), and areas for basking. In addition, females require areas with almost full sunlight for nesting (Landers & Buckner, 1981). The habitat conditions that support this species are primarily created through fire disturbance every few years.

The preference for the upland pine habitat has resulted in the species becoming increasingly impacted by commercial and residential development in the southeast, and land that is converted for agricultural purposes. When canopies become too dense or preferred habitat is lost or degraded, Gopher Tortoises will use marginal habitats such as under power lines, golf course edges, and fence rows.

The primary threats to the gopher tortoise are habitat fragmentation, modification, and loss. Habitat becomes less suitable as midstory vegetation becomes thicker and the understory, grass layer diminishes. Additional threats include increased drought and extreme high temperatures which impacts the ability to mimic historic fire disturbance needed to maintain habitats as open woodland (USFWS, 2021). Population of eastern Louisiana populations have been assessed as populations with low resiliency (greater risk of disappearing) compared to populations in the species core range.

Ringed map turtle

Federally listed as threatened, the ringed map turtle is a riverine species that occurs in the Pearl and Bogue Chitto Rivers outside the study area. The species utilizes stretches of river with moderate current, numerous basking areas, and sparsely vegetated sandy substrates relatively close to shore for nesting (USFWS, 1988). The ringed map turtle spends significant parts of the day basking on submerged logs and prefers open channels where the water column experiences a high degree of light penetration. Declines in population for this species are attributed to habitat modification (i.e., loss of exposed sandbars, basking areas) and water quality deterioration, reservoir construction, channelization, desnagging for navigation, siltation, and the subsequent loss of invertebrate food sources) resulting from changes in hydrologic regime, channel modifications, activities that impact water quality and turbidity, and sand and gravel dredging.

Pearl River map turtle

Federally listed as threatened, the Pearl River ringed map turtle is a freshwater species that occurs in small to medium sized permanent streams with a sand and mud substrate. The species can also be found in large to medium-sized rivers, especially those with an abundance of mollusks, sandy banks, sandbars, deep pools, and logs or other suitable basking sites. Nests are in sandy banks or sand bars. Adult females depend largely on mollusks, especially clams and snails, while males and juveniles feed mostly on insects and other arthropods.

This species is highly vulnerable to availability of preferred prey. In particular, the species is sensitive to the impacts of water pollution and sedimentation on its freshwater mollusk prey. Exploitation for the pet trade, particularly in the Lower Pearl River drainage in Louisiana, may also be a significant threat. Other vulnerabilities include predation of nests by wildlife.

Gulf sturgeon

The gulf sturgeon is federally listed as a threatened species which depends on marine waters, estuarine, and freshwater rivers and streams to complete its lifecycle. Gulf Sturgeon are known to occur in rivers and lakes of the Lake Pontchartrain basin, which includes rivers in Tangipahoa Parish. The species spawns in coastal freshwater rivers in the late winter through spring (March-May) but spend the majority of the year in marine and estuarine waters. Young sturgeon spend their first 2 years in the estuarine and coastal freshwater rivers before migrating into the marine environment of the Gulf of America.

The USFWS has authority over the Gulf sturgeon when the species is within its riverine habitat during spawning and its first two years. After the species moves into the marine habitat as an adult, it falls under the authority of the NMFS. In estuarine areas, responsibility is divided between USFWS and NMFS based on the action agency involved.

While the species is known to occur within the Tangipahoa River, no critical habitat has been designated within the study area.

Declines in populations of this species are primarily attributed to overfishing; habitat loss as a result of water control infrastructure construction; modification of habitat through dredging, desnagging, and other navigation maintenance activities; incidental take by commercial fisherman; and poor water quality associated with contaminants (Federal Register Volume 68, no.53). Due to its anadromous (breeding in freshwater after migrating up rivers from marine and estuarine waters) lifecycle, unobstructed pathways with suitable flow regimes and water quality are required to allow passage between riverine, estuarine, and marine habitats used by Gulf Sturgeon.

Monarch Butterfly

The monarch butterfly (*Danaus plexippus*) was identified as a candidate species in December of 2020, but it is not yet listed or proposed for listing. While no Endangered

Species Act Section (ESA) 7 requirements apply to candidate species, agencies are encouraged to take advantage of any opportunity they may have to conserve such species.

Adult monarch butterflies are large and conspicuous, with bright orange wings surrounded by a black border and covered with black veins. The bright coloring of a monarch serves as a warning to predators that eating them can be toxic. Monarch populations of eastern North America have declined 90%. During the breeding season, monarchs lay their eggs on their obligate milkweed host plant, and larvae emerge after two to five days. Larvae develop over a period of nine to 18 days, feeding on milkweed and sequestering toxic chemicals as a defense against predators. The larva then pupates into a chrysalis before emerging six to 14 days later as an adult butterfly. There are multiple generations of monarchs produced during the breeding season, with most adult butterflies living approximately two to five weeks (USFWS, 2020).

Much of the monarch butterfly's life is spent migrating between Canada, Mexico, and the U.S. The Monarch occurs in a variety of habitats where it searches for its host plant, milkweed. Of the over 100 species of milkweed that exist in North America, only about one fourth of them are known to be important host plants for monarch butterflies. The main monarch host plant is Common Milkweed (*Asclepias syriaca*) (Kaul & Wilsey, 2019). Other common hosts include Swamp Milkweed (*Asclepias incarnata*), Butterfly weed (*Asclepias tuberosa*), Whorled Milkweed (*Asclepias verticillata*), and Poke Milkweed (*Asclepias exaltata*) (USFWS, 2020). Three factors appear most important to explain the decline of Monarchs: loss of milkweed habitat, logging at overwintering sites, changing hydrologic conditions and extreme weather. In addition, natural enemies such as diseases, predators, and parasites, as well as chemicals used in agricultural areas may also contribute to the decline.

Louisiana quillwort

A semi-aquatic, federally listed endangered plant species, found in the East Gulf Coastal Plain of Mississippi and southeastern Louisiana. In Louisiana, known populations occur in the neighboring St. Tammany and Washington Parishes. The species occurs on gravel bars, accreting banks, moist overflow channels in shallow, blackwater streams in riparian woodland, flatwood, and upland pine forests (USFWS, 1996). Activities that disturb hydrologic regimes in these habitats would negatively impact the species as it is sensitive to changes in water quality.

Bald Eagle

The bald eagle was officially removed from the List of Endangered and Threatened Species as of 8 August 2007. However, the bald eagle remains protected under the Migratory Bird Treaty Act (MBTA) and Bald and Golden Eagle Protection Act (BGEPA). Habitats that provide nesting habitat for the bald eagle are found in the study area.

Bald eagles typically nest in large trees located near coastlines, rivers, or lakes that support adequate foraging from October through mid-May. In southeastern Louisiana parishes, eagles typically nest in mature trees (e.g., bald cypress, sycamore, willow, etc.) near fresh to

intermediate marshes or open water. Major threats to this species include habitat alteration, human disturbance, and environmental contaminants.

Furthermore, bald eagles are vulnerable to disturbance during courtship, nest building, egg laying, incubation, and brooding. Disturbance during these periods may lead to nest abandonment, cracked and chilled eggs, and exposure of small young to the elements. Human activity near a nest late in the nesting cycle may also cause flightless birds to jump from the nest tree, thus reducing their chance of survival.

USFWS developed the National Bald Eagle Management (NBEM) Guidelines to provide landowners, land managers, and others with information and recommendations to minimize potential project impacts to bald eagles, particularly where such impacts may constitute "disturbance," which is prohibited by the BGEPA. A copy of the NBEM Guidelines is available at:

https://www.fws.gov/northeast/ecologicalservices/pdf/NationalBaldEagleManagementGuidelines.pdf

These guidelines recommend: (1) maintaining a specified distance between the activity and the nest (buffer area); (2) maintaining natural areas (preferably forested) between the activity and nest trees (landscape buffers); and (3) avoiding certain activities during the breeding season. During construction, on-site personnel should be informed of the possible presence of nesting bald eagles in the vicinity of the project boundary, and should identify, avoid, and immediately report any such nests to this office. If a bald eagle nest occurs or is discovered within 660 feet of the footprint of any Proposed Action, then an evaluation must be performed to determine whether the construction and/or operation of the project is likely to disturb nesting bald eagles. The evaluation that would be conducted in such event, may be found online at: http://www.fws.gov/southeast/es/baldeagle. Following completion of the evaluation, this website will provide a determination of whether additional consultation is necessary.

On 11 September 2009, two Federal regulations were published establishing the authority of USFWS to issue permits for non-purposeful bald eagle take (typically disturbance) and eagle nest take when recommendations of the NBEM Guidelines cannot be achieved. Permits may be issued for nest take only under the following circumstances where: 1) necessary to alleviate a safety emergency to people or eagles, 2) necessary to ensure public health and safety, 3) the nest prevents the use of a human-engineered structure, or 4) the activity or mitigation for the activity will provide a net benefit to eagles. Except in emergencies, only inactive nests may be permitted to be taken.

At-Risk Species

An at-risk species list was provided by USFWS to identify species that are not yet federally-listed but warrant consideration during project planning to avoid or minimize impacts that could lead to population declines. USFWS works with private and public organization in proactive conservation for at-risk species to avoid the need for federally listing. At-risk species that may occur in the study area include Southern snaketail (*Ophiogomphus*

australis), tricolored bat (*Perimyotis subflavus*), Alabama hickorynut (*Obovaria unicolor*), alligator snapping turtle (*Macrochelys temminckii*), and eastern diamondback (*Crotalus adamanteus*). Tricolored bat and alligator snapping turtle were discussed in section 3.4.10.

Southern Snaketail

The Southern snaketail is a dragonfly that typically inhabits medium-sized freshwater streams with gravel substrate. Records from the Tangipahoa River occurred in areas that averaged less than 10 m wide and had a few pools reaching a depth of 2 m. The substrate was primarily a mixture of sand and pea-gravel eroded from local deposits. The larvae are sensitive to water pollution and depend on clean, gravel stream bottoms to survive. Threats may include gravel mining, siltation, pesticides, flood scour, clear cutting/deforestation, perturbation of stream flow, and a naturally occurring limited range of the species.

Alabama Hickorynut

The Alabama hickorynut (*Obovaria unicolor*) is a freshwater mussel species that occurs on sand and gravel bottoms of large river systems with moderate currents in the Eastern gulf drainages of Alabama, Louisiana, Mississippi, and Oklahoma. Moderate gradient pool and riffle habitats in other stream and river sizes can also be utilized by the species.

This species is a long-term brooder that can carry fertilized eggs from June through August of the following year. Like other freshwater mussels, the Alabama hickorynut releases its larvae (glochidia) into the water column, where they parasitize a fish (glochidial host) to transform into a juvenile mussel. Once the glochidia are mature enough, they release from the host to find a suitable substrate. Known suitable host fishes for this species include several small fish species that live along the bottoms of clear streams. Habitat modification and destruction due to siltation and impoundment threaten this species. It is also negatively affected by the pollution of streams and rivers.

Eastern Diamondback Rattlesnake

The eastern diamondback rattlesnake (*Crotalus adamanteus*) historically occupied a very similar range to long leaf pine forests. This species prefers open canopy long-leaf pine savannas with herbaceous ground cover. Presently, eastern diamondback rattlesnakes occur in open canopy forests with an established herbaceous ground layer which partially mimics the conditions found in open canopy long-leaf pine forest. The species may also still occur in areas where remnant native habitat remains. This species requires large tracts of habitat, and home ranges average 116 and 208 acres, for females and males, respectively.

Threats to this species include persecution by humans out of fear, intentional hunting, vehicle strikes, and conversion of suitable habitat to other land uses. Another issue faced by the snake is a lack of any legal protections throughout much of its range.

<u>Migratory Birds</u>

The Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703, et seq.) is the primary legislation in the United States established to conserve migratory birds. In Louisiana, the primary nesting period for forest-breeding migratory birds occurs between 15 April and 1 August. Some species or individuals may begin nesting prior to 15 April or complete their nesting cycle after 1 August, but the vast majority nest during this period. The MBTA prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior.

The Mississippi Alluvial Valley (MAV) is critically important as a major migration corridor for many bird species with more than 40 percent of the waterfowl that breed in North America using the MAV as migratory stopover, wintering or breeding habitat. Approximately 60% of migratory species in North America utilize the Mississippi flyway, one of four primary migratory networks in the country. In addition, at least 107 species of landbirds breed in the MAV, with 70 of those depending upon bottomland hardwood forests for most or all of their life cycle. Over the last few decades, documented long-term population declines of migratory bird species have spurred significant concern over the persistence of many species and has contributed to widespread investigations into the causes of these declines, including habitat loss, feral and free-ranging domestic cats, pesticides, and a variety of other stressors (Rosenberg, et al., 2019); (Baker, Molony, Stone, Cuthill, & Harris, 2008); (Dauphine & Cooper, 2009); (Stanton, Morrissey, & Clark, 2018); (Tallamy & Shriver, 2021) (Hallman, Foppen, Van Turnhout, De Kroon, & Jongejans, 2014). To determine potential occurrences of priority birds occurring within the study area, the USFWS Information for Planning and Consultation (IPaC)(see Appendix D) was used by CEMVS as a primary source.

Wading Bird Colonies

The study area includes habitats that are commonly inhabited by colonial nesting waterbirds and/or seabirds. Wading birds expected to occur in the marshes of the study area include great egret (*Ardea alba*), great blue heron (*Ardea herodias*), tricolored heron (*Egretta tricolor*), green heron (*Butorides virescens*), and white ibis (*Eudocimus albus*).

3.7 SOCIAL ENVIRONMENT

Historically, damages from storm surge and riverine flooding events have adversely impacted business and industrial activity, agricultural activity, local employment and income, which then led to commensurate negative impacts to property values and the tax base, upon which government revenues rely. Public facilities and services have historically grown to meet population demands. The area includes a mixture of community centers, schools, hospitals, airports, colleges, and fire protection.

The transportation infrastructure includes major roads, highways, railroads, and navigable waterways that have developed historically to meet the needs of the public. Interstate 12 (I-12) is an east-west thoroughfare that branches off from Interstate 55 (I- 55) which is a north-south thoroughfare. Both interstates are utilized for hurricane evacuation and post-storm emergency response. Rail facilities are spread throughout the parish.

3.7.1 Cultural, Historic, and Tribal Trust Resources

Cultural resources include historic properties, archaeological resources, and Native American resources, including sacred sites and traditional cultural properties (TCPs). Historic properties have a narrower meaning and are defined in National Historic Preservation Act (NHPA) regulations at 36 CFR 800.16(l); they include prehistoric or historic districts, sites (archaeological and religious/cultural), buildings, structures, or objects listed in or eligible for listing in the National Register of Historic Places (NRHP). Historic properties are identified by qualified agency representatives in consultation with State Historic Preservation Offices (SHPO), federally recognized tribes, and other consulting parties. Common cultural resources include prehistoric Native American archeological sites, historic archeological sites, individually NRHP listed buildings, and National Register Historic Districts (NRHDs).

The cultural prehistory and history of the parish is very rich. The generalized cultural chronology for Louisiana has five primary archaeological components, or "periods," as follows: Paleoindian (11,500-8000 B.C.), Archaic (8000-800 B.C.), Woodland (800 B.C.-1200 A.D.), Mississippian (1200-1700 A.D.), and Historic (1700 A.D.-present).

The PDT identified historic properties based on a review of the NRHP database, the Louisiana Division of Archaeology (LDOA) Louisiana Cultural Resources Map (LDOA website), historic maps, pertinent regional and local cultural resources investigations, historic aerial photography, and other appropriate sources. This review revealed a total of 31 historic properties listed in the NRHP are located within Tangipahoa Parish. These include 4 historic districts, 26 individual buildings, and 1 site.

The Downtown Amite Historic District was listed in 1998 under Criteria A (history). Its period of significance is from 1865 to 1947 and the District is comprised 37 contributing resources of mainly commercial and transportation buildings representing the area's historic role as a commercial center.

The Independence Historic District is also listed under Criteria A in 1982. It is comprised of 31 contributing elements most dating from 1913 to 1931. The buildings are located on both sides of the Illinois Central railroad tracks and were built after a disastrous fire in 1913.

The Ponchatoula Commercial Historic District was listed in 1982 under both Criteria A and Criteria C (architecture and engineering). It's period of significance is from 1900 to 1962. Comprising an area of three streets, it has 48 contributing elements consisting of commercial and residential buildings.

The Hammond Historic District was listed in 1980 with additional documentation that resulted in a boundary increase in 2002. It was listed under both Criteria A and Criteria C, with a period of significance between 1880 and 1970. The district consists of portions of 19 blocks withing the geographical center of modern Hammond and represents commercial center of the town. It has a total of 105 contributing buildings and objects.

The one NRHP site in Tangipahoa Parish is Camp Moore, located in Kentwood. Camp Moore is listed under Criteria A and consists of about 450 acres of land covered by mainly woods and open fields, but also contains a cemetery and memorial. It was the training camp for about 25,000 Louisiana Confederate soldiers during the Civil War.

3.7.2 Archaeological Sites

Approximately 75 cultural resources investigations have occurred within the parish. The LDOA NRHP Eligibility Database indicates that 132 prehistoric and historic archaeological sites have been previously recorded as a result of these investigations. To date, no comprehensive systematic archaeological survey has been conducted throughout the entire study area and the distribution of recorded archaeological sites is largely the result of project-specific Federal and state compliance activities (e.g., linear surveys of roads, pipelines, and power line rights-of-way). Therefore, in addition to considering the known sites within the parish, the footprints of any Proposed Action must also be further assessed for archaeological site potential.

In lieu of additional survey data, Louisiana's Comprehensive Archaeological Plan (Girard, et al., 2022) provides a useful site distribution model that can be used for baseline planning purposes. The unique geomorphology and ecology of the study area has influenced site type and location. To examine how the physical landscape in Louisiana impacts the archaeological record, the LDOA divides the state into a series of regions that follow the ecoregions classification of the Western Ecology Division of the United States Environmental Protection Agency. There are six regions at Level III, three of which fall within the present study area: Southeastern Plains, Southern Coastal Plain and Mississippi Alluvial Plain. Girard et al. (2022:24-32) define how the unique environmental, biological, and physiological characteristics of each region cumulatively influenced cultural development in order to provide context to the distribution of where sites are likely or unlikely to occur. These characteristics are described below.

Southeastern Plains

This region lies in the northern portions of the Florida parishes and consists of level to gently undulating plains formed in Pliocene and Pleistocene deposits that are covered by thin layers of loess in some areas. These deposits consist of sandy loams, silt loams, and clay loams with cherty gravels present. Cherty gravel bars are common due to north-south trending streams and rivers that drain the region. Long-leaf pine woodlands with mixed oak-pine forest are present within upland vegetation. Sites are typically situated on higher ridge crests and along stream margins. Sites will occur in surface contexts in higher elevations while occasional buried sites may be found in alluvial settings. Agricultural and timber harvesting activities within this region effect sites in surface contexts. Gravel-mining operations within the larger drainages also have destroyed sites within the limits of their activities. Additionally, oil and gas development of the Tuscaloosa shale may have significant adverse effects on sites in the future.

Southern Coastal Plain

The Southern Coastal Plain region consists of late Pleistocene terraces with Holocene-age alluvial and deltaic deposits along the coast. The uplands consist of gently rolling topography dissected by north-south trending streams and rivers. Cherty gravels that originated from the Pleistocene sediments accumulate in stream beds. Long-leaf pine forests with infrequent open savannas on level upland surfaces dominate upland vegetation. Holocene alluvial deposits are in floodplains and on low terraces along the major streams, especially the Pearl River. Sites within the upland areas are concentrated on higher ridge crests and overlooking streams. Most of these deposits are shallow with overlapping occupations and no opportunity for stratified sites. Buried and stratified sites may be present in the floodplains of the larger streams.

Mississippi Alluvial Plain, Inland Swamp and Coastal Marshes

The Inland Swamp and Coastal Marshes subregion represents the transition between freshwater backswamps to fresh, brackish, and saline waters of the deltaic marshes. The Atchafalaya Basin, one of the most extensive bottomland hardwood forest swamps in North America, constitutes a large portion of this subregion. Much of the land is low-lying and subject to seasonal flooding. Numerous bayous drain the region with their natural levees providing the only elevated ground. The natural drainage pattern and ecology has been significantly altered by modern control of the Mississippi River and tributary stream channels. One result is extensive modern sediment deposition in some areas of the Swamp. Soils are poorly drained with swamp forest (bald cypress, water tupelo) vegetation along with grasses, sedges, and rushes predominating. Sites are concentrated along natural levees. Channel migration has eroded many landforms, and sediment deposition has buried many others. Regional subsidence has resulted in many older landforms and sites being submerged below the modern surface. Most of the larger shell middens were mined for shell beginning in the late 1800s.

3.7.3 Tribal Trust Resources

Tribal trust resources refer to lands, assets, and resources that the U.S. government holds in trust for federally recognized tribes. They include ancestral lands, burial grounds, sacred sites, and other culturally significant areas, especially those that may qualify as historic properties under NHPA. USACE Civil Work Tribal Consultation Policy (2023) recognize that "the federal government has a unique legal and political relationship with Tribal governments that recognize self-government and self-determination" and that "USACE shall work to meet its trust responsibilities, protect trust resources and treaty responsibilities for actions related to USACE in accordance with provisions of treaties, laws and Executive Orders as well as principle lodged in the Constitution of the United States."

When conducting a civil works planning activity (http://www.usace.army.mil/Missions/Civil-Works/Tribal-Nations/), USACE is directed to follow six principles when engaging with Tribal Governments: sovereignty, trust responsibility, government-to-government relations, consultation elements, tribal self-reliance and projection of cultural and natural resources.

Under Section 106 of the National Historic Preservation Act (NHPA), federal agencies are required to consider the effects of their undertakings on historic properties, including those of cultural or religious significance to Native American tribes. This process mandates that agencies consult with tribes on a government-to-government basis, respecting their sovereignty and acknowledging their special expertise in identifying properties of cultural importance.

Each Tribe has a Tribal Historic Preservation Officer (THPO) who assumes the responsibilities of the Louisiana SHPO for cultural resources within their Tribal lands and consults with Federal agencies on activities that may impact archaeological sites of interest on or off Tribal lands [as defined in 36 CFR § 800.16(x)].

While there are no tribal lands in the parish there are five federally-recognized Tribes that have current and/or ancestral interest within Tangipahoa:

- Choctaw Nation of Oklahoma (CNO)
- Coushatta Tribe of Louisiana (CT)
- Jena Band of Choctaw Indians (JBCI)
- Mississippi Band of Choctaw Indians (MBCI)
- Tunica-Biloxi Tribe of Louisiana (TBTL)

3.7.4 Louisiana Natural and Scenic River

Aesthetic, scenic, recreational, fish, wildlife, ecological, archaeological, geological, botanical, and other natural and physical features and resources within the scenic river corridors are protected under the Louisiana Scenic Rivers Act (LSRA), La. Rev. Stat. 56:1841. Permits are required in order to engage in any activity governed by the act. The Louisiana Department of Wildlife and Fisheries (LDWF) is the lead state agency in the State Scenic River program. In the study area, the Tangipahoa River is a state designated natural and scenic river based on its fishery value and aesthetic characteristics. The Tangipahoa River is known for supporting Kentucky bass as well as other games fish such as black bass, white and black crappie, catfish, and multiple species of sunfish.

None of these rivers are designated under the federal Wild and Scenic Rivers Act, 16 U.S.C. §1271, et seq. No waterbodies in Tangipahoa Parish are designated under the federal Act. Coordination with LDWF occurred throughout the planning process and will continue through development of an approved final report.

3.7.5 Aesthetics

The visual resources assessment procedure (VRAP) for USACE (Smardon, 1988) provides a method to evaluate visual resources affected by USACE water resources projects. These VRAP criteria identify significant visual resources in the study area:

- important urban landscapes, including visual corridors, monuments, sculptures, landscape plantings, and greenspace,

- area is easily accessible by a major population center,
- project is highly visible and/or requires major changes in the existing landscape,
- areas with low scenic quality and limited visibility,
- historic or archeological sites designated as such by the NRHP or State Register of Historic Places,
- parkways, highways, or scenic overlooks and vistas designated as such by a Federal, state, or municipal government agency,
- visual resources that are institutionally recognized by Federal, state, or local policies,
- tourism is important in the area's economy,
- area contains parks, forest preserves, or municipal parks,
- wild, scenic, or recreational water bodies designated by government agencies,
- publicly or privately operated recreation areas.

Significant visual resources are primarily described in the Cultural/Historic and Recreation Resources sections of this document. Specific examples include:

National Registered Historic Districts in Amite, Hammond, Independence, and Ponchatoula.

- Nationally Registered McGehee Hall, Southeastern Louisiana University
- State Designated Natural and Scenic Rivers, Tangipahoa River
- Joyce, Sandy Hills, Tangipahoa Parish School Board Wildlife Management Areas
- Southern Swamp Scenic Byway located in Tangipahoa, Ascension, and Livingston Parishes

Additional visual resources include the primary land uses in the study area which were described in Section 3.3.1. Primary land use types in the Parish include pine forest/plantations, pastureland, and woody wetland (primarily found in the southern extent of the Parish).

3.7.6 Recreation

Three state public areas, comprising 48,000 acres of land provide hunting, trapping, hiking, wildlife viewing, and photography opportunities. Hunting for waterfowl, upland game birds, small game, raccoon, deer, and crawfish. In addition, rivers and streams throughout the parish provide fishing opportunities. The Tangipahoa River provides paddling opportunities throughout much of its length as well as boating opportunities on the lower portion of the river. Several boat launches and paddle craft accesses are located within the parish which provide access to the Tangipahoa River, Bedico Creek, Lake Pontchartrain, and Lake Maurepas.

City parks and recreation infrastructure provides additional recreation opportunities in the form of ball fields, playgrounds, swimming pools, leisure paths, courts, and picnic area. According to the United States Department of the Interior National Park Service Land and Water Conservation Fund (LWCF), 16 recreation projects within the study area have been supported through the LWCF State and Local Assistance Program between 1971 and 2018.

Section 6(f)(3) of the L&WCF Act assures that once an area has been funded with L&WCF assistance, it is continually maintained in public recreation use unless National Park Service (NPS) approves substitution property of reasonably equivalent usefulness and location and of at least equal fair market value.

3.7.7 Noise and Vibration

The Noise Control Act of 1972 (P.L. 92-574) directs federal agencies to comply with applicable federal, state, interstate, and local noise control regulations. In 1974, USEPA provided information suggesting that continuous and long-term noise levels in excess of day-night sound level 65 A-weighted decibels (dBA) are normally unacceptable for noise-sensitive land uses such as residences, schools, churches, and hospitals.

Ambient noise levels within the study area are influenced by land uses including industrial, commercial, residential and agricultural areas. Noise sources include primarily vehicular traffic, trains, and large transport vehicles travelling in the study area. Secondary noise sources include industrial activities and construction along parish and township roads.

3.8 FUTURE WITHOUT PROJECT CONDITIONS

Both USACE policy and NEPA require that, in analyzing alternatives to a proposed action, a “no action” Alternative must be considered. The No Action Alternative or future without project (FWOP) conditions represent the anticipated conditions if the proposed action were not implemented and the predicted project gains (e.g., flood risk reduction) would not be achieved. The Most Likely Future Year (MLFY) is considered to be 2083 for this study.

Without implementation of a flood risk reduction project, other Federal, state, local, and private efforts may still occur within or near the footprints of the Proposed Action. Communities would continue to be at risk from high water events induced by riverine flooding due to heavy rainfall without intervention. Due to the low existing elevation and anticipated sea level rise, it is reasonably foreseeable that the communities located adjacent to the main water bodies would continue to be plagued with challenges related to high water events.

3.8.1 Future Hydrologic Conditions

The project evaluates the effectiveness of flood mitigation alternatives with a focus on the Tangipahoa Parish and a nonstructural Tentatively Selected Plan (TSP). Trends in temperature, precipitation, and streamflow variables are considered.

Based on hydrologic trends, aspects of the study area are at risk of experiencing impacts from changing conditions. USACE requires projects to evaluate and consider changing conditions early in the project development process. The information gathered in this assessment produced a summary of risk identifiers that may be impacted by changing hydrologic conditions to varying degrees, thus impacting communities.

The literature reviewed indicated a reasonable consensus on an increasing trend in observed temperature and precipitation. There was also a consensus that annual average temperatures and precipitation are projected to increase in the future. There was no consensus among the literature on the projected future streamflow trends (either increasing or decreasing). The USACE Comprehensive Hydrology Assessment Tool (CHAT) showed no statistically significant trend of increasing streamflow for the Robert and Osyka gages on the Tangipahoa River and Baptist on the Natalbany river. The USACE Vulnerability Assessment Tool indicated that Lower Mississippi Basin HUC4-0807 watershed is not within the 20% most vulnerable watersheds, and thus not considered relatively vulnerable when compared to other watersheds in the CONUS. Not being considered relatively vulnerable does not mean that the watershed is not susceptible to changing hydrologic conditions.

Tests for nonstationarities were triggered for the Robert and Baptist gages but were not deemed robust enough to be considered a strong nonstationarity. No nonstationarities were triggered for the Osyka gage.

Appendix I - Table I: 1-4 indicates potential residual risks for this Project as a result of changing hydrologic conditions along with a qualitative rating of how likely those residual risks are to occur. The residual risk resulting from anticipated hydrologic changes is classified as medium. The residual risk resulting from anticipated hydrologic changes is classified as medium.

3.8.2 Effects of Changing Conditions

The FWOP condition includes increased flood risk and coastal storm damage associated with higher magnitude precipitation, more frequent tropical storm events, and sea level rise. Inland hydrology changing conditions effects are qualitatively examined and discussed in the Climate Assessment appendix (Appendix I). FWOP conditions also consider future land development; however, quantifiable changes to the hydrology from future development are not expected to have a significant effect. Relative sea level rise is quantified and included in the FWOP models.

The impacts of relative sea level rise (RSLR) with coincident frequency riverine events on the southern side of the parish are exhibited from the coastline of Lake Pontchartrain inland approximately 0.6 miles and approximately 1.7 miles from the coastline of Lake Maurepas. There is some variance along the extent of the coastline due to the topography. In general, the impact zone of RSLR remains south of Louisiana Highway 22 along the southern side of the parish coastline for the 10% AEP (10-year) and 1% AEP (100-year) event simulations. For the 1% AEP event, Figure 3-6 identifies the zone of impact affected by sea level change from the base year 2033 to the MLFY 2083. Sea level change in the FWOP condition models is discussed in Appendix B, Section 4.7.

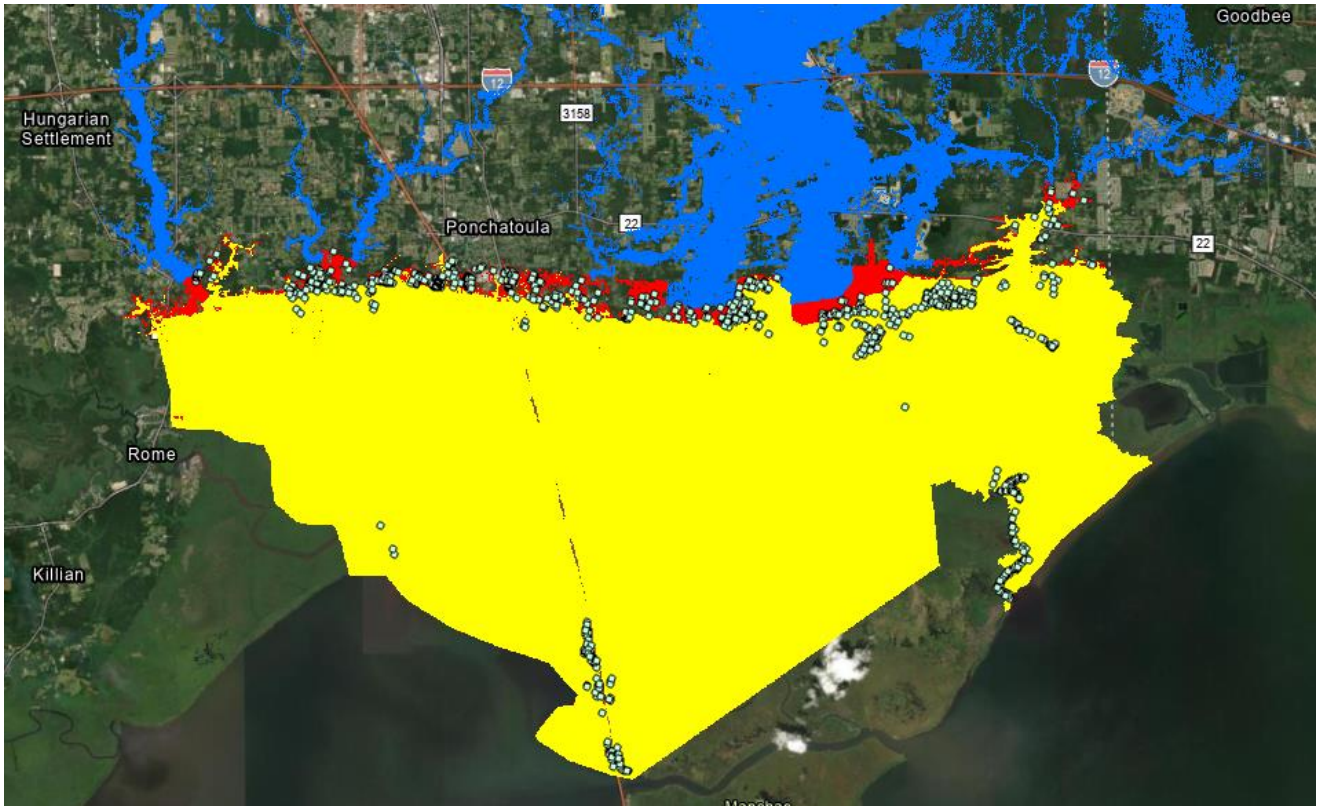


Figure 3-6. Effects of Sea Level Rise (50 years out – MLFY 2083) on Coastal Surge Impacts - 1% AEP Event (Blue is the riverine flood extents. Red is the year 2083 coastal surge extent and Yellow is the base year 2033 coastal surge extent).

No action will lead to continued flooding from the Tangipahoa River, Natalbany River and their tributaries as well as other waterways. Discussed in Appendix I – Climate Assessment, trends in temperature, precipitation (including extremes), and hydrology/streamflow are all projected to increase in the Parish. Changing hydrologic conditions will result in higher and more frequent storm damages and higher average annual damages.

3.8.3 Socioeconomic

The projected hydrologic conditions were entered into the HEC-FDA program to estimate potential future economic damages if no action is taken. No other parameters were changed from the existing conditions modeling. The future conditions damages by probability event are displayed in Table 3-14 and the expected annual damages and equivalent annual damages are displayed in Table 3-15.

Table 3-14. Future Conditions Damages by Probability Event FY 2024 Price Level ($1000s)

Annual Exceedance Probability (AEP) Event	Total Damage ($) (MLFY 2083)
50% (2 yr.)	$58
20% (5 yr.)	$58
10% (10 yr.)	$219,995
4% (25 yr.)	$328,356
2% (50 yr.)	$442,722
1% (100 yr.)	$588,162
0.5% (200 yr.)	$733,284
0.2% (500 yr.)	$946,063

Table 3-15. Future Conditions Economic Damages FY 2024 Price Level

Damage Category	Expected Annual Damage ($1000s) (MLFY 2083)	Equivalent Annual Damage ($1000s) (Equivalent at 2.75%) (MLFY 2038)
Auto	$2,846	$2,517
Commercial	$15,085	$12,583
Industrial	$15,292	$11,435
Public	$1,435	$1,431
Residential	$35,689	$31,380
Total	$70,350	$59,350

There is also a potential for increased life safety concerns both due to increases in population as well as sea level rise. A life-safety sea level rise analysis will be performed post-draft report. There also exists the possibility for higher damages should more structures be built in the floodplain. However, this is expected to be mitigated with strict building codes and enforcement at the local level. The economic modeling also does not account for potential homeowners self-relocating or self-mitigating through elevation or floodproofing without Federal dollars.

3.8.4 Environmental

Overall land use patterns are expected to be similar to current conditions. There is potential for continued loss and degradation of upland habitats (i.e. grassland and pastureland) and other habitats such as scrub/shrub due to continued development, land use change, invasive species spread, and changes in flood frequency and intensity. Other environmental resources are not anticipated to change significantly under the future without project scenario.

SECTION 4
Formulation of Alternatives

Plan formulation supports USACE water resources development missions. A systematic and repeatable planning approach ensures sound decision making. The Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&G) accounts (ER 1105-2-103, Section 1-6) and the Planning Guidance Notebook (ER 1105-2-100) describe the process for Federal water resource studies requiring formulation of alternative plans contributing to Federal objectives. This section details Step 3 of the USACE planning process and presents the results of the plan formulation process. Alternatives were developed in consideration of the study area problems and opportunities, as well as objectives and constraints. Economic, social, and environmental benefits, impacts, and costs are to be identified, measured, and/or qualitatively characterized using the four Principles & Guidelines, which include acceptability, completeness, effectiveness, and efficiency.

The study area is impacted by riverine flooding from major rainfall events as well as storm surge from tropical events in the southern portion of the Parish. Authorization is currently limited to flood risk management. However, project formulation was conducted based on hydraulics associated with riverine flooding as well as coastal surge and compound flooding. This was done so the study team could identify flooding from both riverine flooding and coastal surge for future consideration. The non-federal sponsor, is currently pursuing WRDA 2022 Section 8106(a) which will allow the PDT to “formulate alternatives to maximize the net benefits from the reduction of the comprehensive flood risk within the geographic scope of the study.”

4.1 MANAGEMENT MEASURES AND SCREENING

A management measure is a feature or activity that can be implemented at a specific geographic site to address one or more planning objectives. Alternatives are a set of one or more management measures functioning together to address one or more planning objectives. The study team developed and screened structural, non-structural, and nature based/natural measures utilizing information on existing infrastructure, existing reports, and subject matter expertise consistent with FRM objectives. Input from the CPRA, Tangipahoa Parish, key stakeholders, and the public was very important during this planning step.

All measures were evaluated and screened for capability to meet objectives and avoid constraints, for engineering and economic feasibility, and to maximize benefits provided over the 50-year period of analysis from 2033-2083. Measures that warranted continued consideration and met the success thresholds were assembled into alternative plans.

Table 4-1 lists the structural, nonstructural, and nature based actions that were initially identified to potentially reduce flood risk in the study area. Descriptions of the measures are included in Appendix E – Plan Formulation.

Table 4-1. Flood Risk Management Strategies

STRUCTURAL	NONSTRUCTRUAL	NATURAL / NATURE BASED
Detention Basin	Elevation, Residential	Riparian Habitat to slow inland water transfer
Diversion Channel	Dry Floodproofing, Residential	Reclamation of abandoned quarries for flood storage
Roadway Elevation	Wet Floodproofing, Nonresidential	Detention Ponds with Wetland Restoration
Levee / Floodwall / Pump Station	Property Acquisition Buyouts / Relocation (Reuse of the Floodplain)	Historic Ridge Restoration
Reservoir (unregulated)	Risk Communication with Public / Flood Warning System	Beneficial Use of Dredged Material
Water Control Structure	Optimize Operation of Existing Structures or Projects	Habitat restoration to attenuate waves
Revetment (shoreline)	Evacuation Plans	River Cane restoration
Channel Improvement / Dredging		
Snagging and Clearing		

4.1.1 Structural Measures

Structural measures are physical modifications designed to reduce the frequency of damaging levels of flood inundation by modifying the nature and extent of flooding. Structural measures were identified from the CPRA master plan, Tangipahoa Parish plans, in addition to professional expertise.

The following thresholds were established for structural measure consideration in plan formulation:

- Channels with discharges greater than 800 cfs for the 10% Annual Exceedance Probability (AEP) event (10 Year) flood event were included for consideration. Areas where flow is less than the threshold is considered local drainage and out of the scope for structural measure consideration.
- Specific structural measures considered and designed for:
    - 1% AEP event (100yr-flood) for levees
    - 10% AEP event (10yr-flood) for detention basins

4.1.2 Nonstructural Measures

Nonstructural measures essentially reduce the consequences of flooding, as compared to structural measures, which may also reduce the probability of flooding. Nonstructural measures addressed by the USACE National Nonstructural Floodproofing Committee include building acquisitions or relocations, elevation, and floodproofing of structures, implementing flood warning systems, flood preparedness planning, establishment of land use regulations, development restrictions within the greatest flood hazard areas, and elevated development. See Appendix E, Plan Formulation for detailed description of Nonstructural measures.

- **Relocation:** Involves the physical relocation of an existing structure to an area outside of a hazard prone area.
- **Acquisition:** To reduce the risk of future flood losses, the structure would be purchased from the homeowner with the intention of removing the structure and permanently protecting the land as open space.
- **Elevation**: Elevation is the action of raising a habitable space of a structure above the base flood elevation (BFE). Elevation of structures is anticipated to reduce damages associated with flood depths of 3 to 13 feet above ground surface elevation.
- **Dry Floodproofing:** Dry floodproofing is a combination of methods that make a building and attendant utilities and equipment watertight and substantially impermeable to floodwater, with structural components having the capacity to resist flood loads.
- **Wet Floodproofing:** Wet floodproofing involves retrofitting/modifying a structure to allow floodwaters to enter it in such a way that damage to the structure and its contents is minimized. Wet floodproofing is generally appropriate if a structure has available space where damageable items can be stored temporarily. Wet floodproofing may turn out to be more applicable for specific structures based on water surface elevations (possibly greater than 3 feet above ground surface) at such structures. Compared with the more extensive Non-Structural FRM measures, wet floodproofing is generally the least expensive.

For evaluation purposes, the BFE is defined by the NFIP as the “flood having a 1% chance of being exceeded in any given year is also called the 100-year flood”. BFE is the computed elevation to which floodwater is anticipated to rise during the base flood. Ground elevation is the height of the land at the NSI (structure inventory) marker location, typically at the central point of the structure.

4.1.3 Nature Based Measures

The team also considered the full array of natural measures. 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. Specific examples included the creation of riparian habitat to slow inland water transfer and detention

ponds along with wetland restoration. Other nature based measures were identified from CPRA and Tangipahoa Parish studies, which included the creation of historic ridges along Lake Pontchartrain, restoration of river cane to slow the effects of flooding and the use of abandoned quarries for detention storage.

4.1.4 Screening of Measures

The management measures were initially screened on whether the measure meets planning objectives and avoids constraints as well as qualitative assessments of effectiveness, efficiency, and acceptability, which are three of the four Principles and Guidelines (P&G) evaluation criteria in planning studies. Tables 4-2 and 4-3 presents the initial screening of measure categories.

Table. 4-2. Summary of Flood Risk Management Measures and Screening

Measure	Structural, Non-Structural, Nature/Natural	Meets Objective	Retained for Further Evaluation
Detention Basin	**Structural**	**1,2,3,4,5**	**Yes**
Diversion Channel	**Structural**	**1,2,3,4,5**	**Yes**
Roadway Elevation	**Structural**	**1,2,3,4,5**	**Yes**
Levee / Floodwall / Pump Station	**Structural**	**1,2,3,4,5**	**Yes**
Reservoir (unregulated)	**Structural**	**1,2,3,4,5**	**Yes**
Water Control Structure	**Structural**	**1,2,3,4,5**	**Yes**
Revetment (Shoreline)	**Structural**	**1,2,3,4,5**	**Yes**
Channel Improvement / Dredging	**Structural**	**1,2,3,4,5**	**Yes**
Snagging and Clearing	**Structural**	**1,2,3,4,5**	**Yes**
Elevation, Residential	**Non-structural**	**1,2,4,5**	**Yes**
Dry Floodproofing, Residential	**Non-structural**	**1,2,4,5**	**Yes**
Floodproofing, Nonresidential	**Non-structural**	**1,2,4,5**	**Yes**
Property Acquisition Buyouts / Relocation (Reuse of the floodplain)	**Non-structural**	**1,2,4,5**	**Yes**
Risk Communication with the public Flood Warning System Evacuation Plans	Non-structural	1,2,3,4,5	No. Eliminated from consideration because the study area has an ample forecast/warning system provided by Parish and local government. As noted in Table 1.2. If additional assistance is needed in the future, local government could

Measure	Structural, Non-Structural, Nature/Natural	Meets Objective	Retained for Further Evaluation
			request through other sources, such as State/Federal programs.
Optimization of operation of existing structures or projects	Non-structural	1,2,3,4.5	No. Minimal existing infrastructure
Riparian habitat to slow inland water transfer	Nature based/ Natural	1,2,4	No. Detention pond measures were more effective at storing inland water; areas to covert to riparian habitat for inland water storage were not found in needed areas.
Reclamation of abandoned quarries for flood storage	Nature based/ Natural	1,2,3,4,5	No. Locations not suitable / ineffective at reducing flood risk.
Detention ponds with wetland restoration	**Nature based/ Natural**	**1,2,3,4,5**	**Yes**
Historic Ridge Restoration	**Nature based/ Natural**	**1,2,4**	**Yes**
Habitat Creation to attenuate waves	Nature based/ Natural	1,2,4	No. Marsh alone was eliminated as a standalone measure since it would be ineffective in significantly reducing the level of risk reduction. Additionally, these measures were proven viable in the coastal zone only and outside the scope of this study.
River Cane Restoration (Louisiana Watershed Initiative)	**Nature based/ Natural**	**1,2,4**	**Yes**

After the types of structural, nonstructural, and nature based measure strategies were established, an initial 59 site specific management actions, including structural and nature based actions were identified for evaluation to reduce the risk of flood damages within the study area. Table 4-3 presents the full list of initial site-specific measures. Seventeen site-specific measures were initially screened, and 43 structural measures were carried forward to develop the alternative plans. The screening criteria is included in “Descriptions” and indicated by shaded cells in Table 4-3 below.

Table 4-3: Site Specific Structural Measures and Screening

HUC Sub-Basin	Measure ID	Category	Type	Description
Anderson Canal	AC 2	Nature Based	Ridge Construction and Plantings	Wind Fetch - Ridge Construction and Plantings Lake Maurepas. Screened for Efficiency.
Anderson Canal	AC 3	Structural	Shoreline Revetment	Rock berm along Lake Maurepas. Screened as construction is in progress to reduce shoreline erosion
Beaver Creek	**BC 1**	**Structural**	**Detention Basin**	**Beaver Creek Detention Basin near Village of Tangipahoa**
Beaver Creek	**BC 2 North**	**Structural**	**Detention Basin**	**Beaver Creek Detention Basin North of Village of Tangipahoa**
Beaver Creek	**BC 2 South**	**Structural**	**Detention Basin**	**Beaver Creek Detention Basin south of Village of Tangipahoa**
Bedico Creek	**BED 1**	**Structural**	**Roadway Elevation**	**Elevation of Firetower Rd - Hwy 22 to Hwy 190 (near I-12)**
Bedico Creek	**BED 2**	**Structural**	**Levee / Pump Station**	**Bedico Creek Levee / pump station 1**
Bedico Creek	**BED 3**	**Structural**	**Levee / Pump Station**	**Bedico Creek Levee and 2 pump stations 2**
Bedico Creek	**BED 4**	**Structural**	**Roadway Elevation**	**Roadway elevation Firetower Rd / Hwy 22 intersection.**
East Ponchatoula Creek / Ponchatoula Creek	**ECPC 1a, 1b**	**Structural**	**Levee / Pump Station**	**Hammond Levee and pump station**
East Ponchatoula Creek / Ponchatoula Creek	**ECPC 2**	**Structural**	**Levee / Pump Station**	**Hammond / Woodbridge levee and pump station, long**
East Ponchatoula Creek / Ponchatoula Creek	**ECPC 3**	**Structural**	**Levee**	**Hammond / Whitmar Levee**
East Ponchatoula Creek / Ponchatoula Creek	**ECPC 4**	**Structural**	**Diversion Channel**	**Diversion channel - Ponchatoula Creek**

HUC Sub-Basin	Measure ID	Category	Type	Description
East Ponchatoula Creek / Ponchatoula Creek	EC PC 5	Structural	Levee	Independence levee. Screened: FEMA maps showed inundation, however, modeling and Parish confirmed no flooding occurs up to 100 Year flood event.
Irving Branch Tangipahoa River	IBTR 1	Structural	Water Control Structure	Screened not effectiveness at reducing flood risk.
Little Chappepeela Creek	**LCC 1**	**Structural**	**Roadway Elevation**	**Roadway modifications of Briar Patch Cemetery Road**
Line Creek Terry's Creek	**LCTC 1**	**Structural**	**Water Control Structure and pump station**	**Kentwood pump station, water control structure**
Line Creek Terry's Creek	**LCTC 2**	**Structural**	**Water control structure and pump station**	**Kentwood pump station, water control structure**
Line Creek Terry's Creek	**LCTC 3**	**Structural**	**Levee, pump station, water control structure**	**Kentwood Levee, pump station, water control structure**
Natalbany Creek Natalbany River	**NCNR 1**	**Structural**	**Detention Basin**	**Detention Basin SW of Amite City**
Natalbany Creek Natalbany River	NCNR 1b	Structural	Detention Basin	Screened for cost effectiveness. Proposed location near Amite City cannot significantly reduce the volume of water that flows into the Tangipahoa River
North Pass / Pass Manchac	NPPM 1	Nature Based	Ridge Construction and Plantings	Nature Based solution (constructed ridge and plantings) to reduce wind fetch along Lake Pontchartrain. Screened because ineffective at reducing flood risk.
North Pass / Pass Manchac	NPPM 2	Nature Based	Ridge Construction and Plantings	Nature Based solution (constructed ridge and plantings) to reduce wind fetch along Lake Maurepas. Screened because ineffective at reducing flood risk.
North Pass / Pass Manchac	NPPM 3	Structural	Rock Berm	Constructed rock berm to reduce wind fetch along Lake Maurepas Screened because ineffective at reducing flood risk.
Ponchatoula Creek	**PC 1a, b, c**	**Structural**	**Levee**	**Levee alignments east of Ponchatoula**

HUC Sub-Basin	Measure ID	Category	Type	Description
				Creek,
Ponchatoula Creek	**PC 2a, b**	**Structural**	**Levee**	**Levee alignments west of Ponchatoula Creek,**
Still Branch - Natalbany River	**SBNR 2**	**Structural**	**Detention Basin**	**Natalbany River detention basin - west / Independence**
Selsers Creek	**SC 1**	**Structural**	**Levee**	**Levee at Selsers Creek (Wild Oak)**
Selsers Creek	SC 2	Structural	Channel improvements	Screened. Flooding issue is not caused by tributary that falls within the study scope (less than 800 cfs) Drainage modifications near Blythwood subdivision
Selsers Creek	SC 3	Structural	Levee	Screened for ineffectiveness and significant environmental impacts. Levee near Selsers Creek - watersheds
Selsers Creek	**SC 4**	**Structural**	**Levee**	**Detention basin near Big Branch**
Selsers Creek	**SC 5**	**Structural**	**Detention Basin**	**Detention basin west of Selsers Creek/Chappepeela Sports Park**
Selsers Creek	SC 6	Structural	Detention Basin	Screened for ineffectiveness and significant environmental impacts. Detention basin Selsers Creek / Airport Road
Selsers Creek	SC 7	Structural	Reservoir	Screened for effectiveness and environmental impacts. Reservoir at Selsers Creek west of Airport Road
Selsers Creek	SC 8	Nature Based	Detention Basin	Screened for ineffectiveness. Nature based solution (creek restoration)
Selsers Creek	SC 9	Structural	Levee	Screened for effectiveness. Levee near Selsers Creek
Selsers Creek	**SC 10**	**Structural**	**Detention Basin**	**Detention basin at East of Selsers Creek**
Selsers Creek	**SC 11**	**Structural**	**Detention Basin**	**Detention basin at Selsers Creek (Wild Oak)**
Selsers Creek	**SC 12**	**Structural**	**Roadway Elevation**	**Roadway elevation of Hwy 22 and Sandhill Cemetery Rd. (added later per**

HUC Sub-Basin	Measure ID	Category	Type	Description
				Parish)
Skulls Creek - Tangipahoa River	**SCTR 2**	**Structural**	**Levee**	**Cow Branch Levee near Lee's Landing / South of I-22**
Skulls Creek – Tangipahoa River	SCTR 7	Nature Based	Historic Ridge	Nature Based – CPRA Master Plan berm on Lake Pontchartrain. Screened on effectiveness for this study although measure could be considered through other funding mechanisms as a resiliency measure for the wildlife management area and retention of wetland communities.
Skulls Creek - Tangipahoa River	SCTR 8	Nature Based	River Cane Restoration	Nature Based - Native cane restoration Tangipahoa River and Lake Pontchartrain / Near Joyce WMA. Screened because measure is ineffective at reducing flood damage risk within the scope of this study.
Skulls Creek - Tangipahoa River	**SCTR 9**	**Structural**	**Levee / Pump Station**	**Richardson Rd. Levee and pump station at Tangipahoa River**
Skulls Creek - Tangipahoa River	**SCTR 11**	**Structural**	**Levee**	**Laurel Oak Levee / South of I-12 South of Robert**
Skulls Creek - Tangipahoa River	**SCTR 12**	**Structural**	**Culvert Modification**	**Culvert Modification Sims Creek**
Skulls Creek - Tangipahoa River	**SCTR 14**	**Structural**	**Levee**	**Coburn Levee and pump station**
Skulls Creek - Tangipahoa River	**SCTR 15**	**Structural**	**Levee**	**Tangipahoa River Levee**
Skulls Creek - Tangipahoa River	**SCTR 16**	**Structural**	**Detention Basin**	**Tangipahoa River detention basin (east of Tickfaw)**
Skulls Creek - Tangipahoa River	SCTR 17	Nature Based	Riparian Habitat to Slow Inland Water Transfer	Nature Based detention basin - side channel restoration. Screened. Detention ponds were more effective at reducing flood risk.
Spring Creek /	**SPTR 1a & 1b**	**Structural**	**Levee / Pump Station**	**Village of Tangipahoa Levee and pump**

HUC Sub-Basin	Measure ID	Category	Type	Description
Tangipahoa River				**station**
Washley Creek	**WASH 1**	**Structural**	**Levee / Pump Station**	**Robert Levee and pump station, short**
Washley Creek	**WASH 2**	**Structural**	**Levee / Pump Station**	**Robert Levee and pump station**
Washley Creek	**WASH 3**	**Structural/Nature Based**	**Levee and Nature Based Detention basin**	**Robert Levee and nature based detention basin**
Washley Creek	**WASH 4**	**Structural**	**Detention Basin**	**Upper Washley Creek detention basin**
Multiple	**SNG-1**	**Structural**	**Snagging and Clearing**	**Tangipahoa River North Snagging and Clearing**
Multiple	**SNG-3**	**Structural**	**Snagging and Clearing**	**Tangipahoa River Middle Snagging and Clearing**
Multiple	**SNG 2**	**Structural**	**Snagging and Clearing**	**Tangipahoa River South Snagging and Clearing**
Multiple	**SNG 4**	**Structural**	**Snagging and Clearing**	**Natalbany River Snagging and Clearing**

Shaded cells are measures that were not carried forward for alternative development.

Nature based features were screened due to being ineffective at significantly reducing the magnitude of flooding in the Parish. In addition, AC-2 and SC-8 would result in significant environmental impacts. Many nature based features were considered in combination with structural measures, specifically with detention basins. Though environmental and hydrologic resiliency benefits were considered the project cost and real estate cost far exceeded flood risk reduction benefit. Though nature based solutions were determined to be outside of the scope of this study, they hold potential to be beneficial under a different scope, should the Parish or NFS choose to pursue them.

4.2 DEVELOPMENT OF INITIAL ARRAY OF ALTERNATIVES AND SCREENING

This section summarizes the strategies utilized to identify the initial array of structural and nonstructural alternatives based on initial data collection and professional judgement. The initial array was developed by combining the remaining site-specific management measures. Sixteen alternatives were developed separately by combining all measures related to a given area or source of flooding and assigned within each distinct drainage area based on the USGS 12-digit hydrologic sub-basins affecting the study area (Table 4-3).

Tangipahoa Parish is comprised of 8 major watersheds and 30 hydrologic subbasins. Eighteen HUC sub-basins have documented flooding, from storm surge or riverine flooding causing repetitive flood loss damages. Twenty-one sub-basins have structures which meet our non-structural criteria for elevation or floodproofing. Structural alternatives were developed for each of the following areas: Beaver Creek, Bedico Creek, East Ponchatoula, Irving Branch, Line Creek, Little Chappepeela Creek, Natalbany Creek, Ponchatoula Creek, Selser's Creek, Skulls Creek, Spring Creek, Still Branch, Washley Creek and Lower Tangipahoa River. In areas where the hydrologic influence of the subbasins overlap, measures were evaluated in combination with other alternatives in the same vicinity. This plan formulation approach was based on separable elements as defined in WRDA 1986 Section 103(f) and Engineer Regulation 1105-2-100, Appendix E, Paragraph E-3, Section c (2).

Nonstructural plans for the entire parish were also evaluated, along with combined structural and nonstructural plans for the separate geographic areas.

The nomenclature for each Measure ID as seen in Table 4-3 is above continued throughout Section 4. Each measure was given a unique alphanumerical value based upon the sub-watershed in which the measure would implement and then the order in which the measure was proposed and/or documented during the study for that sub-watershed.

Table 4-4. Initial Array of Alternatives

Alt ID	Sub Basin	Detention ponds (FRM)	Water Control Structures	Diversion channel	Pump stations	Levee, floodwall	Flood gates	Roadway Elevation	Snagging and Clearing
1	No Action Parishwide								
2	Nonstructural Parishwide								
3	Beaver Creek	BC-1, BC-2N, BC-2S							
4	Bedico Creek				BED-2, BED-3	BED-2, BED-3		BED-1, BED-4 (combined into BED 5)	
5	East Ponchatoula Creek-Ponchatoula Creek			ECPC-4	ECPC-1a, ECPC-1b	ECPC-1a, ECPC-1b, ECPC-2, ECPC-3, ECPC-5	ECPC-1a, ECPC-1b, ECPC-2, ECPC-3		
6	Irving Branch – Tangipahoa River		IBTR 1						
7	Line Creek-Terrys Creek		LCTC-1, LCTC-2		LCTC-1, LCTC-2, LCTC-3	LCTC-3			
8	Little Chappepeela Creek							LCC-1	
9	Natalbany Creek-Natalbany River	NCNR-1, NCNR-1b							

Alt ID	Sub Basin	Detention ponds (FRM)	Water Control Structures	Diversion channel	Pump stations	Levee, floodwall	Flood gates	Roadway Elevation	Snagging and Clearing
10	Ponchatoula Creek				PC-1a, PC-1b, PC-1c, PC-2a, PC-2b	PC-1a, PC-1b, PC-1c, PC-2a, PC-2b			
11	Selsers Creek	SC-5, SC-10, SC-11			SC-1, SC-4				
12	Skulls Creek-Tangipahoa River	SCTR-16	SCTR-12		SCTR-2, SCTR-9, SCTR-11, SCTR-14, SCTR-15	SCTR-2, SCTR-9, SCTR-11, SCTR-14, SCTR-15	SCTR-2, SCTR-9, SCTR-11, SCTR-14, SCTR-15		
13	Spring Creek-Tangipahoa River				SPTR-1a, SPTR-1b	SPTR-1a, SPTR-1b	SPTR-1a, SPTR-1b		
14	Still Branch-Natalbany River	SBNR-2							
15	Washley Creek	WASH-3, WASH-4			WASH-1, WASH-2	WASH-1, WASH-2	WASH-1, WASH-2		
16	Lower Tangipahoa, Yellow Water, Ponchatoula								SNG-1, SNG-2, SNG-3, SNG-4

4.2.1 Screening of Initial Array of Alternatives

During the evaluation of the initial array, alternatives were screened or refined based on additional information and modeling (Table 4-5). The majority of the structural measures in the focused array were initially screened due to lack of cost effectiveness. Many of the structural measures were determined to be technically unfeasible since the study area consists of a broadly dispersed (rural) population that receives damages resulting from widespread, low-level flooding. The majority were screened at this higher level because the mitigation benefits did not support developing the measure any further.

A total of 14 alternatives were not carried forward for further alternative development. Five structural alternatives (3, 6, 7, 9, and 14), were screened and removed from consideration. Alternative 3 was screened due to limited opportunities for detention basins to meet project objectives (i.e. currently serving as retention areas, no benefit, environmental impacts, and estimated damages appeared lower than estimated implementation costs). Alternatives 6, 7, and 14, which proposed water control structures and pump stations to reduce risk from riverine flooding, were screened because the estimated damages avoided were lower than the estimated implementation cost. Alternative 9 was screened as HEC-RAS modelling showed this area was no longer flooding, which was then verified by the Parish.

Nonstructural alternatives consisting of elevation for residential and floodproofing for nonresidential were carried forward and continued to be evaluated within subbasins and in areas where structural and nature based measure were screened.

Table 4-5: Initial Array Screening to Focused Array of Alternatives

Alt ID	Subbasin	Alternative Description – Screening Criteria
1	No Action	Carried forward to the Final Array
2	Nonstructural	Carried forward to the Final Array
3	Beaver Creek	**Not carried forward to the Focused array. Screened Measures: BC-1, BC-2, and BC-3.** **FRM detention basins were screened. Approximately 1/3 of unit showed inundation already, proving ineffective and was expected that costs for the Detentions Basins would exceed the damages avoided.**
4	Bedico Creek	Measures carried forward to the Focused array BED-1 and BED-4. **Screened Measures: BED-2 and BED-3** **Both levees were removed from this alternative. Potential damages avoided are not expected to exceed implementation cost. Potential significant environmental concerns related to impacts to quality forested areas within this location.**
5	East Ponchatoula Creek-Ponchatoula Creek	Measures carried forward to the Focused array: ECPC1a, ECPC1b, ECPC-2 and ECPC-3. **Screened Measures: ECPC-4 and ECPC-5.** **Channel Diversion was screened due to effectiveness. Several exist in the area already and no viable location was determined. The Independence Levee was screened as being out of scope as the H&H modelling determined this area was not flooded and was confirmed by the Parish.**
6	Irving Branch Tangipahoa River	Not Carried forward to the Focused array. **Screened Measure: IBTR-1** **The water control structure along the railroad would have been designed to block the water from backing up through the railroad along Highway 51. This measure was screened as the potential damages avoided were not expected to exceed implementation costs since it primarily provided flood risk reduction to only three structures.**
7	Line Creek-Terrys Creek	Not Carried forward to the Focused array. **Screened Measure: LCTC-1, LCTC-2, LCTC-3** **The Water Control Structures and Pump Stations (LCTC-1 and LCTC-2) were screened after further analysis did not show significant hydrology impacts in this area. The Kentwood Levee (LCTC3) was screened as the system proved ineffective and only provided protection to 2 structures and therefore the potential damages avoided were not expected to exceed implementation costs.**
8	Little Chappepeela	Measures carried forward to the Focused array: LCC-1 **Screened Measures: None** **Raise Briar Patch Cemetery Road, southeast of Amite City, just east of the Tangipahoa Parish School Board Wildlife Management Area.**
9	Natalbany Creek-Natalbany River	Not Carried forward to the Focused array. **Screened Measures: NCNR-1 and NCNR-1b** **The Bankston Detention Basin (NCNR-1) was screened after further analysis did not show significant hydrology impacts in this area. Additionally, the Alternate Detention Basin (NCNR-1b) was screened as the detention basin proved ineffective as a result of being located too high in the watershed to be able to significantly reduce the volume of water that flows into the Tangipahoa River.**

Alt ID	Subbasin	Alternative Description – Screening Criteria
10	Ponchatoula Creek	Measures carried forward to Focused array: PC-2a, PC-2b **Screened Measures: PC-1a, PC-1b, and PC-1c** **The Pecan Ridge Levee proved ineffective and provided benefits to approximately 12 structures; therefore the potential damages avoided were not expected to exceed implementation costs.**
11	Selsers Creek	Measures carried forward to Focused array: SC-1, SC-4, SC-5, SC-10, and SC-11, SC- 12 (added) **Screened Measures: No additional screening to Focused array.**
12	Skulls Creek-Tangipahoa River	Measures carried forward to Focused array: SCTR-2, SCTR-9, SCTR-11, SCTR-14, SCTR-15, SCTR-16 **Screened Measures: SCTR-12** **The culvert replacement at I-12 along Sims Creek was screened as the potential damages avoided were not expected to exceed implementation costs.**
13	Spring Creek-Tangipahoa River	Measures carried forward to Focused array: SPTR-1a, SPTR-1b **Screened Measures: No additional screening to Focused array.**
14	Still Branch-Natalbany River	Not Carried forward to the Focused array. **Screened Measures: SBNR-2** **The Independence Detention Basin proved ineffective as the potential damages avoided were not expected to exceed implementation costs.**
15	Washley Creek	Measures carried forward to Focused array: WASH-1, WASH-2, WASH-3, and WASH-4 **Screened Measures: No additional screening to Focused array.**
16	Lower Tangipahoa, Yellow Water, Ponchatoula	Measures carried forward to Focused array: SNG-1, SNG-2, SNG-3, and SNG-4 **Screened Measures: No additional screening to Focused array.**

Shaded cells are measures that were not carried forward for alternative development.

4.3 FOCUSED ARRAY OF ALTERNATIVES AND SCREENING

The screening of the initial array led to a Focused Array of Alternatives, consisting of 11 alternatives with 29 measures that warranted further evaluation (Table 4-6).

Table 4-6: Tangipahoa Parish, Louisiana Feasibility Study Focused Array of Alternatives

Alt ID	Subbasin	Detention ponds (FRM)	Pump stations	Levee, floodwall	Flood gates	Roadway Elevation	Snagging and Clearing
1	No Action Parishwide						
2	Nonstructural Parishwide						
4	Bedico Creek					BED-1, BED-4	
5	East Ponchatoula Creek-Ponchatoula Creek		ECPC-1a, ECPC-1b	ECPC-1a, ECPC-1b, ECPC-2, ECPC-3	ECPC-1a, ECPC-1b, ECPC-2, ECPC-3		
8	Little Chappepeela Creek					LCC-1	
10	Ponchatoula Creek		PC-2a, PC-2b	PC-2a, PC-2b			
11	Selsers Creek	SC-5, SC-10, SC-11	SC-1, SC-4				
12	Skulls Creek-Tangipahoa River	SCTR-16	SCTR-2, SCTR-9, SCTR-11, SCTR-14, SCTR-15	SCTR-2, SCTR-9, SCTR-11, SCTR-14, SCTR-15	SCTR-2, SCTR-9, SCTR-11, SCTR-14, SCTR-15		
13	Spring Creek-Tangipahoa River		SPTR-1a, SPTR-1b	SPTR-1a, SPTR-1b	SPTR-1a, SPTR-1b		
15	Washley Creek	WASH-3, WASH-4	WASH-1, WASH-2	WASH-1, WASH-2	WASH-1, WASH-2		
16	Lower Tangipahoa, Yellow Water, Ponchatoula						SNG-1, SNG-2, SNG-3, SNG-4

4.3.1 Screening of the Focused Array of Alternatives:

The measures in the Focused Array were evaluated, compared, and screened against the following criteria: effectiveness, costs, economic benefits, life safety, impact to environmental resources, community risk factors, and P&G evaluation criteria. The screening was informed by preliminary economic modeling (HEC-FDA), H&H modeling (HEC-RAS and analysis of ADCIRC results) and updated cost estimates. CEMVS Engineering Division developed the estimated levee lengths, quantities, borrow quantities, etc. of the structural measures by using data from previous projects and reports prepared by (or for) USACE, NFS, and stakeholders, study specific H&H modeling, and best engineering judgment. Based on the evaluations, the PDT was able to determine which alternatives and measures performed the best and warranted further investigation.

The screening criteria of the Focused Array resulted in ultimate removal of all structural alternatives. No structural plans were carried forward to the Final Array of Alternatives. Many of the structural measures were determined to be technically unfeasible since the study area consists of a broadly dispersed (rural) population that receives damages resulting from widespread, low-level flooding. The majority were screened at this higher level because the mitigation benefits did not support developing the measure any further. These included the screening of Alternatives 4, 6, 7, and 8 (Table E: 2-7).

Based on HEC-RAS model results, four remaining structural alternatives as part of the focused array showed to be hydraulically effective in flood risk reduction. To further evaluate these structural alternatives the PDT conducted an Abbreviated Risk Assessment (ARA), refined construction quantities and associated construction costs for analysis of the benefit-cost-ratios. The PDT evaluated each on the effectiveness of meeting planning objectives as well potential comprehensive benefits to incorporate the needs and considerations of all at-risk communities and potential life safety risk.

Structural alternatives developed to address roadway flooding, the PDT evaluated life safety risk during flooding events caused by flood depths and velocities. It was determined that while there are areas of the Parish which may result in depths, velocities, or the combination therein to present the possibility of sweeping vehicles off of the road, there also exists alternative routes which are not inundated by flood events. Additionally, there were no communities or groups of homes which are completely cut off in the event of a flood from emergency services as alternative routes are available. These alternatives were screened.

See Appendix E Plan Formulation, Section 2.3 for further detail on the screening of structural alternatives within the Parish. Additionally, Appendix B and Appendix J include mapping and details on the evaluation and screening of structural alternatives.

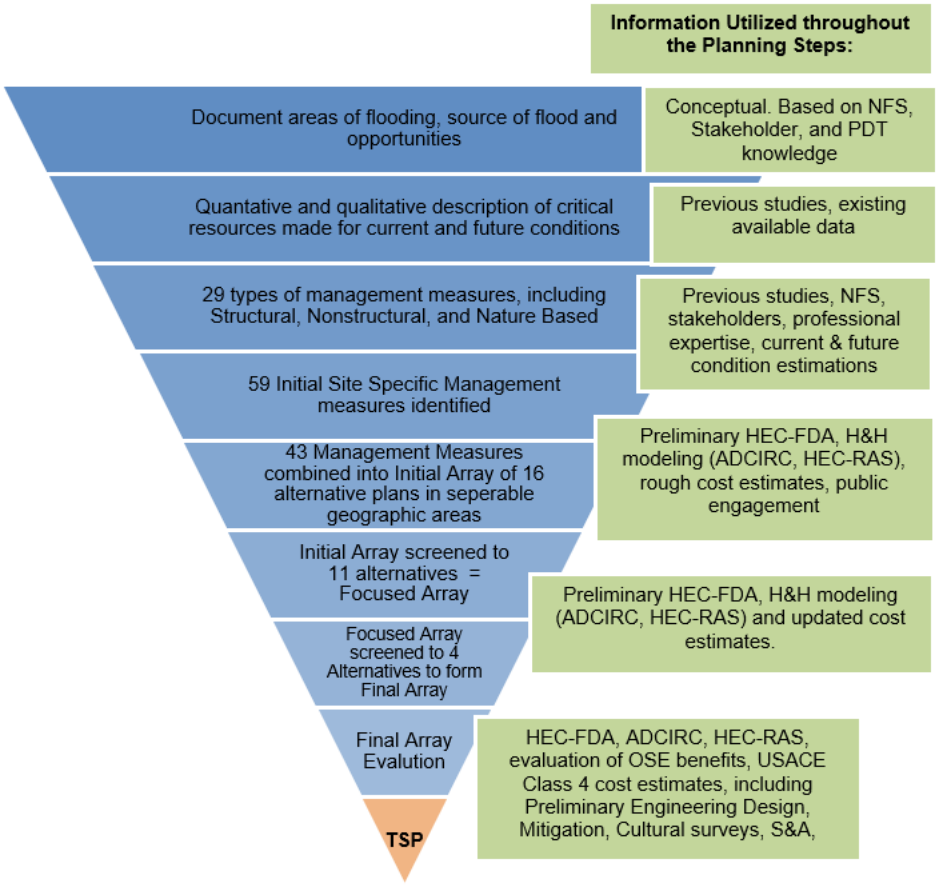


Figure 4-1. Summary of Tangipahoa Parish, Louisiana Feasibility Study Plan Formulation Process

4.4 NONSTRUCTURAL PLAN DEVELOPMENT AND EVALUATION

As described in the previous subsections, all structural alternatives were eliminated from further consideration, leaving only nonstructural alternatives for reducing flood risk across the study area. The PDT reconsidered the single nonstructural plan in the focused array and developed additional nonstructural alternatives for evaluation resulting in the Final Array of Alternatives, which also includes the No Action Plan. For more detail on nonstructural plan development, see Appendix G: Economic and Social Consideration.

An inventory of residential and nonresidential structures was developed using the NSI 2022 data for the study area. Section 3.4.1 describes the NSI and the study area boundary. Table 4-7 shows the total number of structures in the inventory by category which were within the MLFY 2083 H&H model extents as developed by the HEC-RAS model. There are approximately 50,000 total structures in the Parish, however only 4,631 are located within

the largest inundation extent produced by HEC-RAS, the 0.2% AEP event. As a result, only those structures which lie within the largest inundation extent were included in modeling.

Table 4-7: Number of Structures by Category

Residential	Commercial	Industrial	Public	Total Structures
4,381	179	48	23	4,631

4.4.1 Nonstructural Aggregation

Benefits from nonstructural measures were estimated using procedures similar to those used in calculating benefits from structural measures (Sec 219 of WRDA 1999). All nonstructural plans employed the USACE "logical aggregation method" which groups structures by similar flood risk and other characteristics. These structure groups become the unit of analysis, and each group is treated as a separable element that must be incrementally justified.

The study area was initially divided into 100 reaches based on common flood sources, geographic proximity, and other characteristics. Five reaches were removed from non-structural action consideration as they were outside of the study area. Those areas were kept in the modelling to show the residual risk in those areas. Figure 4-2 below shows the original 95 structure groups.

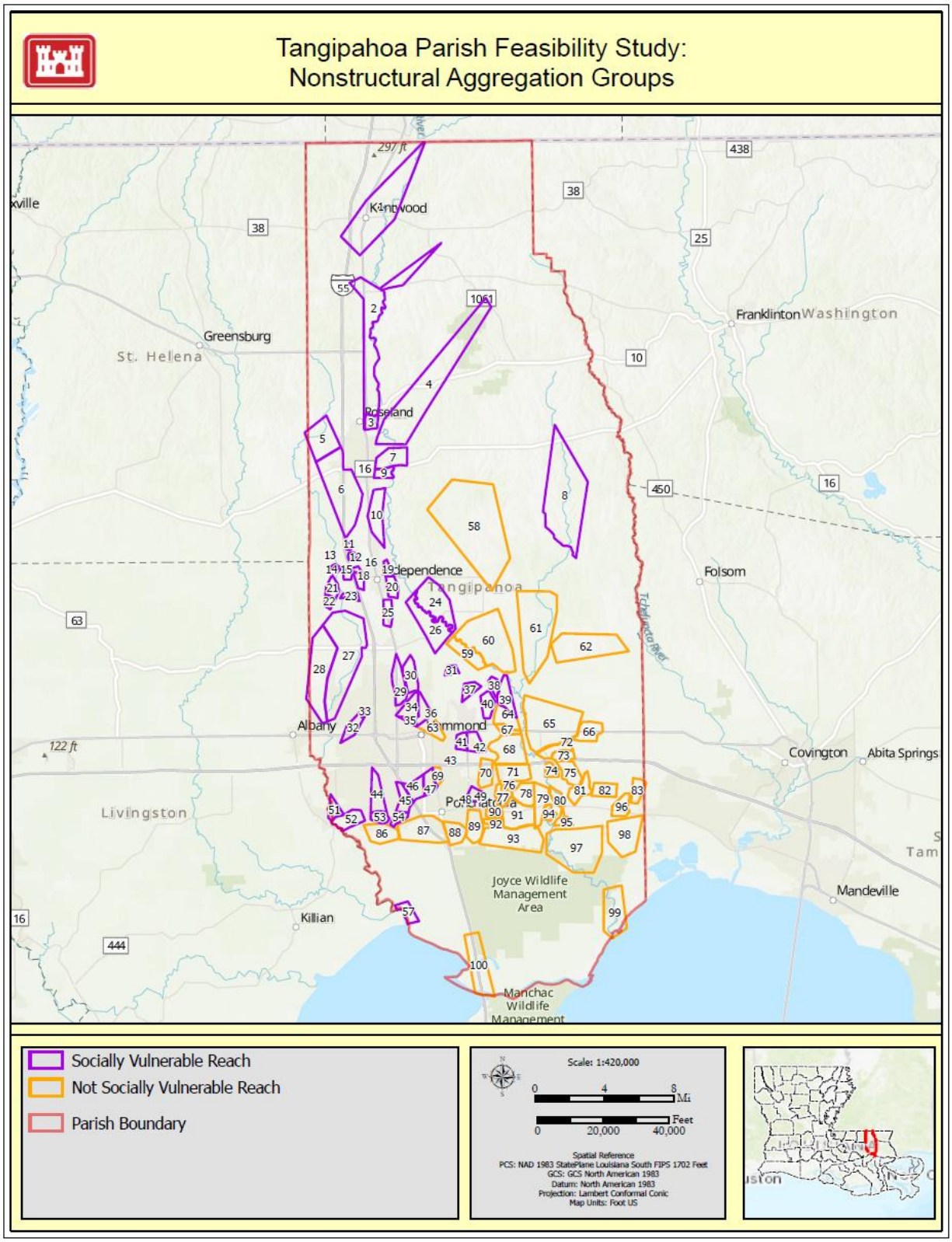


Figure 4-2: Nonstructural Aggregation Areas/Reaches

Upon further evaluation it was determined that some of the groups were delineated too finely. As a result, the PDT reevaluated the reaches by combining based on community cohesion while still maintaining an emphasis on keeping hydrologically dissimilar areas separate. This resulted in 62 groups to be incrementally analyzed. The new aggregation groupings are shown below in Figure 4-3.

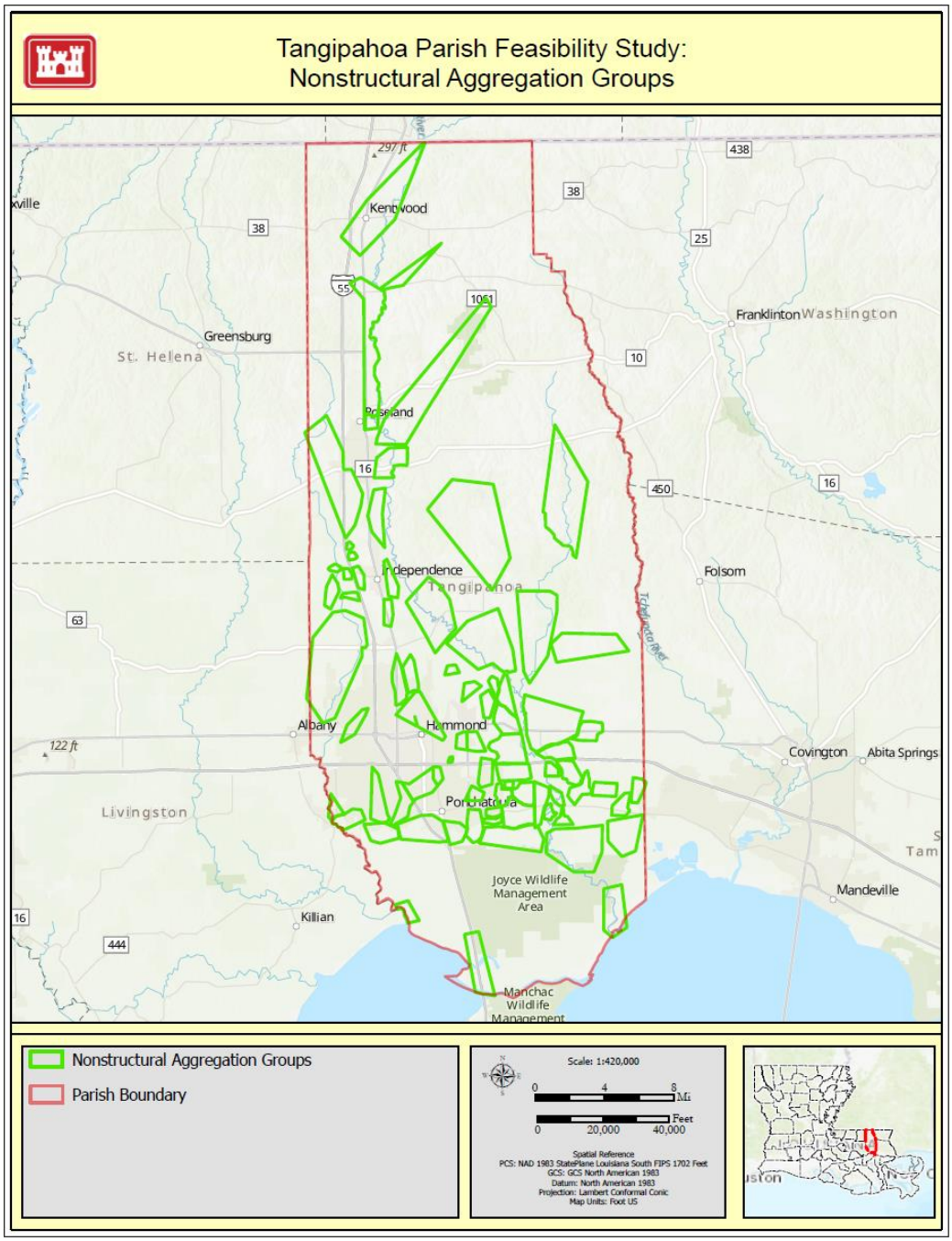


Figure 4-3. Refined Nonstructural Aggregation Areas

4.4.2 Nonstructural Plan Formulation

The categories of potential types of nonstructural management measures described in Section 4.1.2 were evaluated to assist in identifying a broad range of plans that address the planning objectives while avoiding constraints. For evaluation purposes, the nonphysical measures, which consist of flood warning systems/evacuation plans were screened in the evaluation since there are no economic benefits that can be derived, but these measures are intended to incrementally reduce risk at low cost.

The following nonstructural measures and criteria were evaluated:

- **Elevation of Residential Structures**: Elevation of a structure is the action of constructing the habitable space of a structure above the BFE to reduce damages associated with flooding to a maximum of 13 feet above ground surface elevation. Structures are elevated to, 1% AEP BFE + 2 feet (2083) to a maximum of 13 feet above ground level.

- **Dry Floodproofing of Non-residential Structures**: For non-residential structures, dry floodproofing would be applicable for structures that receive flood depths not greater than 3 feet above the adjacent ground surface elevation. Dry floodproofing methods would be applied to a height of 3 feet.

  Wet floodproofing of Non-residential Structures: For non-residential structures, wet floodproofing would involve retrofitting/modifying a structure to allow floodwaters to enter in such a way that damage to the structure and its contents is minimized. This method is used when it is generally appropriate if a structure has available space where damageable items can be stored temporarily. Wet floodproofing is considered more applicable for specific structures based on water surface elevations, i.e. greater than 3 feet above ground surface elevation.

A structure elevation height sensitivity analysis was completed on varying elevations, including BFE, BFE + 1 foot, and BFE + 2 feet to determine which height maximized net NED benefits. It was determined that BFE + 2 feet produced the greatest net NED benefits. In the next planning stage, which is feasibility level design, further analysis will be completed on the NSI (structure inventory) to refine the structure types data within the Parish, which will better determine the nonstructural measure selection by structure type. Further analysis will also be conducted on structure elevation heights using the projected 2083 1% AEP stage, as compared to the 2033 1% AEP stage. Modular homes were included in the assessment.

4.4.3 Nonstructural Plan Evaluation and Screening

The acquisition of structures was not carried forward to the final array because the cost of the alternative exceeded the damages reduced (benefits). Recreational and environmental restoration benefits as a result of the reuse of the floodplain in targeted areas were evaluated qualitatively and it was determined that there would be minimal benefits. Logical groupings of structures prevented singular structure buyouts, however, this resulted in the

buyout of several additional parcels that would not otherwise be necessary for acquisition for flood risk reduction, which does not meet planning objectives. Other nonstructural measures were determined to be both viable and more cost-effective than acquisition of structures which increased costs. It was determined that there are no opportunities identified for beneficial reuse of the floodplain. See Appendix E Plan Formulation, Section 2.5 for detail on the methods of nonstructural plans developed to evaluate the acquisition and relocation of structures in the Parish.

For evaluation purposes, the cost of elevating and floodproofing structures was used to determine the cost of the nonstructural plans since the study area is most often receiving damages from widespread, low-level flooding. Elevation and floodproofing were determined to be more cost effective for this type of flooding compared to other nonstructural measures such as acquisitions or relocations when assessing a structure group.

As previously described, nonstructural plans were initially developed by formulating the plan that maximizes economic benefits. This plan is identified as the NED plan, Plan 1. Following the identification of the NED plan, the team considered potential additional benefits in the OSE account and developed three additional alternatives to capture some of those benefits. These benefits were in areas of community risk factors, health and safety, economic vitality, and social connectedness. In addition to those factors, the effects on critical and civic infrastructure at risk from flooding within the Parish was included in plan formulation. Flood impacts to infrastructure buildings result in disruptions and damages beyond just structure and content damages, thus mitigating those effects provides benefit beyond the NED account. The team examined every community experiencing flood hazards and incorporated the needs and considerations of these communities to determine if a community had characteristics which result in the amplification of impacts as a result of a flood. These plans were formulated using these OSE factors by incrementally expanding from the NED plan (Plan 1). The overall factors provided a solid plan formulation based on a community's ability to respond to and cope with a hazardous event, i.e. flooding. Community risk factors consider the socioeconomic, household, and housing/transportation characteristics within the study area to gain a better understanding of possible consequence enhancing attributes.

Using the refined aggregations of 62 groupings the team developed alternatives using considerations of similar flood risk and OSE effects. Three additional alternatives were incrementally developed as shown in Figure 4-4. Beginning at the top of the figure each of the plans build from the previous plan. At the top of the figure is the NED plan (Plan 1), which is the base of all alternatives. Proceeding down the figure, each plan includes the same structures as the previous plan and is incrementally expanded based on the criteria included in the same colored boxes.

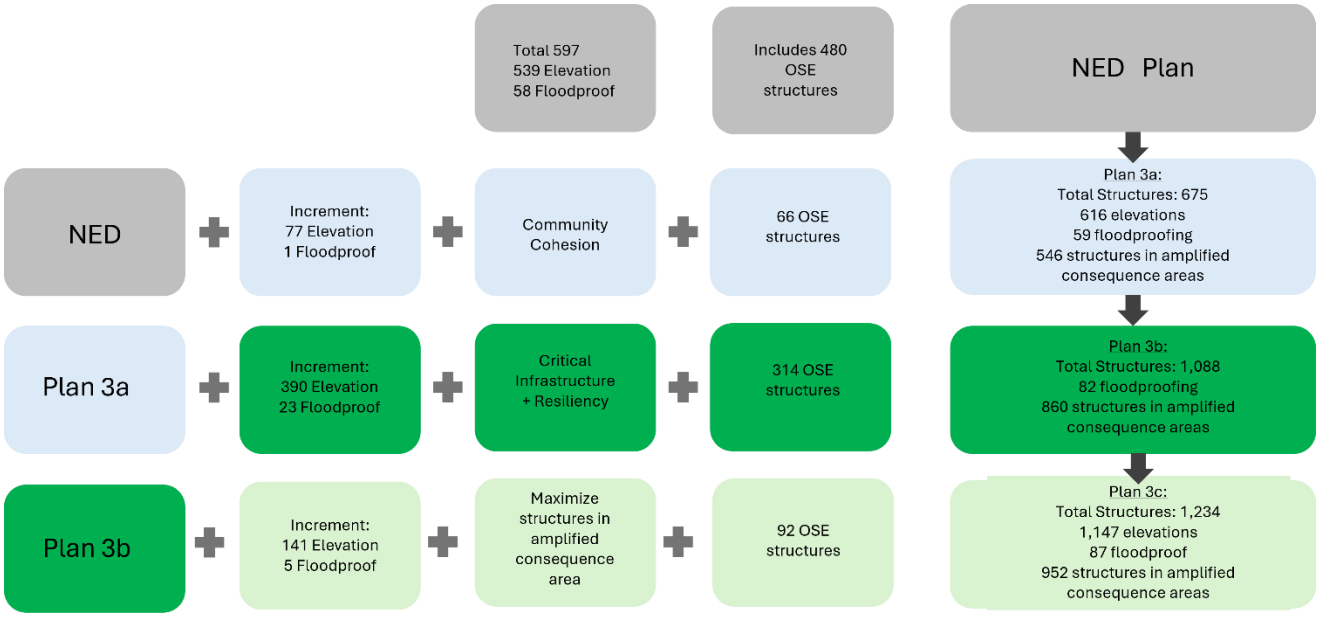


Figure 4-4. Incremental Nonstructural Plan Development

4.5 FINAL ARRAY OF ALTERNATIVES

Four nonstructural plans were carried forward to the final array; they include elevating residential structures and floodproofing non-residential structures utilizing the projected 2033 1% AEP stage. Floodproofing of eligible non-residential structures includes both dry and wet floodproofing methods in the plans below. During feasibility-level design, the PDT will reevaluate the proposed nonstructural measures using the projected 2083 1% AEP stage. Figure 4-5 through 4-8 below shows the Final Array of Alternatives. Appendix E contains additional mapping of alternatives.

Plan 0: No Action Plan

The “No Action” Alternative is developed using existing conditions and forecasting data used to define the future without-project (FWOP) condition. The future without-project condition is the default baseline to which all other alternatives are compared. The without-project condition is the same as the NEPA “no action” condition and it assumes that no action would be taken to address the problem.

Plan 1: Nonstructural NED Plan Identification

Eligibility for nonstructural measures in Plan 1 relied on the optimization of the benefits by floodplain for the aggregations in Figure 4.3. For each reach, the floodplain aggregation that received the highest net NED benefits, when compared to the annualized cost, was selected for inclusion in the plan. Table 4-8 displays the number of structures included in the plan. Plan 1 consists of the floodproofing or elevation of 597 structures. Of the total aggregation

areas, 27 areas were optimized at the 0.1% AEP floodplain, 3 areas were optimized at the 0.04% AEP floodplain, and 2 areas were optimized at the 0.02% AEP floodplain.

Plan 3a: NED + Increment 1: 10% AEP Flood Frequency Comprehensive Increment

Plan 3a includes the same structures as the NED Plan but was incrementally expanded to be inclusive of structures in areas which may not maximize or even have positive net NED benefits but nonetheless experience similar or greater levels of flooding at the 10% AEP when compared to the NED plan. Each incremental group was evaluated based on flood hazard depth and frequency and community risk factors related to community cohesion, and incremental net NED benefits. As such, each incremental structure included experiences frequent flood hazards which are enough to disrupt the day-to-day life of the people living and working in these structures. This plan would provide a meaningful benefit to eligible community members in areas with community risk factors via decreased recovery time and their related expenditures, as well as increased safety, and decreased flood insurance premiums from hazard mitigation. Plan 3a includes floodproofing or elevating 675 structures.

Plans 3b: NED + Increment 2: 4% AEP Flood Frequency Comprehensive Increment

Plan 3b is the total net benefits plan. Plan 3b includes the same structures as the Plan 3a but was incrementally expanded to be inclusive of structures in areas which may not maximize or even have positive net NED benefits but nonetheless experience similar or greater levels of flooding at the 4% AEP than those in the NED plan. In some cases, Plan 3b included structures in the 2% AEP event where there were compelling comprehensive benefits reasons to do so. Similarly, structures were included at the 10% AEP floodplain where there were not comprehensive benefits reasons to be included. Each added group was evaluated based on flood hazard depth and frequency and community risk factors related to those included in Plan 3a with additional inclusion of critical infrastructure and community resiliency. A balance between incremental net benefits, flood hazard and frequency, as well as community cohesion was sought while still ensuring that critical infrastructure was included. Plan 3b would include elevating 1,006 residential structures and floodproofing 82 nonresidential structures, totaling 1,088 structures.

Plan 3c: NED + Increment 3: 2% AEP Flood Frequency Comprehensive Increment

Plan 3c continues to build upon the previous increments. All of the previous benefits are still present and the extra benefits beyond the previous increment are focused on increasing other social effects benefits and a wider floodplain. Plan 3c is the most inclusive plan, allowing for more aggregation areas to have a level of inclusion at the 2% AEP floodplain than any of the previous plans while still being constrained by total comprehensive benefits and similar or greater levels of flooding as the NED Plan. This includes areas at the 2% AEP which had at minimum similar depths of flooding to comparable NED justified areas at the 2% AEP. This plan was determined to have the highest benefits in the OSE category given that it provides the most benefits for communities which are more susceptible to flood hazards and improves community resiliency and cohesion compared to the previous plans. However, it has the lowest net NED benefits of the four plans in the final array while still providing more NED

benefits than costs. Plan 3c would include elevating 1,147 residential structures and floodproofing 87 nonresidential structures.

Table 4-8. Structures Eligible for Nonstructural Measures by Plan

Plans in Final Array	Elevate	Floodproof	Total Structures
Plan 1 (NED)	539	58	597
Plan 3a	616	59	675
Plan 3b	1006	82	1088
Plan 3c	1147	87	1234

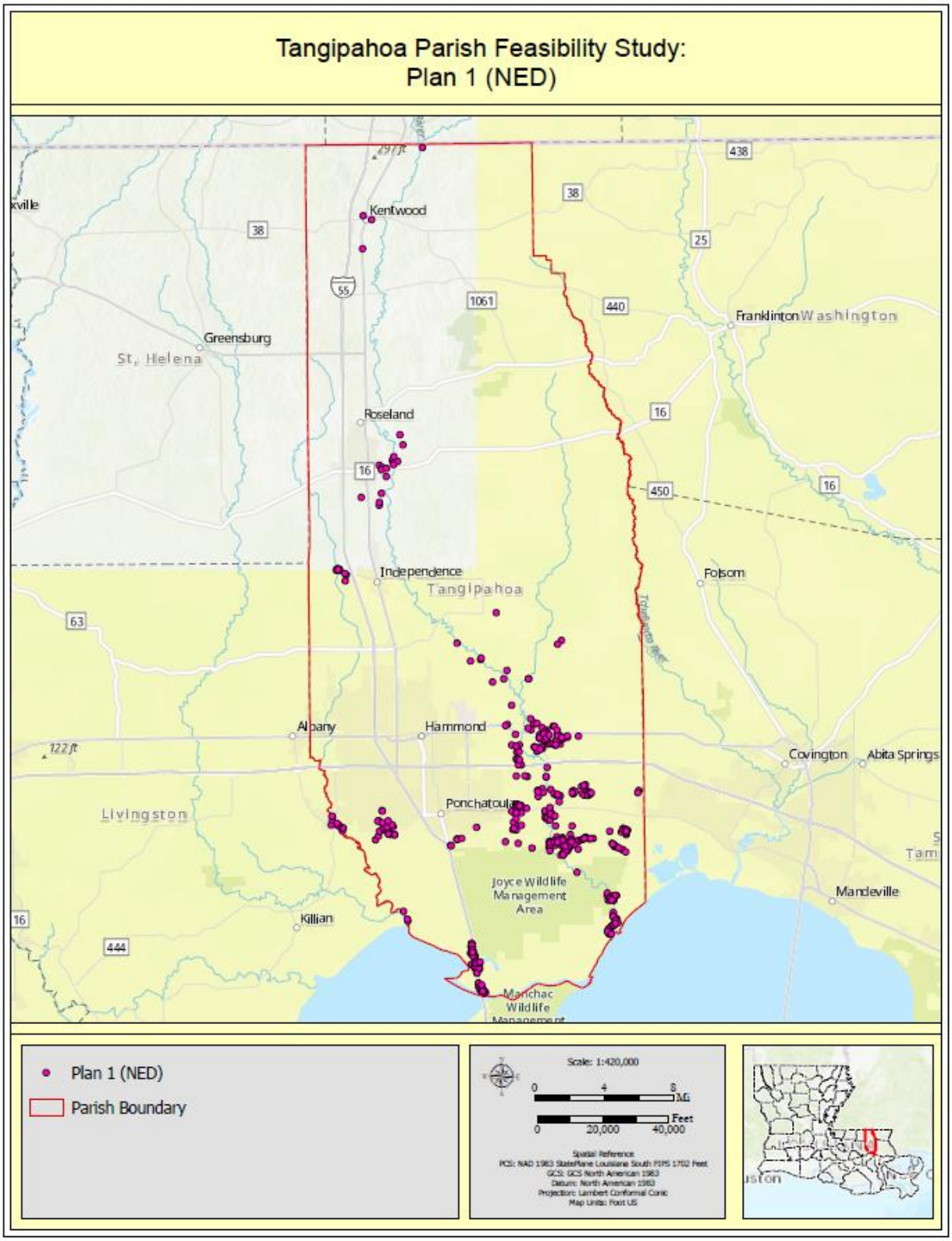


Figure 4-5. Nonstructural NED Plan (Plan 1)

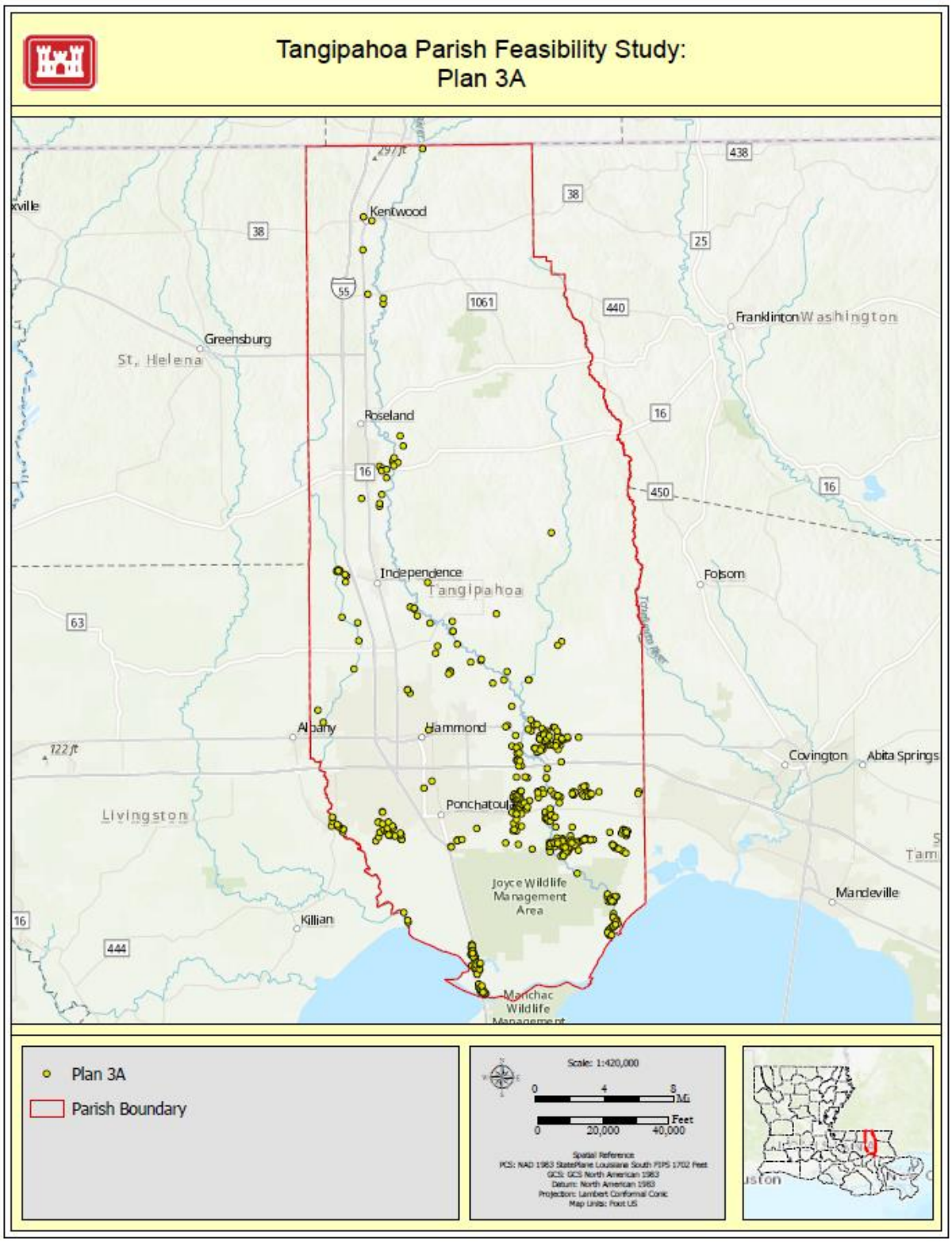


Figure 4-6. Nonstructural Plan 3a

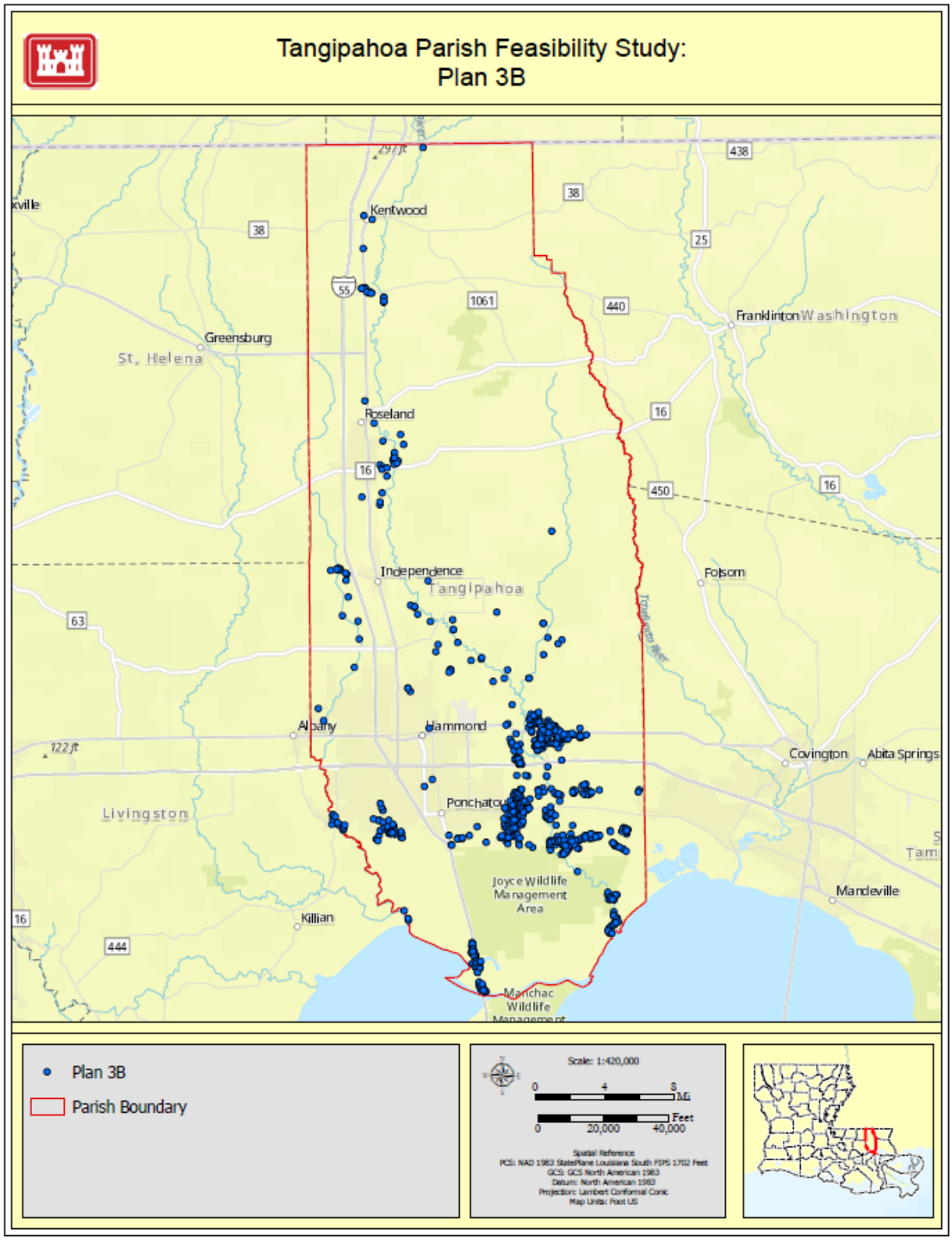


Figure 4-7. Nonstructural Plan 3b

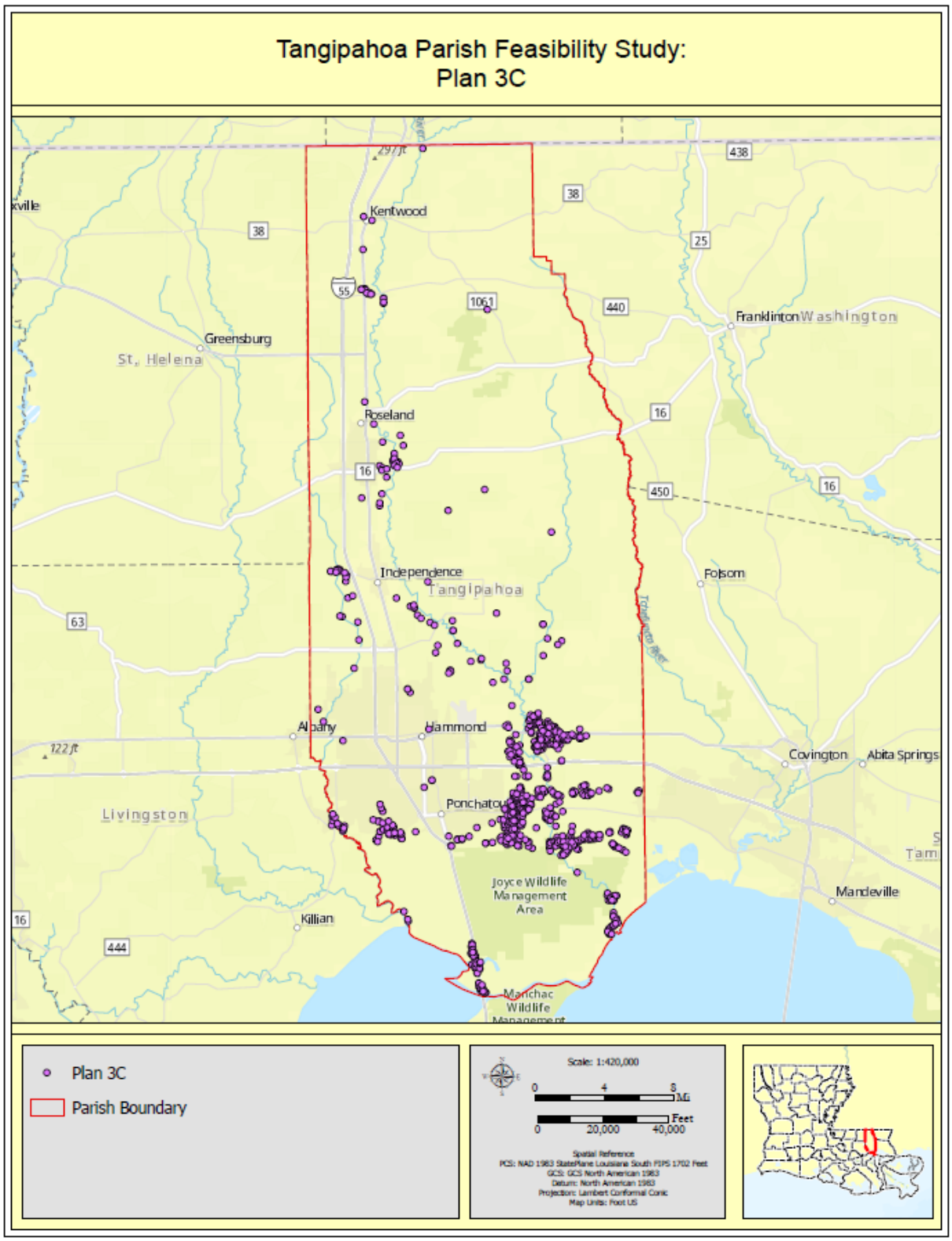


Figure 4-8. Nonstructural Plan 3c

SECTION 5
Environmental Effects and Consequences

5.1 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

In accordance with NEPA, this section includes the scientific and analytic basis for comparison of the considered alternatives identified in Section 4 – Formulation of Alternatives. The discussion includes the alternatives' impacts on those resources identified in Section 3, Inventory and Forecast Conditions, including direct, indirect, and cumulative effects; the relationship between short-term uses and long-term productivity; and any irreversible or irretrievable commitments of resources involved should one of the alternatives be implemented.

The extent and significance of environmental impacts to the TSP include risk and uncertainty that will be further considered during feasibility-level design and analysis. Risk and uncertainties on the TSP's impacts for wetland resources (Section 5.3.1.9), Cultural and Historic Resources (Section 5.3.1.9), and Socioeconomics (Section 5.3.1.13) are addressed in the DIFR/EA. More details on risks managed during the feasibility study can be found in Appendix C, E, and H.

5.2 CUMULATIVE EFFECTS ANALYSIS

The Council on Environmental Quality (CEQ) Regulations define cumulative impacts as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." (40 CFR §1508.7).

Cumulative effects are not caused by a single project but include the effects of a particular project in conjunction with other projects (past, present and future) on the particular resource. Cumulative effects are studied to enable the public, decisionmakers, and project proponents to consider the "big picture" effects of a given project on the community and the environment. The role of the analyst is to narrow the focus of the cumulative effects analysis to important issues of national, regional, and local significance (CEQ, 1997).

The CEQ issued a manual entitled "Cumulative Effects under the National Environmental Policy Act" (CEQ, 1997). This manual presents an 11-step procedure for addressing cumulative impact analysis. The cumulative effects analysis concentrates on whether the actions proposed for this study, combined with the impacts of other projects, would result in a significant cumulative impact, and if so, whether this study's contribution to this impact would be cumulatively considerable.

5.3 SUMMARY OF ENVIRONMENTAL CONSEQUENCES BY EACH ALTERNATIVE

This chapter describes the environmental consequences associated with implementing the final array of alternatives described in Section 4.

5.3.1 Relevant Resources Affected

This section describes the direct, indirect, and cumulative effects of the No Action Alternative, the Nonstructural NED Plan, and the comprehensive nonstructural plans. All nonstructural plans assessed here include house elevations, dry floodproofing, and wet floodproofing as potential measures. Initially, a wide selection of resources was considered, and several were determined not to be affected by the project. This was due to the remote and uninhabited nature of the project area and general lack of significant populated areas in the vicinity. Land use, wetlands, bottomland hardwoods, uplands, aquatic resources/fisheries, prime and unique farmland, and essential fish habitat would not be affected by the proposed project since proposed measures in the nonstructural plans would be limited to the immediate area of included structures. Table 5-1 provides a list of resources in the project area and anticipated impact(s) from implementation of the proposed action.

Table 5-1: Relevant Resources in the Study Area and Anticipated Impacts of the Proposed Action.

Relevant Resource	No Action Alternative	Nonstructural TSP
Wetland Resources	Negative impact	Not impacted
Upland Resources	Not impacted	Not impacted
Aquatic Resources/Fisheries	Not impacted	Not impacted
Wildlife	Not impacted	Minor, temporary negative impact
Threatened, Endangered, and Protected Species	Not impacted	Not impacted
Geology, Soils, and Prime and Unique Farmland	Not impacted	Not impacted
Water Quality	Not impacted	Minor, positive impact
Air Quality	Not impacted	Minor, temporary negative impact
Cultural	Not impacted	Potential for both positive indirect impacts and negative effects. Positive indirect impacts towards preserving at-risk unique architectural and design characteristics that the communities and historic districts in the floodplain strive to maintain and enhance for Nonstructural TSP. Also under NHPA, potential for adverse effects during elevation process or if elevated historic structures do not meet standards for

Relevant Resource	No Action Alternative	Nonstructural TSP
		treatment of historic properties.
Recreation	Not impacted	Potential positive indirect impacts with ensuring the tax base is unaffected to promote use of local recreation facilities
Aesthetics	Not impacted	Potential for minimal positive impact on providing a consistent approach to nonstructural elevations.
Socioeconomic Resources	Potential for adverse impact for no action as some residents may not be able to recover from future flood damage and need to move out of their community	Potential positive nonstructural resources by maintaining community cohesion and including commercial properties.
Community Risk Factors	Continue adverse impact on communities which are more susceptible to flood hazards for no action	Permanent, positive impact for reduced flood risk for included structures.
HTRW	Not impacted	Not impacted

5.3.1.1 Wildlife

Plan 0: No Action Alternative

Direct, indirect, and cumulative impacts

Without implementation of the proposed action (TSP), habitat loss would likely continue at the present rate, resulting in a reduction of habitat diversity and availability for resident terrestrial wildlife.

Plan 1: Nonstructural NED Plan

Direct, indirect, and cumulative impacts

Elevating structures in the floodplain could potentially provide shelter to wildlife species from predators; however, given the limited number of structures elevated, this impact would be low to negligible in extent. Physical disturbance would be limited primarily to the developed area immediately around the structure so impacts to potential habitat would be limited in extent, and would generally be associated with more disturbance tolerant species associated with constructed human landscapes. There could be a temporary, minor indirect disturbance in the vicinity of structures during the elevation of houses or floodproofing of commercial structures. Once nonstructural measures are installed in an area, conditions would be expected to return to pre-project conditions quickly and then follow the habitat change rate that would occur under the No Action alternative. Due to the duration of the anticipated noise disturbance, the impact would be low to negligible in extent.

Plan 3a: Nonstructural Increment 1

Direct, indirect, and cumulative impacts

Implementation of the proposed plan is anticipated to take place over a ten-year period which reduces the extent for potential impacts within a given year and allows for reestablishment of vegetation and wildlife recolonization if temporarily displaced. Physical disturbance would be limited primarily to the developed area immediately around the structure so impacts to potential habitat would be limited in extent and would generally be associated with more disturbance--tolerant species associated with constructed human landscapes. These species would be expected to recover quickly after a structure is raised or floodproofing is completed. Therefore, the overall impact is expected to be similar to Plan 3a, but still anticipated to be low.

Plan 3b: Nonstructural Increment 2

Direct, indirect, and cumulative impacts

Implementation of the proposed plan is anticipated to take place over a ten-year period which reduces the extent for potential impacts within a given year and allows for reestablishment of vegetation and wildlife recolonization if temporarily displaced. Physical disturbance would be limited primarily to the developed area immediately around the structure so impacts to potential habitat would be limited in extent and would generally be associated with more disturbance tolerant species associated with constructed human landscapes. These species would be expected to recover quickly after a structure is raised or floodproofing is completed. Therefore, the overall impact is expected to be similar to Plan 3a, but still anticipated to be low.

Plan 3c: Nonstructural Increment 3

Direct, indirect, and cumulative impacts

Implementation of the proposed plan is anticipated to take place over a ten-year period which reduces the extent for potential impacts within a given year and allows for reestablishment of vegetation and wildlife recolonization if temporarily displaced. Physical disturbance would be limited primarily to the developed area immediately around the structure so impacts to potential habitat would be limited in extent and would generally be associated with more disturbance tolerant species associated with constructed human landscapes. These species would be expected to recover quickly after structure is raised or floodproofing is completed. Therefore, the overall impact is expected to be similar to Plan 3a, but still anticipated to be low.

5.3.1.2 Threatened, Endangered and Protected Species

Table 5-2. Potential T&E Species

Scientific Name	Common Name and Status (T, E, or P)	Listing	Found in Study Area	Determination of Effects
Myotis septentrionalis	Northern Long-eared Bat (E)	Federal	No	No effect
West Indian Manatee	Trichechus manatus (T)	Federal	Yes	No effect
Picoides borealis	Red-cockaded Woodpecker (E)	Federal	Yes	No effect
Gopherus polyphemus	Gopher Tortoise (T)	Federal	Yes	No effect
Graptemys oculifera	Ringed Map Turtle (T)	Federal	No	No effect
Graptemys pearlensis	Pearl River Map Turtle	Federal	Yes	No effect
Acipenser oxyrinchus desotoi	Gulf Sturgeon (T)	Federal	Yes	No effect
Isoetes louisianensis	Louisiana Quillwort (E)	Federal	No	No effect
Haliaeetus leucocephalus	Bald Eagle (P)	State	Yes	Not Likely to Adversely Affect

Plan 0: No Action Alternative

Direct, indirect, and cumulative impacts

With the No Action alternative, no direct impacts to endangered species or their critical habitat would occur. Existing conditions would persist and listed threatened, endangered, or protected species would likely continue to be subject to institutional recognition and further regulations and federal management. Other listed species could also be adversely impacted by the continued habitat loss and degradation.

Plan 1: Nonstructural NED Plan

Direct, indirect, and cumulative impacts

Actions would be limited to the immediate area around existing structures and would not be expected to result in more than negligible impacts to threatened, endangered, and protected species or their critical habitats.

There could be a temporary, minor indirect disturbance in the vicinity of structures during the elevation of houses or floodproofing of commercial structures. Once nonstructural measures are installed in an area, conditions would be expected to return to pre-project conditions quickly and then follow the noise levels that would occur under the No Action alternative. Due to the duration of the anticipated noise disturbance, the indirect impact would be low to

negligible in extent for threatened, endangered, and protected species.

Red-cockaded Woodpecker utilize open, mature old-growth pine ecosystems with numerous potential roosting trees that have a 200-foot-wide buffer of continuous forest and foraging habitat that occurs in pine or pine-hardwood stands within one-half mile. Impacts to trees could occur during installation of nonstructural features if the existing tree canopy would prevent installation, but such impacts would only occur if necessary. Due to the Red-cockaded Woodpecker's life history and habitat requirements relative to potential trees impacted, this alternative would have no effect on the species.

Gopher tortoises utilize open pine habitats with sandy soils. With the loss of its preferred habitats, the gopher tortoise has utilized marginalized habitats such as pipeline and powerline rights-of-way, fence rows, old fields, and pasturelands. Since all project features would be limited to existing structures, there would be no effect for gopher tortoise as part of the Nonstructural NED Plan.

Northern long-eared bats utilize mixed pine-hardwood forests with intermittent streams for foraging but have not been document in Tangipahoa Parish to date. As a result, this alternative would have no effect on the species.

Bald eagles generally utilize large diameter, mature trees in areas with lower population densities away from development. Potential trees that could be affected by construction of nonstructural measures would be limited to the immediate area around included structures. Due to the close proximity to inhabited homes, no direct impacts to the Bald Eagle are anticipated.

No impacts to aquatic habitats are anticipated as a result of this alternative. Therefore, there would be no effect for West Indian manatee, ringed map turtle, Pearl River map turtle, gulf sturgeon, and Louisiana quillwort.

Coordination will continue with the USFWS Ecological Services Office throughout feasibility level design to avoid or minimize impacts to fish and wildlife resources.

Plan 3a: Nonstructural Increment 1

Direct, indirect, and cumulative impacts

The direct, indirect, and cumulative impacts to threatened, endangered, and protected species for the considered action would be proportionally similar to the impacts specified for Plan 1 described above.

Plan 3b: Nonstructural Increment 2

Direct, indirect, and cumulative impacts

The direct, indirect, and cumulative impacts to threatened, endangered, and protected species for the considered action would be proportionally similar to the impacts specified for Plan 1 described above.

Plan 3c: Nonstructural Increment 3

Direct, indirect, and cumulative impacts

The direct, indirect, and cumulative impacts to threatened, endangered, and protected species for the considered action would be proportionally similar to the impacts specified for Plan 1 described above.

5.3.1.3 Geology, Soils and Water Bottoms, and Prime Farmland

Plan 0: No Action Alternative

Direct, indirect, and cumulative impacts

This alternative would not have an effect on prime farmland. Soils and water bottoms could continue to experience both anthropogenic and natural impacts within the study area, including the sand and gravel operations, timber removal, and erosional forces that alter the river channel.

Cumulatively, the soils and water bottoms would continue to experience periodic shifts during rainfall events.

Plan 1: Nonstructural NED Plan

Direct, indirect, and cumulative impacts

Structures elevated or purchased in the floodplain could contain but not affect prime farmland and soils since potential action would be limited to the already developed structure area. Soils and water bottoms would be expected to follow the same trends as the no action alternative.

Plan 3a: Nonstructural Increment 1

Direct, indirect, and cumulative impacts

The direct, indirect, and cumulative impacts to geology, soils and water bottoms, and prime farmland for the considered action would be proportionally similar to the impacts specified for Plan 1 described above.

Plan 3b: Nonstructural Increment 2

Direct, indirect, and cumulative impacts

The direct, indirect, and cumulative impacts to geology, soils and water bottoms, and prime farmland for the considered action would be proportionally similar to the impacts specified for Plan 1 described above.

Plan 3c: Nonstructural Increment 3

Direct, indirect, and cumulative impacts

The direct, indirect, and cumulative impacts to geology, soils and water bottoms, and prime farmland for the considered action would be proportionally similar to the impacts specified for Plan 1 described above.

5.3.1.4 Water Quality

Plan 0: No Action Alternative

Direct, indirect, and cumulative impacts

Without implementation of the proposed action, no direct impacts to water quality would occur. There would be an increased risk of damages resulting from flooding of structures within the study area, with drainage of floodwaters containing sediment, nutrients, organics, and structure or equipment debris and associated chemicals into waterbodies of the study area. In the future, increased development and environmental changes may exacerbate water quality issues in the study area.

Plan 1: Nonstructural NED Plan

Direct, indirect, and cumulative impacts

Indirect impacts would include continuation of existing water quality trends. This plan would reduce the risk of damages resulting from flooding of structures within the study area, with drainage of floodwaters containing nutrients, organics, and structure and equipment debris or associated chemicals into waterbodies of the study area. Future conditions may be affected by development (e.g., residential and commercial), which may impact runoff volume, rate, and contaminant dispersal.

Construction impacts to runoff would be minimized through implementation of a Stormwater Pollution Prevention Plan (SWPPP). Any structure modification would adhere to applicable regulations pertaining to surface water quality, such as Louisiana Permitted Discharge Elimination System (LPDES) permitting. Elevating and floodproofing structures, as well as protecting commercial structures with localized storm surge risk reduction measures, would prevent them from being flooded, which would reduce water quality impacts associated with flooding events which exist under the FWOP conditions. Any structures not raised face the risk of flooding and are capable of releasing contaminants associated with structure and housed materials.

Plan 3a: Nonstructural Increment 1

Direct, indirect, and cumulative impacts

The direct, indirect, and cumulative impacts to water quality for the considered action would be proportionally similar to the impacts specified for Plan 1 described above.

Plan 3b: Nonstructural Increment 2

Direct, indirect, and cumulative impacts

The direct, indirect, and cumulative impacts to water quality for the considered action would be proportionally similar to the impacts specified for Plan 1 described above. The reduction in water quality impacts is expected to be slightly greater under this plan due to the greater number of structures eligible in this plan.

Plan 3c: Nonstructural Increment 3

Direct, indirect, and cumulative impacts

The direct, indirect, and cumulative impacts to water quality for the considered action would be proportionally similar to the impacts specified for Plan 1 described above. The reduction in water quality impacts is expected to be slightly greater under this plan due to the greater number of structures eligible in this plan.

5.3.1.5 HTRW

Structural damages associated with flooding events and debris deposition would be expected to continue in the FWOP condition. Associated sedimentation and debris deposition in structure is forecasted to occur in the FWOP. Sediment being transported from within the watershed has the potential to be contaminated. This potential risk for deposition of contaminated sediment would remain the same between future without and future with as no measures proposed as part of the proposed plan would influence the sediment input throughout the watershed.

For each residential structure, the NFS would fund an American Society Testing Materials (ASTM) Phase 1 HTRW/asbestos investigation, inspections, surveys, and boundary monumentations following ASTM standard E1527-21. The land and the structure must be certified as “clean” by the appropriate State office before any project funds may be expended. All asbestos must be abated and disposed of properly. Asbestos discovered during floodproofing would be removed at Project cost, while HTRW discovered during floodproofing must be remediated by the property owner prior to the initiation of the floodproofing work.

Plan 0: No Action Alternative

Direct, indirect, and cumulative impacts

Without implementation of the proposed action, no direct impacts to HTRW would occur. The deposition of sediment and debris transported from the watershed would be anticipated to continue in structures affected by flooding. Sediment transported during flood events has the potential to be contaminated. Currently landowners are responsible for hazardous material handling and waste management in accordance with RCRA. Compliance with RCRA is unknown at this time for the entire project area. Properties not in compliance risk

the potential for release of HTRW materials in the stormwater and into adjacent wetlands and waterbodies as floodwaters recede.

Plan 1: Nonstructural NED Plan

Direct, indirect, and cumulative impacts

A Phase 1 HTRW assessment would be required for each structure subject to modification and acceptance into the project. Compliance with applicable hazardous waste management laws and regulations (e.g., RCRA, CERCLA) would be achieved prior to construction. If any substances regulated under these laws were discovered, the current landowners would be required to comply with all applicable requirements for their structure to be eligible. Since compliance with hazardous waste management laws and regulations is an eligibility criterion prior to construction, no impacts arising from any HTRW issues are anticipated with implementation of the project. Wet floodproofing activities would not increase the potential for HTRW impacts over the FWOP conditions. Wet floodproofing design criteria allows water exchange and flow rates the same as the existing conditions. Implementation of this plan may indirectly result in a minor benefit in the future with project if properties are remediated as a condition of eligibility.

Plan 3a: Nonstructural Increment 1

Direct, indirect, and cumulative impacts

The direct, indirect, and cumulative impacts to water quality for the considered action would be proportionally similar to the impacts specified for Plan 1 described above.

Plan 3b: Nonstructural Increment 2

Direct, indirect, and cumulative impacts

The direct, indirect, and cumulative impacts to water quality for the considered action would be proportionally similar to the impacts specified for Plan 1 described above. The reduction in water quality impacts is expected to be slightly greater under this plan due to the greater number of structures eligible in this plan.

Plan 3c: Nonstructural Increment 3

Direct, indirect, and cumulative impacts

The direct, indirect, and cumulative impacts to water quality for the considered action would be proportionally similar to the impacts specified for Plan 1 described above. The reduction in water quality impacts is expected to be slightly greater under this plan due to the greater number of structures eligible in this plan.

5.3.1.6 Air Quality

The parish is currently designated as being in attainment for all NAAQS All of the nonstructural plans would be expected to produce less emissions compared to the no action plan due to a

reduction in repeat flood repairs and displacement duration. A detailed description of the methodology used can be found in Appendix D

Table 5-3: Total emissions (metric tons) by project alternative.

Emission	CO_2	CH_4	N_2O	CO_2e	Net Total
Plan 0: No Action	16,759.9	0.7	0.1	16,820	
Plan 1: NED	5,262.3	0.2	0.0	5,276	-11,544
Plan 3a:	4097.1	0.2	0.0	4112	-12,708
Plan 3b:	1,886.9	0.1	0.0	1894	-14,926
Plan 3c:	753.7	0.0	0.0	756	-16,064

Plan 0: No Action Alternative

Direct, indirect, and cumulative impacts

Without implementation of the proposed action, no direct impacts to air quality would occur. Air quality would be anticipated to follow current trends.

Plan 1: Nonstructural NED Plan

Direct, indirect, and cumulative impacts

This alternative would have a negligible, temporary impacts on air quality. Temporary, minor impacts would be limited to equipment emissions associated with nonstructural measures and would return to prior conditions once structures are completed in an area. Overall, emissions in the study area related to flood-related activities (i.e. emissions associated with repairing damaged structures, evacuation, implementing nonstructural measures) would be expected to decrease compared to the no action alternative.

Plan 3a: Nonstructural Increment 1

Direct, indirect, and cumulative impacts

The direct, indirect, and cumulative impacts to air quality for the considered action would be proportionally similar to the impacts specified for Plan 1 described above.

Plan 3b: Nonstructural Increment 2

Direct, indirect, and cumulative impacts

The direct, indirect, and cumulative impacts to air quality for the considered action would be proportionally similar to the impacts specified for Plan 1 described above.

Plan 3c: Nonstructural Increment 3

Direct, indirect, and cumulative impacts

The direct, indirect, and cumulative impacts to air quality for the considered action would be proportionally similar to the impacts specified for Plan 1 described above.

5.3.1.7 Cultural and Historic Resources

Plan 0: No Action Alternative

Direct, indirect, and cumulative impacts

Impacts to cultural and historic resources within the study area have resulted from both natural processes, (e.g., flooding and erosion) and human activities (e.g., development, recreational use, and vandalism). Riverine environments are dynamic and impacts to cultural and historic resources would continue at the current trend because of natural processes and anthropogenic modifications to the landscape. The No Action Alternative would have no immediate impact on archaeological resources. Continuing longer term artificial and natural processes would likely continue to erode and deteriorate known archaeological resources, while exposing previously undocumented sites and/or artifacts. The No Action Alternative would also have no immediate impact on historic buildings, structures, and other infrastructure. However, the built environment would not remain static over time and would continue to evolve. Adverse impacts effects that are expected to occur to some built-environment resources include noncompatible modifications, deterioration due to neglect and abandonment, and damage from flooding or other natural disasters. Other historic buildings, structures, and infrastructure will likely be maintained and/or restored in manners consistent with the Secretary of the Interior's (SOI) Standards for the Treatment of Historic Properties (48 FR 44716-42; September 29, 1983). Further, the number of potentially NRHP-eligible built-environment properties will increase over time as resources continue to age and gather historical significance. No change would occur in the management condition of cultural and historic resources; Federal actions or undertakings would continue to be reviewed in accordance with Section 106 of the NHPA.

Plan 1: Nonstructural NED Plan

Direct, indirect, and cumulative impacts

Section 106 of the NHPA (54 U.S.C. § 306108) and its implementing regulations (36 CFR Part 800) requires an assessment of the potential impact of an undertaking on historic properties that are within the proposed project's area of potential effects (APE), which is defined as the geographic area(s) "within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist" (36 CFR 800.16(d)). The APE for cultural resources extends beyond the study area and is non-structural measures are applied to historic properties, and where structural or non-structural measures have the potential to affect the viewshed of historic properties. An effect is an alteration to the characteristics of a historic property qualifying it for inclusion in or eligibility for the NRHP (36 CFR 800.16(i)). Examples of effects include visual intrusions, alterations of setting, noise, vibrations, viewsheds, and physical impacts.

CEMVN has determined that the Non-Structural Program is a Federal Undertaking, as

defined by 54 U.S.C. § 300320 and 36 CFR § 800.16(y), consisting of one project with multiple construction items, subject to review under Section 106 of the NHPA, 54 U.S.C. § 306108, and its implementing regulations under 36 CFR § 800 (2004); and may result in multiple construction items, that may affect properties listed in or eligible for listing on the National Register of Historic Places (NRHP) pursuant to 36 CFR Part 60 (historic properties) and/or properties having religious and cultural significance to Federally-Recognized Tribes including sites that may contain human remains and/or associated cultural items**.**

Based on the results of CEMVN's feasibility-level analysis, there are presently no structures identified on Federal or Tribal lands eligible to participate in the Non-Structural Program**.** However because the scope and programmatic nature of the Non-Structural Program makes it unreasonable to fully identify historic properties or determine the effects of the Undertaking at the present time CEMVN has elected to negotiate a Programmatic Agreement (PA) in consultation with stakeholders, as provided for in 36 CFR § 800.14(b)(1)(ii), to govern the implementation of this Project and fulfill its obligations under Section 106 of the NHPA including the resolution of adverse effects for the Undertaking**.**

A review of Plan 1 indicates that the considered action includes ground disturbing activities (e.g., access, staging, foundation work and hardening, site cleanup, and other associated site work) within the project footprint that may affect archeological resources in a manner that may diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Plan 1 also has potential for direct impacts to historic built-environment resources (e.g., residential, commercial, and public structures). These structures may possess unique architectural and design characteristics that many property-owners strive to maintain and enhance. The considered action includes direct modifications (i.e., elevation, floodproofing, retrofit) to potential built-environment historic properties that may diminish the integrity of the property's design, materials, and/or workmanship, but also have potential to cause other types of direct effects to the integrity of the property's location, setting, feeling, or association. USACE anticipates that many potential direct adverse effects to archaeological resources can be avoided or minimized by confining Nonstructural work to substantially within the existing building/structure footprint through work restrictions designed to avoid impacts to archaeological resources developed in consultation with SHPO, Federally-Recognized Tribes, and other Consulting Parties that will be incorporated into the PA.

USACE also anticipates that many potential direct adverse effects to the built environment resources may be avoided or minimized through a "design review" process developed in consultation with SHPO, Federally-Recognized Tribes, and other Consulting Parties that will be included within the PA in which USACE will seek ways to revise the scope of the project to substantially conform to the SOI Standards, and/or avoid or minimize adverse effects for NRHP-listed or eligible historic properties and/or properties of religious or cultural significance to Federally-Recognized Tribes, or TCP(s). The Nonstructural treatment selected should whenever possible, utilize design principles and practices that retain or minimize changes to the building's historic features, integrity, and character. Should the proposal have a direct adverse effect on a NRHP-eligible cultural resource that cannot be

avoided or minimized, USACE would work toward a resolution of adverse effects with SHPO, Federally Recognized Tribes, and other Consulting Parties following the procedures negotiated in the PA. Any additional conditions or requirements would be documented at that time.

In addition to individual historic properties where Nonstructural measures are implemented, Plan 1 also has the potential for indirect impacts to known and undocumented built environment resources in the larger context of the surrounding viewshed that the building(s) occupy, or are adjacent to, through the successive introduction of new visual elements and/or modifications to the viewshed and overall visual landscape of known and previously undocumented (e.g., individual/contributing NRHP-eligible structures, local and NRHP-listed or eligible NRHDs), that may diminish the integrity of these property's location, setting, and feeling. The arrangement of structures within their community represents a distinct pattern of cultural development that should be valued and preserved. The type, scale, location, and pattern of historic properties define the overall character of a neighborhood. A Nonstructural design proposal for a single property, regardless of if the individual structure is historic or not, must also consider its relationship to historic properties within the neighborhood and/or historic district in which it is located. The treatment of an individual property's site features, design, materials, and/or workmanship can play a critical role in avoiding or minimizing the potentially disruptive indirect visual impacts that Nonstructural measures can have on a surrounding neighborhood, historic district, or other types of built-environment resources.

Although Plan 1 has the potential to indirectly impact multiple historic properties, one of the most significant outcomes of this effort would be to reduce risk to historic structures from future flood events so they maintain their character in relation to other historic buildings within each neighborhood or historic district, thus protecting the architectural qualities of each neighborhood or historic district as a whole. Therefore, Plan 1 may have positive indirect impacts towards preserving at-risk unique architectural and design characteristics that the communities and historic districts in the floodplain strive to maintain and enhance.

USACE anticipates that many of the potential indirect adverse effects to built-environment resources will be localized and could be avoided or minimized through the design review process that will be included within the PA. The Nonstructural measures represent a framework in which a range of potential flood risk reduction actions are required to be considered, each with a unique range of planning considerations and constraints, including neighborhood context. Where possible, by integrating both traditional and innovative Nonstructural design approaches it is still possible to reinforce a historic building's physical relationship to its site, neighboring buildings, the street on which it is located, as well as the neighborhood or historic district it may be located within or adjacent to, in a sensitive manner to produce the best individualized approach for a given historic building, neighborhood, and/or historic district. These approaches can reduce the damaging visual effects of altering historic properties in a manner that maintains or complements their individual character and setting. Appropriate techniques to avoid or minimize potential indirect negative visual effects could include considering ways to revise the scope of the project to substantially conform to the SOI Standards; limiting elevation heights; shifting specific project elements away from the historic property to lessen the adverse effect (e.g., buffering); aesthetic camouflaging

treatments; and/or use of sympathetic infill panels and landscaping features to visually shield project elements from historic properties within the surrounding viewshed. Potential adverse impacts to NRHP-eligible historic buildings, structures, NRHD(s), or other built environment resources that cannot be avoided or minimized would be mitigated as appropriate following the procedures negotiated in the PA in consultation with SHPO, Federally-Recognized Tribes, and other Consulting Parties, as appropriate. Any additional conditions or requirements would be documented at that time.

Cumulative impacts to cultural resources would be the additive combination of the direct and indirect impacts of Plan 1 and other Federal, state, local, and private, flood risk projects existing and/or authorized for construction withing Tangipahoa Parish. Activities associated with this alternate action have the potential to directly and/or indirectly effect existing and previously undocumented cultural resources within the project footprints, surrounding viewsheds, and communities they occur in.

Potential negative impacts of Plan 1 may include direct, indirect, and cumulative effects to properties included in or eligible for inclusion in the NRHP and cultural resources significant at the state, local, and national level and/or of significance to Federally-Recognized Tribes that may be listed or eligible for the NRHP, including archaeological sites, historic structures, local and NRHDs, and other built-environment resources. Conversely, Plan 1 may have long-term positive net impacts to cultural resources within communities in the floodplain. USACE acknowledges that the implementation of Plan 1 may result in modifications to historic buildings or other built-environment resources potentially not meeting the SOI Standards. However, the overarching goal of this effort is to reduce risk from future flood events within Tangipahoa Parish, thus; potentially protecting the architectural qualities of communities within the floodplain as a whole. Therefore, Plan 1 may also result in net positive cumulative impacts towards preserving nonrenewable at-risk unique architectural and design characteristics that the communities and historic districts strive to maintain and enhance. Otherwise, damage to, or widespread loss of, cultural resources could lead to the loss of connection to place, causing a net loss of cultural diversity within the floodplain and its surrounding communities. This is important because the cultural resources within many portions of the floodplain are understudied and/or not duplicated or replaced at other locations. Because most cultural resources are nonrenewable this would constitute a significant cumulative impact. The assessment of direct, indirect, and cumulative impacts for Plan 1 may require a comprehensive inventory and NRHP evaluation of built-environment resources inclusive of each site where nonstructural measures are proposed in addition to the larger surrounding viewshed that would need to be completed in PED; it is recommended that inventory work for each site should be conducted no more than five (5) years in advance of construction. Potential adverse impacts to archaeological sites, historic buildings, structures, NRHD(s), or other built-environment resources listed or eligible for the NRHP that cannot be avoided or minimized would be mitigated following the procedures negotiated in the PA in consultation with SHPO, Federally Recognized Tribes, and other Consulting Parties, as appropriate. Any additional conditions or requirements would be documented at that time.

Plan 3a: Nonstructural Increment 1

Direct, indirect, and cumulative impacts

No known NRHP properties will be affected by plan 3a. None of the potential structures are listed on the NRHP individually or are located within a historic district. However, none of the structures are known to have been evaluated for the NRHP; therefore a PA is being developed to resolve any potential effects. The direct, indirect, and cumulative impacts to cultural resources for the considered action would be proportionally similar to the impacts specified for Plan 1 described above but would increase as more structures are included in the Plan 3a.

Plan 3b: Nonstructural Increment 2

Direct, indirect, and cumulative impacts

No known NRHP properties will be affected by plan 3b. None of the potential structures are listed on the NRHP individually or are located within a historic district. However, none of the structures are known to have been evaluated for the NRHP; therefore a PA is being developed to resolve any potential effects. The direct, indirect, and cumulative impacts to cultural resources for the considered action would be proportionally similar to the impacts specified for Plan 1 described above but would increase as more structures are included in the Plan 3b.

Plan 3c: Nonstructural Increment 3

Direct, indirect, and cumulative impacts

No known NRHP properties will be affected by plan 3c. None of the potential structures are listed on the NRHP individually or are located within a historic district. However, none of the structures are known to have been evaluated for the NRHP; therefore a PA is being developed to resolve any potential effects. The direct, indirect, and cumulative impacts to cultural resources for the considered action would be proportionally similar to the impacts specified for Plan 1 described above but would increase as more structures are included in the Plan 3c.

5.3.1.8 Aesthetics

Plan 0: No Action Alternative

Direct, indirect, and cumulative impacts

The study area consists primarily of a mosaic of forest, pine plantations, pasture, and cropland dissected by rivers and creeks, roads, and development. Visual resources would continue to evolve from existing conditions as a result of both land use trends and natural processes over the course of time. Waterways would continue to swell to capacity and overflow into nearby areas seasonally. Communities near these waterways would continue to experience high water events seasonally due to stormwater inputs from development adding to, and at times exceeding, the pre-development capacity.

Plan 1: Nonstructural NED Plan

Direct, indirect, and cumulative impacts

Elevating and floodproofing homes would not impact viewsheds into any surrounding areas. In areas where there is public access from a street or roadway, these nonstructural elements would not change the viewshed. The NED plan could have a potential minor positive impact by applying a consistent approach to nonstructural elevations in the Parish. The surrounding landscape features would be expected to follow current trends and would be left unaffected by proposed project actions. Access to the structure foundation would be needed for nonstructural measures and could result in impacts to home landscaping and disturbance to lawn vegetation.

Plan 3a: Nonstructural Increment 1

Direct, indirect, and cumulative impacts

The direct, indirect, and cumulative impacts to aesthetics for the considered action would be proportional the impacts specified for Plan 1 described above.

Plan 3b: Nonstructural Increment 2

Direct, indirect, and cumulative impacts

The direct, indirect, and cumulative impacts to aesthetics for the considered action would be proportional to the impacts specified for Plan 1 described above.

Plan 3c: Nonstructural Increment 3

Direct, indirect, and cumulative impacts

The direct, indirect, and cumulative impacts to aesthetics for the considered action would be proportional to the impacts specified for Plan 1 described above.

5.3.1.9 Recreation

Plan 0: No Action Alternative

Direct, indirect, and cumulative impacts

Without intervention, communities within the study area would continue to be at risk from high water events induced by stormwater inputs. Recreational resources would continue to be influenced by existing conditions as a result of land use trends, funding, and natural processes over the course of time.

Plan 1: Nonstructural NED Plan

Direct, indirect, and cumulative impacts

The nonstructural features could have potential indirect positive impacts by keeping residents and businesses in their current communities. This could help reduce movement of residents out of the Parish and ensure the tax base remains for promotion of recreation facilities.

Plan 3a: Nonstructural Increment 1

Direct, indirect, and cumulative impacts

The direct, indirect, and cumulative impacts to recreation for the considered action would be proportional to the impacts specified for Plan 1 described above.

Plan 3b: Nonstructural Increment 2

Direct, indirect, and cumulative impacts

The direct, indirect, and cumulative impacts to recreation for the considered action would be proportional to the impacts specified for Plan 1 described above.

Plan 3c: Nonstructural Increment 3

Direct, indirect, and cumulative impacts

The direct, indirect, and cumulative impacts to recreation for the considered action would be proportional to the impacts specified for Plan 1 described above.

5.3.1.10 Socioeconomics

Tangipahoa Parish as a whole is in the 96th percentile for risk from natural disasters according to the FEMA National Risk Index (Figure 1), meaning that it is more at risk from natural disasters than 96% of all other counties or parishes within the United States. A description of the three risk factor categories and their indicators is described in Section 3.4.5.1. A table summarizing the benefits communities with substantial community risk factors across the evaluated plans is provided below in Table 5-4.

Table 5-4: Number of Structures in Areas with Potentially Amplified Consequences Due to Community Risk Factors

	Plan 0: No action	**Plan 1: Nonstructural NED Plan**	**Plan 3a: Nonstructural Increment 1**	**Plan 3b: Nonstructural Increment 2**	**Plan 3c: Nonstructural Increment 3**
Structures included in areas more at risk	0	470	546	860	952

	Plan 0: No action	**Plan 1: Nonstructural NED Plan**	**Plan 3a: Nonstructural Increment 1**	**Plan 3b: Nonstructural Increment 2**	**Plan 3c: Nonstructural Increment 3**
Total structures included in plan	0	597	675	1,088	1,234
% of structures in areas more at risk	N/A	78.7%	80.9%	79%	77%

The no action alternative would not provide flood risk reduction to the residents living within the study area. There would be no direct impact on communities with potentially amplified consequences due to community risk factors under this alternative. This alternative fails to provide flood risk reduction, therefore the actual and perceived risks to communities with potentially amplified consequences would be higher than under the nonstructural alternatives. Indirect impacts under the no action alternative include a higher potential for permanent displacement of population groups with less access to disaster aid resources, and greater financial and emotional strain for those that are more vulnerable to flood related damages, lost wages, lost healthcare, and structural repair costs.

Cumulative impacts under the no action alternative include the potential for a decline in population in communities where potentially amplified consequences resulting from community risk factors occur. Repeated impacts of flooding may reduce residents' ability to prepare for or recover from future flood events. Other Federal, State, local, and private flood risk reduction efforts would also influence these populations.

Plan 1: Nonstructural NED Plan

Direct, indirect, and cumulative impacts

All residents will have the choice of elevation. Direct impacts include temporary disruption of use of homes during elevation. At this time, there are 597 structures (the vast majority are residential structures) located in the 10%, 4%, and 2% AEP floodplains and it is uncertain who may participate in the non-structural plan. Two critical infrastructures facilities, fifty-eight non-residential structures, and three civic infrastructure facilities are included as candidates for wet or dry floodproofing, depending on structure characteristics in this plan. All structures within these floodplains are in economically justified reaches and would be flood-proofed or elevated; therefore, all residents within the reaches, irrespective of race, ethnicity, or income, would be able to choose to participate in the plan.

This plan would greatly benefit eligible community members by reducing recovery time after flood events, lowering long-term expenditures (e.g., structure repairs and insurance premiums), and increasing the safety of structures. Depending on the number of structures that participate, the nonstructural measures would be expected to reduce overall flood risk in the region, improve overall community resiliency to future events, and maintain community cohesion by increasing the likelihood of stable residence and less disruption of businesses and civic infrastructure after flood events within the study area. The nonstructural measures would provide flood risk reduction to those choosing home elevation. Despite existing first floor elevations differing among individual structures, elevations would provide the same level of risk reduction benefits per structure at the MLFY of 2083 (end of the period of analysis). Homeowners would be responsible for costs associated with repairs to ensure a structurally sound home prior to elevation and would be responsible for temporary relocation costs during elevation. All other costs of elevating structures, including the cost to elevate the structure, would not be borne by any single individual or the community; rather, these costs would be part of the proposed project costs.

The out-of-pocket costs to elevate a structure are the responsibility of the eligible homeowner. These costs could be an adverse impact if the homeowner is living at or below the poverty level. Mitigation strategies to increase participation and to bridge the financial gap to participation are discussed at the end of this section, below, with the heading "Mitigation of Potential Direct Impacts".

Beneficial indirect impacts include reducing flood risk of the residents and businesses that choose to participate in the program and improving the ability to recover much more quickly after a storm event. Other positive social effects and comprehensive benefits are discussed in more detail in of the Appendix G – Economic and Social Considerations.

Positive cumulative impacts are expected to occur as a result of the lower flood risk in the area under this alternative. Additionally, other Federal, State, and local flood risk reduction projects will provide positive cumulative impacts by reducing flood risk to communities in the Parish. Housing within floodplains that are elevated will have a lower flood risk from storm events. For those living in structures in floodplains that choose not to elevate, flood risk from future storm events will continue.

Plan 3a: Nonstructural Increment 1

Direct, indirect, and cumulative impacts

Plan 3a beneficial impacts would be expected to be proportionally greater than Plan 1 and include flood risk reduction to 675 structures or 78 more structures than are in the NED Plan 1. Both eligible homes and businesses could be elevated or floodproofed which adds to the resiliency of communities to recover after a disaster. Potential adverse indirect impacts from Plan 3a are similar to those discussed for the NED Plan 1 and include the possibility that low-income homeowners may not be able to afford the out of-pocket costs to have their home elevated. Direct impacts for homeowners who chose to participate in the elevation program include a lower flood risk since their structure would be elevated to the 100-year

storm elevation or to a maximum of 13 feet. The ground surface would still be at risk for flooding which includes street flooding and any potential flooding of property remaining at grade, such as automobiles. Eligible businesses, if they decide to participate in the program, would be floodproofed which would result in a lower flood risk. After a flood event, these participating businesses would likely be able to reopen and offer their services to residents in their communities much more quickly than if they choose not to participate in the floodproofing program.

Plan 3b: Nonstructural Increment 2

Direct, indirect, and cumulative impacts

The beneficial impacts of this plan are anticipated to increase proportionally to the increase in number of structures that could be floodproofed by the NED and 3a Plans. Plan 3b was incrementally expanded to be inclusive of structures in areas which may not maximize or even have positive net NED benefits but nonetheless experience similar or greater levels of flooding at the 4% AEP than those in the NED plan at the same frequency. Plan 3b includes 491 more eligible structures that are not in the NED plan and 413 not in Plan 3a. Three critical infrastructure facilities were identified for potential floodproofing due to flood risk. A total of 1088 structures are eligible under Plan 3b. Three critical infrastructure facilities, eighty-two non-residential structures, and five civic infrastructure facilities are included as candidates for wet or dry floodproofing, depending on structure characteristics in this plan. In some cases, Plan 3b included structures in the 2% AEP event as long as there were compelling comprehensive benefits reasons to do so such as flood hazard depth and frequency, community cohesion, critical infrastructure, and incremental net NED benefits mentioned previously.

The additional benefits gained in Plan 3b are surrounding critical infrastructure, community cohesion, and increased flood risk mitigation that incorporates the needs and considerations of communities with risk factors that amplify flood consequences. Depending on the number of structures that participate, the nonstructural measures would be expected to reduce overall flood risk in the region, improve overall community resiliency to future events, and maintain community cohesion by increasing the likelihood of stable residence and less disruption of businesses and civic infrastructure after flood events within the study area. Adverse indirect impacts may include the homeowner having to pay for temporary housing and costs associated with preparing their home for elevation. Tenants who are deemed to be temporarily “displaced” under the Uniform Relocation Assistance and Real Property Acquisition Act (URA) regulations, may be eligible for certain benefits in accordance with Uniform Relocation Assistance and Real Property Acquisition Policies for Federal and Federally Assisted Projects of 1970, Public Law 91-646, 84 Stat. 1894 (42 U.S.C. 4601), as amended by the Surface Transportation and Uniform Relocation Assistance Act of 1987, Title IV of Public Law 100-17, 101 Stat. 246-256; 49 Code of Federal Regulations 24; and HUD Handbook 1378 (collectively referred to as the URA). There may be instances where temporary housing costs may not be approved; therefore, some homeowners, particularly those who are low-income, may not be able to afford the out-of-pocket costs and ultimately prevent them from participating in the elevation plan. Mitigation of these potential financial

reasons to volunteer for elevation are discussed in the section below, Mitigation of Potential Direct Impacts.

Plan 3c: Nonstructural Increment 3

Direct, indirect, and cumulative impacts

Plan 3c is similar to Plan 3b except Plan 3c includes 637 more eligible structures that are not in the NED plan, and 146 more structures that are not in Plan 3b. Positive direct benefits will accrue to residents and businesses in areas that choose to participate in the plan and include a lower flood risk. Adverse indirect impacts may include the homeowner having to pay for temporary housing and costs associated with preparing their home for elevation. Tenants who are deemed to be temporarily "displaced" under the URA regulations, may be eligible for certain benefits in accordance with Uniform Relocation Assistance and Real Property Acquisition Policies for Federal and Federally Assisted Projects of 1970, PL 91-646, 84 Stat. 1894 (42 U.S.C. 4601), as amended by the Surface Transportation and Uniform Relocation Assistance Act of 1987, Title IV of Public Law 100-17, 101 Stat. 246-256; 49 Code of Federal Regulations 24; and HUD Handbook 1378 (collectively referred to as the URA). There may be instances where temporary housing costs may not be approved; therefore, some homeowners, particularly those who are low-income, may not be able to afford the out-of-pocket costs and ultimately prevent them from participating in the elevation plan. Mitigation of these potential financial reasons to volunteer for elevation are discussed in the section below, Mitigation of Potential Direct Impacts.

5.3.1.10.1.1 Mitigation of Potential Indirect Impacts

For those residents who may not be able to participate in the elevation program because of financial reasons and who are low-income, there may be opportunities of other federal, state and local authorities to assist and bridge the financial gap to increase participation. To increase participation rates for the TSP, for homeowners who cannot afford the cost associated with the nonstructural plan (where SV and or income criteria may be developed), the following items may be considered, but may require additional Congressional authority:

- Allowances, such as those referenced in the WRDA 2022, Section 8154, to provide temporary relocation assistance to voluntary homeowner participants in nonstructural projects.
- Future agreements developed with a NFS may include that no cost share be requested directly of the property owner.
- Develop an assistance program to help connect preliminary eligible homeowners to other programs to meet some of the USACE secondary eligibility criteria such as repair condition of the structure. An example would be State of Louisiana Partial Action Plan No.1 for the Utilization of Community Development Block Grant Funds in Response to Hurricane Isaac administered through the Louisiana Office of Community Development/ Disaster Recovery Unit.

SECTION 6
Evaluate and Compare Alternative Plans

This section evaluates and compares the final array of alternatives, which are Steps 4 and 5 of the USACE Planning Process. Plans were developed with incrementally justified measures in accordance with ER 1105-2-103 and WRDA 1986. The four plans in the final array, in addition to the no action plan, were progressed for further evaluation in selecting the TSP. Evaluation and comparison of alternatives is based on preliminary modeling, cost estimates, and evaluation of effects. The results of those preliminary analyses are presented in this chapter. The following four accounts have been established for planning studies to facilitate evaluation and consider all effects, beneficial and adverse, of the alternative plans:

1. The National Economic Development (NED) account displays changes in the economic value of the national output of goods and services.

2. The Environmental Quality (EQ) account displays non-monetary effects on ecological, cultural, and aesthetic resources including the positive and adverse effects of aquatic ecosystem restoration plans.

3. The Regional Economic Development (RED) account displays changes in the distribution of regional economic activity that result from each alternative plan. Evaluations of regional effects are to be carried out using nationally consistent projections of income, employment, output, and population.

4. The Other Social Effects (OSE) account displays plan effects on social aspects such as community resilience, public health, life safety, displacement, energy conservation, and similar effects.

Evaluation and comparison of alternatives is based on the four P&G criteria: completeness, acceptability, efficiency, and effectiveness. In some cases, the evaluation may be qualitative. This evaluation and screening informs the decision in selecting the TSP.

6.1 ECONOMIC COSTS AND BENEFITS OF ALTERNATIVE PLANS

The HEC-FDA 1.4.3 Corps-certified model was used to calculate the damages and benefits over the period of analysis to calculate expected annual without- project and with-project damages and the damages reduced for each of the plans in the final array (Table 6-1). The economic and engineering inputs necessary for the model to calculate damages include the existing condition structure inventory, contents-to- structure value ratios, foundation heights, ground elevations, depth-damage relationships, and without-project stage-probability relationships. The benefit exceedance probability relationship for each of the plans was compared to the point estimate of the average annual cost (Table 6-2). As benefits exceeding costs translates to a benefit-to-cost ratio (BCR) of 1 or more, the table can also

be translated as the probability the plan will produce a positive net benefit and BCR greater than 1.

The net benefits for the Plans were calculated by subtracting the annual costs from the base year equivalent annual benefits. Table 6-1 shows the average annual costs, benefits, net benefits, and benefit-to-cost ratios for the plans in the final array. Table 6-2 shows the probability of annual NED benefits exceeding annual costs. More information about these economic inputs is provided in Appendix G.

Table 6-1: *Annual Costs and Benefits Summary (FY24 Price Level; FY24 Discount Rate)*

Final Array	Plan 1 (NED)	Plan 3a	Plan 3b	Plan 3c
Construction First Cost	$345,152,000	$381,222,000	$595,068,000	$665,077,000
Interest During Construction	$1,172,000	$1,295,000	$2,021,000	$2,259,000
Total Construction Cost	$346,324,000	$382,516,000	$597,089,000	$667,336,000
Average Annual Construction Cost	$12,828,000	$14,168,000	$22,116,000	$24,718,000
Equivalent Annual Benefits	$23,369,000	$24,583,000	$30,742,000	$31,966,000
Annual Net Benefits	$10,540,000	$10,414,000	$8,625,000	$7,247,000
Benefit-to-Cost Ratio (BCR)	1.82	1.74	1.39	1.29

Table G: 6-2: Probability Annual Benefits Exceed Annual Costs (2024 Price Level; FY24 Federal Discount Rate; $1000s)

Plan	Probability Benefits Exceeds Indicated Values: 75%	Probability Benefits Exceeds Indicated Values: 50%	Probability Benefits Exceeds Indicated Values: 25%	Annual Costs	Probability Benefits Exceed Low Cost
Plan 1 (NED)	$15,235	$21,247	$30,565	$ 12,828	>75%
Plan 3a	$16,079	$22,328	$32,150	$ 14,186	>75%
Plan 3b	$18,335	$27,294	$40,841	$ 22,116	>50%
Plan 3c	$18,862	$28,315	$42,592	$ 24,718	>50%

The NED plan is the plan that reasonably maximizes net benefits. As shown on Table 6-1, Plan 1 has the greatest annual net benefits and was identified as the preliminary NED plan.

6.2 RISK ANALYSIS

Future With Project (FWP) and FWOP performance statistics help inform the risk of a flood event for a specific frequency. Three components are indicators of project performance: AEP, long-term exceedance probability (LTEP), and conditional non-exceedance probability (CNEP). AEP is the likelihood flooding occurs in any given year. LTEP is the probability that flooding occurs in a period of 10, 30, or 50 years. CNEP, also called assurance, is the probability that flooding does not occur, conditional on a flood event of 0.02, 0.01 and 0.002 frequency occurring. For detailed information on LTEP and CNEP see Appendix G.

AEP represents the probability of any event equaling or exceeding a specified stage in any given year. For this study, the target stage is determined by the exceedance of a percentage of the mean damage associated with a specified event.

6.3 EVALUATION OF STUDY PLANNING OBJECTIVES

The final array of alternatives was compared to the study objectives, which are presented in Section 2.2. A comparison summary is presented in Table 6-2.

Objective 1, which is to manage risk to public safety, was evaluated through the performance analysis described in Section 2.4 of the DIFR/EA. Life safety concerns were addressed for the Tangipahoa Parish study via was stability criteria evaluated within the study area utilizing depth, velocity, structure, and population data. The No Action Alternative does not decrease the risk to public safety. None of the proposed nonstructural plans mitigate life safety risk on roadways; however, mitigation of proposed elevations and floodproofing does reduce the number of structures experiencing high hazard conditions due to hydrostatic pressures according to the stability criteria thresholds in the LifeSim technical manual. The decreased life safety concern is consistent among all of the plans in the final array. Additionally, the Tangipahoa Parish Government has several roadways it monitors to determine if it they should be shut down to traffic due to flooding. It is expected that the Parish will continue these efforts. There is a minor positive impact regarding life safety risk reduction for all nonstructural plans because of structure elevation. Life safety risk reduction is specific to residents who shelter in place during events not requiring evacuation.

Objective 2, reduce flood damages to residential and nonresidential structures, was evaluated through the performance analysis described in Section 6.1 of the DIFR/EA. The economic analysis quantitively measured the change in the number and frequency of flooded structures as well as the estimated damages, compared to the No Action Alternative. All of the alternatives in the final array meet Objective 2 by reducing the number of residential and nonresidential structures impacted by flooding and reducing the annual flood damages when compared with the No Action Alternative.

Objective 3 is to reduce interruption to the nation’s transportation corridors, particularly the I-55 / I-12 infrastructure. Transportation corridors include one or more routes that connect centers of economic activity. Transportation corridors provide transportation and other logistics services that promote trade among the cities and countries along the corridor. Interstates 55 and 12 are the major transportation corridor within the study area. During the

historic 2016 flooding, portions of I-55 were inundated. Hydraulic modeling showed that Interstate 12 will remain open in the Parish at frequencies greater the 1% AEP. Interstate 55 will remain open at frequencies greater than or equal to the 0.2% AEP event north of Highway 22. Coastal surge events regularly impact travel on Interstate 55 south of Highway 22. The final array consists of nonstructural measures, which would not reduce flood risk to roadways. Therefore, Objective 3 is not used in evaluation of the Final Array of Alternatives.

Objective 4 is to increase community resiliency, which is the ability of a community to absorb, adapt to, and recover from the effects of a flood in a timely and effective manner, while also maintaining essential functions and minimizing long-term disruptions.

Objective 5 is to incorporate the needs and considerations of all at-risk communities, in conjunction with managing flood risk. Both Objectives 4 and 5 were qualitatively evaluated by determining the scale at which each plan maximizes flood risk for structures within communities with risk factors that amplify consequences. This was completed using an incremental analysis of OSE benefits method that is based on FEMA's National Risk Index (NRI) data. Plans 1, 3a, 3b, 3c met these objectives to varying degrees with the inclusion of structures in areas with consequence-amplifying risk factors, which would ensure these communities are not disproportionately impacted by flooding. Table 6-2 provides a summary of the final array evaluation of the study objectives.

Table 6-2. Final Array Evaluation of Study Objectives

Alternative	Obj 1. Manage the risk to public (life) safety associated with flooding.	Obj 2. Reduce economic loss due to flood damage to structures from flooding.	Obj 3. Reduce economic impacts due to interruption of national transportation corridors	Obj 4. Increase community resiliency	Obj 5. Benefit communities with risk factors that amplify consequences
Plan 0: No Action	N/A	N/A	N/A	N/A	N/A
Plan 1: Nonstructural NED	LOW	MED	NONE	LOW	LOW
Plan 3a: NED + Increment 1	LOW	MED	NONE	LOW	LOW
Plan 3b: NED + Increment 2	LOW	MED	NONE	HIGH	HIGH
Plan 3c: NED + Increment 3	LOW	MED	NONE	HIGH	HIGH

High-Signifies the metric was met considerably.

Medium-Signifies the metric was met moderately.

Low-Signifies the metric was minimally met if all.

6.4 PRINCIPLES AND GUIDELINES CRITERIA EVALUATION

The four evaluation and screening criteria required by the P&G (completeness, effectiveness, efficiency, and acceptability) were also used to aide in the selection of the TSP. Descriptions of the P&G criteria are below. Alternatives considered in any planning study should meet minimum subjective standards of these criteria to qualify for further consideration and comparison with other plans. Table 6-3 presents the P&G evaluation criteria.

- *Acceptability* is the workability and viability of the alternative plan with respect to acceptance by state and local entities and the public, and compatibility with existing laws, regulations, and public policies (P&G Section VI.1.6.2(c)(4). Acceptability means a measure or plan is technically, environmentally, economically, and socially feasible. Measures or plans that are clearly not feasible should be dropped from consideration.
- *Completeness* is a determination of whether the plan includes all elements necessary to achieve the objectives of the plan. It is an indication of the degree that the outputs of the plan are dependent upon the actions of others.
- *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.

Table 6-3 Final Array Evaluation to P&G Criteria

Alternative	Acceptability	Completeness	Effectiveness	Efficiency
Plan 0: No Action	Partially. Viable in accordance with state and local entities and laws. Provides no solution to the identified problems	No. No features which does not produce benefits.	No. The alternative does not alleviate the problems identified and does not meet study objectives.	No. No money is expended, no benefits are gained.
Plan 1: Nonstructural NED	Yes. Viable and in accordance with state and local existing laws.	Yes. The alternative includes all features needed to produce the stated effects.	Partially. The alternative alleviates some of the flood risk.	Yes in the NED Account. The most cost-effective means of providing a reduction of

Alternative	Acceptability	Completeness	Effectiveness	Efficiency
				damages to eligible structures.
Plan 3a: **NED + OSE Increment 1**	Yes. Viable and in accordance with state and local existing laws.	Yes. The alternative includes all features needed to produce the stated effects.	Partially. The alternative alleviates some of the flood risk.	Partially. It is cost effective but does have a slightly lower net NED benefits and increased cost but provides some potential to reduce flooding for SV areas. 2nd Highest
Plan 3b: **NED + OSE Increment 2**	Yes. Viable and in accordance with state and local existing laws.	Yes. The alternative includes all features needed to produce the stated effects.	Partially. The alternative alleviates some of the flood risk.	Yes, benefits exceed the cost in NED Account and this plan includes OSE account benefits by providing the higher potential than 3a to reduce flooding in amplified-consequence areas. This plan maximizes total net benefits, both monetary and non-monetary. Highest incremental gain in structures in amplified-consequence areas.
Plan 3c: **NED + OSE Increment 3**	Yes. Viable and in accordance with state and local existing laws.	Yes. The alternative includes all features needed to produce the stated effects.	Partially. The alternative alleviates some of the flood risk. It does not achieve Objective 3 of the study.	Partially. It is cost effective but does have the lowest net benefits and increased cost but provides the highest potential to reduce flooding for amplified-consequence areas.

6.5 COMPARISON OF ALTERNATIVES TO SYSTEM OF ACCOUNTS - FLOOD RISK MANAGEMENT SYSTEM

Plan formulation has been conducted with a focus on achieving the federal objective of water and related land resources project planning, which is to contribute to NED consistent with protecting the Nation's environment, pursuant to national environmental statues, applicable EOs, and other Federal planning requirements. Plan formulation considers all effects, beneficial or adverse, to each of the four evaluation accounts identified in the USACE P&G which are NED, EQ, RED, and OSE.

6.5.1 NED Account Comparison

The intent of comparing alternative flood risk reduction plans in terms of NED account was to identify the beneficial and adverse effects that the plans may have on the national economy. Beneficial effects are increases in the economic value of the national output of goods and services attributable to a plan. Increases in NED were expressed as the plans' economic benefits, and the adverse NED effects were the investment opportunities lost by committing funds to the implementation of a plan. The factors considered included structure and content damage, and emergency costs. The NED plan is the plan that reasonably maximizes net benefits. As shown on Table 6-4, Plan 1 has the greatest annual net benefits and was identified as the preliminary NED plan.

Table 6-4. Annual Costs and Benefits Summary (FY 2024 Price Level; FY24 Discount Rate))

Final Array	Plan 1 (NED)	Plan 3a	Plan 3b	Plan 3c
Construction First Cost	$345,152,000	$381,222,000	$595,068,000	$665,077,000
Interest During Construction	$1,172,000	$1,294,000	$2,021,000	$2,259,000
Total Construction Cost	$346,324,426	$382,516,950	$597,089,351	$667,336,160
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Equivalent Annual Benefits	$23,369,000	$24,583,000	$30,742,000	$31,966,000
Annual Net Benefits	$10,540,000	$10,414,000	$8,625,000	$7,247,000
Benefit-to-Cost Ratio (BCR)	1.82	1.74	1.39	1.29

6.5.2 EQ Account Comparison

The EQ account is an assessment of favorable or unfavorable ecological, aesthetic, and cultural or natural resources changes. Environmental impacts of the alternatives are described in detail in Section 5. The analysis was conducted with the participation of agencies, local governments, and stakeholders through an on-going and engaging series of scoping meetings, public input meetings, agency and stakeholder meetings, and on-site meetings, and will continue through the PED study phase and coordination of the project through State and Agency reviews. The EQ account was another means of evaluating the plans to assist in

making recommendations. The factors considered included habitat change and threatened & endangered species risk. None of the plans in the final array have any significant impacts on the environment.

6.5.3 RED Account Comparison

The RED account addresses the impacts that the USACE expenditures associated with the implementation of the nonstructural plans will have on the levels of income, output, and employment throughout the region. This RED analysis employs input-output economic analysis, which measures the interdependence among industries and workers in an economy. This analysis uses a matrix representation of a regional economy to predict the effect that changes in one industry will have on other industries. The greater the interdependence among industry sectors, the larger the multiplier effect on the economy. Changes to government spending drive the input-output model to project new levels of sales (output), value added Gross Regional Product (GRP), employment, and income for each industry. RECONS Version 2 was the specific input-output model used to estimate the regional economic development impacts of the TSP Plan. This modeling tool automates calculations and generates estimates of jobs, labor income, value added, and sales using IMPLAN®'s multipliers and ratios, customized impact areas for USACE project locations, and customized spending profiles for USACE projects, business lines, and work activities. Table 6-5 summarizes RED impacts from RECONs. Additional information can also be found in Appendix G - Economic and Social Consideration. The factors include the total expenditure, value added (gross regional product), and full-time equivalent jobs.

Table 6-5. RED Impacts from RECONS

Alternative	Expenditures	Gross Regional Product	Full Time Equivalent Jobs
Plan 0: No Action	$0	$0	0
Plan 1: Nonstructural NED	$345,152,000	$552,517,000	5,964.60
Plan 3a: NED + OSE Increment 1	$381,222,000	$610,257,000	6,588.0
Plan 3b: NED + OSE Increment 2	$595,068,000	$952,581,000	10,283.5
Plan 3c: NED + OSE Increment 3	$665,077,000	$1,064,651,000	11,493.3

6.5.4 Other Social Effects (OSE)

Water resource projects conducted by USACE are to comprehensively evaluate the impact on social well-being within a community. Communities impacted by hazardous events,

including frequent and/or severe inundation experience affects both during and after related to their resilience, overall well-being, community cohesion, and their quality of life. Other social effects of the plans are evaluated based on their performance across socioeconomic status, household characteristics, and housing type, transportation availability, health and safety, and resiliency.

As previously mentioned in Section 5.3.1.10.1.2, within communities with risk factors that amplify consequences, there is potential that participation in a project may decrease due to financial reasons. Additional analysis will be conducted on potential opportunities with federal, state and local authorities to reduce the impacts to communities with risk factors that potentially amplify consequences and lower the ability to participate.

6.5.4.1 Consequence-Enhancing Risk Factors and Resiliency

Communities with high risk from natural disasters according to the FEMA NRI, are disproportionately impacted by flood events and often lack the capacity in terms of infrastructure and capital, both physical and monetary, to recover quickly. These communities often never recover to the same levels of productivity, population, and income that those areas experienced prior to a major flood event. Thus, while formulating strategies for non-structural measures, the PDT wanted to keep this information in mind. Essentially, flood risk reduction projects in areas which experience community risk factors are not fully captured in the traditional NED framework. That is to say, the benefits that these communities experience as a result of federal investment to reduce the risk from flooding are not simply the reduction in damages to structures and contents. The benefits provided to communities with these factors include resiliency and cohesion. In effect, the comprehensive plans beyond the NED plan provide these communities a greater ability to cope with and rebound from flood events. These benefits are non-monetary and were deemed to be just as important as the NED benefits, we have traditionally seen in FRM projects. Table 6-6 presents a summary of structures in communities experiencing ”Very High” to “Relatively High – Very High” levels of NRI community risk factors across each of the plans

Table 6-6: Summary of Benefits in Areas More at Risk

Benefit Category	Plan 1	Plan 3a	Plan 3b	Plan 3c
Structures included in amplified-consequence **areas**	470	546	860	952
Total Structures included	597	675	1,088	1234
% of structures in amplified-consequence **areas**	78.7%	80.9%	79%	77.1%

Plan 1: Nonstructural NED Plan

This plan, while not specifically formulated with considerations of comprehensive benefits such as mitigating flood risk for areas with significant community risk factors, improving community resiliency, cohesion, and reducing frequent flood hazards. It nonetheless provides significant benefit to amplified-consequence areas as highlighted in the table

above. Given that individuals in these communities are historically overburdened by excessive costs related to both hazard mitigation and hazard response, this plan would provide a significant impact to eligible community members via decreased recovery time and their related expenditures, as well as increased safety of their home, and decreased flood insurance premiums from hazard mitigation.

Plan 3a: NED + Increment 1: 10% AEP Flood Frequency Increment

As mentioned in section 1, Plan 3a includes the same structures as the NED plan but was incrementally expanded to be inclusive of structures in areas which may not maximize or have even positive net NED benefits but nonetheless experience similar or greater levels of flooding at the 10% AEP than those included in the NED plan. Each aggregation group increment was evaluated based on flood hazard depth and frequency, community cohesion, and incremental net NED benefits. As such, each incremental structure included experiences frequent flood hazards which are enough to disrupt the day-to-day life of the people living and working in said structures. This plan would provide a significant impact to eligible community members via decreased recovery time and their related expenditures, as well as increased safety of their home, and decreased flood insurance premiums from hazard mitigation.

Plan 3b: NED + Increment 2: 4% AEP Flood Frequency Comprehensive Increment

As mentioned previously, each subsequent plan builds incrementally upon the previous. Thus, all of the benefits of the previous increments are still present in Plan 3b. Plan 3b was incrementally expanded to be inclusive of structures in areas which may not maximize or even have positive net NED benefits but nonetheless experience similar or greater levels of flooding at the 4% AEP than those in the NED plan. In some cases, Plan 3b included structures in the 2% AEP event as long as there were compelling comprehensive benefits reasons to do so such as flood hazard depth and frequency, community cohesion, critical infrastructure, and incremental net NED benefits as mentioned previously. The extra benefits of Plan 3b are surrounding critical infrastructure, community cohesion, and increased flood risk mitigation for populations more at risk from flooding due to consequence-enhancing community risk factors.

Plan 3c: NED + Increment 3: 2% AEP Flood Frequency Comprehensive Increment

Plan 3c continues to build upon the previous increments. All of the previous benefits are still present and the extra benefits beyond the previous increment are focused on increased other social effects benefits and a wider floodplain. Plan 3c is the most inclusive plan, allowing for more aggregation areas to have a level of inclusion at the 2% AEP floodplain than any of the previous plans while still being constrained by total comprehensive benefits and similar or greater levels of flooding as the NED Plan. That is to say, we did not include areas at the 2% AEP which didn't at minimum have similar depths of flooding to comparable NED justified areas at the 2% AEP. In developing plans, this plan was determined to have the highest benefits in the other social effects category given that it provides the most benefits for at-risk communities and improves community resiliency and cohesion more than

the previous plans. However, it has the lowest net NED benefits of the four plans in the final array while still providing more NED benefits than costs.

6.5.4.2 Health and Safety

Life Safety:

A life-safety assessment was performed for each plan considered. These evaluations, conducted using the methodology outlined in the LifeSim technical manual, consistently demonstrated that larger-scale mitigation plans result in incrementally reduced life-risk. However, it's important to note that nonstructural measures alone – such as elevation and floodproofing – do not eliminate the need for evacuation. While these measures reduce the number of structures exposed to high-hazard flood conditions, they do not address life safety risks on roadways. Tangipahoa Parish currently monitors key roadways for flooding and will continue to do so to ensure public safety. Further details regarding the life-safety evaluations can be found in Appendix G. *Critical Infrastructure:*
Plans 1, 3a, 3b, 3c

Critical infrastructure was assessed by surveying the physical critical infrastructure that is mitigated under the final array. In an inundation event, facilities would be able to return to operation quicker and thus be able to provide emergency services and care to community members who have previously and will continue to need assistance. Under Plan 1, there are two critical infrastructure facilities (fire department and an electric power substation) included for floodproofing mitigation. The subsequent increments which include more critical infrastructure for flood risk reduction are Plans 3b and Plan3c. Plan 3b includes the floodproofing of another fire department. Plan 3c includes the same three critical infrastructure facilities which are included in Plan 3b.

6.5.4.3 Economic Vitality

Economic vitality was assessed via employment by industry and the number of commercial structures mitigated under each of the plans.

Plan 1: Nonstructural – Optimized NED Plan:

Under plan 1, it would be expected that the trade, transportation, and utilities sector would continue to be impacted. These impacts would be from continued inundation on roadways and for those structures that remain unmitigated in the with project condition. There are 58 non-residential structures that are included as a part of this plan that would have increased risk reduction via floodproofing and therefore experience less of a pause in operation when inundation occurs. This would directly translate to continued consumption for those business. Employees would also be able to continue working for those businesses that are included in Plan 1.

Plan 3a: NED + Increment 1: 10% AEP Flood Frequency

Under Plan 3a, the number of commercial structures included in commercial mitigation increases to 59. The increase in floodproofed commercial structures would allow more businesses to return to operation following an inundation event. This would directly decrease the amount of time that employees are temporarily unemployed, and therefore lost personal income, in the study area.

Plan 3b: NED + Increment 2: 4% AEP Flood Frequency Comprehensive Increment

Under Plan 3b, the number of commercial structures included in commercial mitigation increases to 82. The increase in floodproofed commercial structures would allow more businesses to return to operation following an inundation event. This would directly decrease the amount of time that employees are temporarily unemployed, and therefore lost personal income, in the study area.

Plan 3c: NED + Increment 3: 2% AEP Flood Frequency Comprehensive Increment

Under Plan 3c, the number of commercial structures included in commercial mitigation increases to 87. The increase in floodproofed commercial structures would allow more businesses to return to operation following an inundation event. This would directly decrease the amount of time that employees are temporarily unemployed, and therefore lost personal income, in the study area.

6.5.4.4 Social Connectedness

Impacts to social connectedness were measured via inclusion of civic infrastructure in each of the plans. Civic infrastructure includes community centers and places of worship. Under Plan 1 and Plan 3a, there are three civic infrastructure facilities included. Each of them is a place of worship. Plan 3b increases this number to five total civic infrastructure buildings and Plan 3c includes the greatest number of civic infrastructure buildings at six. In the with-project condition, these civic infrastructure facilities would be floodproofed, allowing for protection of contents and the structures. This risk reduction would decrease the length of time that operations occur; thus, encouraging and sustaining community places of gathering and increasing opportunities for connectedness and identity among individuals.

6.5.4.5 Participation

The voluntary participation in nonstructural plans will be evaluated after the DFIR/EA is released to the public for review. Additional analysis will be completed and incorporated within the study to potentially offset disproportionate impacts to portions of the community with limited resources related to participation.

6.5.4.6 Summary of OSE Effects

Plans 1, 3a, 3b, and 3c all deliver significant benefits beyond traditional flood damage reduction. Below is a summary of the increasing OSE benefits as the plans incrementally expand from Plan 1 to Plan 3c:

Flood risk mitigation is provided to communities which are in the 96th percentile for risk

from natural disasters according to FEMA's National Risk Index. Mitigating risk to these communities has benefits far beyond just flood damage reduction including but not limited to community resilience as well as reducing the impact of future flood events in terms of decreased economic activity, recovery times, and future disaster relief funds and flood insurance payments. These benefits are present for each plan but scale proportionally with the number of structures in each plan. As such, these benefits increase as each incrementally justified, larger plan, is examined.

Critical Infrastructure is another OSE benefit which extends far beyond just flood damage reduction. Under Plan 1, there are two critical infrastructure facilities included for floodproofing – a fire station and an electric power substation. Plan 3a includes those same two facilities as Plan 1. Moving to Plan 3b, another fire department and a medical clinic is included for floodproofing. Plan 3c includes the same four critical infrastructure facilities as Plan 3b.

Similarly, civic infrastructure flood mitigation is another component of the plans and provide benefits beyond just flood damages prevented. Under Plan 1 and 3a, three civic infrastructure facilities are slated for floodproofing, each being a place of worship. Plan 3b increases this number to five. Plan 3c increases this number to six total.

Plan 1 (NED plan) benefits at--risk areas and would have a positive impact on communities with significant community risk factors. Plan 3b builds incrementally upon the NED, thus including additional benefits related to community cohesion, critical infrastructure and resiliency, and inclusion of more at--risk populations. While Plan 3b was more focused on increased flood risk for non-NED justified areas which experience very frequent flooding, Plan 3b is more inclusive in that regard and allows for aggregation areas to be included at less frequent events and is, for the majority of the aggregation areas, inclusive beyond the NED plan to the 4% AEP floodplain as long as there is a comprehensive reason for inclusion at said floodplain.

Regarding economic vitality, under Plan 3b, the number of commercial structures included in commercial mitigation increases to 82. The increase in floodproofed commercial structures would allow more businesses to return to operation following an inundation event. This would directly decrease the amount of time that employees are temporarily unemployed, and therefore lost personal income, in the study area.

When evaluating the effects of social connectedness, under Plan 1, there are three civic infrastructure facilities included. All of them are places of worship. Plan 3b increases this number to five total civic infrastructure buildings. In the "with project" condition, these civic infrastructure facilities would be floodproofed, allowing for protection of contents and the structures. This risk reduction would decrease the length of time that operations occur; thus, encouraging and sustaining community places of gathering and increasing opportunities for connectedness and identity among individuals.

6.5.5 Summary of P&G Accounts

Table 6-7 compares the four Federal accounts against the four nonstructural alternatives in the final array. This is a summary of the highest-ranking alternatives by account. Based on evaluation described in Section 6.4.4, Plan 3b is identified as the Total Net Benefits plan.

Table 6-7. Final Array Evaluation to Four Federal Accounts

Four Accounts	Plan 1: NED Plan	Plan 3a: NED + Increment 1	Plan 3b: NED + Increment 2	Plan 3c: NED + Increment 3
NED	Avg. Annual Benefits $23.37M	Avg Annual Benefits $24.58M	Avg. Annual Benefits $30.74M	Avg. Annual Benefits $31.97M
NED	Net Annual Benefits $10.54M	Net Annual Benefits: $10.41M	Net Annual Benefits: $8.63M	Net Annual Benefits: $7.25M
EQ	No significant impacts to the environment	No significant impacts to the environment	No significant impacts to the environment	No significant impacts to the environment
RED	$552.52M	$610.26M	$952.58M	$1.06Billion
RED	FTE Jobs: 5,964.6	FTE Jobs: 6,588.0	FTE Jobs: 10,283.5	FTE Jobs: 11,493.3
OSE	Overall minor positive benefits. These benefits are realized via FEMA's NRI Community Risk Factors.	Both Minor & Moderate positive benefits. These benefits are realized via FEMA's NRI Community Risk Factors.	Both Moderate & significant positive benefits. These benefits are realized via FEMA's NRI Community Risk Factors. .	Mainly significant positive benefits. These benefits are realized via FEMA's NRI Community Risk Factors.

Includes Real Estate costs (with 30% contingency for RE), 14% PED, 8% S&A, and 49% contingency for design and construction

FY 24 Interest 2.75% and FY 2024 Price Level

Table 6-8 shows the incremental evaluation of each of the nonstructural plans in the Final Array. When comparing 3a to 3b, although there appears to be considerable increase between increments, the increase in benefits maximizes benefits related to community risk factors, community cohesion, critical infrastructure, and resiliency. Additionally, by virtue of how structures are positioned within the floodplain, formulating additional plans for an increment between 3a and 3b would require an alternative method in analyzing the increments and evaluation criteria. As seen below, there is an increase in the number of structures plans that include more frequent flooding events to less frequent events.

Table 6-8. Summary of Incremental Evaluation of Final Array of Alternatives

Evaluation	Plan 1	Plan 3a	Plan 3b	Plan 3c
Benefit-Cost Ratio	1.82	1.74	1.39	1.29
Annual NED Benefits	$10.54M	$10.41M	$8.62M	$7.25M
Incremental Net Benefits	$10,500,000	$(125,000)	$(1,800,000)	$(1,400,000)
Incremental Net Benefits Per Incremental Structure	$17,657	-$1,624	-$4,331	-$9,438
Number of Total Structures	597	675	1088	1234
Number of Elevations	539	616	1006	1147
Number of Floodproofing	58	59	82	87
Incremental Total Number of Structures	597	78	413	146
Incremental Elevations	539	77	390	141
Incremental Floodproofing	58	1	23	5
Number of Structures in amplified consequence areas	470	546	860	952

Incremental Structures in amplified consequence areas	480	66	314	92
Cost per structure	$580,000	$567,000	$548,000	$540,000
Incremental Cost Per incremental Structure	$580,000	$464,000	$519,000	$481,000
Incremental Cost	$ 346.30M	$ 36.2M	$ 214.5M	$ 70.2M
Total Cost (incl IDC)	$345.15M	$381.22M	$595.07M	$665.08M

6.6 TSP SELECTION

In Step 6 of the USACE Planning process, a Tentatively Selected Plan (TSP) is selected from the final array of alternatives. As summarized in previous sections of Section 6, the plan formulation process used the best available information at this phase of the study to evaluate and compare the final array of alternatives to identify the TSP. Currently, the TSP has been identified as Plan 3b: Nonstructural Plan with additive for OSE benefits because it provides flood risk reduction in terms of NED along with the added benefit of flood risk reduction to communities with potential for amplified consequence enhancing risk factors which maximizes the OSE account. Plan 3b also meet the study planning objectives and meets P&G Guidelines. While this plan is not the NED Plan, it provides the best level of comprehensive benefits for flood risk reduction to the study area and is considered the Total Net Benefits Plan for this study. Plan 1 has the greatest annual net benefits and was identified as the preliminary NED plan.

According to USACE policy, the NED plan is selected for recommendation unless an exception is obtained from the ASA(CW). Per ER 1105-2-103, paragraph 2-4(f)(5)(d), “For projects requiring Congressional authorization or that are authorized subject to a determination by the Secretary, the process continues at the division and headquarters levels through subsequent reviews and approval. The final agency decision maker for these projects is the Secretary through the ASA(CW). If the district recommends a plan other than the NED plan, or NER for aquatic ecosystem restoration, an exception request must be prepared and submitted to the ASA(CW) for approval. The request must explain the overriding reasons for the exception, and the trade-offs among costs, and the economic, social, and environmental benefits that the plan would provide. If the recommendation is the plan that reasonably maximizes total net benefits across the four P&G accounts, it will be designated as the Total Net Benefits plan.” Therefore, CEMVS is currently requesting a policy exception from the requirement to recommend the NED plan and is currently identifying Plan 3b as the TSP. If the policy exception is not granted, the TSP will default to Plan 1: Nonstructural NED Plan.

During the final portion of the Feasibility phase, called the feasibility level design phase, additional analyses will be completed to refine and optimize the design and cost estimates of

the measures included in the TSP. The revised design and costs will be incorporated into the numerical modeling (Hydraulics and Economics) to develop refined assessments of the performance and cost-effectiveness of the TSP, which will be included in the final Integrated Feasibility Report (FIFR) and final Environmental Assessment (FEA) as the Recommended Plan. The final report will fully describe the Recommended Action, as well as its costs, benefits, and consequences. Because uncertainty cannot be eliminated, the final report will further document the levels of certainty and the associated risks that are inherent in the assumptions and analyses.

SECTION 7
Tentatively Selected Plan

7.1 PLAN 3B: NONSTRUCTURAL: NED + INCREMENT 2 (TOTAL NET BENEFITS PLAN)

The federal TSP is Plan 3b, the Total Net Benefits Plan, includes a total of 1,088 structures consisting of elevating 1,006 residential structures and dry or wet floodproofing of 82 nonresidential structures. Plan 3b is inclusive of structures in areas which may not maximize or even have positive net NED benefits but nonetheless experience similar or greater levels of flooding at the 4% AEP than those in the NED plan. In some cases, Plan 3b includes structures in the 2% AEP event where comprehensive benefits were gained. Similarly, some areas were included at the 10% AEP floodplain where there were not comprehensive benefits reasons to include a larger area. Each aggregation group increment was evaluated based on flood hazard depth and frequency and incorporates community risk factors related to community cohesion, critical infrastructure, and incremental net NED benefits (Figure 7-1).

The reduction in damages would be achieved by elevating residential structures up to 13 feet above ground surface and floodproofing nonresidential structures up to 3 feet above ground surface. During implementation, each structure would be individually surveyed. Participation in the TSP is 100 percent voluntary. This plan is estimated to have an annual cost of $22.11 million (total project cost of $596.12 million including interest during construction), a BCR 1.39, and net benefits of $8.63 million at the current Federal discount rate (FDR) of 2.75 percent and FY 2024 Price Level.

Table 7-1. Summary of Costs and Benefits of the TSP (Plan 3b: Total Net Benefits Plan)

Item	Plan 3b (TSP)
Construction First Cost	$595,068,000
Interest During Construction	$2,021,351
Total Construction Cost	$597,089,351
Average Annual Construction Cost	$22,116,700
Equivalent Annual Benefits	$30,742,290
Annual Net Benefits	$8,625,590
Benefit-to-Cost Ratio (BCR)	1.39

FY 2024 Interest 2.75% and FY 2024 Price Level

Table 7-2. TSP Evaluation of Four Accounts

Four Accounts	Plan 3b: NED + Increment 2
NED	Avg. Annual Benefits: $30.74M
NED	Avg. Annual Costs: $22.11M
NED	Net Annual Benefits: $8.63M
NED	Total Cost: $597.09M
NED	BCR: 1.39
EQ	No significant impacts to the environment
RED	$952.58M
RED	FTE Jobs: 10,283.5
OSE	Both Moderate & significant positive benefits. These benefits are realized via FEMA's NRI Community Risk Factors.

If the policy exception per ER1105-2-103,2-4(f)(5)(d) is not granted, the Recommended Plan will default to Plan 1: Nonstructural NED Plan. The NED costs and benefits for the final array are described in Table 6-1. The NED Plan includes a total of 597 structures and consists of the elevation of 539 residential structures and floodproofing of 58 nonresidential structures. Of the total aggregation areas, 27areas were optimized at the 0.1% AEP floodplain, 3 areas were optimized at the 0.04% AEP floodplain, and 2 areas were optimized at the 0.02% AEP floodplain.

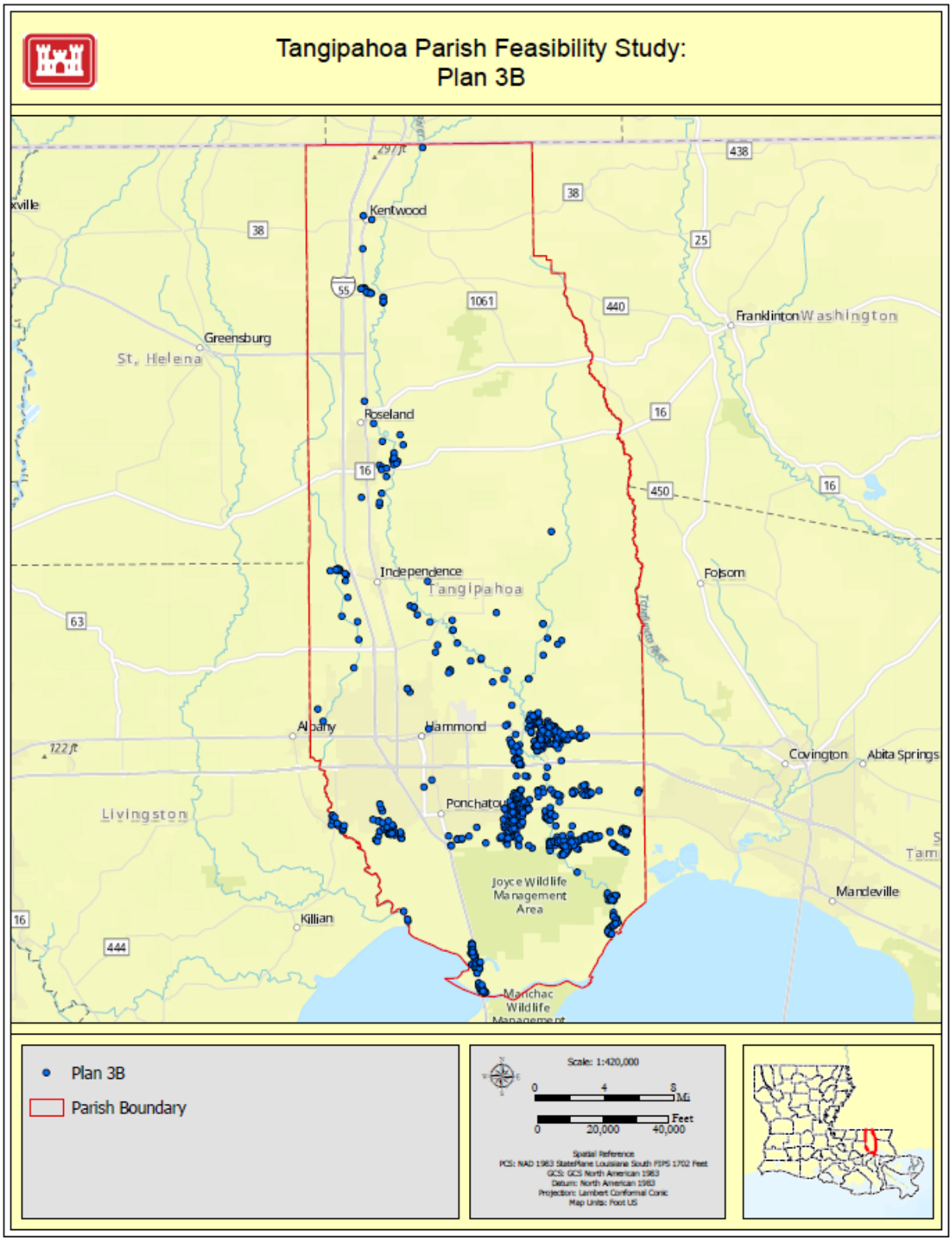

Figure 7-1. Tentatively Selected Plan - Nonstructural Plan 3b

7.2 IMPLEMENTING THE PLAN

Appendix H - Nonstructural Implementation Plan details the nonstructural planning and implementation for elevations and floodproofing of structures, in accordance with 22 July 2024 Memorandum for "Guidance for Nonstructural Project Planning and Implementation". Subject to project authorization, appropriation and availability of funding, full environmental compliance, and execution of a binding agreement with the NFS, construction is currently assumed to begin in 2033. The schedule assumes that implementation of the Nonstructural Plan will occur over an approximate 10-year period with approximately 100 structures to be elevated and/or floodproofed a year after an 18-month PED phase. The project requires construction authorization and the appropriation of construction funds. A continuous funding stream is needed to complete this project within the anticipated timeline, which requires continuing appropriations from Congress and the State of Louisiana to fund the detailed design phase and fully fund construction contracts.

7.2.1 Real Estate

Plan 3b: NED + Increment 2: 4% AEP Flood Frequency Comprehensive Increment

A total of approximately 1,088 structures in the study area met the requirement of having a First Floor Elevation (FFE) at or below the applicable floodplain. The estimated total cost for Real Estate for Plan 3b is $111.8 M. These costs include administrative costs associated with implementation of the plan and temporary residential relocations of tenants during structure elevation. Real estate tasks associated with elevating (approximately 1006 structures) and floodproofing (approximately 82 structures) could include such items as obtaining rights-of entry, title work, preparation, execution, and recordation of the estates and any needed curative documents, appraisals or value estimates, residential relocation costs for tenants, and subsequent inspections to ensure the work was performed in accordance with the Project Partnership Agreement (PPA).

Plan 1: Nonstructural NED Plan

The initial Nonstructural NED plan involves the floodproofing or elevation of 597 structures located in the floodplain. The estimated total cost for Real Estate for Plan 1, if a waiver is not obtained, is $105.6 M This plan would involve elevating approximately 539 structures and floodproofing approximately 58 structures.

In both plans, floodproofing non-residential structures and elevating residential structures will be offered to property owners on a voluntary basis and implemented only with the property owner's consent. Property owners who have preliminarily eligible structures that wish to participate in the floodproofing measures will be required to apply for the program and provide a right-of-entry to their property. The proposed legal mechanism to undertake the residential elevation or non-residential floodproofing measures would be through the use of a non-standard permanent Restrictive Easement that would outline the elevation or floodproofing treatment, identify restrictions owners must take or abstain from to ensure the long-term performance of elevation and floodproofing measures, and contain restrictions and covenants that would run with the land. The restrictive easements will be recorded in local

land records to run with the land. The proposed nonstandard Restrictive Easement will be executed between the property owner and the NFS. If a property owner elects not to have the nonstructural treatment performed on their structure and an agreement is not obtained, eminent domain will not be pursued.

7.2.2 Operations, Maintenance, Repair, Rehabilitation, and Replacement

There are no NFS OMRR&R obligations for the completed nonstructural work other than the performance of monitoring and periodic inspections. For all structure types (residential and nonresidential) OMRR&R costs are expected to be 'de minimus'. The PDT is coordinating with the NFS and the National Nonstructural Committee to develop cost estimates associated with monitoring and periodic inspections. Costs for these efforts have not yet been calculated but will be included in the final report. The required inspection and monitoring of the completed nonstructural work shall be detailed in the Final OMRR&R Manual issued by USACE to the NFS. These OMRR&R obligations shall commence upon the issuance of a Notice of Construction Completion (NCC) by USACE. In accordance with the requirements of the Final OMRR&R Manual, the NFS shall conduct periodic inspections at specified intervals and provide written certifications to USACE that the structures and lands have been inspected and document whether or not any violations have been found. Nonstructural Inspection/Implementation Checklist will be developed as part of the OMRR&R Manual.

Inspections by the NFS of elevated structures will determine among other things, that no part of the structure located below the level of the lowest habitable finished floor has been converted to living area for human habitation, or otherwise altered in any manner which would impede the movement of waters beneath the structure; that the area below the predicted MLFY of 2083 the 100-year BFE is being used solely for the parking of vehicles, limited storage, or access to the structure and not for human habitation; that mechanical, electrical or plumbing devices have not been installed below the BFE; that the property is in compliance with all applicable floodplain ordinances and regulations. There may be exceptions to this for individual structures and circumstances, but these will require approval. USACE shall have the right, but not the obligation, to perform its own inspections of the elevated and flood proofed structures pursuant to the project.

Beginning at the time of issuance of the NCC, the property owner shall be responsible for all costs and risk associated with maintaining, repairing, rehabilitating, and replacing the completed floodproofing measures on the property.

7.2.3 Cost Sharing Requirements

A NFS must support all phases of the project. For nonstructural features, design and implementation phases are cost-shared, with the NFS providing 35 percent of the total project costs. Once a project has been implemented, OMRR&R of the project is a 100 percent non-Federal responsibility.

Total project first costs of the TSP at FY 24 price levels are approximately $595,068,000. The total fully funded cost of the project (Table 7-3). As part of feasibility level design activities, the costs will continue to be refined and will be updated within the final report.

Table 7-3. TSP Project First and Total Apportionments

Discipline/Activity	Project First Costs
Real Estate	$32.64M
Cultural Resources Preservation	$1.09M
Buildings, Ground & Utilities	$310.60M
Planning, Engineering, & Design	$43.48M
Construction Management	$24.85M
Contingency	$182.41M
Total Project First Cost (constant dollar basis) Apportionment	**$595.07M**
Federal Share (65%)	$386.80M
Non-Federal Share (35%)	$208.27M

14% PED costs and 8% S&A rate

FY24 Interest 2.75% and FY 2024 Price Level

7.2.4 Federal Responsibilities for the Selected Plan

The Federal Government will be responsible for PED and construction of the project in accordance with the applicable provisions of Public Law 99-662 (WRDA of 1986), as amended. The Government, subject to congressional authorization, the availability of funds, and the execution of a binding agreement with the NFS in accordance with Section 221 of the Flood Control Act of 1970, as amended, and using those funds provided by the NFS, shall expeditiously construct the project, applying those procedures usually applied to Federal projects, pursuant to Federal laws, regulations, and policies.

7.2.5 Non-Federal Responsibilities for the Selected Plan

Federal implementation of the project for nonstructural flood risk management includes, but is not limited to, the following required items of local cooperation to be undertaken by the non-Federal sponsor in accordance with applicable Federal laws, regulations, and policies:

1. Provide 35 percent of construction costs, as further specified below:

i. Provide, during design, 35 percent of design costs in accordance with the terms of a design agreement entered into prior to commencement of design work for the project;
ii. Provide all lands, easements, rights-of-way, and placement areas and perform all relocations determined by the Federal government to be required for the project;
iii. Provide, during construction, any additional contribution necessary to make its total contribution equal to at least 35 percent of construction costs;

2. Prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) that might reduce the level of flood risk reduction the project affords, hinder operation and maintenance of the project, or interfere with the project's proper function;
3. Inform affected interests, at least yearly, of the extent of risk reduction afforded by the flood risk management features; participate in and comply with applicable Federal floodplain management and flood insurance programs; prepare a floodplain management plan for the project to be implemented not later than one year after completion of construction of the project; and publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in adopting regulations, or taking other actions, to prevent unwise future development and to ensure compatibility with the project;
4. Operate, maintain, repair, rehabilitate, and replace the project or functional portion thereof at no cost to the Federal government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal laws and regulations and any specific directions prescribed by the Federal government;
5. Give the Federal government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor owns or controls for access to the project to inspect the project, and, if necessary, to undertake work necessary to the proper functioning of the project for its authorized purpose;
6. Hold and save the Federal government free from all damages arising from design, construction, operation, maintenance, repair, rehabilitation, and replacement of the project, except for damages due to the fault or negligence of the Federal government or its contractors;
7. Perform, or ensure performance of, any investigations for hazardous, toxic, and radioactive wastes (HTRW) that are determined necessary to identify the existence and extent of any HTRW regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. 9601-9675, and any other applicable law, that may exist in, on, or under real property interests that the Federal government determines to be necessary for construction, operation, and maintenance of the project;
8. Agree, as between the Federal government and the non-Federal sponsor, to be solely responsible for the performance and costs of cleanup and response of any HTRW regulated under applicable law that are located in, on, or under real property interests required for construction, operation, and maintenance of the project, including the costs of any studies and investigations necessary to determine an appropriate

response to the contamination, without reimbursement or credit by the Federal government;

9. Agree, as between the Federal government and the non-Federal sponsor, that the nonfederal sponsor shall be considered the owner and operator of the project for the purpose of CERCLA liability or other applicable law, and to the maximum extent practicable shall carry out its responsibilities in a manner that will not cause HTRW liability to arise under applicable law; and
10. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended, (42 U.S.C. 4630 and 4655) and the Uniform Regulations contained in 49 C.F.R Part 24, in acquiring real property interests necessary for construction, operation, and maintenance of the project including those necessary for relocations, and placement area improvements; and inform all affected persons of applicable benefits, policies, and procedures in connection with said act.

7.2.6 Risk and Uncertainty

Risk and uncertainty are intrinsic in water resources planning and design. Risk is a measure of the probability and consequence of uncertain future events. It is the chance of an undesirable outcome. Uncertainty refers to the likelihood an outcome results from a lack of knowledge about critical elements or processes contributing to risk or natural variability in the same elements or processes. Throughout the planning process, the PDT identified risk and uncertainty using collaboration with the NFS and stakeholders and in accordance with USACE policies related to risk such as USACE ER 1105-2-100 and ER 1105-2-103. Risk informed decisions were made regarding the reliability of estimated benefits and the costs of alternative plans.

Measures were developed to manage risk by expanding on and referencing successful similar completed projects along the Louisiana coast, as well as nationwide. Experience from previous projects helped in the identification of possible risks and decrease uncertainty in plan formulation. No measure or alternative in the TSP is burdened by significant risk or uncertainty regarding its eventual success. Significant risks were avoided by using proper design, appropriate selection, and correct seasonal timing of applications. Risks were also managed through extensive coordination with other agencies and experts. This subsection described various categories of risk and uncertainties pertinent to the study. See Section 4 for information regarding how the PDT incorporated risk-informed decision making into the planning process.

7.2.6.1 Costs and Level of Design

USACE decision documents recognize cost risk and uncertainty surrounding implementation. All cost estimates will carry a degree of uncertainty. The estimated total project first cost for the TSP is $595,070,000 at a Class 4 level of technical information which represents preliminary design.

The currently known major uncertainty drivers for costs are the following:

- Owner Participation Rate
- Scope Maturity
- Availability of Floodproof Contractors.

The major contributor to the resulting total project contingency for the Schedule feature was:

- Contract Acquisition
- PED and S&A Cost
- Temporary Relocation of Residents.

Engineering design factors that carry uncertainty include:

- Final design for construction
- Level of detail used in Modeling analysis, and assumptions requiring validation or adjustment
- Existing or future projects cause unexpected effects on the TSP

As the project moves into the next phases, USACE will focus on risk management and mitigation of the costs and other significant risk drivers to the extent practicable within the limitations of the study. However, there still exists the potential for other unanticipated and uncontrollable changes in environmental or economic conditions that could further increase the total project first cost beyond the current estimate and/or necessitate changes in the project's design.

7.2.6.2 Environmental Factors

The PDT has identified the following environmental factors that inherently carry uncertainty and could impact the accrual of benefits within the 50-year period of analysis. These environmental risks to implementation would be managed by gathering data and making changes to the project, if necessary.

7.2.6.3 Relative Sea Level Rise

To evaluate potential future changes in project performance due to relative sea level change, ER 1100-2-8162 requires planning studies and engineering designs to be formulated and evaluated considering all possible rates of relative sea level rise (RSLR). There is a low, intermediate, and high projection curve. The ER directs to the USACE Sea Level Change Curve Calculator online tool to develop the three rates. For the high-subsidence area of coastal Louisiana, the Sea-Level Calculator for Non-NOAA Long-Term Tide Gauges was used specifically. After comparing and evaluating the rates determined by the calculator, the PDT determined that the 'intermediate' rate of sea level rise should be used in this study for future conditions model runs in the analysis of alternatives. This topic is discussed further in Appendix B - Hydrologic & Hydraulics, Section 4.8.2.

In recognition of the uncertainty presented by RSLR, CEMVS will reevaluate if the intermediate scenario of sea level change is reasonably representative of observed conditions during the next project phase. If observed conditions significantly exceeding the

intermediate projection are identified during design or construction, reevaluation of the TSP plan will be considered.

7.2.6.4 Residual Risk

The TSP will greatly reduce, but not eliminate future flood risk damages, and residual risk would remain in the study area. The structures eligible for inclusion in the nonstructural plans were based on the combined riverine and coastal flood risk. While this is comprehensive, this does still leave structures with residual flood risk within the study area as nonstructural measures may not mitigate flood risk for very infrequent events. The residual risk, along with the potential consequences, will continue to be communicated to the NFS and will become a requirement of any communication and evacuation plan when this plan is implemented. Nonstructural measures are voluntary, and this analysis assumes 100 percent participation. A participation rate sensitivity analysis will be performed after TSP. Table 7-4 below shows the residual risk.

Table 7-4. Residual Risk for No Action, NED, and TSP ($1,000s)

Plan	Equivalent Annual Damages	Benefits	Residual Damages
No action	$59,350	$0	$59,350
Plan 1	$59,350	$23,369	$35,981
Plan 3b	$59,350	$30,742	$28,608

Due to the nature of the nonstructural measures included in this analysis, there is no reduction in residual risk to roads, railways, or vehicles. There is also no reduction in damages associated with debris cleanup or other emergency costs. In addition to the residual risk associated with dollar damages, life safety concerns are not addressed for individuals outside of the structures where nonstructural measures are planned to be implemented. This applies to individuals who decide not to participate since the measures proposed are voluntary. There is no expected transformed risk with the construction of the proposed measures for any plans in the final array.

Changes in analysis after TSP, but before the Agency Decision Milestone include, but are not limited to: refinement of the structure inventory, refinements to the uncertainty model inputs regarding H&H and economics, and conducting on the ground evaluations of structures within the TSP. The team also plans to take into consideration any changes suggested by public comments received during the upcoming comment period. Each of these changes carry the potential to impact the structures eligible for nonstructural measures, as defined by the current methodologies, as well as to change damage and benefit values.

Residual Risk in the future with-project condition is largely driven by three categories; (1.) Structures eligible for nonstructural actions but not included in the TSP due to lack of comprehensive justification, (2.) Structures which receive inundation but were ineligible for

nonstructural actions, and (3.) Structures which are included in the plan but receive damages at infrequent events which are in excess of the mitigation action design. This is exacerbated in the coastal areas by sea level rise. An elevation height sensitivity analysis as well as analyzing dry versus wet floodproofing methods involving the projected MLFY of 2083 H&H will be conducted post-draft report. That is expected to further reduce residual risk in the study area.

7.2.6.5 Potential Induced Flooding

No potential induced flooding is anticipated with nonstructural plans.

SECTION 8
Environmental Compliance

8.1 ENVIRONMENTAL COMPLIANCE TABLE

Table 8-1 provides a list of all relevant environmental laws, regulations, and Executive Orders and includes a brief statement summarizing how the project will comply with the requirements. Additionally, the status of all Federal permits, licenses, and other authorizations that must be obtained in implementing the project as well as any issues preventing full compliance with laws, regulations, and Executive Orders are noted.

Table 8-1. Environmental Compliance

FEDERAL STATUTES and COMPLIANCE REQUIREMENTS	Compliance Status*
Endangered Species Act of 1973, as amended: Compliance requires coordination with the U.S. Fish and Wildlife Service (USFWS) to determine if any endangered or threatened species or their critical habitat would be impacted by the project. USACE is requesting concurrence with their not likely to adversely affect determination with review of this draft report. Additional time-sensitive, tiered Section 7 Consultations will be coordinated during TSP design and if approved implementation of project measures.	PC
Fish and Wildlife Coordination Act of 1934, as amended: Compliance requires coordination with the USFWS and the State wildlife agencies. These agencies were part of the interagency team utilized during plan formulation. The Draft Fish and Wildlife Coordination Act Report recommendations have been incorporated into the draft EA. Any additional comments received during draft reviews or during feasibility design will be addressed in the report and appendices accordingly.	PC
Magnuson-Stevens Fishery Conservation Act, as amended: Compliance requires coordination with the NMFS to determine if essential fish habitats (EFH) would be impacted by the project. Coordination with NMFS has determined that no EFH habitats in Tangipahoa Parish would be impacted by the project.	FC
Marine Mammal Protection Act of 1972, as amended: Compliance requires coordination with NMFS and USFWS to determine if marine mammal would be impacted by the project. Coordination with NMFS and USFWS has determined that no marine mammals would be impacted by the project.	FC
Migratory Bird Treaty Act: Compliance requires coordination with USFWS to avoid and minimize potential take of protected migratory bird species, unless permitted by USFWS. Coordination with USFWS will continue through TSP design and implementation phases to avoid potential impacts to migratory birds. If a Bald Eagle nest is found within or adjacent to construction of a nonstructural measure then the National Bald Eagle Management Guidelines would be followed.	PC
National Historic Preservation Act of 1966, as amended: Compliance requires USACE to consider the effects of project on any property included in or eligible for inclusion in the National Register of Historic Places. A programmatic agreement is being developed in consultation with	PC

FEDERAL STATUTES and COMPLIANCE REQUIREMENTS	Compliance Status*
the federally recognized tribes and the Louisiana SHPO in accordance with 36CRF800.14(B)(1)(ii). The PA will undergo a 30-day public notice process prior to the Final Integrated Feasibility Report and Final Environmental Assessment.	
National Environmental Policy Act of 1969, as amended: Compliance requires preparation of this EA, consideration of public comments, and preparation and public review of the final EA. Comments received during the public and agency reviews will be considered and evaluated as the team works toward production of a final EA document. Signing of the Finding of No Significant Impact would bring this project into full compliance.	PC
Farmland Protection Policy Act of 1981, as amended: Compliance requires coordination with the Natural Resources Conservation Service to determine if any designated prime or unique farmlands are affected by the project. Full compliance will be received on a site-by-site basis with associated coordination during detailed designs. Proposed project features would be limited to areas already in development (i.e. locations of residential or commercial structures and would not result in a change in land use.	FC
Executive Order 11988, Floodplain Management: Directs Federal agencies to reduce flood loss risk; minimize flood impacts on human safety, health, and welfare; and restore and preserve the natural and beneficial values served by floodplains. The proposed action is in compliance with E.O. 11988 because it would only include non-structural measures and not result in development of the floodplain.	FC
Executive Order 11990, Protection of Wetlands: the purpose of this E.O. is to "minimize the destruction, loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. To meet these objectives, the order requires federal agencies, in planning their actions, to consider alternatives to wetland sites and limit potential damage if an activity affecting a wetland cannot be avoided. The proposed action would not result in impacts to wetlands and therefore is in compliance.	FC
Clean Water Act of 1972, as amended: sets and maintains goals and standards for water quality and purity. Section 404b(1) requires an evaluation to assess short and long-term impacts associated with the placement of fill materials into waters of the United States. Section 401 requires a water quality certification from the LDEQ that a project does not violate established effluent limitations and water quality standards. The proposed project would not involve placement of fill into waters of the United States or result in runoff or release of pollutants that would impact water quality standards.	FC
Clean Air Act of 1970, as amended: Compliance requires coordination with the U.S. Environmental Protection Agency and analysis of potential impacts on air quality. The study area is in attainment of NAAQS. Potential actions associated with the project are not expected to change attainment categorization.	FC
Coastal Zone Management Act: requires that "each federal agency conducting or supporting activities directly affecting the coastal zone shall conduct or support those activities in a manner which is, to the maximum extent practicable, consistent with approved state management programs." Coordination with Louisiana Department of Natural Resources regarding consistency with the CZMA is in progress and would be completed prior to the finalization of the FONSI.	PC

*PC: Partial Compliance

*FC: Full Compliance

8.2 PUBLIC INVOLVEMENT

Since the study began, the PDT has biweekly meetings (Wednesdays) with NFS and key stakeholder, such as TPG and USFWS to discuss progress and challenges for the project.

Early NEPA coordination with the NFS, stakeholders, Federal and State agencies, and Federally-Recognized Tribes was conducted on January 31, 2023. Additional coordination occurred as part of public meetings, social media, and the CEMVN study website. Pre-scoping meetings were held on February 15 and 16, 2023 in Hammond and Kentwood, located in the Parish. A scoping charette with NFS, stakeholders, Federal and State agencies, and Federally-Recognized Tribes occurred as a group on February 23 and 24, 2023 to share public input and refine scope of the project.

The collaborative stakeholders associated with this study are USACE, CPRA, and Tangipahoa Parish. Resource agencies associated with this study include the U.S. Fish and Wildlife Service (FWS), U.S. Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS), and the Louisiana Department of Wildlife and Fisheries (LDWF). Additionally, in partial fulfillment of USACE's responsibilities under E.O. 13175, early NEPA coordination was initiated with the following Tribes: Alabama Coushatta Tribe of Texas, Caddo Nation of Oklahoma, Chitimacha Tribe of Louisiana, Choctaw Nation of Oklahoma, Coushatta Tribe of Louisiana, Jena Band of Choctaw Indians, Mississippi Band of Choctaw Indians, Muscogee Nation, Seminole Nation of Oklahoma, Seminole Tribe of Florida, and Tunica-Biloxi Tribe of Louisiana on January 31, 2023. Frequent coordination with collaborative stakeholders has occurred throughout the project on a biweekly basis. Periodic coordination with the resource agencies occurred throughout the study to provide updates on project developments and to seek their input.

Pre-scoping open houses were conducted for the Tangipahoa Parish feasibility study on February 15 and 16, 2023 to inform and engage residents about flood related hazards and issues in the Parish. The meetings were held in Hammond and Kentwood in an attempt to reduce overall travel distance for potential participants in the meetings. Sixteen people from the Parish attended the Hammond meeting and seven people attended the Kentwood meeting. Overall, 56 comments/concerns were received as a result of the pre-scoping meeting. These comments were used to identify or confirm flood hazard in an area, identify major concerns from the community, and refine the comprehensive list of potential measures which were then used to develop alternatives throughout the study.

Scoping outreach meetings for the project were conducted on September 13 and 14, 2023 in Amite City and Hammond. Prior to these meetings, outreach coordination focused on civic and faith-based organization in the Parish was performed. In all, 224 churches, six libraries, two community centers, eight HeadStart child centers, four senior centers, and three non-profit organizations were contacted to provide one-page summaries for the study with information about how to participate in the upcoming meetings and provide comments or feedback. Approximately 135 non-USACE people attended the meetings over the two evenings. Scoping identified three primary areas of concern, including drainage maintenance in communities and the Parish as a whole, impacts of development on flood

hazard, and requests for clearing and snagging of channels. As a result of the meeting, the PDT evaluated a range of clearing and snagging measures on channels that fell within the study scope (i.e. channels with discharges greater than 800 cubic feet per second for the 10% annual exceedance probability event). More details on the outreach meetings can be found in Appendix D.

Additional public meetings are planned to coincide with the public review of the DIFR/EA. A public notice of this draft DIFR/EA was made available for a 45-day comment period beginning August 9, 2024, and ending September 23, 2024. Comments received during the review period are included in Appendix D and responses will be provided.

The draft Fish and Wildlife Coordination Act report was received from USFWS on August 1, 2024. The report contained an analysis of the potential impacts on fish and wildlife resources that could result from the proposed alternative and provides recommendations to minimize those impacts. Comments have been incorporated into this DIFR/EA. State and federal agency comments received during the public review period were evaluated and incorporated in the development of this DIFR/EA. Coordination with state and federal agencies will continue to avoid and minimize impacts to significant resources in the study area. Additionally, ESA Section 7 consultation will be completed prior to the development of a FONSI for the study.

8.2.1 List of Statement Recipients

Preparation of this DIFR/EA was coordinated with appropriate Federal, Tribal, State, and local interests, as well as environmental groups and other interested parties. The following agencies as well as other interested parties will receive copies for review:

U.S. Department of the Interior, Fish and Wildlife Service
U.S. Environmental Protection Agency, Region VI
U.S. Department of Commerce, National Marine Fisheries Service
U.S. Natural Resources Conservation Service, State Conservationist
Coastal Protection and Restoration Authority Board of Louisiana
Advisory Council on Historic Preservation
Governor’s Executive Assistant for Coastal Activities
Louisiana Department of Wildlife and Fisheries
Louisiana Department of Natural Resources, Coastal Management Division
Louisiana Department of Environmental Quality
Louisiana State Historic Preservation Officer
Louisiana Departments of Transportation and Development

SECTION 9
Recommendation

The recommendations contained herein reflect the information available at this time and current departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to higher authority as proposals for authorization and implementation funding. However, prior to transmittal to higher authority, the sponsor, the states, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

9.1 USACE PLAN RECOMMENDATION

The TSP for this study includes a nonstructural plan for eligible properties within the study area. The TSP as detailed in the DIFR/EA has been identified by CEMVS for future recommendation for authorization as a Federal project, with such modifications thereof as in the discretion of the Commander, Headquarters, USACE, may be advisable. The USACE recognizes that the NFS, supports the current identification of the TSP, but the NFS will also concurrently review the DIFR/EA.

This DIFR/EA underwent additional concurrent ATR, public, and policy reviews. The PDT, CEMVS management, and USACE vertical team representatives throughout the agency considered comments provided during the public/concurrent review period prior to providing feedback to a USACE Headquarters Senior Leaders Panel. This panel will consider significant public, technical, legal, and policy comments on the TSP and other alternatives in conjunction with a decision to endorse the TSP and propose a way forward to complete feasibility-level design and the FIFR-EA.

The FIFR-EA is scheduled to be submitted in 2025 to USACE headquarters after which a Chief's Report will be developed. Once the Chief of Engineers approves and signs the Report, the Chief of Staff will sign the notification letters forwarding the Report to the chairpersons of the Senate Committee on Environmental and Public Works and the House of Representatives Committee on Transportation and Infrastructure. The signed Chief's Report will also be provided to the ASA(CW) for review by the Administration.

The DIFR/EA fully describes flood risk to structures and life safety associated with riverine and residual risk to those structures caused by coastal storm flood events. The measures of the TSP were formulated to reduce the risk of rainfall flood damages to key infrastructure and structures. The TSP would greatly reduce, but not eliminate future damages, and residual risk would remain.

9.2 RECOMMENDED ACTIONS BY OTHERS

Additional recommendations that may be implemented by others that will further reduce the residual risks associated with flood damages were identified during the study.

9.3 CONTENT PROTECTION MEASURES OF WET FLOODPROOFED BUILDINGS

While wet floodproofing reduces structural damages, it does not reduce the risk and associated benefits to contents. The NFS, or individual owners, are encouraged to consider implementing content protection measures.

9.4 PATH FORWARD

This draft report is available for 2nd public review beginning 5 June 2025. The official closing date for the receipt of comments is 5 July, which is 30 days from the date on which the notice of availability of the DIFR/EA appears in the Federal Register during this review period. Comments may be mailed to the address listed below. Comments may also be emailed to the email address listed below.

U.S. Army Corps of Engineers
Attention: Chief, Environmental Branch
CEMVS–RPEDN, Room 3.200,
1222 Spruce Street, St. Louis, MO 63103
Email: tangipahoafs@usace.army.mil

SECTION 10
List of Preparers

10.1 LIST OF PREPARERS

Table 10-1 provides a list of individuals involved in preparation of the document and significant supporting information.

Table 10-1. List of Preparers

Discipline/Qualification/Role	Team Member
Project Manager	Brandon Schneider
Plan Formulation	Craig Evans Katy Fechter Hannah Caudill
Economics & Socioeconomics	Schuyler Bucher
Environmental Resources and Coordination	Lane Richter
Hydrology and Hydraulics	Joel Asunskis, Technical Lead Bradley Kruse
Real Estate	Gary Albarez
Geographic Information System	Matt Hill Portia Stagge
Civil Engineering	Matt Hartman
Cultural Resources, Tribal Coordination	Mark Smith
Hazardous, Toxic and Radioactive Waste	Kaleb Rakers
Geotechnical	Heather Lecroix
Cost Engineering	Michelle Puzach
District Quality Control	Michelle Kniep Ben Logan Kip Runyon Joseph Asher Leff John Boeckmann Amanda Goltz Lara Anderson

SECTION 11
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SECTION 12
List of Acronyms and Abbreviations

ACHP	Advisory Council on Historic Preservation
ADCIRC	Advanced Circulation Model
AEP	Annual Exceedance Probability
AMM	Alternatives Milestone Meeting
APE	Area of Potential Effects
AQCR	Air Quality Control Region
ASA(CW)	Assistant Secretary of the Army for Civil Works
ASCII	American Standard Code for Information Exchange
ASTM	American Society for Testing Materials
BBA	Bipartisan Budget Act
BCR	Benefit to Cost Ratio
BGEPA	Bald and Golden Eagle Protection Act
BMP	Best Management Practice
BLH	Bottomland Hardwood
CAA	Clean Air Act
CAR	Coordination Act Report
CDP	Census Designated Place
CEMVN	USACE New Orleans District
CEMVS	USACE St. Louis District
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation & Liability Act
CFS	Cubic Feet Per Second
CNO	Choctaw Nation of Oklahoma
CO	Carbon Monoxide
CPRA	Coastal Protection and Restoration Authority
CSRM	Coastal Storm Risk Management
CWA	Clean Water Act
DEA	Draft Environmental Assessment

DIFR	Draft Integrated Feasibility Report
EAD	Estimated Annual Damages
EFH	Essential Fish Habitat
EO	Executive Order
EPA	Environmental Protection Agency
EQ	Environmental Quality
ER	Engineer Regulation
ESA	Endangered Species Act
ESA	Environmental Site Assessment
FCSA	Federal Cost Share Agreement
FDR	Federal Discount Rate
FEA	Final Environmental Assessment
FEMA	Federal Emergency Management Agency
FIFR	Final Integrated Feasibility Report
FLOAT	Flood Loss Outreach and Awareness Taskforce
FRM	Flood Risk Management
FWCA	Fish and Wildlife Coordination Act
FWCAR	Coordination Act Report
FWP	Future With Project
FWS	Fish and Wildlife Services
FWOP	Future With Out Project
GIS	Geographic Information System
H&H	Hydraulics and Hydrology
HEC-FDA	The Flood Damage Reduction Analysis
HEC-RAS	Hydrologic Engineering Center- River Analysis System
HMGP	Hazard Mitigation Grant Program
HSDRRS	Hurricane & Storm Damage Risk Reduction System
HTRW	Hazardous, Toxic, and Radioactive Waste
HQUSACE	Headquarters United States Army Corps of Engineers
IER	Individual Environmental Report
LDEQ	Louisiana Department of Environmental Quality

LDNR	Louisiana Department of Natural Resources
LDOA	Louisiana Division of Archaeology
LDRIPs	Long Term Disaster Recovery Investment Plans
LDWF	Louisiana Department of Wildlife and Fisheries
LERRD	Lands, Easements, Rights-of-way, Relocations and Disposal Areas
LIDAR	Light Detection and Ranging
LSRA	Louisiana Scenic Rivers Act
LWCF	Land and Water Conservation Fund
LWFMP	LA Statewide Comprehensive Water Based Floodplain Management Program
MAV	Mississippi Alluvial Valley
MBTA	Migratory Bird Treaty Act
MCACES	Micro-Computer Aided Cost Estimating System
MDAH	Mississippi Division of Archives and History
MSA	Metropolitan Statistical Area
MSC	Major Subordinate Command
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MSL	Mean Sea Level
MVD	Mississippi Valley Division
NAAQS	National Ambient Air Quality Standards
NAWMP	North American Waterfowl Management Plan
NB	Nature Based
NBEM	National Bald Eagle Management
NCDC	National Climatic Data Center
NED	National Economic Development
NEPA	National Environmental Policy Act
NFS	Non- Federal Sponsor
NGVD	National Geographic Vertical Datum
NHL	National Historic Landmarks
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NLAA	Not Likely to Adversely Affect

NO2	Nitrogen Dioxide
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPS	National Park Service
NRCS	Natural Resource Conservation Service
NRHD	National Register of Historic District
NRHP	National Register of Historic Places
NRI	National Risk Index
NS	Nonstructural
O&M	Operation and Maintenance
OCD	Office of Community of Development
OMRR&R	Operations, Maintenance, Repair, Rehabilitation, and Replacement
OSE	Other Social Effects
O3	Ozone
PA	Public Assistance
PA	Programmatic Agreement
Pb	Lead
PPA	Project Partnership Agreement
PBF	Physical Biological Features
P&G	Principles and Guidelines
PED	Pre-Construction Engineering and Design
PDT	Project Delivery Team
Phase 1 ESA	Phase 1 Environmental Site Assessment
PM	Particulate Matter
PMP	Project Management Plan
PPA	Project Partnership Agreement
PPT	Parts Per Thousand
RCRA	Resource Conservation and Recovery Sites
REC	Recognized Environmental Condition
RED	Regional Economic Development
REP	Real Estate Plan

ROD	Record of Decision
RMP	Risk Management Plan
ROE	Right of Entry
ROM	Rough Order of Magnitude
ROW	Right Of Way
RPEDN	Regional Planning and Environment Division North
RPEDS	Regional Planning and Environment Division South
RSLC	Relative Sea Level Change
RSLR	Relative Sea Level Rise
SHPO	State Historic Preservation Officer
SLC	Sea Level Change
SMART	Specific Measurable Attainable Risk Informed Timely
SO2	Sulfur Dioxide
SWPPP	Stormwater Pollution Prevention Plan
T&E	Threatened and Endangered
TCP	Traditional Cultural Property
TRI	Toxic Release Inventory
TSCA	Toxic Substances Control Act
TSP	Tentatively Selected Plan
URA	Uniform Relocation Assistance Act
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VOC	Volatile Organic Compound
VRAP	Visual Resources Assessment Procedure
WBDHU12	USGS Watershed Boundary Dataset Hydrologic Unit 12
WIIN	Water Infrastructure Improvement Act for the Nation
WSE	Water Surface Elevation
WMA	Wildlife Management Area
WQC	Water Quality Certification
WRDA	Water Resources Development Act

WRRDA	Water Resources Reform and Development Act
WVA	Wetland Value Assessment